

Recommended Rest Frequencies for Observed Interstellar Molecular Microwave Transitions—1985 Revision

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Recommended Rest Frequencies for Observed Interstellar Molecular Microwave Transitions — 1985 Revision

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Accurate transition frequencies for the transitions of the molecular species detected in interstellar clouds are presented. These are recommended for reference in future astronomical observations in the radio and microwave regions. The transition frequencies have been selected through critical examination and analysis of the spectroscopic data in the literature. The species identity, quantum number labels, and probable error limits (2σ) are presented for each transition. Representative line antenna temperatures are also given for a typical source as a convenience to users. References are cited to both the astronomical and laboratory literature.

Key words: hyperfine structure; interstellar; microwave spectra; molecular; radio astronomy; rotational transitions.

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1. Introduction

A wide variety of molecular rotational and hyperfine transitions have been measured by radio astronomical techniques. Six years ago the first summary of the rest frequencies recommended for use in future observations was published¹. Since this earlier review was published, a large number of new measurements have been reported. The current report updates the previous summary, and provides a current source of radio astronomical observations and improved accuracy in transition frequencies which are critical in identifying the molecular source of these spectral observations as well as physical properties of the molecular clouds.

2. Source and Selection of Spectral Frequencies

At this writing 59 interstellar and circumstellar molecular species have been observed in the microwave region. These are listed in Table 1 according to empirical formula. Table 1 also provides the common names of the species, isotopic forms which have been observed and the

approximate number of transitions detected for each isotopic species. The last column of Table 1 indicates the source of the rest frequencies given, e.g. literature references to laboratory measurements, analysis of the literature data in the present work, or previously published reviews which include accurate frequency predictions of transitions not measured in the laboratory²⁻²³. Since the laboratory spectra for all of the interstellar species represented here have not been treated in published reviews, the laboratory literature has been thoroughly searched and spectral fitting carried out where feasible to obtain accurate frequency predictions. In some cases the earlier publications are out of date since new laboratory measurements are now available. The species for which the above is true are identified with footnote e in Table 1 and the corresponding spectral line entries in Table 2 do not show a reference to the laboratory literature.

The primary criterion for selection of the transition frequencies was the quoted accuracy of frequency measurements or calculated standard deviation (2σ) for calculated frequencies. For well behaved species, i.e. those which can be fit with well established Hamiltonians and whose spectra have been extensively measured, the calculated transition frequencies are often more accurate than any individual measurement. For this reason many of the entries in Table 2 are calculated values and identified with an asterisk (*) following the frequency entry. For several diatomic species, in particular CO, CS, and SiO, the fit-

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ting included both microwave and high resolution infrared measurements and all isotopic species were included in a simultaneous fit to the Dunham expansion. A similar analysis of the various isotopic forms of SO was carried out as described by Tiemann²⁴, however only microwave measurements were included. Analyses carried out for the polyatomic species were limited to individual isotopic forms. For several species which exhibit internal rotation, namely CH₃OH, CH₃SH, CH₃CHO, HCOOCH₃, and CH₃NH₂, the Hamiltonians currently available cannot fit the experimental data to within the accuracy of the measured data, particularly for the E symmetry state. As a result the measured frequencies are more accurate and thus preferable to calculated values.

3. Description of the Tables

As described earlier, Table 1 provides the identity of species detected in interstellar clouds and circumstellar shells. The major emphasis of the present work is to present accurate transition frequencies for all of the spectral lines observed. These transition frequencies are given in Table 2. Table 2 provides the recommended frequency in column (1). If the frequency is a calculated value, an asterisk (*) follows the value and in parentheses the uncertainty (2σ) is given for each transition frequency. The molecular identification is listed in column (2) and this is followed in column (3) by the quantum numbers identifying the upper and lower states involved in the transition. Columns (4) – (6) show the observed interstellar line antenna temperature, T_r' or T_a' , the molecular cloud source and telescope employed in the observation, respectively. The reader should note that a number of footnote labels appear in the antenna temperature column. The footnotes are listed at the end of the table. Most often the molecular cloud source is Orion A or Sagittarius B2 since these are the most prolific molecular sources. In some cases the intensities obtained from other molecular clouds are listed when these appeared to be more representative or when the observations are unique to a particular source. The telescope abbreviations shown in column (6) are defined in Table 3. In column (7) the references to the interstellar measurements are given. These generally refer to the first reported observation of the transition, but in some cases a more recent report is given when it is felt that the antenna temperatures are more reliable in the later study. However, no attempt was made to evaluate the accuracy of the temperatures quoted.

The reference codes in columns (7) and (8) employ the first three letters of the last name of the leading author, followed by the last two digits of the year of publication. This method was chosen to provide more latitude in editing the tables and references than could be achieved with the common numerical sequence system. The references to the laboratory measured frequencies are listed in column (8). If no entry appears, the values were calculated in the present work (asterisk after frequency) or were

taken from the previously published reviews^{2–23}. The list of references to Table 2 directly follows the table.

Table 3 identifies the telescope abbreviations which appear in Table 2.

3.1. Comments on the Tables

For several species there is significant improvement in the accuracy of the frequencies presented here, compared to the earlier work¹. In particular, reviews on the species CH₃CN, CH₃CH₂OH, CH₃CH₂CN, and SO₂ have provided more precise calculated transition frequencies^{20,22,23}. New laboratory data and analyses of CO, CS, SiO, OCS, and SO have also improved the calculated values for these species. Several errors in ref. 1 have been corrected. These include the frequency for the HNO $1_{01}-0_{00}$ at 81477.49 MHz rather than 81447.49 MHz, and correction of the quantum numbers for the formamide lines at 93811 MHz and 102064 MHz. Several previously unidentified lines have been assigned. These are U90146 assigned to HCOOCH₃, U101139 assigned to CH₃SH, U105577 assigned to CH₃OH, and U115383 assigned to SiC₂.

Some readers may notice several “omissions” of published interstellar observations on CH₄ and CO⁺. Fox and Jennings²⁵ reported observations of CH₄ at six frequencies. Subsequently, Elldér et al.²⁶ examined the frequency region of five of the millimeter lines reported for CH₄ and could only verify a doublet at 76702 MHz and 76711 MHz which they attribute to the $6_{24}-5_{23}$ E and A lines of methyl formate. Similarly, Snyder et al.²⁸ have examined the 4.6 GHz region with the MPI 100 m telescope and failed to detect the previously reported feature. Erickson et al.²⁷ reported the detection of the CO⁺ $J=2-1$ $F=5/2-3/2$ transition at 236.063 GHz. Recently, Blake et al.²⁹ reexamined this region for transitions of ¹³CH₃OH and assigned the 236.063 GHz line to the $5_{-2}-4_{-2}$ and $5_{-2}-4_{-1}$ E transitions of ¹³CH₃OH. Thus, there appears to be little evidence remaining for the identification of these species in the microwave spectral region. The identification of HNO and NaOH are questioned by a number of workers due to the limited number of transitions observed.

A substantial number of interstellar transitions which were originally reported as unidentified were subsequently assigned in later studies by the original authors and others. Attempts were made to footnote these when the assignments are not given in the references cited for a given transition. As a last note, the unidentified line U18148 reported by Henkel et al. (Hen83) was not confirmed by recent more sensitive measurements by Matthews and co-workers³⁰.

4. Acknowledgments

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5. References

- ¹F.J. Lovas, L.E. Snyder, and D.R. Johnson, "Recommended Rest Frequencies for Observed Interstellar Molecular Transitions." *Astrophys. J. Suppl. Series* **41**, 451 (1979).
- ²D.R. Johnson, F.J. Lovas, and W.H. Kirchhoff, "Microwave Spectra of Molecules of Astrophysical Interest. I. Formaldehyde, Formamide, and Thioformaldehyde." *J. Phys. Chem. Ref. Data* **1**, 1011 (1972).
- ³W.H. Kirchhoff, D.R. Johnson, and F.J. Lovas, "Microwave Spectra of Molecules of Astrophysical Interest. II. Methylenimine." *J. Phys. Chem. Ref. Data* **2**, 1 (1973).
- ⁴R.M. Lees, F.J. Lovas, W.H. Kirchhoff, and D.R. Johnson, "Microwave Spectra of Molecules of Astrophysical Interest. III. Methanol." *J. Phys. Chem. Ref. Data* **2**, 205 (1973).
- ⁵P. Helmlinger, F.C. DeLucia, and W.H. Kirchhoff, "Microwave Spectra of Molecules of Astrophysical Interest. IV. Hydrogen Sulfide." *J. Phys. Chem. Ref. Data* **2**, 215 (1973).
- ⁶F.C. DeLucia, P. Helmlinger, and W.H. Kirchhoff, "Microwave Spectra of Molecules of Astrophysical Interest. V. Water Vapor." *J. Phys. Chem. Ref. Data* **3**, 211 (1974).
- ⁷A.G. Maki, "Microwave Spectra of Molecules of Astrophysical Interest. VI. Carbonyl Sulfide and Hydrogen Cyanide." *J. Phys. Chem. Ref. Data* **3**, 221 (1974).
- ⁸F.J. Lovas, and P. Krupenie, "Microwave Spectra of Molecules of Astrophysical Interest. VII. Carbon Monoxide, Carbon Monosulfide, and Silicon Monoxide." *J. Phys. Chem. Ref. Data* **3**, 245 (1974).
- ⁹E. Tiemann, "Microwave Spectra of Molecules of Astrophysical Interest. VIII. Sulfur Monoxide." *J. Phys. Chem. Ref. Data* **3**, 259 (1974).
- ¹⁰A. Bauder, F.J. Lovas, and D.R. Johnson, "Microwave Spectra of Molecules of Astrophysical Interest. IX. Acetaldehyde." *J. Phys. Chem. Ref. Data* **5**, 53 (1976).
- ¹¹G. Winnewisser, W.H. Hocking, and M.C.L. Gerry, "Microwave Spectra of Molecules of Astrophysical Interest. X. Isocyanic Acid." *J. Phys. Chem. Ref. Data* **5**, 79 (1976).
- ¹²E. Tiemann, "Microwave Spectra of Molecules of Astrophysical Interest. XI. Silicon Sulfide." *J. Phys. Chem. Ref. Data* **5**, 1147 (1976).
- ¹³R.A. Beaudet, and R.L. Poynter, "Microwave Spectra of Molecules of Astrophysical Interest. XII. Hydroxyl Radical." *J. Phys. Chem. Ref. Data* **7**, 311 (1978).
- ¹⁴W.J. Lafferty, and F.J. Lovas, "Microwave Spectra of Molecules of Astrophysical Interest. XIII. Cyanoacetylene." *J. Phys. Chem. Ref. Data* **7**, 441 (1978).
- ¹⁵M.C.L. Gerry, K. Yamada, and G. Winnewisser, "Microwave Spectra of Astrophysical Interest. XIV. Vinyl Cyanide (Acrylonitrile)." *J. Phys. Chem. Ref. Data* **8**, 107 (1979).
- ¹⁶A. Bauer, D. Boucher, J. Burie, J. Demaison, and A. Dubrulle, "Microwave Spectra of Molecules of Astrophysical Interest. XV. Propyne." *J. Phys. Chem. Ref. Data* **8**, 537 (1979).
- ¹⁷A. Bauder, "Microwave Spectra of Molecules of Astrophysical Interest. XVI. Methyl Formate." *J. Phys. Chem. Ref. Data* **8**, 583 (1979).
- ¹⁸F.J. Lovas, H. Lutz, and H. Dreizler, "Microwave Spectra of Molecules of Astrophysical Interest. XVII. Dimethyl Ether." *J. Phys. Chem. Ref. Data* **8**, 1051 (1979).
- ¹⁹E. Willemot, D. Dangoisse, N. Mannanteuil, and J. Bellet, "Microwave Spectra of Molecules of Astrophysical Interest. XVIII. Formic Acid," *J. Phys. Chem. Ref. Data* **9**, 59 (1980).
- ²⁰D. Boucher, J. J. Burie, A. Bauer, A. Dubrulle, and J. Demaison, "Microwave Spectra of Molecules of Astrophysical Interest. XIX. Methyl Cyanide." *J. Phys. Chem. Ref. Data* **9**, 659 (1980).
- ²¹I. Ozier, M.C.L. Gerry, and A.G. Robiette, "Microwave Spectra of Molecules of Astrophysical Interest. XX. Methane." *J. Phys. Chem. Ref. Data* **10**, 1085 (1981).
- ²²F.J. Lovas, "Microwave Spectra of Molecules of Astrophysical Interest. XXI. Ethanol (C_2H_5OH) and Propionitrile (C_3H_5CN)."*J. Phys. Chem. Ref. Data* **11**, 251 (1982).
- ²³F.J. Lovas, "Microwave Spectra of Molecules of Astrophysical Interest. XXII. Sulfur Dioxide (SO_2)."*J. Phys. Chem. Ref. Data* **14**, 395 (1985).
- ²⁴E. Tiemann, "Isotope Shifts of the Molecular Parameters in the $X^3\Sigma^-$ State of Sulfur Monoxide." *J. Mol. Spectrosc.* **91**, 60 (1982).
- ²⁵K. Fox, and D.E. Jennings, "Methane Detected in Orion A." *Astrophys. J. (Letters)* **226**, L43 (1978).
- ²⁶See reference Eri80 in the references to Table 2.
- ²⁷See reference Eri81 in the references to Table 2.
- ²⁸T.L. Wilson, and L.E. Snyder, "On the Evidence for Methane in Orion KL: A Search for the 4.6 GHz Line." *Astrophys. J. (Letters)* **290**, L63 (1985).
- ²⁹See reference Bla84 in the references to Table 2.
- ³⁰H.E. Matthews, private communication, August 1984.

TABLE 1. A listing by empirical formula of the isotopic forms of the interstellar molecules which appear in Table 2

| Empirical formula | Name | Isotopic species | Number of transitions observed ^a | Source of spectral data ^b |
|--------------------------------|------------------------------------|-----------------------------------|---|--------------------------------------|
| CH | Methylidyne radical | CH | 5 | c |
| CHN | Hydrogen cyanide | HCN | 6 | 7 |
| | | H ¹³ CN | 3 | |
| | | HC ¹⁵ N | 3 | |
| | | DCN | 7 | |
| CHN | Hydrogen isocyanide | HNC | 4 | c |
| | | H ¹⁵ NC | 1 | |
| | | HN ¹³ C | 4 | |
| | | DNC | 3 | |
| CHNO | Isocyanic acid | HNCO | 29 | 11 |
| CHNS | Thioisocyanic acid | HNCS | 5 | c |
| CHO | Formyl radical | HCO | 8 | c |
| CHO ⁺ | Formylum | HCO ⁺ | 3 | c,e |
| | | H ¹³ CO ⁺ | 3 | |
| | | HC ¹⁷ O ⁺ | 1 | |
| | | HC ¹⁸ O ⁺ | 2 | |
| | | DCO ⁺ | 4 | |
| | | D ¹³ CO ⁺ | 1 | |
| CHO ⁺ | HOC ⁺ ion | HOC ⁺ | 1 | c |
| CHO ₂ ⁺ | HOCO ⁺ ion | HOCO ⁺ | 3 | c,e |
| CHS ⁺ | Thioformylum | HCS ⁺ | 5 | c,e |
| CH ₂ N ₂ | Cyanamide | NH ₂ CN | 9 | c,e |
| CH ₂ O | Formaldehyde (methanal) | H ₂ CO | 24 | c,e,(2) ^d |
| | | H ₂ ¹³ CO | 11 | |
| | | H ₂ C ¹⁸ O | 1 | |
| | | HDCO | 7 | |
| CH ₂ O ₂ | Formic acid | HCOOH | 18 | 19 |
| CH ₂ S | Thioformaldehyde | H ₂ CS | 21 | c,e,(2) |
| | | H ₂ ¹³ CS | 3 | |
| | | H ₂ C ³⁴ S | 1 | |
| CH ₃ N | Methylenimine | CH ₂ NH | 5 | 3 |
| | | ¹³ CH ₂ NH | 1 | |
| CH ₃ NO | Formamide | NH ₂ CHO | 33 | e,(2) |
| | | NH ₂ ¹³ CHO | 1 | |
| CH ₄ O | Methanol (methyl alcohol) | CH ₃ OH ^f | 183 | c,4 |
| | | ¹³ CH ₃ OH | 19 | |
| | | CH ₃ OD | 2 | |
| CH ₄ S | Methyl mercaptan (methanethiol) | CH ₃ SH | 11 | c |
| CH ₃ N | Methylamine | CH ₃ NH ₂ | 10 | c |
| CN | Cyanogen radical | CN | 21 | c |
| | | ¹³ CN | 6 | |
| CO | Carbon monoxide | CO | 9 | e,(8) |
| | | ¹³ CO | 3 | |
| | | C ¹⁷ O | 4 | |
| | | C ¹⁸ O | 2 | |
| | | ¹³ C ¹⁸ O | 1 | |
| COS | Carbonyl sulfide | OCS | 14 | c,e,(7) |
| | | O ¹³ CS | 5 | |
| | | OC ³⁴ S | 5 | |
| CS | Carbon monosulfide | CS | 8 | e,(8) |
| | | ¹³ CS | 4 | |
| | | C ³³ S | 4 | |
| | | C ³⁴ S | 6 | |
| C ₂ H | Ethyne radical | HC ₂ | 14 | c |
| | | DC ₂ | 3 | |

TABLE 1. A listing by empirical formula of the isotopic forms of the interstellar molecules which appear in Table 2 — Continued

| Empirical formula | Name | Isotopic species | Number of transitions observed ^a | Source of spectral data ^b |
|---------------------------------|---|------------------------------------|---|--------------------------------------|
| C ₂ H ₂ O | Ketene | CH ₂ CO | 22 | e |
| C ₂ H ₃ N | Acetonitrile | CH ₃ CN ^f | 103 | |
| | | ¹³ CH ₃ CN | 4 | |
| | | CH ₃ ¹³ CN | 6 | |
| C ₂ H ₄ O | Acetaldehyde | CH ₃ CHO | 34 | c,e10 |
| C ₂ H ₄ O | Methyl formate | HCOOCH ₃ | 277 | e,17 |
| C ₂ H ₆ O | Ethanol (ethyl alcohol) | CH ₃ CH ₂ OH | 21 | 22 |
| C ₂ H ₆ O | Dimethyl ether | CH ₃ OCH ₃ | 90 | 18 |
| C ₂ Si | Silacyclop propane | SiC ₂ | 10 | c |
| C ₃ H | C ₃ H radical | HC ₃ | 12 | c |
| C ₃ HN | Cyanoacetylene | HC ₃ N ^f | 47 | 14 |
| | | H ¹³ CCCN | 9 | |
| | | HC ¹³ CCN | 7 | |
| | | HCC ¹³ CN | 6 | |
| | | DC ₃ N | 4 | |
| C ₃ H ₂ | Cyclopropenylidene | CH ₂ C ₂ | 10 | c |
| C ₃ H ₃ N | Acrylonitrile (vinyl cyanide) | CH ₂ CHCN | 89 | c,15 |
| C ₃ H ₄ | Propyne (methyl acetylene) | CH ₃ CCH | 42 | 16 |
| C ₃ H ₅ N | Propionitrile (ethyl cyanide) | CH ₃ CH ₂ CN | 162 | 22 |
| C ₃ N | Cyanoethynyl radical | C ₃ N | 20 | c |
| C ₃ O | Tricarbon monoxide | C ₃ O | 4 | c |
| C ₄ H | Butadiynyl radical | HC ₄ | 31 | c |
| C ₄ H ₃ N | 2-butylenenitrile | CH ₃ CCCN | 7 | e |
| C ₄ HN | Cyanobutadiyne | HC ₃ N | 34 | c,e |
| | | DC ₃ N | 2 | |
| C ₅ H ₄ | Penta-1,3-diyne (methyl diacetylene) | CH ₃ C ₄ H | 4 | e |
| C ₅ HN | Cyanohexatriyne | HC ₇ N | 9 | c,e |
| C ₆ HN | Cyanoctatrayne | HC ₉ N | 4 | e |
| C ₁₁ HN | Cyanodecapentyne | HC ₁₁ N | 3 | c |
| HNO | Nitroxyl hydride | HNO | 1 | c |
| HN ₂ ⁺ | Diazenylium | N ₂ H ⁺ | 8 | c |
| | | N ₂ D ⁺ | 5 | |
| | | ¹⁵ NNH ⁺ | 1 | |
| | | N ¹⁵ NH ⁺ | 3 | |
| HNaO | Sodium hydroxyde | NaOH | 2 | e |
| HO | Hydroxyl radical | OH | 17 | 13 |
| | | ¹⁷ OH | 2 | |
| | | ¹⁸ OH | 4 | |
| H ₂ O | Water | H ₂ O | 3 | c,(6) |
| | | HDO | 5 | |
| H ₂ S | Hydrogen sulfide | H ₂ S | 2 | c,(5) |
| H ₃ N | Ammonia | NH ₃ | 41 | c |
| | | ¹⁵ NH ₃ | 6 | |
| | | NH ₂ D | 8 | |
| NO | Nitric oxide | NO | 4 | c |
| NS | Nitric sulfide | NS | 4 | c |

TABLE 1. A listing by empirical formula of the isotopic forms of the interstellar molecules which appear in Table 2 — Continued

| Empirical formula | Name | Isotopic species | Number of transitions observed ^a | Source of spectral data ^b |
|-------------------|---------------------|---|---|--------------------------------------|
| OS | Sulfur monoxide | SO ³⁴ SO ³³ SO S ¹⁸ O | 20 12 1 2 | e,(9) |
| OSi | Silicon monoxide | SiO ^f ²⁹ SiO ³⁰ SiO | 18 3 2 | e,(8) |
| O ₂ S | Sulfur dioxide | SO ₂ ^f ³⁴ SO ₂ | 83 27 | 23 |
| SSi | Silicon monosulfide | SiS Si ³⁴ S ²⁹ SiS ³⁰ SiS | 11 1 2 1 | 12 |
| U | Unidentified | --- | 172 | c |

^aOnly resolved lines are enumerated in the table. When a blend of several transitions was reported, e.g. for hyperfine structure, only one line was counted.

^bThese notes and references provide the source of the transition frequencies and spectral assignments for the entries in Table 2.

^cSee the laboratory literature references given for the entries in Table 2.

^dThe references shown in parentheses were not used directly for the transition frequencies, but are given for completeness.

^eTransition frequencies were calculated from least squares fitting of the literature data in the present work.

^fVibrationally excited states of this species are also observed.

TABLE 2. Recommended rest frequencies for observed interstellar molecular lines

| Frequency unc. | Formula | Quantum numbers | T_r (K) | Source | Telescope | Astr. Ref. | Lab. Ref. |
|----------------|-----------------------------------|--|-----------|---------|-----------|------------|-----------|
| | | | T_a (K) | | | | |
| 701.679 (4) | CH | $^2\Pi_{3/2} J=3/2 F=2-2$ | -0.6 | W51 | Arecibo | 350m | Ziu85 |
| 724.791 (4) | CH | $^2\Pi_{3/2} J=3/2 F=1-1$ | -0.5 | W51 | Arecibo | 350m | Ziu85 |
| 834.267 (2) | CH ₃ OH | 1(1)-1(1) A | 0.58 | Sgr A | NRAO | 43m | Bal70 |
| 1065.075 (5) | CH ₃ CHO | 1(1,0)-1(1,1) A | 0.3 | Sgr A | NRAO | 43m | Got73 |
| 1371.709*(2) | HC ₂ CHCN | 2(1,1)-2(1,2) F=1-1 | 0.012 | Sgr B2 | Parkes | 64m | Gar75 |
| 1371.794*(2) | HC ₂ CHCN | 2(1,1)-2(1,2) F=3-3 | 0.034 | Sgr B2 | Parkes | 64m | Gar75 |
| 1371.947*(2) | HC ₂ CHCN | 2(1,1)-2(1,2) F=2-2 | 0.019 | Sgr B2 | Parkes | 64m | Gar75 |
| 1538.113*(1) | NH ₂ CHO | 1(1,0)-1(1,1) F=1-1 | 0.08 | Sgr B2 | NRAO | 43m | Got73a |
| 1538.678*(1) | NH ₂ CHO | 1(1,0)-1(1,1) F=1-2 | 0.09 | Sgr B2 | NRAO | 43m | Got73a |
| 1539.265*(1) | NH ₂ CHO | 1(1,0)-1(1,1) F=2-1 | 0.10 | Sgr B2 | NRAO | 43m | Got73a |
| 1539.526*(1) | NH ₂ CHO | 1(1,0)-1(1,1) F=1-0 | 0.08 | Sgr B2 | NRAO | 43m | Got73a |
| 1539.831*(1) | NH ₂ CHO | 1(1,0)-1(1,1) F=2-2 | 0.36 | Sgr B2 | NRAO | 43m | Got73a |
| 1540.994*(1) | NH ₂ CHO | 1(1,0)-1(1,1) F=0-1 | 0.10 | Sgr B2 | NRAO | 43m | Got73a |
| 1570.805 (5) | NH ₂ ¹³ CHO | 1(1,0)-1(1,1) F=2-2 | 0.04 | Sgr B2 | Parkes | 64m | Gar80 |
| 1584.274 (2) | ¹⁸ OH | $^2\Pi_{3/2} J=3/2 F=1-2$ | -0.05 | Sgr B2 | Parkes | 64m | Wil81a |
| 1610.249 (3) | HCOOCH ₃ | 1(1,0)-1(1,1) A | 0.07 | Sgr B2 | Parkes | 64m | Bro75 |
| 1610.906 (3) | HCOOCH ₃ | 1(1,0)-1(1,1) E | 0.061 | Sgr B2 | MPI | 100m | Chu75 |
| 1612.2310 (2) | OH | $^2\Pi_{3/2} J=3/2 F=1-2$ | -0.80 | OriMC-2 | Parkes | 64m | Gar64 |
| 1624.518 (10) | ¹⁷ OH | $^2\Pi_{3/2} J=3/2 F, F_1=7/2, 4-7/2, 4$ | -0.045 | Sgr A | Parkes | 64m | Gar76 |
| 1626.161 (10) | ¹⁷ OH | $^2\Pi_{3/2} J=3/2 F, F_1=9/2, 4-9/2, 4$ | -0.056 | Sgr A | Parkes | 64m | Gar76 |
| 1637.564 (2) | ¹⁸ OH | $^2\Pi_{3/2} J=3/2 F=1-1$ | -0.2 | Sgr A | Parkes | 64m | Gar70 |
| 1638.805 (3) | HCOOH | 1(1,0)-1(1,1) | 0.04 | Sgr B2 | NRAO | 43m | Zuc71 |
| 1639.503 (2) | ¹⁸ OH | $^2\Pi_{3/2} J=3/2 F=2-2$ | -0.5 | Sgr A | Parkes | 64m | Gar70 |
| 1665.4018 (1) | OH | $^2\Pi_{3/2} J=3/2 F=1-1$ | -5.15 | OriMC-2 | NRAO | 43m | Wei68 |
| 1667.3590 (1) | OH | $^2\Pi_{3/2} J=3/2 F=2-2$ | -6.30 | OriMC-2 | NRAO | 43m | Wei63 |
| 1692.795 (2) | ¹⁸ OH | $^2\Pi_{3/2} J=3/2 F=2-1$ | -0.04 | Sgr B2 | Parkes | 64m | Whi81 |
| 1720.5300 (1) | OH | $^2\Pi_{3/2} J=3/2 F=2-1$ | -1.10 | OriMC-2 | Parkes | 64m | Gar64 |
| 2661.61 *(5) | HC ₅ N | 1-0 F=1-1 | 0.020 | Sgr B2 | Parkes | 64m | Bro76 |
| 2662.87 *(5) | HC ₅ N | 1-0 F=2-1 | 0.036 | Sgr B2 | Parkes | 64m | Bro76 |
| 2664.76 *(5) | HC ₅ N | 1-0 F=0-1 | 0.023 | Sgr B2 | Parkes | 64m | Bro76 |
| 3139.402*(1) | H ₂ CS | 2(1,1)-2(1,2) | -0.33 | Sgr B2 | Parkes | 64m | Sin73 |
| 3195.167 (10) | CH ₃ CHO | 2(1,1)-2(1,2) A | 0.2 | Sgr B2 | Parkes | 64m | Fou74 |
| 3263.794 (3) | CH | $^2\Pi_{1/2} J=1/2 F=0-1$ | 0.24 | Cas A | OSO | 25.6m | Ryd76 |
| 3335.481 (2) | CH | $^2\Pi_{1/2} J=1/2 F=1-1$ | 0.25 | Cas A | OSO | 25.6m | Ryd76 |
| 3349.193 (3) | CH | $^2\Pi_{1/2} J=1/2 F=1-0$ | 0.18 | Cas A | OSO | 25.6m | Ryd74 |
| 4388.7786 (3) | H ₂ C ¹⁸ O | 1(1,0)-1(1,1) F=1-0 | b | Sgr B2 | Parkes | 64m | Gar71a |
| 4388.7960*(4) | H ₂ C ¹⁸ O | 1(1,0)-1(1,1) F=0-1 | b | Sgr B2 | Parkes | 64m | Gar71a |
| 4388.7963 (2) | H ₂ C ¹⁸ O | 1(1,0)-1(1,1) F=2-2 | n.r.c | Sgr B2 | Parkes | 64m | Gar71a |
| 4388.8011 (2) | H ₂ C ¹⁸ O | 1(1,0)-1(1,1) F=2-1 | b | Sgr B2 | Parkes | 64m | Gar71a |
| 4388.8035 (3) | H ₂ C ¹⁸ O | 1(1,0)-1(1,1) F=1-2 | b | Sgr B2 | Parkes | 64m | Gar71a |
| 4388.8084 (3) | H ₂ C ¹⁸ O | 1(1,0)-1(1,1) F=1-1 | b | Sgr B2 | Parkes | 64m | Gar71a |
| 4592.9563 (1) | H ₂ ¹³ CO | 1(1,0)-1(1,1)1/2, 1/2-1/2, 3/2 | b | W33 | MPI | 100m | Wil76b |
| 4592.9738 (1) | H ₂ ¹³ CO | 1(1,0)-1(1,1)1/2, 1/2-3/2, 3/2 | b | W33 | MPI | 100m | Wil76b |
| 4592.9759 (3) | H ₂ ¹³ CO | 1(1,0)-1(1,1)3/2, 1/2-1/2, 3/2 | -0.1b | W33 | MPI | 100m | Wil76b |
| 4592.9857 (1) | H ₂ ¹³ CO | 1(1,0)-1(1,1)3/2, 1/2-5/2, 3/2 | b | W33 | MPI | 100m | Wil76b |
| 4592.9934 (1) | H ₂ ¹³ CO | 1(1,0)-1(1,1)3/2, 1/2-3/2, 3/2 | b | W33 | MPI | 100m | Wil76b |
| 4593.0494 (2) | H ₂ ¹³ CO | 1(1,0)-1(1,1)1/2, 1/2-1/2, 1/2 | b | W33 | MPI | 100m | Wil76b |
| 4593.0690 (1) | H ₂ ¹³ CO | 1(1,0)-1(1,1)3/2, 1/2-1/2, 1/2 | b | W33 | MPI | 100m | Wil76b |
| 4593.0800 (3) | H ₂ ¹³ CO | 1(1,0)-1(1,1)1/2, 1/2-3/2, 1/2 | b | W33 | MPI | 100m | Wil76b |
| 4593.0812 (1) | H ₂ ¹³ CO | 1(1,0)-1(1,1)1/2, 1/2-1/2, 3/2 | b | W33 | MPI | 100m | Wil76b |
| 4593.0864 (3) | H ₂ ¹³ CO | 1(1,0)-1(1,1)3/2, 1/2-1/2, 3/2 | b | W33 | MPI | 100m | Wil76b |
| 4593.08654(5) | H ₂ ¹³ CO | 1(1,0)-1(1,1)5/2, 3/2-5/2, 3/2 | -0.55b | W33 | MPI | 100m | Wil76b |
| 4593.0942 (2) | H ₂ ¹³ CO | 1(1,0)-1(1,1)5/2, 3/2-3/2, 3/2 | b | W33 | MPI | 100m | Wil76b |
| 4593.0961 (2) | H ₂ ¹³ CO | 1(1,0)-1(1,1)3/2, 3/2-5/2, 3/2 | b | W33 | MPI | 100m | Wil76b |
| 4593.0985 (2) | H ₂ ¹³ CO | 1(1,0)-1(1,1)1/2, 3/2-3/2, 3/2 | b | W33 | MPI | 100m | Wil76b |
| 4593.0994 (3) | H ₂ ¹³ CO | 1(1,0)-1(1,1)3/2, 1/2-3/2, 1/2 | b | W33 | MPI | 100m | Wil76b |
| 4593.1039 (1) | H ₂ ¹³ CO | 1(1,0)-1(1,1)3/2, 3/2-3/2, 3/2 | b | W33 | MPI | 100m | Wil76b |
| 4593.1741 (1) | H ₂ ¹³ CO | 1(1,0)-1(1,1)1/2, 3/2-1/2, 1/2 | b | W33 | MPI | 100m | Wil76b |
| 4593.1795 (1) | H ₂ ¹³ CO | 1(1,0)-1(1,1)3/2, 3/2-1/2, 1/2 | b | W33 | MPI | 100m | Wil76b |
| 4593.2003 (1) | H ₂ ¹³ CO | 1(1,0)-1(1,1)5/2, 3/2-3/2, 1/2 | -0.1b | W33 | MPI | 100m | Wil76b |
| 4593.2046 (3) | H ₂ ¹³ CO | 1(1,0)-1(1,1)1/2, 3/2-3/2, 1/2 | b | W33 | MPI | 100m | Wil76b |
| 4593.2099 (2) | H ₂ ¹³ CO | 1(1,0)-1(1,1)3/2, 3/2-3/2, 1/2 | b | W33 | MPI | 100m | Wil76b |
| 4617.126*(1) | NH ₂ CHO | 2(1,1)-2(1,2) F=2-2 | 0.07 | Sgr B2 | NRAO | 43m | Rub71 |
| 4618.966*(1) | NH ₂ CHO | 2(1,1)-2(1,2) F=3-3 | 0.30d | Sgr B2 | NRAO | 43m | Rib73 |
| 4619.989*(1) | NH ₂ CHO | 2(1,1)-2(1,2) F=1-1 | -0.05 | Sgr B2 | NRAO | 43m | Rub71 |

TABLE 2. Recommended rest frequencies for observed interstellar molecular lines — Continued

| Frequency unc. | Formula | Quantum numbers | $T_r^*(\text{K})$ | Source | Telescope | Astr. Ref. | Lab. Ref. | |
|----------------|----------------------------------|---------------------------|-----------------------|------------|-----------|------------|---------------|---------------|
| | | | $T_s^*(\text{K})$ | | | | | |
| | OH | $^2\Pi_{1/2} J=1/2 F=0-1$ | 0.3 | Sgr B2 | NRAO | 43m | Tha70 Rad68 | |
| | OH | $^2\Pi_{1/2} J=1/2 F=1-1$ | 0.3e | Sgr B2 | Parkes | 64m | Gar71 Rad68 | |
| | OH | $^2\Pi_{1/2} J=1/2 F=1-0$ | 1.7 | W3 | NRAO | 43m | Zuc68 Rad68 | |
| | H ₂ CO | $1(1,0)-1(1,1) F=1-0$ | -0.2 | TMC-1 | NRAO | 43m | Pal69 Kuk75 | |
| | H ₂ CO | $1(1,0)-1(1,1) F=0-1$ | b | TMC-1 | NRAO | 43m | Pal69 Kuk75 | |
| | H ₂ CO | $1(1,0)-1(1,1) F=2-2$ | b | TMC-1 | NRAO | 43m | Pal69 Kuk75 | |
| | H ₂ CO | $1(1,0)-1(1,1) F=2-1$ | -0.8b | TMC-1 | NRAO | 43m | Pal69 Kuk75 | |
| | H ₂ CO | $1(1,0)-1(1,1) F=1-2$ | b | TMC-1 | NRAO | 43m | Pal69 Kuk75 | |
| | H ₂ CO | $1(1,0)-1(1,1) F=1-1$ | b | TMC-1 | NRAO | 43m | Pal69 Kuk75 | |
| | HCOOH | $2(1,1)-2(1,2)$ | 0.04 | Sgr B2 | MPI | 100m | Win75 Win75 | |
| | CH ₃ OH | $3(1)-3(1) A$ | 0.05d | Sgr B2 | Parkes | 64m | Rob74 Heu73 | |
| | CH ₂ NH | $1(1,0)-1(1,1) F=0-1$ | 0.05 | Sgr B2 | Parkes | 64m | God73 | |
| | CH ₂ NH | $1(1,0)-1(1,1) F=1-0$ | b | Sgr B2 | Parkes | 64m | God73 | |
| | CH ₂ NH | $1(1,0)-1(1,1) F=2-2$ | 0.15b | Sgr B2 | Parkes | 64m | God73 | |
| | CH ₂ NH | $1(1,0)-1(1,1) F=2-1$ | b | Sgr B2 | Parkes | 64m | God73 | |
| | CH ₂ NH | $1(1,0)-1(1,1) F=1-2$ | 0.07b | Sgr B2 | Parkes | 64m | God73 | |
| | CH ₂ NH | $1(1,0)-1(1,1) F=1-1$ | 0.05 | Sgr B2 | Parkes | 64m | God73 | |
| | HC ₃ N | $2-1 F=2-2$ | 0.01 | Sgr B2 | Parkes | 64m | Gar78a Gar78a | |
| | HC ₃ N | $2-1 F=1-0$ | b | Sgr B2 | Parkes | 64m | Gar78a Gar78a | |
| | HC ₃ N | $2-1 F=2-1$ | b | Sgr B2 | Parkes | 64m | Gar78a Gar78a | |
| | HC ₃ N | $2-1 F=3-2$ | 0.044 | Sgr B2 | Parkes | 64m | Gar78a Gar78a | |
| | HC ₃ N | $2-1 F=1-1$ | 0.01 | Sgr B2 | Parkes | 64m | Gar78a Gar78a | |
| | OH | $^2\Pi_{3/2} J=5/2 F=2-3$ | -0.12 | G291.3-0.7 | Parkes | 64m | Whi76 Rad68 | |
| | OH | $^2\Pi_{3/2} J=5/2 F=2-2$ | 7 | W3(OH) | NRAO | 43m | Zuc72a Mee75 | |
| | OH | $^2\Pi_{3/2} J=5/2 F=3-3$ | 20 | W3(OH) | NRAO | 43m | Zuc72a Mee75 | |
| | OH | $^2\Pi_{3/2} J=5/2 F=3-2$ | 0.04 | W33 | MPI | 100m | Gar83 Bea78 | |
| | H ₂ CS | $3(1,2)-3(1,3)$ | n.r. | Sgr B2 | ARO | 46m | Mac75 | |
| | CH ₃ CHO | $3(1,2)-3(1,3)$ | n.r. | Sgr B2 | ARO | 46m | Mac75 | |
| | HC ₇ N | $7-6 F=6-5$ | b | TMC-1 | NEROC | 37m | Rod80 Rod80 | |
| | HC ₇ N | $7-6 F=7-6$ | 0.006b | TMC-1 | NEROC | 37m | Rod80 Rod80 | |
| | HC ₇ N | $7-6 F=8-7$ | b | TMC-1 | NEROC | 37m | Rod80 Rod80 | |
| | HC ₅ N | $3-2 F=2-1$ | 0.040 | TMC-1 | NEROC | 37m | Rod80 Rod80 | |
| | HC ₅ N | $3-2 F=3-2$ | 0.039 | TMC-1 | NEROC | 37m | Rod80 Rod80 | |
| | HC ₅ N | $3-2 F=4-3$ | 0.055 | TMC-1 | NEROC | 37m | Rod80 Rod80 | |
| | OH | $^2\Pi_{1/2} J=5/2 F=2-2$ | 0.13f | W3(OH) | NEROC | 37m | Bal71 Bal71 | |
| | CH ₃ NH ₂ | $2(0,2)-1(0,1) F=1-0 Aa$ | 0.05 | Sgr B2 | Parkes | 64m | Fou74a Lov85 | |
| | CH ₃ NH ₂ | $2(0,2)-1(0,1) F=3-2 Aa$ | 0.18 | Sgr B2 | Parkes | 64m | Fou74a Lov85 | |
| | CH ₃ NH ₂ | $2(0,2)-1(0,1) F=2-2 Aa$ | 0.04b | Sgr B2 | Parkes | 64m | Fou74a Lov85 | |
| | CH ₃ NH ₂ | $2(0,2)-1(0,1) F=1-1 Aa$ | b | Sgr B2 | Parkes | 64m | Fou74a Lov85 | |
| | CH ₃ NH ₂ | $2(0,2)-1(0,1) F=2-1 Aa$ | 0.1 | Sgr B2 | Parkes | 64m | Fou74a Lov85 | |
| | H ¹³ CCCN | $1-0 F=1-1$ | 0.039 | Sgr B2 | MPI | 100m | Chu77 | |
| | H ¹³ CCCN | $1-0 F=2-1$ | 0.080 | Sgr B2 | MPI | 100m | Chu77 | |
| | H ¹³ CCCN | $1-0 F=0-1$ | 0.025 | Sgr B2 | MPI | 100m | Chu77 | |
| | HC ₃ N | 8-7 | 0.16 | TMC-1 | MPI | 100m | Tol81 | |
| | HC ¹³ CN | $1-0 F=1-1$ | 0.025 | Sgr B2 | MPI | 100m | Chu77 | |
| | HCC ¹³ CN | $1-0 F=1-1$ | n.r. | Sgr B2 | MPI | 100m | Chu77 | |
| | HCC ¹³ CN | $1-0 F=2-1$ | 0.055 | Sgr B2 | MPI | 100m | Chu77 | |
| | HCC ¹³ CN | $1-0 F=2-1$ | 0.05 | Sgr B2 | MPI | 100m | Chu77 | |
| | HC ₃ N | $1-0 F=1-1$ | 0.82 | Sgr B2 | MPI | 100m | Chu77 deZ71 | |
| | HC ₃ N | $1-0 F=2-1$ | 2.11 | Sgr B2 | MPI | 100m | Chu77 deZ71 | |
| | HC ₃ N | $1-0 F=0-1$ | 0.16 | Sgr B2 | MPI | 100m | Chu77 deZ71 | |
| | CH ₃ OCH ₃ | $2(0,2)-1(1,1) AA$ | b | Sgr B2 | Parkes | 64m | Win76 Win76 | |
| | CH ₃ OCH ₃ | $2(0,2)-1(1,1) EE$ | 0.05bg | Sgr B2 | Parkes | 64m | Win76 Win76 | |
| | CH ₃ OCH ₃ | $2(0,2)-1(1,1) AE+EA$ | b | Sgr B2 | Parkes | 64m | Win76 Win76 | |
| | NH ₂ CHO | $3(1,2)-3(1,3) F=3-3$ | 0.055 | Sgr B2 | NRAO | 43m | God84 | |
| | NH ₂ CHO | $3(1,2)-3(1,3) F=4-4$ | 0.080 | Sgr B2 | NRAO | 43m | God84 | |
| | NH ₂ CHO | $3(1,2)-3(1,3) F=2-2$ | b | Sgr B2 | NRAO | 43m | God84 | |
| U | 9486.71 | unidentified | 0.025 | TMC-1 | NRAO | 43m | Mat83a | |
| U | 9493.061*(4) | C ₄ H | $1-0 J=3/2-1/2 F=1-0$ | 0.090 | TMC-1 | NRAO | 43m | Bel83a Got83 |
| U | 9496.4(1) | unidentified | 0.008 | CasA | NRAO | 43m | Bel83 | |
| | 9497.616*(2) | C ₄ H | $1-0 J=3/2-1/2 F=2-1$ | 0.245 | TMC-1 | NRAO | 43m | Bel83a Got83 |
| | 9508.005*(4) | C ₄ H | $1-0 J=3/2-1/2 F=1-1$ | 0.080 | TMC-1 | NRAO | 43m | Bel83a Got83 |
| | 9547.953(5) | C ₄ H | $1-0 J=1/2-1/2 F=1-0$ | 0.095 | TMC-1 | NRAO | 43m | Bel83a Gue82a |
| | 9551.717*(4) | C ₄ H | $1-0 J=1/2-1/2 F=0-1$ | 0.080 | TMC-1 | NEROC | 37m | Bel83a Got83 |

TABLE 2. Recommended rest frequencies for observed interstellar molecular lines — Continued

| Frequency unc. | Formula | Quantum numbers | $T_e^*(\text{K})$ | $T_a^*(\text{K})$ | Source | Telescope | Astr. Ref. | Lab. Ref. |
|----------------|---------------------------------|----------------------------------|---------------------------|-------------------|-----------|-----------|------------|---------------|
| | C ₂ H | 1-0 $J=1/2-1/2 F=1-1$ | 0.115 | | TMC-1 | NRAO | 43m | Bel83a Got83 |
| | C ₃ N | 1-0 $J=3/2-1/2 F=5/2-3/2$ | 0.02 | | TMC-1 | ARO | 46m | Mac81a Gue82a |
| | HC ₂ N | 9-8 | 0.08 | | TMC-1 | ARO | 46m | Kro78 |
| | HC ₃ N | 18-17 | 0.021 | | TMC-1 | ARO | 46m | Bro78 |
| | H ₂ CS | 4(1,3)-4(1,4) | -0.040 | | Sgr B2 | ARO | 46m | Doh74 |
| | CH ₃ CHO | 4(1,3)-4(1,4) A | 0.021 | | Sgr B2 | ARO | 46m | Bel83b Bau76 |
| | HC ₃ N | 4-3 | 0.036 | | Sgr B2 | ARO | 46m | Ave76 |
| | SO | 1(2)-1(1) | 0.4 | | Sgr B2 | NRAO | 43m | Cla78 |
| | OH | 2 $\Pi_{3/2}$ $J=7/2 F=4-4$ | 3.2 | | W3(OH) | NRAO | 43m | Tur70 ter76 |
| | H ₂ ¹³ CO | 2(1,1)-2(1,2) | -0.47 | | Sgr B2 | MPI | 100m | Hen83a |
| | HC ₁₁ N | 41-40 | 0.014 | | TMC-1 | NRAO | 43m | Bel85 Bel85 |
| | HC ₉ N | 24-23 | 0.058 | | TMC-1 | NRAO | 43m | Bel85 Bel85 |
| | H ₂ CO | 2(1,1)-2(1,2) $F=1-1$ | b | | Sgr B2 | NRL | 26m | Eva70 Kuk75 |
| | H ₂ CO | 2(1,1)-2(1,2) $F=1-2$ | b | | Sgr B2 | NRL | 26m | Eva70 Kuk75 |
| | H ₂ CO | 2(1,1)-2(1,2) $F=3-3$ | -1.3b | | Sgr B2 | NRL | 26m | Eva70 Kuk75 |
| | H ₂ CO | 2(1,1)-2(1,2) $F=2-2$ | b | | Sgr B2 | NRL | 26m | Eva70 Kuk75 |
| | HC ₉ N | 25-24 | 0.073 | | TMC-1 | NRAO | 43m | Bro78 |
| | HC ₇ N | 13-12 | 0.06 | | TMC-1 | Parke | 64m | Gar78 |
| | SiS | 1-0 | 1.0 | | IRC+10216 | MPI | 100m | Gra81 |
| | HC ₃ N | 2-1 $F=2-2$ | b | | Sgr B2 | Parke | 64m | McG77 |
| | HC ₃ N | 2-1 $F=1-0$ | b | | Sgr B2 | Parke | 64m | McG77 |
| | HC ₃ N | 2-1 $F=2-1$ | 0.36b | | Sgr B2 | Parke | 64m | McG77 |
| | HC ₃ N | 2-1 $F=3-2$ | b | | Sgr B2 | Parke | 64m | McG77 |
| | HC ₃ N | 2-1 $F=1-2$ | b | | Sgr B2 | Parke | 64m | McG77 |
| | HC ₃ N | 2-1 $F=1-1$ | b | | Sgr B2 | Parke | 64m | McG77 |
| | C ₃ H ₂ | 1(1,0)-1(0,1) | 1.82 | | TMC-1 | NRAO | 43m | Mat85a Mat85a |
| | CH ₃ CN | 1(0)-0(0) $F=1-1$ | 0.081 | | TMC-1 | NRAO | 43m | Mat83 |
| | CH ₃ CN | 1(0)-0(0) $F=2-1$ | 0.120 | | TMC-1 | NRAO | 43m | Mat83 |
| | CH ₃ CN | 1(0)-0(0) $F=0-1$ | 0.031 | | TMC-1 | NRAO | 43m | Mat83 |
| | HC ₂ CHCN | 2(1,2)-1(1,1) $F=3-2$ | 0.021 | | TMC-1 | NRAO | 43m | Mat83a |
| | HC ₅ N | 7-6 | 0.5 | | TMC-1 | NRAO | 43m | Jen82 |
| | NH ₃ | 8(5)-8(5) | 0.39 | | OriMC-1 | MPI | 100m | Her85a Poy75 |
| | NH ₃ | 6(2)-6(2) | 0.50 | | OriMC-1 | MPI | 100m | Her85a Poy75 |
| | HC ₂ CHCN | 2(0,2)-1(0,1) $F=1-0$ | 0.010 | | TMC-1 | NRAO | 43m | Mat83a |
| | HC ₂ CHCN | 2(0,2)-1(0,1) $F=2-1$ | 0.032 | | TMC-1 | NRAO | 43m | Mat83a |
| | HC ₂ CHCN | 2(0,2)-1(0,1) $F=3-2$ | 0.045 | | TMC-1 | NRAO | 43m | Mat83a |
| U | 18968.48 | unidentified | 0.011 | | TMC-1 | NRAO | 43m | Mat83a |
| | 18968.66 | unidentified | 0.009 | | TMC-1 | NRAO | 43m | Mat83a |
| | 19014.7204(15) | C ₂ H | 2-1 $J=5/2-3/2 F=2-1$ | 0.44 | TMC-1 | NRAO | 43m | Gue82a Gue82a |
| | 19015.1435(15) | C ₂ H | 2-1 $J=5/2-3/2 F=3-2$ | 0.65 | TMC-1 | NRAO | 43m | Gue82a Gue82a |
| | 19025.107 (4) | C ₄ H | 2-1 $J=5/2-3/2 F=2-2$ | 0.048 | TMC-1 | NRAO | 43m | Gue82a Gue82a |
| | 19044.760 (4) | C ₄ H | 2-1 $J=3/2-1/2 F=1-1$ | 0.055 | TMC-1 | NRAO | 43m | Gue82a Gue82a |
| | 19054.4762(15) | C ₄ H | 2-1 $J=3/2-1/2 F=2-1$ | 0.42 | TMC-1 | NRAO | 43m | Gue82a Gue82a |
| | 19055.9468(15) | C ₄ H | 2-1 $J=3/2-1/2 F=1-0$ | 0.15 | TMC-1 | NRAO | 43m | Gue82a Gue82a |
| | 19099.656 (6) | C ₄ H | 2-1 $J=3/2-3/2 F=1-1$ | 0.039 | TMC-1 | NRAO | 43m | Gue82a Gue82a |
| | 19174.07 (6) | HC ₉ N | 33-32 | 0.003 | IRC+10216 | NRAO | 43m | Mat85 |
| | 19175.950*(10) | HC ₇ N | 17-16 | 0.465 | TMC-1 | NRAO | 43m | Mat85 |
| | 19218.465 (5) | NH ₃ | 7(4)-7(4) | 0.64 | OriMC-1 | MPI | 100m | Her85a Poy75 |
| | 19243.531 (20) | C ₃ O | 2-1 | 0.035 | TMC-1 | NRAO | 43m | Mat84 Mat84 |
| | 19262.160 (20) | CH ₃ CHO | 1(0,1)-0(0,0) E | 0.014 | TMC-1 | NRAO | 43m | Mat85 Bau76 |
| | 19265.156 (20) | CH ₃ CHO | 1(0,1)-0(0,0) A | 0.016 | TMC-1 | NRAO | 43m | Mat85 Bau76 |
| | 19426.677*(5) | HC ₂ CHCN | 2(1,1)-1(1,0) $F=2-1$ | 0.010 | TMC-1 | NRAO | 43m | Mat83a |
| | 19427.848*(5) | HC ₂ CHCN | 2(1,1)-1(1,0) $F=3-2$ | 0.021 | TMC-1 | NRAO | 43m | Mat83a |
| | 19429.120*(20) | HC ₂ CHCN | 2(1,1)-1(1,0) $F=1-0$ | 0.010 | TMC-1 | NRAO | 43m | Mat83a |
| | 19757.538 (5) | NH ₃ | 6(3)-6(3) | 1.2 | OriMC-1 | MPI | 100m | Her85a Poy75 |
| | 19780.800 (3) | C ₃ N | 2-1 $J=5/2-3/2 F=5/2-3/2$ | 0.058 | TMC-1 | NRAO | 43m | Gue82a Gue82a |
| | 19780.826 (4) | C ₃ N | 2-1 $J=5/2-3/2 F=3/2-1/2$ | 0.050 | TMC-1 | NRAO | 43m | Gue82a Gue82a |
| | 19781.094 (3) | C ₃ N | 2-1 $J=5/2-3/2 F=7/2-5/2$ | 0.094 | TMC-1 | NRAO | 43m | Gue82a Gue82a |
| | 19799.951 (5) | C ₃ N | 2-1 $J=5/2-3/2 F=3/2-1/2$ | 0.022 | TMC-1 | NRAO | 43m | Gue82a Gue82a |
| | 19800.121 (3) | C ₃ N | 2-1 $J=5/2-3/2 F=5/2-3/2$ | 0.055 | TMC-1 | NRAO | 43m | Gue82a Gue82a |
| | 19838.346 (5) | NH ₃ | 5(1)-5(1) | 0.56 | OriMC-1 | MPI | 100m | Her85a Poy75 |
| | 19967.416 (33) | CH ₃ OH | 2(1)-3(0) E | 73.2 | W3(OH) | MPI | 100m | Wil85 Wil85 |
| | 20357.226 (14) | CH ₃ C ₄ H | 5(1)-4(1) | 0.073 | TMC-1 | MPI | 100m | Wal84 Wal84 |
| | 20357.423 (14) | CH ₃ C ₄ H | 5(0)-4(0) | 0.077 | TMC-1 | MPI | 100m | Wal84 Wal84 |
| | 20371.45 (10) | NH ₃ | 5(2)-5(2) | 0.9 | SgrB2N | MPI | 100m | Wal84 Poy75 |
| | 20657.336*(4) | CH ₃ CCCN | 5(0)-4(0) | 0.043 | TMC-1 | NRAO | 43m | Bro84 |

TABLE 2. Recommended Rest Frequencies for Observed Interstellar Molecular Lines — Continued

| Frequency unc. | Formula | Quantum numbers | T_r (K) T_a (K) | Source | Telescope | Astr. Ref. | Lab. Ref. |
|-----------------|-------------------------------|----------------------------------|------------------------|-----------|-----------|---------------|--------------|
| 20719.221 (5) | NH ₃ | 8(6)-8(6) | 0.70 | OriMC-1 | MPI | 100m | Her85a Poy75 |
| 20735.452 (5) | NH ₃ | 9(7)-9(7) | 0.25 | OriMC-1 | MPI | 100m | Her85a Poy75 |
| 20804.830 (5) | NH ₃ | 7(5)-7(5) | 0.82 | OriMC-1 | MPI | 100m | Her85a Poy75 |
| 20852.527 (5) | NH ₃ | 10(8)-10(8) | 0.17 | OriMC-1 | MPI | 100m | Her85a Poy75 |
| 20970.65 (5) | CH ₃ OH $\nu_1=1$ | 10(1)-11(2) A+ | 0.2 | W3(OH) | MPI | 100m | Sny85b Lee68 |
| 20994.617 (5) | NH ₃ | 6(4)-6(4) | 1.3 | OriMC-1 | MPI | 100m | Her85a Poy75 |
| 21134.311 (5) | NH ₃ | 4(1)-4(1) | 0.94 | OriMC-1 | MPI | 100m | Her85a Poy75 |
| 21285.275 (5) | NH ₃ | 5(3)-5(3) | 2.1 | OriMC-1 | MPI | 100m | Her85a Poy75 |
| 21301.262* (1) | HC ₃ N | 8-7 | 0.031 | Sgr B2 | ARO | 46m | Bro76 |
| 21431.923* (10) | HC ₃ N | 19-18 | 0.89 | TMC-1 | NRAO | 43m | Buj81 |
| 21498.16 * (10) | HC ₃ N | 37-36 | 0.06 | TMC-1 | NRAO | 43m | Buj81 |
| 21550.31 (5) | CH ₃ OH $\nu_1=1$ | 12(2)-11(1) A- | -0.4 | W3(OH) | MPI | 100m | Sny85b Lee68 |
| 21703.3580 (2) | NH ₃ | 4(2)-4(2) | 0.6 | OriMC-1 | MPI | 100m | Nys78 Kuk70 |
| 21980.5453 (1) | HNCO | 1(0,1)-0(0,0) $F=0-1$ | 0.025 | TMC-1 | NRAO | 43m | Bro81 Kuk71 |
| 21981.4706 (1) | HNCO | 1(0,1)-0(0,0) $F=2-1$ | 0.107 | TMC-1 | NRAO | 43m | Bro81 Kuk71 |
| 21982.0854 (1) | HNCO | 1(0,1)-0(0,0) $F=1-1$ | 0.040 | TMC-1 | NRAO | 43m | Bro81 Kuk71 |
| 22235.044 (5) | H ₂ O | 6(1,6)-5(2,3) $F=7-6$ | b | W49 | NRAO | 43m | Mor73 Kuk69 |
| 22235.077 (5) | H ₂ O | 6(1,6)-5(2,3) $F=6-5$ | b | W49 | NRAO | 43m | Mor73 Kuk69 |
| 22235.120 (5) | H ₂ O | 6(1,6)-5(2,3) $F=5-4$ | 2000i | W49 | NRAO | 43m | Mor73 Kuk69 |
| 22235.253 (5) | H ₂ O | 6(1,6)-5(2,3) $F=6-6$ | b | W49 | NRAO | 43m | Mor73 Kuk69 |
| 22235.298 (5) | H ₂ O | 6(1,6)-5(2,3) $F=5-5$ | b | W49 | NRAO | 43m | Mor73 Kuk69 |
| 22624.8892 (2) | ¹³ NH ₃ | 1(1)-1(1) $F, F_1=1.5, 1-1.3, 1$ | b | OriMC-1 | MPI | 100m | Her85 Kuk67 |
| 22624.9331 (2) | ¹³ NH ₃ | 1(1)-1(1) $F, F_1=1.5, 1-0.8, 1$ | b | OriMC-1 | MPI | 100m | Her85 Kuk67 |
| 22624.9410 (2) | ¹⁵ NH ₃ | 1(1)-1(1) $F, F_1=0.5, 1-0.8, 1$ | b | OriMC-1 | MPI | 100m | Her85 Kuk67 |
| 22624.9469 (2) | ¹⁵ NH ₃ | 1(1)-1(1) $F, F_1=1.5, 2-1.5, 2$ | 0.22b | OriMC-1 | MPI | 100m | Her85 Kuk67 |
| 22649.843 (1) | ¹⁵ NH ₃ | 2(2)-2(2) | 0.36 | OriMC-1 | MPI | 100m | Her85 Kuk68 |
| 22653.022 (5) | NH ₃ | 5(4)-5(4) | 0.6 | OMC-1 | MPI | 100m | Nys78 Poy75 |
| 22688.312 (5) | NH ₃ | 4(3)-4(3) | 1.2 | OMC-1 | MPI | 100m | Nys78 Poy75 |
| 22732.429 (5) | NH ₃ | 6(5)-6(5) | 0.6 | OMC-1 | MPI | 100m | Nys78 Poy75 |
| 22789.421 (1) | ¹⁵ NH ₃ | 3(3)-3(3) | 0.53 | OriMC-1 | MPI | 100m | Her85 Kuk67 |
| 22827.767 (20) | HCOOCH ₃ | 2(1,2)-1(1,1) E | 0.15 | OriMC-1 | MPI | 100m | Chu80 |
| 22828.143* (9) | HCOOCH ₃ | 2(1,2)-1(1,1) A | 0.15 | OriMC-1 | MPI | 100m | Chu80 |
| 22834.1851 (1) | NH ₃ | 3(2)-3(2) | 0.11 | Sgr B2 | NRAO | 11m | Mor73a Kuk65 |
| 22878.949* (10) | DC ₃ N | 9-8 | 0.019 | TMC-1 | NRAO | 43m | Sch81 |
| 22924.940 (5) | NH ₃ | 7(6)-7(6) | 1.0 | OMC-1 | MPI | 100m | Nys78 Poy75 |
| 23046.0158 (2) | ¹⁵ NH ₃ | 4(4)-4(4) | 0.26 | OriMC-1 | MPI | 100m | Her85 Kuk68 |
| 23098.8190 (1) | NH ₃ | 2(1)-2(1) | 0.29 | Sgr B2 | NRAO | 11m | Mor73a Kuk70 |
| 23121.20 (10) | CH ₃ OH | 9(2)-10(1) A+ | 9.5 e | W3(OH) | MPI | 100m | Wil84 Lee68 |
| 23232.238 (5) | NH ₃ | 8(7)-8(7) | 0.2 | OMC-1 | MPI | 100m | Nys78 Poy75 |
| 23421.9823 (2) | ¹⁵ NH ₃ | 5(5)-5(5) | 0.14 | OriMC-1 | MPI | 100m | Her85 Kuk68 |
| 23444.82 (10) | CH ₃ OH | 10(1)-9(2) A- | -0.77 | W3(OH) | MPI | 100m | Men85 Lee68 |
| 23600.187 (50) | SiC ₂ | 1(0,1)-0(0,0) | 0.11 | IRC+10216 | MPI | 100m | Sny85 Sny85 |
| 23657.471 (5) | NH ₃ | 9(8)-9(8) | 0.1 | OMC-1 | MPI | 100m | NYs78 Poy75 |
| 23687.889* (10) | HC ₃ N | 21-20 | 0.21 | TMC-1 | NEROC | 37m | Kro78 |
| 23692.9265 (2) | NH ₃ | 1(1)-1(1) $F, F_1=1/2, 1-1/2, 0$ | 0.16 | L134N | OSO | 20m | Ryd77 Ryd77 |
| 23692.9688 (1) | NH ₃ | 1(1)-1(1) $F, F_1=3/2, 1-1/2, 0$ | 0.24 | L134N | OSO | 20m | Ryd77 Kuk67 |
| 23693.8722 (1) | NH ₃ | 1(1)-1(1) $F, F_1=1/2, 1-3/2, 2$ | 0.17 | L134N | OSO | 20m | Ryd77 Kuk67 |
| 23693.9051 (1) | NH ₃ | 1(1)-1(1) $F, F_1=3/2, 1-5/2, 2$ | 0.30b | L134N | OSO | 20m | Ho 77 Kuk67 |
| 23693.9145 (1) | NH ₃ | 1(1)-1(1) $F, F_1=3/2, 1-3/2, 2$ | b | L134N | OSO | 20m | Ho 77 Kuk67 |
| 23694.4591 (1) | NH ₃ | 1(1)-1(1) $F, F_1=1/2, 1-1/2, 1$ | b | L134N | OSO | 20m | Ho 77 Kuk67 |
| 23694.4700 (1) | NH ₃ | 1(1)-1(1) $F, F_1=1/2, 1-3/2, 1$ | 0.40b | L134N | OSO | 20m | Ho 77 Kuk67 |
| 23694.4709 (1) | NH ₃ | 1(1)-1(1) $F, F_1=3/2, 2-5/2, 2$ | b | L134N | OSO | 20m | Ho 77 Kuk67 |
| 23694.4803 (1) | NH ₃ | 1(1)-1(1) $F, F_1=3/2, 2-3/2, 2$ | b | L134N | OSO | 20m | Ho 77 Kuk67 |
| 23694.5014 (1) | NH ₃ | 1(1)-1(1) $F, F_1=3/2, 1-1/2, 1$ | b | L134N | OSO | 20m | Ho 77 Kuk67 |
| 23694.5060 (1) | NH ₃ | 1(1)-1(1) $F, F_1=5/2, 2-5/2, 2$ | 0.50b | L134N | OSO | 20m | Ho 77 Kuk67 |
| 23694.5123 (1) | NH ₃ | 1(1)-1(1) $F, F_1=3/2, 1-3/2, 1$ | b | L134N | OSO | 20m | Ho 77 Kuk67 |
| 23694.5153 (1) | NH ₃ | 1(1)-1(1) $F, F_1=5/2, 2-3/2, 2$ | b | L134N | OSO | 20m | Ho 77 Kuk67 |
| 23695.0672 (1) | NH ₃ | 1(1)-1(1) $F, F_1=3/2, 2-3/2, 1$ | 0.18b | L134N | OSO | 20m | Ho 77 Kuk67 |
| 23695.0782 (1) | NH ₃ | 1(1)-1(1) $F, F_1=3/2, 2-3/2, 1$ | b | L134N | OSO | 20m | Ho 77 Kuk67 |
| 23695.1132 (1) | NH ₃ | 1(1)-1(1) $F, F_1=5/2, 2-3/2, 1$ | 0.25 | L134N | OSO | 20m | Ho 77 Kuk67 |
| 23696.0297 (2) | NH ₃ | 1(1)-1(1) $F, F_1=1/2, 0-1/2, 1$ | 0.29b | L134N | OSO | 20m | Ho 77 Kuk67 |
| 23696.0406 (2) | NH ₃ | 1(1)-1(1) $F, F_1=1/2, 0-3/2, 1$ | b | L134N | OSO | 20m | Ho 77 Kuk67 |
| 23697.9 (4) | HC ₁₁ N | 70-69 | 0.006 | IRC+10216 | NEROC | 37m | Bel82 Bel82 |
| 23720.575 (5) | NH ₃ | 2(2)-2(2) $F_1=1-2$ | b | OriMC-1 | NEROC | 37m | Bar77 Kuk67 |
| 23721.336 (5) | NH ₃ | 2(2)-2(2) $F_1=3-2$ | b | OriMC-1 | NEROC | 37m | Bar77 Kuk67 |

TABLE 2. Recommended rest frequencies for observed interstellar molecular lines — Continued

| Frequency unc. | Formula | Quantum numbers | $T_e^*(\text{K})$ | $T_a^*(\text{K})$ | Source | Telescope | Astr. Ref. | Lab. Ref. |
|----------------|----------------------------------|---------------------------|-------------------|-------------------|--------|-----------|------------|-----------|
| 23722.6323(5) | NH ₃ | 2(2)-2(2) $F_1=2-2$ | b | OriMC-1 | NEROC | 37m | Bar77 | Kuk67 |
| 23722.6336(1) | NH ₃ | 2(2)-2(2) $F_1=3-3$ | 0.43j | OriMC-1 | NEROC | 37m | Bar77 | Kuk67 |
| 23722.6344(5) | NH ₃ | 2(2)-2(2) $F_1=1-1$ | b | OriMC-1 | NEROC | 37m | Bar77 | Kuk67 |
| 23723.929(5) | NH ₃ | 2(2)-2(2) $F_1=2-3$ | b | OriMC-1 | NEROC | 37m | Bar77 | Kuk67 |
| 23724.691(5) | NH ₃ | 2(2)-2(2) $F_1=2-1$ | b | OriMC-1 | NEROC | 37m | Bar77 | Kuk67 |
| 23817.6153(20) | OH | $^2\Pi_{3/2} J=9/2 F=4-4$ | -0.05 | W3(OH) | MPI | 100m | Win78 | Mee75 |
| 23826.6211(30) | OH | $^2\Pi_{3/2} J=9/2 F=5-5$ | -0.13 | W3(OH) | MPI | 100m | Win78 | Mee75 |
| 23867.805(5) | NH ₃ | 3(3)-3(3) $F_1=2-3$ | b | OriMC-1 | NEROC | 37m | Bar77 | Kuk67 |
| 23868.450(5) | NH ₃ | 3(3)-3(3) $F_1=4-3$ | b | OriMC-1 | NEROC | 37m | Bar77 | Kuk67 |
| 23870.1279(5) | NH ₃ | 3(3)-3(3) $F_1=3-3$ | b | OriMC-1 | NEROC | 37m | Bar77 | Kuk67 |
| 23870.1296(1) | NH ₃ | 3(3)-3(3) $F_1=4-4$ | 0.53j | OriMC-1 | NEROC | 37m | Bar77 | Kuk67 |
| 23870.1302(5) | NH ₃ | 3(3)-3(3) $F_1=2-2$ | b | OriMC-1 | NEROC | 37m | Bar77 | Kuk67 |
| 23871.807(5) | NH ₃ | 3(3)-3(3) $F_1=3-4$ | b | OriMC-1 | NEROC | 37m | Bar77 | Kuk67 |
| 23872.453(5) | NH ₃ | 3(3)-3(3) $F_1=3-2$ | b | OriMC-1 | NEROC | 37m | Bar77 | Kuk67 |
| 23922.3132(2) | ¹⁵ NH ₃ | 6(6)-6(6) | 0.13 | OriMC-1 | MPI | 100m | Her85 | Kuk68 |
| 23963.901*(2) | HC ₅ N | 9-8 | 1.2 | TMC-1 | SRCAL | 25m | Lit77 | |
| 24037.1(1) | HC ₁₁ N | 71-70 | 0.006 | IRC+10216 | NEROC | 37m | Bel82 | Bel82 |
| 24139.4169(1) | NH ₃ | 4(4)-4(4) | 0.25j | OriMC-1 | NEROC | 37m | Bar77 | Kuk70 |
| 24205.287(5) | NH ₃ | 10(9)-10(9) | 0.1 | OriMC-1 | MPI | 100m | Nys78 | Poy75 |
| 24296.523(20) | HCOOCH ₃ | 2(0,2)-1(0,1) E | 0.09 | OriMC-1 | NRAO | 43m | Chu80 | Bau79 |
| 24298.476(20) | HCOOCH ₃ | 2(0,2)-1(0,1) A | 0.12 | OriMC-1 | NRAO | 43m | Chu80 | Bau79 |
| 24325.927(1) | OCS | 2-1 | 0.30 | Sgr B2 | NEROC | 37m | Gol81 | Wan73 |
| 24375.2(2) | HC ₁₁ N | 72-71 | 0.006 | IRC+10216 | NEROC | 37m | Bel82 | Bel82 |
| 24428.652(3) | CH ₃ C ₄ H | 6(1)-5(1) | 0.107 | TMC-1 | MPI | 100m | Wal84 | Wal84 |
| 24428.886(16) | CH ₃ C ₄ H | 6(0)-5(0) | 0.131 | TMC-1 | MPI | 100m | Wal84 | Wal84 |
| 24532.9887(1) | NH ₃ | 5(5)-5(5) | 0.09j | OriMC-1 | NEROC | 37m | Bar77 | Kuk70 |
| 24788.539*(5) | CH ₃ CCCN | 6(1)-5(1) | 0.048 | TMC-1 | NEROC | 37m | Bro84 | |
| 24788.778*(5) | CH ₃ CCCN | 6(0)-5(0) | 0.076 | TMC-1 | NEROC | 37m | Bro84 | |
| 24815.869*(10) | HC ₇ N | 22-21 | 0.24 | TMC-1 | SRCAL | 25m | Lit78 | |
| 24928.70(10) | CH ₃ OH | 3(2)-3(1) E | 1.2 | OriMC-1 | NEROC | 37m | Bar75 | Lee73 |
| 24933.468(2) | CH ₃ OH | 4(2)-4(1) E | 1.0i | OriMC-1 | NEROC | 37m | Bar71 | Gai74 |
| 24934.382(5) | CH ₃ OH | 2(2)-2(1) E | 0.35 | OriMC-1 | NEROC | 37m | Bar75 | Gai74 |
| 24959.080(2) | CH ₃ OH | 5(2)-5(1) E | 1.1i | OriMC-1 | NEROC | 37m | Bar71 | Gai74 |
| 25018.123(2) | CH ₃ OH | 6(2)-6(1) E | 1.7i | OriMC-1 | NEROC | 37m | Bar71 | Gai74 |
| 25056.025(5) | NH ₃ | 6(6)-6(6) | 0.17j | OriMC-1 | NEROC | 37m | Bar77 | Kak75 |
| 25124.873(2) | CH ₃ OH | 7(2)-7(1) E | 1.5i | OriMC-1 | NEROC | 37m | Bar71 | Gai74 |
| 25294.411(3) | CH ₃ OH | 8(2)-8(1) E | 0.7i | OriMC-1 | NEROC | 37m | Bar71 | Gai74 |
| 25421.036*(9) | DC ₅ N | 10-9 | 0.027 | TMC-1 | NEROC | 37m | Mac81 | |
| 25715.182(5) | NH ₃ | 7(7)-7(7) | 3. | OriMC-1 | MPI | 100m | Mau85 | Poy75 |
| 25878.18(10) | CH ₃ OH | 10(2)-10(1) E | 0.9 | OriMC-1 | NRL | 26m | Mat80 | Lee73 |
| 26518.981(10) | NH ₃ | 8(8)-8(8) | 0.70 | OriMC-1 | MPI | 100m | Ziu81 | Poy75 |
| 26626.534*(2) | HC ₅ N | 10-9 | 1.0 | TMC-1 | NRAO | 43m | Jen82 | |
| 27294.078*(1) | HC ₅ N | 3-2 $F=2-1$ | 0.70 | HCL2C | OSO | 20m | Cer84 | |
| 27294.295*(1) | HC ₅ N | 3-2 $F=3-2$ | 0.96 | HCL2C | OSO | 20m | Cer84 | |
| 27294.347*(1) | HC ₅ N | 3-2 $F=4-3$ | 3.400 | TMC-1 | OSO | 20m | Irv83a | |
| 27477.943(10) | NH ₃ | 9(9)-9(9) | 0.76 | OriMC-1 | MPI | 100m | Ziu81 | Poy75 |
| 28532.31(1) | C ₄ H | 3-2 $J=7/2-5/2 F=3-2$ | 0.42 | TMC-1 | OSO | 20m | Irv81 | Gue82a |
| 28532.46(1) | C ₄ H | 3-2 $J=7/2-5/2 F=4-3$ | 0.49 | TMC-1 | OSO | 20m | Irv81 | Gue82a |
| 28571.37(1) | C ₄ H | 3-2 $J=5/2-3/2 F=3-2$ | 0.39 | TMC-1 | OSO | 20m | Irv81 | Gue82a |
| 28571.53(2) | C ₄ H | 3-2 $J=5/2-3/2 F=2-1$ | 0.23 | TMC-1 | OSO | 20m | Irv81 | Gue82a |
| 28919.929*(6) | CH ₃ CCCN | 7(1)-6(1) | 0.049 | TMC-1 | OSO | 20m | Bro84 | |
| 28920.207*(6) | CH ₃ CCCN | 7(0)-6(0) | 0.053 | TMC-1 | OSO | 20m | Bro84 | |
| 28974.781(3) | H ₂ CO | 3(1,2)-3(1,3) $F=2-2$ | b | Sgr B2 | n.r. | | Wel70 | Tak59 |
| 28974.804(2) | H ₂ CO | 3(1,2)-3(1,3) $F=4-4$ | n.r.b | Sgr B2 | n.r. | | Wel70 | Tak59 |
| 28974.814(3) | H ₂ CO | 3(1,2)-3(1,3) $F=3-3$ | b | Sgr B2 | n.r. | | Wel70 | Tak59 |
| 29676.14(2) | C ₃ N | 3-2 $J=7/2-5/2 F=7/2-5/2$ | 0.11 | TMC-1 | OSO | 20m | Fri80 | Gue82a |
| 29676.28(2) | C ₃ N | 3-2 $J=7/2-5/2 F=9/2-7/2$ | 0.11 | TMC-1 | OSO | 20m | Fri80 | Gue82a |
| 29678.877*(18) | ³⁴ SO | 1(0)-0(1) | 0.25 | L134N | OSO | 20m | Ryd80 | |
| 29694.99(2) | C ₃ N | 3-2 $J=5/2-3/2 F=3/2-1/2$ | 0.04 | TMC-1 | OSO | 20m | Fri80 | Gue82a |
| 29695.14(2) | C ₃ N | 3-2 $J=5/2-3/2 F=7/2-5/2$ | 0.15 | TMC-1 | OSO | 20m | Fri80 | Gue82a |
| 30001.539*(18) | SO | 1(0)-0(1) | 0.44 | Sgr B2 | NRAO | 11m | Got78 | |
| 31105.26(10) | CH ₃ OCH ₃ | 2(1,1)-2(0,2) AE+EA | b | OriMC-1 | NRL | 26m | Sny74 | Sny74 |
| 31106.20(5) | CH ₃ OCH ₃ | 2(1,1)-2(0,2) EE | 0.2b | OriMC-1 | NRL | 26m | Sny74 | Sny74 |
| 31107.12(10) | CH ₃ OCH ₃ | 2(1,1)-2(0,2) AA | b | OriMC-1 | NRL | 26m | Sny74 | Sny74 |
| 31583.706*(6) | HC ₇ N | 28-27 | 0.30 | TMC-1 | OSO | 20m | Sne81 | |

TABLE 2. Recommended rest frequencies for observed interstellar molecular lines — Continued

| Frequency unc. | Formula | Quantum numbers | $T_r^*(\text{K})$ | Source | Telescope | Astr. Ref. | Lab. Ref. | |
|----------------|----------------|------------------------------------|---------------------------------|--------|-----------|------------|-----------|--------|
| | | | $T_a^*(\text{K})$ | | | | | |
| | 31951.777*(2) | HC ₃ N | 12-11 | 1.77 | TMC-1 | OSO | 20m | Sne81 |
| | 32627.221*(60) | C ₃ H | $^2\Pi_{1/2} J=3/2-1/2, F=2-1b$ | 0.28 | TMC-1 | OSO | 20m | Tha85 |
| | 32634.336*(60) | C ₃ H | $^2\Pi_{1/2} J=3/2-1/2, F=1-0b$ | 0.13 | TMC-1 | OSO | 20m | Tha85 |
| | 32660.614*(60) | C ₃ H | $^2\Pi_{1/2} J=3/2-1/2, F=2-1a$ | 0.35 | TMC-1 | OSO | 20m | Tha85 |
| | 32663.312(60) | C ₃ H | $^2\Pi_{1/2} J=3/2-1/2, F=1-0a$ | 0.17 | TMC-1 | OSO | 20m | Tha85 |
| | 33051.302*(6) | CH ₃ CCCN | 8(1)-7(1) | 0.043 | TMC-1 | OSO | 20m | Bro84 |
| | 33051.621*(6) | CH ₃ CCCN | 8(0)-7(0) | 0.057 | TMC-1 | OSO | 20m | Bro84 |
| | 34182.761*(1) | CH ₃ CCH | 2(1)-1(1) | 0.20 | TMC-1 | OSO | 20m | Irv81 |
| | 34183.414*(1) | CH ₃ CCH | 2(0)-1(0) | 0.25 | TMC-1 | OSO | 20m | Irv81 |
| | 34614.386*(2) | HC ₃ N | 13-12 | 1.50 | TMC-1 | OSO | 20m | Sne81 |
| | 36169.24(10) | CH ₃ OH | 4(-1)-3(0) E | 12.5 | Sgr B2 | NRAO | 11m | Lov76 |
| | 36202.040*(32) | SO | 2(3)-2(2) | 0.4 | OriMC-1 | Parkes | 64m | Bro80 |
| | 36309.629(3) | SiS | 2-1 | 0.5 | IRC+10216 | MPI | 100m | Gra81 |
| | 36392.238*(1) | HC ₃ N | 4-3 $F=3-2$ | b | Sgr B2 | Parkes | 64m | McG77 |
| | 36392.332*(1) | HC ₃ N | 4-3 $F=4-3$ | 1.25b | Sgr B2 | Parkes | 64m | McG77 |
| | 36392.365*(1) | HC ₃ N | 4-3 $F=5-4$ | b | Sgr B2 | Parkes | 64m | McG77 |
| | 36793.739*(1) | CH ₃ CN | 2(1)-1(1) $F=2-1$ | b | Sgr B2 | Parkes | 64m | Bla77 |
| | 36794.204*(1) | CH ₃ CN | 2(0)-1(0) $F=2-2$ | b | Sgr B2 | Parkes | 64m | Bla77 |
| | 36794.340*(1) | CH ₃ CN | 2(1)-1(1) $F=2-2$ | b | Sgr B2 | Parkes | 64m | Bla77 |
| | 36794.417*(1) | CH ₃ CN | 2(0)-1(0) $F=1-0$ | b | Sgr B2 | Parkes | 64m | Bla77 |
| | 36795.024*(1) | CH ₃ CN | 2(1)-1(1) $F=3-2$ | 0.98b | Sgr B2 | Parkes | 64m | Bla77 |
| | 36795.475*(1) | CH ₃ CN | 2(0)-1(0) $F=2-1$ | b | Sgr B2 | Parkes | 64m | Bla77 |
| | 36795.568*(1) | CH ₃ CN | 2(0)-1(0) $F=3-2$ | b | Sgr B2 | Parkes | 64m | Bla77 |
| | 36796.348*(1) | CH ₃ CN | 2(1)-1(1) $F=1-0$ | b | Sgr B2 | Parkes | 64m | Bla77 |
| | 36797.584*(1) | CH ₃ CN | 2(0)-1(0) $F=1-1$ | b | Sgr B2 | Parkes | 64m | Bla77 |
| | 37276.985*(3) | HC ₃ N | 14-13 | 2.09 | TMC-1 | NRO | 45m | Suz84a |
| U | 40880.0 | unidentified | | 0.07 | Sgr B2 | NRAO | 11m | Kut80 |
| | 42215.539*(5) | DC ₃ N | 5-4 $F=4-3$ | b | TMC-1 | FCRAO | 14m | Lan80 |
| | 42215.590*(5) | DC ₃ N | 5-4 $F=5-4$ | 0.14b | TMC-1 | FCRAO | 14m | Lan80 |
| | 42215.613*(5) | DC ₃ N | 5-4 $F=6-5$ | b | TMC-1 | FCRAO | 14m | Lan80 |
| | 42519.379*(17) | SiO | 1-0 $v=3$ | 2.0 | VX Sgr | IRT | 13.7m | Sca78 |
| | 42602.153*(3) | HC ₃ N | 16-15 | 0.40 | TMC-1 | NEROC | 37m | Irv83 |
| | 42674.205*(21) | HCS ⁺ | 1-0 | 0.085 | TMC-1 | NEROC | 37m | Irv83 |
| | 42820.587*(15) | SiO | 1-0 $v=2$ | 15i | VY CMa | NRAO | 11m | Buh74 |
| | 43122.080*(12) | SiO | 1-0 $v=1$ | 29i | OriMC-1 | NRAO | 11m | Sny75 |
| | 43423.858*(10) | SiO | 1-0 $v=0$ | 0.50 | OriMC-1 | NEROC | 37m | Sny78 |
| U | 43962.998*(2) | HNCO | 2(0,2)-1(0,1) $F=3-2$ | ~1b | Sgr B2 | NRAO | 11m | Sny72 |
| | 43963.042*(2) | HNCO | 2(0,2)-1(0,1) $F=2-1$ | b | Sgr B2 | NRAO | 11m | Sny72 |
| | 44069.49(10) | CH ₃ OH | 7(0)-6(1) A+ | 3.9 | SgrB2 | NRO | 45m | Mor85 |
| | 45264.721*(3) | HC ₃ N | 17-16 | 0.83 | TMC-1 | NRAO | 11m | Buj81 |
| | 45379.00(2) | unidentified | | 2.06 | TMC-1 | NRO | 45m | Suz84 |
| | 45490.264*(1) | HC ₃ N | 5-4 $F=4-3$ | b | Sgr B2 | NRAO | 11m | Mor76 |
| | 45490.316*(1) | HC ₃ N | 5-4 $F=5-4$ | 2.05j | Sgr B2 | NRAO | 11m | Mor76 |
| | 45490.340*(1) | HC ₃ N | 5-4 $F=6-5$ | b | Sgr B2 | NRAO | 11m | Mor76 |
| | 46247.578*(8) | ¹³ CS | 1-0 | 0.148 | Sgr B2 | NRAO | 11m | Tur73 |
| | 46755.62*(2) | C ₂ H ₂ | 2(1,1)-2(0,2) | 1.00 | TMC-1 | NRO | 45m | Suz85 |
| U | 47927.275*(3) | HC ₃ N | 18-17 | 1.50 | TMC-1 | NRO | 45m | Suz84a |
| | 48108.504(20) | C ₃ O | 5-4 | 0.158 | TMC-1 | NRO | 45m | Suz84a |
| | 48206.956*(7) | C ³⁴ S | 1-0 | 0.380 | DR21 (OH) | NRAO | 11m | Tur73 |
| | 48284.521*(8) | H ₂ CO | 4(1,3)-4(1,4) | 0.63 | OriMC-1 | NRAO | 11m | Hol77 |
| | 48372.4670(2) | CH ₃ OH | 1(0)-0(0) A+ | 0.44 | OriMC-1 | NRAO | 11m | Hol77 |
| | 48377.09(50) | CH ₃ OH | 1(0)-0(0) E | 0.29 | OriMC-1 | NRAO | 11m | Lee73 |
| | 48583.264(10) | C ³³ S | 1-0 $F=1/2-3/2$ | b | Sgr B2 | NRAO | 11m | Tur73 |
| | 48585.906(10) | C ³³ S | 1-0 $F=5/2-3/2$ | ~0.12b | Sgr B2 | NRAO | 11m | Moc55 |
| | 48589.068(10) | C ³³ S | 1-0 $F=3/2-3/2$ | b | Sgr B2 | NRAO | 11m | Tur73 |
| | 48651.6043(10) | OCS | 4-3 | 0.45 | Sgr B2 | NRAO | 11m | Dub80 |
| U | 48990.964*(9) | CS | 1-0 | 3.53 | OriMC-1 | NRAO | 11m | Tur73 |
| | 68972.154*(4) | SO ₂ | 6(1,5)-6(0,6) | 0.8 | OriMC-1 | NRAO | 11m | Joh76 |
| | 69464.094*(9) | SO ₂ | 14(4,10)-15(3,13) | 0.70 | OriMC-1 | OSO | 20m | Sch83 |
| | 69534.310*(12) | CH ₃ CH ₂ CN | 8(1,8)-7(1,7) | 0.20 | OriMC-1 | OSO | 20m | Joh84 |
| | 69575.927*(3) | SO ₂ | 1(1,1)-0(0,0) | 0.6 | OriMC-1 | NRAO | 11m | Joh76 |
| | 69607.15(10) | CH ₃ OH | $\nu_1=1?$ 9(1)-10(2) A+ | 0.30 | OriMC-1 | OSO | 20m | Joh84 |
| | 69653.586*(5) | SO ₂ | 3(2,2)-4(1,3) | 0.60 | OriMC-1 | OSO | 20m | Sch83 |
| | 70733.213*(52) | D ¹³ CO ⁺ | 1-0 | 0.079 | TMC-1 | BTL | 7m | Gue82b |
| | 71024.781*(4) | H ₂ ¹³ CO | 1(0,1)-0(0,0) | 0.06 | OriMC-1 | BTL | 7m | Kah84 |

TABLE 2. Recommended rest frequencies for observed interstellar molecular lines — Continued

| Frequency unc. | Formula | Quantum numbers | $T_r^*(\text{K})$ | Source | Telescope | Astr. Ref. | Lab. Ref. |
|----------------|----------------|------------------------------------|--------------------------|--------|-----------|------------|-----------------|
| | | | $T_a^*(\text{K})$ | | | | |
| | 71971.61 *(14) | $\text{CH}_3\text{CH}_2\text{OH}$ | 10(1,9)-10(0,10) | 0.05 | Sgr B2 | BTL | 7m Cum85 |
| | 72039.331*(13) | DCO^+ | 1-0 | 0.87 | L134 | NRAO | 11m Hol76 |
| | 72108.609*(11) | $\text{CH}_3\text{CH}_2\text{CN}$ | 8(2,6)-7(2,5) | 0.07 | Sgr B2 | BTL | 7m Cum85 |
| | 72409.092*(12) | H_2CO | 5(1,4)-5(1,5) | 0.1 | OriMC-1 | NRAO | 11m Wil73 |
| | 72413.4843(10) | DCN | 1-0 $F_1=1-1 F=1-0,1,2$ | b | OriMC-1 | NRAO | 11m Wil73 DeL69 |
| | 72413.5143(10) | DCN | 1-0 $F_1=1-1 F=2-1,2$ | 0.2b | OriMC-1 | NRAO | 11m Wil73 DeL69 |
| | 72413.5584(10) | DCN | 1-0 $F_1=1-1 F=0-0,1$ | b | OriMC-1 | NRAO | 11m Wil73 DeL69 |
| | 72414.9054(10) | DCN | 1-0 $F_1=2-1 F=1-0,1,2$ | b | OriMC-1 | NRAO | 11m Wil73 DeL69 |
| | 72414.9270(10) | DCN | 1-0 $F_1=2-1 F=2-1,2$ | 0.25b | OriMC-1 | NRAO | 11m Wil73 DeL69 |
| | 72414.9732(10) | DCN | 1-0 $F_1=2-1 F=3-2$ | b | OriMC-1 | NRAO | 11m Wil73 Del69 |
| | 72417.0297(10) | DCN | 1-0 $F_1=0-1 F=1-0,1,2$ | 0.2 | OriMC-1 | NRAO | 11m Wil73 Del69 |
| | 72475.074*(11) | HC^{13}CCN | 8-7 | 0.08 | IRC+10216 | OSO | 20m Joh84 |
| | 72482.056*(5) | HCC^{13}CN | 8-7 | 0.08 | IRC+10216 | OSO | 20m Joh84 |
| | 72618.102*(10) | SiS | 4-3 | 0.77 | IRC+10216 | OSO | 20m Joh84 |
| | 72668.123*(24) | SO_2 | 26(4,22)-25(5,21) | 0.30 | OriMC-1 | OSO | 20m Sch83 |
| | 72680.848*(88) | HCOOCH_3 | 6(2,5)-5(2,4) E | 0.18 | OriMC-1 | OSO | 20m Joh84 |
| | 72685.581*(20) | HCOOCH_3 | 6(2,5)-5(2,4) A | 0.18 | OriMC-1 | OSO | 20m Joh84 |
| U | 72721. | unidentified | | 0.15 | OriMC-1 | OSO | 20m Joh84 |
| | 72758.242*(2) | SO_2 | 6(0,6)-5(1,5) | 0.8 | OriMC-1 | NRAO | 11m Joh76 |
| | 72758.242*(2) | SO_2 | 6(0,6)-5(1,5) | 3.40 | OriMC-1 | OSO | 20m Sch83 |
| | 72783.824*(2) | HC_3N | 8-7 | 2.29 | Sgr B2 | NRAO | 11m Mor76 |
| | 72837.950*(5) | H_2CO | 1(0,1)-0(0,0) | 0.5 | OriMC-1 | TAO | 6m Aka74 |
| | 72962.731*(23) | $\text{HC}_3\text{N} \nu_7=1$ | 8-7 1e | 0.15 | OriMC-1 | OSO | 20m Joh84 |
| | 72976.7794(10) | OCS | 6-5 | 0.25 | Sgr B2 | TAO | 6m Aka74 Dub80 |
| | 73044.01 (10) | CH_3NH_2 | 5(1,5)-5(0,5) $F=4-4$ | b | Sgr B2 | TAO | 6m Kai74 Kai74 |
| | 73044.20 (10) | CH_3NH_2 | 5(1,5)-5(0,5) $F=6-6$ | 0.5b | Sgr B2 | TAO | 6m Kai74 Kai74 |
| | 73045.15 (10) | CH_3NH_2 | 5(1,5)-5(0,5) $F=5-5$ | b | Sgr B2 | TAO | 6m Kai74 Kai74 |
| | 73081.190*(8) | $\text{CH}_3\text{CH}_2\text{OH?}$ | 4(2,2)-4(1,3) | 0.10 | Sgr B2 | BTL | 7m Cum85 |
| | 73466.93 *(10) | CH_3OCH_3 | 10(2,8)-10(1,9) EA + AE | b | OriMC-1 | OSO | 20m Joh84 |
| | 73468.71 *(5) | CH_3OCH_3 | 10(2,8)-10(1,9) EE | 0.20b | OriMC-1 | OSO | 20m Joh84 |
| | 73470.49 *(5) | CH_3OCH_3 | 10(2,8)-10(1,9) AA | b | OriMC-1 | OSO | 20m Joh84 |
| | 73577.453*(2) | CH_3CN | 4(3)-3(3) | 0.83 | OriMC-1 | OSO | 20m Joh84 |
| | 73584.545*(2) | CH_3CN | 4(2)-3(2) | 1.00 | OriMC-1 | OSO | 20m Joh84 |
| | 73588.801*(2) | CH_3CN | 4(1)-3(1) | 2.20b | OriMC-1 | OSO | 20m Joh84 |
| | 73590.220*(2) | CH_3CN | 4(0)-3(0) | b | OriMC-1 | OSO | 20m Joh84 |
| | 73664.38 *(12) | HCOOCH_3 | 6(5,2)-5(5,1) E | b | OriMC-1 | OSO | 20m Joh84 |
| | 73665.596*(25) | HCOOCH_3 | 6(5,2)-5(5,1) A | 0.15b | OriMC-1 | OSO | 20m Joh84 |
| | 73665.736*(25) | HCOOCH_3 | 6(5,1)-5(5,0) A | b | OriMC-1 | OSO | 20m Joh84 |
| | 73720.51 *(15) | CH_3OCH_3 | 9(2,7)-9(1,8) AE + EA | b | OriMC-1 | OSO | 20m Joh84 |
| | 73722.40 *(5) | CH_3OCH_3 | 9(2,7)-9(1,8) EE | 0.25b | OriMC-1 | OSO | 20m Joh84 |
| | 73724.28 *(4) | CH_3OCH_3 | 9(2,7)-9(1,8) AA | b | OriMC-1 | OSO | 20m Joh84 |
| | 73782.91 *(10) | HCOOCH_3 | 6(4,2)-5(4,1) E | b | OriMC-1 | OSO | 20m Joh84 |
| | 73784.523*(20) | HCOOCH_3 | 6(4,3)-5(4,2) A | 0.15b | OriMC-1 | OSO | 20m Joh84 |
| | 73787.88 *(10) | HCOOCH_3 | 6(4,3)-5(4,2) E | b | OriMC-1 | OSO | 20m Joh84 |
| | 73796.793*(20) | HCOOCH_3 | 6(4,2)-5(4,1) A | 0.10 | OriMC-1 | OSO | 20m Joh84 |
| | 73842. (1) | $\text{CH}_3\text{OH} \nu_7=1?$ | 9(1)-10(2) A- | 0.30 | OriMC-1 | OSO | 20m Joh84 |
| | 74149.26 *(14) | CH_3OCH_3 | 11(2,9)-11(1,10) EA + AE | b | OriMC-1 | OSO | 20m Joh84 |
| | 74150.95 *(9) | CH_3OCH_3 | 11(2,9)-11(1,10) EE | 0.30b | OriMC-1 | OSO | 20m Joh84 |
| | 74152.64 *(5) | CH_3OCH_3 | 11(2,9)-11(1,10) AA | b | OriMC-1 | OSO | 20m Joh84 |
| | 74263.58 *(13) | HCOOCH_3 | 6(3,3)-5(3,2) E | 0.15 | OriMC-1 | OSO | 20m Joh84 |
| | 74296.755*(19) | HCOOCH_3 | 6(3,3)-5(3,2) A | 0.20 | OriMC-1 | OSO | 20m Joh84 |
| | 74404.579*(39) | 34SO2 | 6(0,6)-5(1,5) | 0.30 | OriMC-1 | OSO | 20m Sch83 |
| | 74551.989*(4) | HC_3N | 28-27 | 0.30 | IRC+10216 | OSO | 20m Joh84 |
| | 74747.51 *(16) | CH_3OCH_3 | 8(2,6)-8(1,7) AE + EA | b | OriMC-1 | OSO | 20m Joh84 |
| | 74749.50 *(10) | CH_3OCH_3 | 8(2,6)-8(1,7) EE | 0.20b | OriMC-1 | OSO | 20m Joh84 |
| | 74751.49 *(4) | CH_3OCH_3 | 8(2,6)-8(1,7) AA | b | OriMC-1 | OSO | 20m Joh84 |
| | 74866.514*(16) | SO_2 | 24(6,18)-25(5,21) | 0.20 | OriMC-1 | OSO | 20m Sch83 |
| | 74891.643*(34) | $\text{CH}_3\text{CHO?}$ | 4(1,4)-3(1,3) A | 0.13 | Sgr B2 | BTL | 7m Cum85 |
| | 74926.336*(57) | $\text{CH}_3\text{CHO?}$ | 4(1,4)-3(1,3) E | 0.07 | Sgr B2 | BTL | 7m Cum85 |
| | 74976.040*(8) | $\text{CH}_3\text{CH}_2\text{OH}$ | 3(1,3)-2(0,2) | 0.23 | Sgr B2 | BTL | 7m Cum85 |
| | 75399.248*(6) | NaOH | 3-2 | 0.04 | Sgr B2 | NRAO | 11m Wil81 |
| | 75515.35 (10) | CH_3OH | 13(-5)-14(-4) E | 0.37 | OriMC-1 | OSO | 20m Joh84 Sas84 |
| | 75585.695*(17) | HC_2CHCN | 8(0,8)-7(0,7) | 0.10 | Sgr B2 | BTL | 7m Cum85 |
| | 75656. | unidentified | | 0.12 | OriMC-1 | OSO | 20m Joh84 |
| | 75816.45 (5) | CH_3SH | 3(-1)-2(-1) E | ~0.05 | Sgr B2 | BTL | 7m Lin79 Lee80 |

TABLE 2. Recommended rest frequencies for observed interstellar molecular lines — Continued

| Frequency unc. | Formula | Quantum numbers | T_r (K) T_a (K) | Source | Telescope | Astr. Ref. | Lab. Ref. |
|----------------|----------------|------------------------------------|------------------------------|--------|-----------|---------------|-----------------|
| | | | | | | | |
| | 75838.866*(16) | HC ₂ CHCN? | 8(2,7)-7(2,6) | 0.06 | Sgr B2 | BTL | 7m Cum85 |
| | 75862.87 (5) | CH ₃ SH | 3(0)-2(0) A | 0.19b | Sgr B2 | BTL | 7m Lin79 Lee80 |
| | 75864.43 (5) | CH ₃ SH | 3(0)-2(0) E | b | Sgr B2 | BTL | 7m Lin79 Lee80 |
| | 75906.42 *(14) | CH ₃ OCH ₃ | 12(2,10)-12(1,11) AE+EA | b | OriMC-1 | OSO | 20m Joh84 |
| | 75908.03 *(10) | CH ₃ OCH ₃ | 12(2,10)-12(1,11) EE | 0.30b | OriMC-1 | OSO | 20m Joh84 |
| | 75909.65 *(7) | CH ₃ OCH ₃ | 12(2,10)-12(1,11) AA | b | OriMC-1 | OSO | 20m Joh84 |
| | 75921.978*(13) | HC ₂ CHCN? | 8(4,5)-7(4,4) | 0.06b | Sgr B2 | BTL | 7m Cum85 |
| | 75922.000*(13) | HC ₂ CHCN? | 8(4,4)-7(4,3) | b | Sgr B2 | BTL | 7m Cum85 |
| | 75926.795*(13) | HC ₂ CHCN? | 8(5)-7(5) | b | Sgr B2 | BTL | 7m Cum85 |
| | 75927.705*(14) | HC ₂ CHCN? | 8(3,6)-7(3,5) | b | Sgr B2 | BTL | 7m Cum85 |
| | 75931.857*(14) | HC ₂ CHCN? | 8(3,5)-7(3,4) | b | Sgr B2 | BTL | 7m Cum85 |
| | 75937.822*(13) | HC ₂ CHCN? | 8(6)-7(6) | 0.13 | Sgr B2 | BTL | 7m Cum85 |
| | 75987.149*(4) | DC ₃ N | 9-8 | 0.11 | TMC-1 | FCRAO | 14m Sch81 |
| U | 76090. | unidentified | | 0.10 | OriMC-1 | OSO | 20m Joh84 |
| | 76117.43 *(1) | C ₂ H | 8-7 J=17/2-15/2 | 0.17 | IRC+10216 | OSO | 20m Joh84 Got83 |
| U | 76128.895*(16) | HC ₂ CHCN | 8(2,6)-7(2,5) | 0.10 | OriMC-1 | OSO | 20m Joh84 |
| U | 76152. | unidentified | | 0.10 | OriMC-1 | OSO | 20m Joh84 |
| U | 76156.02 *(1) | C ₂ H | 8-7 J=15/2-13/2 | 0.17 | IRC+10216 | OSO | 20m Joh84 Got83 |
| U | 76168. | unidentified | | 0.12 | OriMC-1 | OSO | 20m Joh84 |
| | 76199.199 (60) | C ₂ H | 2Π _{1/2} J=7/2-5/2b | 0.12 | IRC+10216 | OSO | 20m Tha85 Tha85 |
| | 76204.501 (60) | C ₂ H | 2Π _{1/2} J=7/2-5/2a | 0.12 | IRC+10216 | OSO | 20m Tha85 Tha85 |
| | 76247.27 (19) | CH ₃ OH | 11(1)-10(2) A- | 0.6 | OriMC-1 | NRAO | 11m Jen79 Sas84 |
| | 76305.727 (50) | DNC | 1-0 | 0.34 | NGC 2264 | NRAO | 11m God77 Cre76 |
| | 76362.17 *(16) | CH ₃ OCH ₃ | 7(2,5)-7(1,6) AE+EA | b | OriMC-1 | OSO | 20m Joh84 |
| | 76364.26 *(10) | CH ₃ OCH ₃ | 7(2,5)-7(1,6) EE | 0.30b | OriMC-1 | OSO | 20m Joh84 |
| | 76366.35 *(4) | CH ₃ OCH ₃ | 7(2,5)-7(1,6) AA | b | OriMC-1 | OSO | 20m Joh84 |
| | 76412.170*(5) | SO ₂ | 10(1,9)-9(2,8) | 2.5 | OriMC-1 | OSO | 20m Sch83 |
| | 76509.67 (10) | CH ₃ OH | 5(0)-4(1) E | 0.6 | OriMC-1 | NRAO | 11m Jen79 Sas84 |
| U | 76648.6 (15) | unidentified | | 0.09 | Sgr B2 | BTL | 7m Cum85 |
| | 76701.834*(87) | HCOOCH ₃ | 6(2,4)-5(2,3) E | 0.25 | OriMC-1 | OSO | 20m Ell80 |
| | 76711.160*(20) | HCOOCH ₃ | 6(2,4)-5(2,3) A | 0.22 | OriMC-1 | OSO | 20m Ell80 |
| | 76796.094*(88) | HCOOCH ₃ | 6(1,5)-5(1,4) E | 0.22 | OriMC-1 | OSO | 20m Joh84 |
| | 76804.010*(21) | HCOOCH ₃ | 6(1,5)-5(1,4) A | 0.23 | OriMC-1 | OSO | 20m Joh84 |
| | 76866.1 *(10) | CH ₃ CHO? | 4(0,4)-3(0,3) E | 0.13 | Sgr B2 | BTL | 7m Cum85 |
| | 76878.91 *(6) | CH ₃ CHO? | 4(0,4)-3(0,3) A | 0.10 | Sgr B2 | BTL | 7m Cum85 |
| | 76972.62 *(14) | C ₂ O | 8-7 | 0.059 | TMC-1 | NRAO | 12m Bro85 |
| | 77107.86 (9) | N ₂ D ⁺ | 1-0 F ₁ =1-1 | 0.25 | L134N | NRAO | 11m Sny77 And77 |
| | 77109.61 (8) | N ₂ D ⁺ | 1-0 F ₁ =2-1 | 0.30 | L134N | NRAO | 11m Sny77 And77 |
| | 77112.2 (1) | N ₂ D ⁺ | 1-0 F ₁ =0-1 | 0.15 | L134N | NRAO | 11m Sny77 And77 |
| | 77214.361*(4) | HC ₃ N | 29-28 | 0.25 | IRC+10216 | OSO | 20m Joh84 |
| | 77633.827*(16) | HC ₂ CHCN? | 8(1,7)-7(1,6) | 0.12 | Sgr B2 | BTL | 7m Cum85 |
| U | 77978.5 (13) | unidentified | | 0.13 | Sgr B2 | BTL | 7m Cum85 |
| U | 77983. | unidentified | | 0.20 | OriMC-1 | OSO | 20m Joh84 |
| | 78183.631*(12) | CH ₃ CH ₂ CN | 9(1,9)-8(1,8) | 0.25 | OriMC-1 | OSO | 20m Joh84 |
| | 78361.41 *(15) | CH ₃ OCH ₃ | 6(2,4)-6(1,5) AE+EA | b | OriMC-1 | OSO | 20m Joh84 |
| | 78363.59 *(9) | CH ₃ OCH ₃ | 6(2,4)-6(1,5) EE | 0.25b | OriMC-1 | OSO | 20m Joh84 |
| | 78365.77 *(4) | CH ₃ OCH ₃ | 6(2,4)-6(1,5) AA | b | OriMC-1 | OSO | 20m Joh84 |
| | 78479.41 *(16) | HCOOCH ₃ | 7(1,7)-6(1,6) E | 0.75b | OriMC-1 | OSO | 20m Joh84 |
| | 78481.394*(28) | HCOOCH ₃ | 7(1,7)-6(1,6) A | 0.65b | OriMC-1 | OSO | 20m Joh84 |
| | 78856.40 *(10) | CH ₃ OCH ₃ | 13(2,11)-13(1,12) AE+EA | b | OriMC-1 | OSO | 20m Joh84 |
| | 78857.91 *(8) | CH ₃ OCH ₃ | 13(2,11)-13(1,12) EE | 0.38b | OriMC-1 | OSO | 20m Joh84 |
| | 78859.43 *(6) | CH ₃ OCH ₃ | 13(2,11)-13(1,12) AA | b | OriMC-1 | OSO | 20m Joh84 |
| | 79098.65 *(96) | CH ₃ CHO | 4(1,3)-3(1,2) E | 0.15 | Sgr B2 | BTL | 7m Cum85 |
| | 79150.131*(34) | CH ₃ CHO | 4(1,3)-3(1,2) A | 0.3 | Sgr B2 | NRAO | 11m Lis78 |
| | 79151.01 *(2) | C ₃ N | 8-7 J=17/2-15/2 | 0.27 | IRC+10216 | OSO | 20m Joh84 Got83 |
| | 79169.77 *(2) | C ₃ N | 8-7 J=15/2-13/2 | 0.27 | IRC+10216 | OSO | 20m Joh84 Got83 |
| U | 79220. | unidentified | | 0.043 | Sgr B2 | BTL | 7m Wan78 |
| U | 79221.9 (50) | unidentified | | 0.05 | Sgr B2 | BTL | 7m Cum85 |
| | 79350.476*(8) | H ¹³ CCCN | 9-8 | 0.56 | Sgr B2 | BTL | 7m Wan78 Joh76a |
| | 79449.73 (9) | NH ₂ CN | 4(1,4)-3(1,3) | 0.27 | Sgr B2 | BTL | 7m Wan78 Joh76a |
| | 79581.3 *(5) | ¹³ CH ₃ OH | 5(-1)-4(0) E | 0.15 | OriMC-1 | OSO | 20m Joh84 |
| | 79677.507*(7) | CH ₃ CH ₂ CN | 9(0,9)-8(0,8) | 0.25 | OriMC-1 | OSO | 20m Joh84 |
| | 79753.49 *(7) | CH ₃ OCH ₃ | 15(3,13)-14(4,10) AA | b | OriMC-1 | OSO | 20m Joh84 |
| | 79756.55 *(20) | CH ₃ OCH ₃ | 15(3,13)-14(4,10) EE | 0.06b | OriMC-1 | OSO | 20m Joh84 |
| | 79759.52 *(34) | CH ₃ OCH ₃ | 15(3,13)-14(4,10) EA | b | OriMC-1 | OSO | 20m Joh84 |

TABLE 2. Recommended rest frequencies for observed interstellar molecular lines — Continued

| Frequency unc. | Formula | Quantum numbers | $T_r^*(\text{K})$ | $T_a^*(\text{K})$ | Source | Telescope | Astr. Ref. | Lab. Ref. |
|---------------------|-----------------------------------|--------------------------|-------------------|-------------------|--------|-----------|------------|-----------|
| 79759.68 *(34) | CH_3OCH_3 | 15(3,13)-14(4,10) AE | b | OriMC-1 | OSO | 20m | Joh84 | |
| 79781.71 *(16) | HCOOCH_3 | 7(0,7)-6(0,6) E | 0.30b | OriMC-1 | OSO | 20m | Joh84 | |
| 79783.893*(29) | HCOOCH_3 | 7(0,7)-6(0,6) A | b | OriMC-1 | OSO | 20m | Joh84 | |
| 79876.712*(5) | HC_3N | 30-29 | 0.25 | IRC+10216 | OSO | 20m | Joh84 | |
| 79979.596 (90) | NH_2CN | 4(0,4)-3(0,3) | 0.07 | Sgr B2 | NRAO | 11m | Tur77 | Joh76a |
| 80076.606*(48) | CH_2CO | 4(1,4)-3(1,3) | 0.1 | Sgr B2 | NRAO | 11m | Tur77 | |
| 80404.898*(12) | $\text{CH}_3\text{CH}_2\text{CN}$ | 9(2,8)-8(2,7) | 0.25 | OriMC-1 | OSO | 20m | Joh84 | |
| U 80484. | unidentified | | ~0.2 | Sgr B2 | NRAO | 11m | Tur75a | |
| | NH_2CN | 4(1,3)-3(1,2) | 0.36g | Sgr B2 | NRAO | 11M | Tur75a | Joh76a |
| | CH_3OCH_3 | 5(2,3)-5(1,4) AE+EA | b | Sgr B2 | NRAO | 11m | Tur75a | Lov79 |
| | CH_3OCH_3 | 5(2,3)-5(1,4) EE | 0.2bg | Sgr B2 | NRAO | 11m | Tur75a | Lov79 |
| | CH_3OCH_3 | 5(2,3)-5(1,4) AA | b | Sgr B2 | NRAO | 11m | Tur75a | Lov79 |
| | HDO | 1(1,0)-1(1,1) | ~0.4g | OriMC-1 | NRAO | 11m | Tur75b | |
| | $\text{CH}_3\text{CH}_2\text{CN}$ | 9(6,4)-8(6,2) | b | OriMC-1 | OSO | 20m | Olo84 | |
| | $\text{CH}_3\text{CH}_2\text{CN}$ | 9(6,3)-8(6,2) | 0.3b | OriMC-1 | OSO | 20m | Olo84 | |
| | $\text{CH}_3\text{CH}_2\text{CN}$ | 9(5,4)-8(5,3) | b | OriMC-1 | OSO | 20m | Olo84 | |
| | $\text{CH}_3\text{CH}_2\text{CN}$ | 9(5,5)-8(5,4) | 0.4b | OriMC-1 | OSO | 20m | Olo84 | |
| | $\text{CH}_3\text{CH}_2\text{CN}$ | 9(7,2)-8(7,1) | b | OriMC-1 | OSO | 20m | Olo84 | |
| | $\text{CH}_3\text{CH}_2\text{CN}$ | 9(7,3)-8(7,2) | 0.2b | OriMC-1 | OSO | 20m | Olo84 | |
| | $\text{CH}_3\text{CH}_2\text{CN}$ | 9(4,6)-8(4,5) | 0.12b | OriMC-1 | NRAO | 11m | Hol80 | |
| U 80619.233*(12) | $\text{CH}_3\text{CH}_2\text{CN}$ | 9(4,5)-8(4,4) | b | OriMC-1 | NRAO | 11m | Hol80 | |
| | $\text{CH}_3\text{CH}_2\text{CN}$ | 9(3,7)-8(3,6) | 0.04 | OriMC-1 | NRAO | 11m | Hol80 | |
| | $\text{CH}_3\text{CH}_2\text{CN}$ | 9(3,6)-8(3,5) | 0.05 | OriMC-1 | NRAO | 11m | Hol80 | |
| | 80733. (1) | unidentified | 0.04 | Sgr B2 | NRAO | 11m | Hol80 | |
| | 80832.075*(51) | CH_2CO | 4(0,4)-3(0,3) | 0.1 | Sgr B2 | NRAO | 11m | Tur77 |
| 80993.16 (10) | CH_3OH | 7(2)-8(1) A- | 1.50 | OriMC-1 | OSO | 20m | Joh84 | Sas84 |
| 81261.441*(12) | $\text{CH}_3\text{CH}_2\text{CN}$ | 9(2,7)-8(2,6) | 0.40 | OriMC-1 | OSO | 20m | Joh84 | |
| 81477.49 (10) | HNO | 1(0,1)-0(0,0) | 0.033 | Sgr B2 | NRAO | 11m | Uli77 | Sai72 |
| U 81478. | unidentified | | 0.10 | IRC+10216 | OSO | 20m | Joh84 | |
| U 81506.1 (6) | unidentified | | 0.19 | Sgr B2 | BTL | 7m | Cum85 | |
| U 81507. | unidentified | | 0.10 | IRC+10216 | OSO | 20m | Joh84 | |
| 81534.125*(11) | HC^{13}CCN | 9-8 | 0.050 | Sgr B2 | BTL | 7m | Wan78 | |
| 81541.981*(5) | HCC^{13}CN | 9-8 | 0.052 | Sgr B2 | BTL | 7m | Wan78 | |
| 81586.188*(48) | CH_2CO | 4(1,3)-3(1,2) | 0.15 | Sgr B2 | NRAO | 11m | Tur77 | |
| 81653.08 (10) | CH_3OH | 18(4)-19(3) E | 0.35 | OriMC-1 | OSO | 20m | Joh84 | Sas84 |
| 81693.447*(4) | NH_2CHO | 4(1,4)-3(1,3) | 0.18 | Sgr B2 | BTL | 7m | Cum85 | |
| 81881.468*(1) | HC_3N | 9-8 | 2.51 | Sgr B2 | BTL | 7m | Wan78 | |
| 82082.730*(26) | $\text{HC}_3\text{N} \nu_7=1$ | 9-8 1e | 0.30 | OriMC-1 | OSO | 20m | Joh84 | |
| 82093.55 *(2) | C_3H_2 | 2(0,2)-1(1,1) | 0.12 | Sgr B2 | BTL | 7m | Tha85a | Tha85a |
| 82101.67 *(5) | HNCS | 7(0,7)-6(0,6) | 0.05 | Sgr B2 | NRAO | 11m | Fre79 | |
| 82124.322*(51) | SO_2 | 10(1,9)-9(2,8) | 0.10 | OriMC-1 | OSO | 20m | Joh84 | |
| 82200.372*(26) | $\text{HC}_3\text{N} \nu_7=1$ | 9-8 1f | 0.23 | OriMC-1 | OSO | 20m | Joh84 | |
| 82458.616*(12) | $\text{CH}_3\text{CH}_2\text{CN}$ | 9(1,8)-8(1,7) | 0.45 | OriMC-1 | OSO | 20m | Joh84 | |
| 82539.041*(5) | HC_3N | 31-30 | 0.13 | OriMC-1 | NRAO | 11m | Buj81 | |
| 82649.30 (10) | CH_3OCH_3 | 3(1,3)-2(0,2) AE+EA | b | OriMC-1 | NRAO | 11m | Cla79 | Cla79 |
| 82650.18 (10) | CH_3OCH_3 | 3(1,3)-2(0,2) EE | 0.2b | OriMC-1 | NRAO | 11m | Cla79 | Cla79 |
| 82651.08 (10) | CH_3OCH_3 | 3(1,3)-2(0,2) AA | b | OriMC-1 | NRAO | 11m | Cla79 | Cla79 |
| 82686.50 (10) | CH_3OCH_3 | 4(2,2)-4(1,3) AE+EA | 0.10 | OriMC-1 | NRAO | 11m | Cla79 | Cla79 |
| 82688.77 (10) | CH_3OCH_3 | 4(2,2)-4(1,3) EE | 0.12 | OriMC-1 | NRAO | 11m | Cla79 | Cla79 |
| 82691.14 (10) | CH_3OCH_3 | 4(2,2)-4(1,3) AA | 0.08 | OriMC-1 | NRAO | 11m | Cla79 | Cla79 |
| 82951.970*(10) | SO_2 | 13(4,10)-14(3,11) | 1.10 | OriMC-1 | OSO | 20m | Sch83 | |
| 82966.20 (2) | C_3H_2 | 3(1,2)-3(0,3) | 0.16 | Sgr B2 | BTL | 7m | Cum85 | Tha85a |
| 83043.782*(45) | $^{34}\text{SO}_2$ | 8(1,7)-8(0,8) | 0.50 | OriMC-1 | OSO | 20m | Sch83 | |
| 83057.99 *(48) | OC^{34}S | 7-6 | 0.040 | Sgr B2 | BTL | 7m | Gol81 | |
| 83097.53 *(11) | CH_3OCH_3 | 14(2,12)-14(1,13) AE+EA | b | OriMC-1 | OSO | 20m | Joh84 | |
| 83099.00 *(9) | CH_3OCH_3 | 14(2,12)-14(1,13) EE | 0.35b | OriMC-1 | OSO | 20m | Joh84 | |
| 83100.47 *(7) | CH_3OCH_3 | 14(2,12)-14(1,13) AA | b | OriMC-1 | OSO | 20m | Joh84 | |
| U 83163. | unidentified | | 0.12 | IRC+10216 | OSO | 20m | Joh84 | |
| | HC_2CHCN | 9(1,9)-8(1,8) | 0.20 | OriMC-1 | OSO | 20m | Joh84 | |
| | CH_3OCH_3 | 8(1,7)-7(2,6) AA | b | OriMC-1 | OSO | 20m | Joh84 | |
| | CH_3OCH_3 | 8(1,7)-7(2,6) EE | 0.17b | OriMC-1 | OSO | 20m | Joh84 | |
| | CH_3OCH_3 | 8(1,7)-7(2,6) AE+EA | b | OriMC-1 | OSO | 20m | Joh84 | |
| | SO_2 | 8(1,7)-8(0,8) | ~2 | OriMC-1 | NRAO | 11m | Sny75a | |
| | CH_3NH_2 | 5(1,5)-5(0,5) As $F=6-6$ | 0.05b | Sgr B2 | BTL | 7m | Cum85 | Tak73 |
| | CH_3NH_2 | 5(1,5)-5(0,5) As $F=5-5$ | b | Sgr B2 | BTL | 7m | Cum85 | Tak73 |

TABLE 2. Recommended rest frequencies for observed interstellar molecular lines — Continued

| Frequency unc. | Formula | Quantum numbers | $T_r^*(\text{K})$ | Source | Telescope | Astr. Ref. | Lab. Ref. |
|----------------|----------------|------------------------------------|--|--------|-----------|------------|------------------|
| | | | $T_a^*(\text{K})$ | | | | |
| U | 84219.75 *(5) | CH ₃ CHO | 2(1,2)-1(0,1) A | 0.05 | Sgr B2 | BTL | 7m Cum85 |
| | 84308. | unidentified | | 0.10 | OriMC-1 | OSO | 20m Joh84 |
| | 84320.936*(32) | SO ₂ | 32(5,27)-31(6,26) | 0.10 | OriMC-1 | OSO | 20m Joh84 |
| | 84410.68 *(12) | 34SO? | 2(2)-1(1) | 0.03 | Sgr B2 | BTL | 7m Cum85 |
| | 84423.81 (10) | CH ₃ OH | 13(-3)-14(-2) E | 0.80 | OriMC-1 | OSO | 20m Joh84 Sas84 |
| | 84449.19 *(16) | HCOOCH ₃ | 7(2,6)-6(2,5) E | 0.45 | OriMC-1 | OSO | 20m Joh84 |
| | 84454.758*(28) | HCOOCH ₃ | 7(2,6)-6(2,5) A | 0.45 | OriMC-1 | OSO | 20m Joh84 |
| U | 84505.35 | unidentified | | 0.08 | OriMC-1 | NRAO | 11m Kui77 |
| | 84521.21 (8) | CH ₃ OH | 5(-1)-4(0) E | 2.8 | Sgr B2 | NRAO | 11m Zuc72 |
| | 84542.331*(3) | NH ₂ CHO | 4(0,4)-3(0,3) | 0.21 | Sgr B2 | BTL | 7m Cum85 |
| | 84595.760*(7) | CH ₃ CH ₂ OH | 4(2,3)-4(1,4) | 0.06b | Sgr B2 | BTL | 7m Cum85 |
| | 84597.64 (10) | CH ₃ NH ₂ | 2(1)-2(0) Ea $F=2-2$ | b | Sgr B2 | BTL | 7m Cum85 Tak73 |
| | 84598.54 (10) | CH ₃ NH ₂ | 2(1)-2(0) Ea $F=3-3$ | b | Sgr B2 | BTL | 7m Cum85 Tak73 |
| | 84632.02 (10) | CH ₃ OCH ₃ | 3(2,1)-3(1,2) AE+EA | 0.14 | OriMC-1 | NRAO | 11m Cla79 |
| | 84634.40 (10) | CH ₃ OCH ₃ | 3(2,1)-3(1,2) EE | ~0.09b | OriMC-1 | NRAO | 11m Cla79 |
| | 84636.80 (10) | CH ₃ OCH ₃ | 3(2,1)-3(1,2) AA | b | OriMC-1 | NRAO | 11m Cla79 |
| | 84727.70 *(2) | C ₂ H ₂ | 3(2,2)-3(1,3) | 0.04 | Sgr B2 | BTL | 7m Cum85 Tha85a |
| | 84744.17 (10) | CH ₃ OH | 19(4)-18(5) E | 0.46b | OriMC-1 | OSO | 20m Joh84 Sas84 |
| | 84746.036*(20) | ³⁰ SiO | 2-1 $\nu=0$ | 0.08b | OriMC-1 | NRAO | 11m Cla77 |
| | 84807.797*(10) | NH ₂ CHO | 4(2,3)-3(2,2) n,t | 0.18 | Sgr B2 | NRAO | 11m Wil81 |
| | 84865.166*(9) | O ¹³ CS | 7-6 | 0.032 | Sgr B2 | BTL | 7m Gol81 |
| | 84888.996*(18) | NH ₂ CHO | 4(3,2)-3(3,1) n,t | 0.08b | Sgr B2 | NRAO | 11m Wil81 |
| | 84890.989*(18) | NH ₂ CHO | 4(3,1)-3(3,0) n,t | b | Sgr B2 | NRAO | 11m Wil81 |
| U | 84946.004*(17) | HC ₂ CHCN | 9(0,9)-8(0,8) | 0.10 | OriMC-1 | OSO | 20m Joh84 |
| | 84970. | unidentified | | 0.20 | OriMC-1 | OSO | 20m Joh84 |
| | 85093.274*(10) | NH ₂ CHO | 4(2,2)-3(2,1) | 0.12 | Sgr B2 | BTL | 7m Cum85 |
| | 85139.108*(2) | OCS | 7-6 | 0.7 | Sgr B2 | NRAO | 11m Sol73 |
| | 85162.256 (40) | HC ¹⁸ O ⁺ | 1-0 | 0.1 | L134N | BTL | 7m Lan78 Gue82b |
| U | 85201.348*(5) | HC ₃ N | 32-31 | 0.030 | IRC+10216 | BTL | 7m Gol81 |
| | 85230.6 (6) | unidentified | | 0.07 | Sgr B2 | BTL | 7m Cum85 |
| | 85265.470*(7) | CH ₃ CH ₂ OH | 6(0,6)-5(1,5) | 0.25 | Sgr B2 | NRAO | 11m Zuc75 |
| | 85302.654*(16) | HC ₂ CHCN | 9(2,8)-8(2,7) | 0.12 | Sgr B2 | BTL | 7m Cum85 |
| | 85338.89 (2) | C ₃ H ₂ | 2(1,2)-1(0,1) | 3.1 | TMC-1 | NRAO | 11m Tha81 Tha85a |
| | 85347.90 (30) | HCS ⁺ | 2-1 | 0.4 | OriMC-1 | NRAO | 11m Tha81 Gud81 |
| | 85416.762*(14) | HC ₂ CHCN | 9(4,6)-8(4,5) | 0.12b | OriMC-1 | OSO | 20m Joh84 |
| | 85416.813*(14) | HC ₂ CHCN | 9(4,5)-8(4,4) | b | OriMC-1 | OSO | 20m Joh84 |
| | 85426.932*(15) | HC ₂ CHCN | 9(3,7)-8(3,6) | 0.10 | OriMC-1 | OSO | 20m Joh84 |
| U | 85435. | unidentified | | 0.2h | Sgr B2 | NRAO | 11m Sny73 |
| | 85442.601*(1) | CH ₃ CCH | 5(3)-4(3) | 0.11 | OriMC-1 | NRAO | 11m Chu83 |
| | 85450.7660*(7) | CH ₃ CCH | 5(2)-4(2) | 0.14 | OriMC-1 | NRAO | 11m Chu83 |
| | 85455.6665*(6) | CH ₃ CCH | 5(1)-4(1) | 0.23 | OriMC-1 | NRAO | 11m Chu83 |
| | 85457.3002*(7) | CH ₃ CCH | 5(0)-4(0) | 0.28 | OriMC-1 | NRAO | 11m Chu83 |
| U | 85506. | unidentified | | 0.10 | OriMC-1 | OSO | 20m Joh84 |
| U | 85530.68 (15) | HOCO ⁺ | 4(0,4)-3(0,3) | 0.5 | Sgr B2 | NRAO | 11m Tha81 Tha81 |
| U | 85565. | unidentified | | 0.05 | IRC+10216 | OSO | 20m Joh84 |
| | 85567.97 (10) | CH ₃ OH | 6(-2)-7(-1) E | 0.3 | OriMC-1 | NRAO | 11m Lov76a Sas84 |
| | 85634.00 *(1) | C ₂ H | 9-8 $J=19/2-17/2$ | 0.08 | IRC+10216 | NRAO | 11m Gue78 Got83 |
| | 85640.456*(30) | SiO | 2-1 $\nu=2$ | 0.11 | R Cas | NRAO | 11m Cla81 |
| | 85672.57 *(1) | C ₄ H | 9-8 $J=17/2-15/2$ | 0.07 | IRC+10216 | NRAO | 11m Gue78 Got83 |
| | 85715.433*(16) | HC ₂ CHCN | 9(2,7)-8(2,6) | 0.06 | Sgr B2 | BTL | 7m Cum85 |
| | 85759.132*(20) | ²⁹ SiO | 2-1 $\nu=0$ | 0.13 | OriMC-1 | NRAO | 11m Lov76a |
| | 85919.12 *(22) | HCOOCH ₃ | 7(6,1)-6(6,0) E | 0.12 | OriMC-1 | OSO | 20m Ell80 |
| | 85924.747 (20) | NH ₂ D | 1(1,1)0 ⁺ -1(0,1)0 ⁻ $F=0-1$ | 0.40 | L183 | OSO | 20m Olb85 Bes83 |
| | 85925.684 (20) | NH ₂ D | 1(1,1)0 ⁺ -1(0,1)0 ⁻ $F=2-1$ | 0.40 | L183 | OSO | 20m Olb85 Bes83 |
| | 85926.263 (10) | NH ₂ D | 1(1,1)0 ⁺ -1(0,1)0 ⁻ | 0.14 | OriMC-1 | NRAO | 11m Tur78 Bes83 |
| | 85926.263 (10) | NH ₂ D | 1(1,1)0 ⁺ -1(0,1)0 ⁻ $F=1-1$ | b | L183 | OSO | 20m Olb85 Bes83 |
| | 85926.263 (10) | NH ₂ D | 1(1,1)0 ⁺ -1(0,1)0 ⁻ $F=2-2$ | 0.99b | L183 | OSO | 20m Olb85 Bes83 |
| | 85926.858 (20) | NH ₂ D | 1(1,1)0 ⁺ -1(0,1)0 ⁻ $F=1-2$ | 0.40 | L183 | OSO | 20m Olb85 Bes83 |
| | 85927.204*(39) | HCOOCH ₃ | 7(6,2)-6(6,1) A+E | 0.3b | OriMC-1 | OSO | 20m Ell80 |
| | 85927.210*(39) | HCOOCH ₃ | 7(6,1)-6(6,0) A | b | OriMC-1 | OSO | 20m Ell80 |
| | 85927.721 (20) | NH ₂ D | 1(1,1)0 ⁺ -1(0,1)0 ⁻ $F=1-0$ | 0.40 | L183 | OSO | 20m Olb85 Bes83 |
| | 85973.13 *(9) | CH ₃ OCH ₃ | 13(2,12)-12(3,9) AA | b | OriMC-1 | OSO | 20m Joh84 |
| | 85976.04 *(17) | CH ₃ OCH ₃ | 13(2,12)-12(3,9) EE | 0.06b | OriMC-1 | OSO | 20m Joh84 |
| | 85978.92 *(25) | CH ₃ OCH ₃ | 13(2,12)-12(3,9) EA+AEE | b | OriMC-1 | OSO | 20m Joh84 |
| | 86021.00 *(19) | HCOOCH ₃ | 7(5,2)-6(5,1) E | 0.12 | OriMC-1 | OSO | 20m Ell80 |

TABLE 2. Recommended rest frequencies for observed interstellar molecular lines — Continued

| Frequency unc. | Formula | Quantum numbers | $T_r^*(\text{K})$ | $T_a^*(\text{K})$ | Source | Telescope | Astr. Ref. | Lab. Ref. |
|-------------------|------------------------------------|-----------------------------|-------------------|-------------------|--------|-----------|------------|-----------|
| 86028.24 * (19) | HCOOCH ₃ | 7(5,3)-6(5,2) A | 0.20b | OriMC-1 | OSO | 20m | Ell80 | |
| 86029.422* (32) | HCOOCH ₃ | 7(5,3)-6(5,2) E | b | OriMC-1 | OSO | 20m | Ell80 | |
| 86030.189* (32) | HCOOCH ₃ | 7(5,2)-6(5,1) A | 0.32 | OriMC-1 | OSO | 20m | Ell80 | |
| 86054.961 (25) | HC ¹⁵ N | 1-0 | 0.80g | OriMC-1 | NRAO | 11m | Lin77 | Pea76 |
| 86074.20 (10) | CH ₃ NH ₂ | 4(1,4)-4(0,4) F=3-3 | b | Sgr B2 | NRAO | 11m | Kai74 | Tak73 |
| 86074.44 (10) | CH ₃ NH ₂ | 4(1,4)-4(0,4) F=5-5 | 0.2b | Sgr B2 | NRAO | 11m | Kai74 | Tak73 |
| 86075.43 (10) | CH ₃ NH ₂ | 4(1,4)-4(0,4) F=4-4 | b | Sgr B2 | NRAO | 11m | Kai74 | Tak73 |
| 86093.55 * (24) | SO | 2(2)-1(1) | ~1.7 | OriMC-1 | NRAO | 11m | Cla74 | |
| 86153.709* (25) | SO ₂ | 39(9,31)-40(8,32) | 0.07 | OriMC-1 | OSO | 20m | Joh84 | |
| 86210.053* (28) | HCOOCH ₃ | 7(4,4)-6(4,3) A | 0.18 | OriMC-1 | OSO | 20m | Joh84 | |
| 86223.53 * (17) | HCOOCH ₃ | 7(4,3)-6(4,2) E | 0.35b | OriMC-1 | OSO | 20m | Joh84 | |
| 86223.76 (10) | CH ₃ OCH ₃ | 2(2,0)-2(1,1) AE | b | OriMC-1 | NRAO | 11m | Cla79 | Cla79 |
| 86224.53 * (17) | HCOOCH ₃ | 7(4,4)-6(4,3) E | b | OriMC-1 | OSO | 20m | Joh84 | |
| 86225.67 (12) | CH ₃ OCH ₃ | 2(2,0)-2(1,1) EA | b | OriMC-1 | NRAO | 11m | Cla79 | Cla79 |
| 86226.728 (96) | CH ₃ OCH ₃ | 2(2,0)-2(1,1) EE | 0.28b | OriMC-1 | NRAO | 11m | Cla79 | Cla79 |
| 86228.72 (2) | CH ₃ OCH ₃ | 2(2,0)-2(1,1) AA | b | OriMC-1 | NRAO | 11m | Cla79 | Cla79 |
| 86243.442* (24) | SiO | 2-1 ν=1 | 17.4i | OriMC-1 | NRAO | 11m | Sny74a | |
| 86265.798* (27) | HCOOCH ₃ | 7(3,5)-6(3,4) A | 0.15 | OriMC-1 | OSO | 20m | Joh84 | |
| 86268.74 * (17) | HCOOCH ₃ | 7(3,5)-6(3,4) E | 0.20 | OriMC-1 | OSO | 20m | Joh84 | |
| 86338.767 (30) | H ¹³ CN | 1-0 F=1-1 | b | OriMC-1 | NRAO | 11m | Sny71 | Pea76 |
| 86340.184 (30) | H ¹³ CN | 1-0 F=2-1 | ~2b | OriMC-1 | NRAO | 11m | Sny71 | Pea76 |
| 86342.274 (30) | H ¹³ CN | 1-0 F=0-1 | b | OriMC-1 | NRAO | 11m | Sny71 | Pea76 |
| U 86360. | unidentified | | 0.10 | IRC+10216 | OSO | 20m | Joh84 | |
| U 86395.8 (15) | unidentified | | 0.06 | Sgr B2 | BTL | 7m | Cum85 | |
| U 86413. | unidentified | | 0.15 | OriMC-1 | OSO | 20m | Joh84 | |
| U 86416.9 (13) | unidentified | | 0.05 | Sgr B2 | BTL | 7m | Cum85 | |
| U 86418. | unidentified | | 0.20 | OriMC-1 | OSO | 20m | Joh84 | |
| U 86546.18 * (1) | HCOOH | 4(1,4)-3(1,3) | 0.07 | Sgr B2 | BTL | 7m | Cum85 | |
| U 86593.74 * (22) | C ₃ O | 9-8 | 0.028 | TMC-1 | FCRAO | 14m | Bro85 | |
| U 86615.76 (10) | CH ₃ OH | 7(2)-6(3) A- | 0.6 | OriMC-1 | NRAO | 11m | Lov76a | Sas84 |
| U 86639.108* (7) | SO ₂ | 8(3,5)-9(2,8) | ~0.6 | OriMC-1 | NRAO | 11m | Sny75a | |
| U 86670.82 (4) | HCO | 1(0,1)-0(0,0) 3/2-1/2 F=2-1 | 0.15 | OriMC-2 | NRAO | 11m | Sny76 | Pic78 |
| U 86708.35 (4) | HCO | 1(0,1)-0(0,0) 3/2-1/2 F=1-0 | 0.04 | Sgr B2 | BTL | 7m | Cum85 | Pic78 |
| U 86754.294 (30) | H ¹³ CO ⁺ | 1-0 | 0.6 | OriMC-1 | NRAO | 11m | Sny76a | Gue82b |
| U 86777.43 (4) | HCO | 1(0,1)-0(0,0) 1/2-1/2 F=1-1 | 0.02 | DR21 | OSO | 20m | Sch85a | Pic78 |
| U 86805.75 (4) | HCO | 1(0,1)-0(0,0) 1/2-1/2 F=0-1 | 0.02 | DR21 | OSO | 20m | Sch85a | Pic78 |
| U 86819.851* (13) | CH ₃ CH ₂ CN | 10(1,10)-9(1,9) | 0.20 | OriMC-1 | OSO | 20m | Dow82 | |
| U 86819.851* (13) | CH ₃ CH ₂ CN | 10(1,10)-9(1,9) | 0.50 | OriMC-1 | OSO | 20m | Joh84 | |
| U 86846.998* (20) | SiO | 2-1 ν=0 | 0.9 | OriMC-1 | NRAO | 11m | Dic72 | |
| U 86864. | unidentified | | 0.08 | OriMC-1 | OSO | 20m | Dow82 | |
| U 86866. | unidentified | | 0.05 | IRC+10216 | OSO | 20m | Joh84 | |
| U 86903.06 (10) | CH ₃ OH | 7(2)-6(3) A + | 0.2 | OriMC-1 | NRAO | 11m | Lov76a | Sas84 |
| U 86980. | unidentified | | 0.10 | OriMC-1 | OSO | 20m | Joh84 | |
| U 87057.5 (5) | HC ¹⁷ O ⁺ | 1-0 | 0.05 | Sgr B2 | BTL | 7m | Gue82 | Gue82 |
| U 87090.735 (46) | HN ¹³ C | 1-0 F=0-1 | 0.08 | L134N | BTL | 7m | Fre79a | Fre79a |
| U 87090.859 (46) | HN ¹³ C | 1-0 F=2-1 | 0.42 | L134N | BTL | 7m | Fre79a | Fre79a |
| U 87090.942 (46) | HN ¹³ C | 1-0 F=1-1 | 0.25 | L134N | BTL | 7m | Fre79a | Fre79a |
| U 87143.40 * (17) | HCOOCH ₃ | 7(3,4)-6(3,3) E | 0.37 | OriMC-1 | OSO | 20m | Joh84 | |
| U 87161.285* (27) | HCOOCH ₃ | 7(3,4)-6(3,3) A | 0.25 | OriMC-1 | OSO | 20m | Joh84 | |
| U 87284.156 (30) | HC ₂ | 1-0 3/2-1/2 F=1-1 | 0.53 | OriMC-1 | NRAO | 11m | Got83a | Got83a |
| U 87316.925 (4) | HC ₂ | 1-0 3/2-1/2 F=2-1 | 4.00 | OriMC-1 | NRAO | 11m | Got83a | Got83a |
| U 87328.624 (6) | HC ₂ | 1-0 3/2-1/2 F=1-0 | 2.27 | OriMC-1 | NRAO | 11m | Got83a | Got83a |
| U 87402.004 (5) | HC ₂ | 1-0 1/2-1/2 F=1-1 | 2.25 | OriMC-1 | NRAO | 11m | Got83a | Got83a |
| U 87407.165 (11) | HC ₂ | 1-0 1/2-1/2 F=0-1 | 1.02 | OriMC-1 | NRAO | 11m | Got83a | Got83a |
| U 87446.512 (23) | HC ₂ | 1-0 1/2-1/2 F=1-0 | 0.56 | OriMC-1 | NRAO | 11m | Tuc78 | Got83a |
| U 87479. | unidentified | | 0.05 | IRC+10216 | OSO | 20m | Joh84 | |
| U 87550.545* (28) | ³⁰ SiS | 5-4 | 0.027 | IRC+10216 | FCRAO | 14m | Ziu84 | |
| U 87597.333* (3) | HNCO | 4(1,4)-3(1,3) | 0.13 | OriMC-1 | OSO | 20m | Joh84 | |
| U 87715.980* (9) | CH ₃ CH ₂ OH | 5(2,4)-5(1,5) | 0.06 | Sgr B2 | BTL | 7m | Cum85 | |
| U 87766.42 * (26) | HCOOCH _{3?} | 8(0,8)-7(1,7) E | 0.03b | Sgr B2 | BTL | 7m | Cum85 | |
| U 87769.03 * (2) | HCOOCH _{3?} | 8(0,8)-7(1,7) A | b | Sgr B2 | BTL | 7m | Cum85 | Plu84 |
| U 87782.23 (10) | CH ₃ NH ₂ | 3(1,3)-3(0,3) As F=4-4 | 0.03b | Sgr B2 | BTL | 7m | Cum85 | Tak73 |
| U 87783.09 (10) | CH ₃ NH ₂ | 3(1,3)-3(0,3) As F=3-3 | b | Sgr B2 | BTL | 7m | Cum85 | Tak73 |
| U 87848.875* (4) | NH ₂ CHO | 4(1,3)-3(1,2) | 0.31 | Sgr B2 | BTL | 7m | Cum85 | |
| U 87863.632* (5) | HC ₃ N | 33-32 | 0.23 | IRC+10216 | OSO | 20m | Joh84 | |

TABLE 2. Recommended rest frequencies for observed interstellar molecular lines — Continued

| Frequency unc. | Formula | Quantum numbers | T_r (K) T_a (K) | Source | Telescope | Astr. Ref. | Lab. Ref. | | |
|----------------|------------------------------------|------------------------------------|------------------------|-----------|-----------|---------------|--------------|--------|--------|
| | HNCO | 4(2,3)-3(2,2) | 0.06b | Sgr B2 | BTL | 7m | Cum85 | | |
| | HNCO | 4(2,2)-3(2,1) | b | Sgr B2 | BTL | 7m | Cum85 | | |
| | HNCO | 4(0,4)-3(0,3) | ~2.4 | Sgr B2 | NRAO | 11m | Sny71 | | |
| | H ¹³ CCCN | 10-9 | 0.15 | IRC+10216 | OSO | 20m | Joh84 | | |
| | HNCO | 4(1,3)-3(1,2) | ~0.3 | Sgr B2 | NRAO | 11m | Sny73 | | |
| | Si ³⁴ S | 5-4 | 0.10 | IRC+10216 | OSO | 20m | Joh84 | | |
| | CH ₃ CH ₂ CN | 10(0,10)-9(0,9) | 0.12 | OriMC-1 | NRAO | 11m | Joh77 | | |
| | CH ₃ OH | 15(3)-14(4) A+ | 0.73 | OriMC-1 | OSO | 20m | Joh84 | Sas84 | |
| | HCN | 1-0 F=1-1 | 9.6 | OriMC-1 | NRAO | 11m | Uli76 | DeL69 | |
| | HCN | 1-0 F=2-1 | 17.2 | OriMC-1 | NRAO | 11m | Uli76 | DeL69 | |
| | HCN | 1-0 F=0-1 | 6.8 | OriMC-1 | NRAO | 11m | Uli76 | DeL69 | |
| | CH ₃ NH ₂ | 2(0,2)-1(0,1) Aa | b | Sgr B2 | NRAO | 11m | Kai75 | Kai75 | |
| | CH ₃ NH ₂ | 2(0,2)-1(0,1) Es | 0.15b | Sgr B2 | NRAO | 11m | Kai75 | Kai75 | |
| | CH ₃ NH ₂ | 2(0,2)-1(0,1) A+E | 0.04 | Sgr B2 | NRAO | 11m | Kut80 | Joh72 | |
| | CH ₃ NH ₂ | 2(0,2)-1(0,1) As,Ea | b | Sgr B2 | NRAO | 11m | Kai75 | Kai75 | |
| | CH ₃ OCH ₃ | 15(2,13)-15(1,14) EA+AE | b | OriMC-1 | OSO | 20m | Joh84 | | |
| | CH ₃ OCH ₃ | 15(2,13)-15(1,14) EE | 0.05 | OriMC-1 | NRAO | 11m | Kut80 | | |
| | CH ₃ OCH ₃ | 15(2,13)-15(1,14) EE | 0.27b | OriMC-1 | OSO | 20m | Joh84 | | |
| | CH ₃ OCH ₃ | 15(2,13)-15(1,14) AA | 0.06 | OriMC-1 | NRAO | 11m | Kut80 | | |
| | CH ₃ OCH ₃ | 15(2,13)-15(1,14) AA | b | OriMC-1 | OSO | 20m | Joh84 | | |
| | ³⁴ SO ₂ | 7(3,5)-8(2,6) | 0.10 | OriMC-1 | OSO | 20m | Sch83 | | |
| U | 88741.8 | unidentified | 0.03 | OriMC-1 | NRAO | 11m | Kut80 | | |
| U | 88749.8 | unidentified | 0.03 | OriMC-1 | NRAO | 11m | Kut80 | | |
| U | 88770.8 | unidentified | 0.03 | OriMC-1 | NRAO | 11m | Kut80 | | |
| | 88843.24 *(16) | HCOOCH ₃ | 7(1,6)-6(1,5) E | 0.09 | OriMC-1 | NRAO | 11m | Kut80 | |
| | 88851.61 *(3) | HCOOCH ₃ | 7(1,6)-6(1,5) A | 0.07 | OriMC-1 | NRAO | 11m | Kut80 | |
| U | 88861. | unidentified | 0.15 | OriMC-1 | OSO | 20m | Gol81b | | |
| | 88865.692 (26) | H ¹⁵ NC | 1-0 | 0.15 | DR21 (OH) | NRAO | 11m | Bro77 | Say76 |
| | 88940.09 (10) | CH ₃ OH | 15(3)-14(4) A- | 1.30 | OriMC-1 | OSO | 20m | Joh84 | Sas84 |
| | 89045.59 *(2) | C ₂ N | 9-8 J=19/2-17/2 | 0.13l | IRC+10216 | NRAO | 11m | Gue77 | Got83 |
| | 89064.36 *(2) | C ₂ N | 9-8 J=17/2-15/2 | 0.14l | IRC+10216 | NRAO | 11m | Gue77 | Got83 |
| U | 89087. | unidentified | 0.07 | IRC+10216 | OSO | 20m | Joh84 | | |
| | 89103.730*(26) | ²⁹ SiS | 5-4 | 0.07 | IRC+10216 | OSO | 20m | Joh84 | |
| | 89188.518*(9) | HCO ⁺ | 1-0 | 10.8 | OriMC-1 | NRAO | 11m | Uli76 | |
| | 89297.651*(13) | CH ₃ CH ₂ CN | 10(2,9)-9(2,8) | 0.32 | OriMC-1 | OSO | 20m | Joh84 | |
| | 89314.68 *(26) | HCOOCH ₃ | 8(1,8)-7(1,7) E | 0.35b | OriMC-1 | OSO | 20m | Joh84 | |
| | 89316.632*(44) | HCOOCH ₃ | 8(1,8)-7(1,7) A | b | OriMC-1 | OSO | 20m | Joh84 | |
| | 89331.302*(33) | ¹³ CH ₃ CN | 5(0)-4(0) | 0.22 | Sgr B2 | BTL | 7m | Cum85 | |
| | 89487.415 (15) | HOC ⁺ | 1-0 | 0.08 | Sgr B2 | FCRAO | 14m | Woo83 | Gud82 |
| | 89505.86 (4) | CH ₃ OH | 8(-4)-9(-3) E | 0.3 | OriMC-1 | NRAO | 11m | Lov76a | Lov78 |
| | 89562.317*(12) | CH ₃ CH ₂ CN | 10(6)-9(6) | 0.08b | OriMC-1 | NRAO | 11m | Joh77 | |
| | 89565.031*(12) | CH ₃ CH ₂ CN | 10(7)-9(7) | 0.05b | OriMC-1 | NRAO | 11m | Joh77 | |
| | 89568.105*(12) | CH ₃ CH ₂ CN | 10(5)-9(5) | 0.11b | OriMC-1 | NRAO | 11m | Joh77 | |
| | 89573.052*(13) | CH ₃ CH ₂ CN | 10(8)-9(8) | 0.03b | OriMC-1 | NRAO | 11m | Joh77 | |
| | 89579.177*(1) | HCOOH | 4(0,4)-3(0,3) | 0.05 | Sgr B2 | FCRAO | 14m | Woo83 | Wil80 |
| | 89590.035*(12) | CH ₃ CH ₂ CN | 10(4,7)-9(4,6) | 0.05b | OriMC-1 | NRAO | 11m | Joh77 | |
| | 89591.019*(12) | CH ₃ CH ₂ CN | 10(4,6)-9(4,5) | 0.05b | OriMC-1 | NRAO | 11m | Joh77 | |
| | 89628.451*(13) | CH ₃ CH ₂ CN | 10(3,8)-9(3,7) | 0.13 | OriMC-1 | NRAO | 11m | Joh77 | |
| | 89684.718*(13) | CH ₃ CH ₂ CN | 10(3,7)-9(3,6) | 0.22 | OriMC-1 | OSO | 20m | Joh84 | |
| U | 89726. | unidentified | 0.07 | IRC+10216 | OSO | 20m | Joh84 | | |
| | 89861.48 *(1) | HCOOH | 4(2,3)-3(2,2) | 0.13 | Sgr B2 | BTL | 7m | Cum85 | |
| U | 89936. | unidentified | 0.20 | OriMC-1 | OSO | 20m | Joh84 | | |
| U | 89960. | unidentified | 0.20 | OriMC-1 | OSO | 20m | Joh84 | | |
| | 90117.600*(9) | CH ₃ CH ₂ OH | 4(1,4)-3(0,3) | 0.25g | Sgr B2 | NRAO | 11m | Zuc75 | |
| | 90145.74 *(16) | HCOOCH ₃ | 7(2,5)-6(2,4) E | 0.32 | OriMC-1 | OSO | 20m | Joh83 | |
| | 90156.476*(29) | HCOOCH ₃ | 7(2,5)-6(2,4) A | 0.25 | OriMC-1 | OSO | 20m | Joh83 | |
| U | 90212. (1) | unidentified | 0.04 | Sgr B2 | NRAO | 11m | Hol80 | | |
| | 90227.68 *(27) | HCOOCH ₃ | 8(0,8)-7(0,7) E | 0.15 | OriMC-1 | NRAO | 11m | Hol80 | |
| | 90229.61 *(4) | HCOOCH ₃ | 8(0,8)-7(0,7) A | 0.15 | OriMC-1 | NRAO | 11m | Hol80 | |
| | 90263.833 (30) | ¹⁵ NNH ⁺ | 1-0 | 0.035 | DR21(OH) | BTL | 7m | Lin83 | Gud82a |
| | 90453.358*(13) | CH ₃ CH ₂ CN | 10(2,8)-9(2,7) | 0.35 | OriMC-1 | OSO | 20m | Joh84 | |
| | 90525.892*(5) | HC ₅ N | 34-33 | 0.20 | IRC+10216 | OSO | 20m | Joh84 | |
| | 90548.251*(28) | SO ₂ | 25(3,23)-24(4,20) | 0.6 | OriMC-1 | OSO | 20m | Sch83 | |
| | 90593.059*(11) | HC ¹³ CCN | 10-9 | 0.35 | Sgr B2 | NRAO | 11m | Uli78 | |
| | 90601.791*(5) | HCC ¹³ CN | 10-9 | 0.18 | Sgr B2 | NRAO | 11m | Uli78 | |

TABLE 2. Recommended rest frequencies for observed interstellar molecular lines — Continued

| Frequency unc. | Formula | Quantum numbers | $T_r^*(\text{K})$ | $T_s^*(\text{K})$ | Source | Telescope | Astr. Ref. | Lab. Ref. | |
|----------------|----------------|------------------------------------|----------------------|-------------------|-----------|-----------|------------|-----------|--------|
| U | 90663.450 | HNC | 1-0 $F=0-1$ | n.r. | L134N | BTL | 7m | Fre79a | Fre79a |
| | 90663.543 (40) | HNC | 1-0 | 1.6 | L134 | NRAO | 11m | Sny77a | Pea76 |
| | 90663.574 | HNC | 1-0 $F=2-1$ | n.r. | L134N | BTL | 7m | Fre79a | Fre79a |
| | 90663.656 | HNC | 1-0 $F=1-1$ | n.r. | L134N | BTL | 7m | Fre79a | Fre79a |
| | 90684.2 | unidentified | | 0.2 | SgrB2 | NRAO | 11m | Sch85 | |
| | 90703.78 (5) | CH ₃ OD | 2(-1)-1(-1) E | 0.14b | Sgr B2 | NRAO | 11m | Got79 | Lov78 |
| | 90705.77 (5) | CH ₃ OD | 2(0)-1(0) A | b | Sgr B2 | NRAO | 11m | Got79 | Lov78 |
| | 90763. | unidentified | | 0.20 | OriMC-1 | OSO | 20m | Joh84 | |
| | 90771.546*(26) | SiS | 5-4 | 0.35 | IRC+10216 | NRAO | 11m | Mor75 | |
| | 90841. (3) | unidentified | | 0.08 | Sgr B2 | NRAO | 11m | Cla79 | |
| U | 90908. (3) | unidentified | | 0.05 | Sgr B2 | NRAO | 11m | Cla79 | |
| | 90928. (1) | unidentified | | 0.07 | Sgr B2 | NRAO | 11m | Cla79 | |
| | 90937.539 (40) | CH ₃ OCH ₃ | 6(0,6)-5(1,5) AA | b | OriMC-1 | NRAO | 11m | Sny74 | Cla79 |
| | 90938.099 (30) | CH ₃ OCH ₃ | 6(0,6)-5(1,5) EE | 0.17b | OriMC-1 | NRAO | 11m | Sny74 | Cla79 |
| | 90938.674 (50) | CH ₃ OCH ₃ | 6(0,6)-5(1,5) AE+EA | b | OriMC-1 | NRAO | 11m | Sny74 | Cla79 |
| | 90978.993*(2) | HC ₃ N | 10-9 | 1.77 | OriMC-1 | NRAO | 11m | Mor76 | |
| | 91202.607*(27) | HC ₃ N $\nu_7=1$ | 10-9 $\ell=1e$ | 0.2 | OriMC-1 | NRAO | 11m | Cla76 | |
| | 91204.328 (30) | N ¹⁵ NH ⁺ | 1-0 $F=1-1$ | 0.02 | DR21(OH) | BTL | 7m | Lin83 | Gud82a |
| | 91205.999 (30) | N ¹⁵ NH ⁺ | 1-0 $F=2-1$ | 0.025 | DR21(OH) | BTL | 7m | Lin83 | Gud82a |
| | 91208.663 (70) | N ¹⁵ NH ⁺ | 1-0 $F=0-1$ | 0.01 | DR21(OH) | BTL | 7m | Lin83 | Gud82a |
| U | 91333.308*(27) | HC ₃ N $\nu_7=1$ | 10-9 $\ell=1f$ | 0.2 | OriMC-1 | NRAO | 11m | Cla76 | |
| | 91549.122*(13) | CH ₃ CH ₂ CN | 10(1,9)-9(1,8) | 0.2 | Sgr B2 | NRAO | 11m | Joh77 | |
| | 91959.024*(2) | CH ₃ CN | 5(4)-4(4) $F=6-5$ | 0.08b | OriMC-1 | NRAO | 11m | Lov76a | |
| | 91959.359*(2) | CH ₃ CN | 5(4)-4(4) $F=4-3$ | b | OriMC-1 | NRAO | 11m | Lov76a | |
| | 91971.310*(1) | CH ₃ CN | 5(3)-4(3) $F=6-5$ | 0.20b | OriMC-1 | NRAO | 11m | Lov76a | |
| | 91971.465*(1) | CH ₃ CN | 5(3)-4(3) $F=4-3$ | b | OriMC-1 | NRAO | 11m | Lov76a | |
| | 91980.089*(1) | CH ₃ CN | 5(2)-4(2) $F=6-5$ | 0.16 | OriMC-1 | NRAO | 11m | Lov76a | |
| | 91985.317*(1) | CH ₃ CN | 5(1)-4(1) | 0.28b | OriMC-1 | NRAO | 11m | Lov76a | |
| | 91987.090*(1) | CH ₃ CN | 5(0)-4(0) | b | OriMC-1 | NRAO | 11m | Lov76a | |
| | 92352.7 | unidentified | | ~0.1 | OriMC-1 | NRAO | 11m | Cla76 | |
| U | 92494.299*(17) | ¹³ CS | 2-1 | 0.215 | OriMC-1 | NRAO | 11m | Tur73 | |
| | 93065. (1) | SiC ₂ | 4(0,4)-3(0,3) | 0.11 | IRC+10216 | NRAO | 11m | Sny83 | Tha84 |
| | 93171.67 | N ₂ H ⁺ | 1-0 $F_1=1-1 F=0-1$ | 0.5 | L134N | NRAO | 11m | Sny79 | Sny79 |
| | 93171.91 | N ₂ H ⁺ | 1-0 $F_1=1-1 F=2-2$ | 0.7 | L134N | NRAO | 11m | Sny77 | Sny79 |
| | 93172.09 | N ₂ H ⁺ | 1-0 $F_1=1-1 F=1-1$ | 0.8 | L134N | NRAO | 11m | Sny77 | Sny79 |
| | 93173.50 | N ₂ H ⁺ | 1-0 $F_1=2-1 F=2-1$ | 0.9 | L134N | NRAO | 11m | Sny77 | Sny79 |
| | 93173.83 | N ₂ H ⁺ | 1-0 $F_1=2-1 F=3-2$ | 0.9 | L134N | NRAO | 11m | Sny77 | Sny79 |
| | 93174.01 | N ₂ H ⁺ | 1-0 $F_1=2-1 F=1-0$ | 0.6 | L134N | NRAO | 11m | Sny77 | Sny79 |
| | 93176.32 | N ₂ H ⁺ | 1-0 $F_1=0-1 F=1-2$ | 0.7 | L134N | NRAO | 11m | Sny77 | Sny79 |
| | 93188.127*(5) | HC ₃ N | 35-34 | 0.09 | OriMC-1 | NRAO | 11m | Lov82 | |
| U | 93196.62 (1) | CH ₃ OH $\nu_7=1$ | 1(0)-2(1) E | 0.18 | OriMC-1 | NRAO | 11m | Lov82 | Lov82 |
| | 93580.84 *(5) | CH ₃ CHO | 5(1,5)-4(1,4) A | 0.17 | Sgr B2 | BTL | 7m | Cum85 | |
| | 93595.28 (10) | CH ₃ CHO | 5(1,5)-4(1,4) E | 0.17 | Sgr B2 | BTL | 7m | Cum85 | Bau76 |
| | 93666.65 *(12) | CH ₃ OCH ₃ | 12(1,11)-12(0,12) EE | 0.10 | OriMC-1 | NRAO | 11m | Hol80 | |
| | 93780. (3) | unidentified | | 0.14p | OriMC-1 | NRAO | 11m | Cla79 | |
| | 93830.050 (20) | HNCS | 8(0,8)-7(0,7) | 0.05 | OriMC-1 | BTL | 7m | Fre79 | Yam79 |
| | 93844. (2) | unidentified | | 0.06 | Sgr B2 | NRAO | 11m | Cla79 | |
| | 93854.44 (10) | CH ₃ OCH ₃ | 4(2,3)-4(1,4) AE+EA | 0.14 | OriMC-1 | NRAO | 11m | Cla79 | Cla79 |
| | 93857.11 (10) | CH ₃ OCH ₃ | 4(2,3)-4(1,4) EE | 0.20 | OriMC-1 | NRAO | 11m | Cla79 | Cla79 |
| | 93859.64 (10) | CH ₃ OCH ₃ | 4(2,3)-4(1,4) AA | 0.03 | OriMC-1 | NRAO | 11m | Cla79 | Cla79 |
| U | 93870.5 | unidentified | | 0.2s | Sgr B2 | NRAO | 11m | Cla79 | |
| | 94245. (1) | SiC ₂ | 4(2,3)-3(2,2) | 0.10 | IRC+10216 | NRAO | 11m | Tha84 | |
| | 94276.638*(18) | HC ₃ CHCN | 10(0,10)-9(0,9) | 0.08 | Sgr B2 | NRAO | 11m | Joh77 | |
| | 94405.17 (15) | ¹³ CH ₃ OH | 2(-1)-1(-1) E | b | Sgr B2 | NRAO | 11m | Got79 | Lee73 |
| | 94407.02 (10) | ¹³ CH ₃ OH | 2(0)-1(0) A + | 0.8b | Sgr B2 | NRAO | 11m | Got79 | Lee73 |
| | 94410.76 (10) | ¹³ CH ₃ OH | 2(0)-1(0) E | b | Sgr B2 | NRAO | 11m | Got79 | Lee73 |
| | 94541.81 (10) | CH ₃ OH | 8(3)-9(2) E | 0.43 | OriMC-1 | NRAO | 11m | Hol83 | Sas84 |
| | 95150.32 *(2) | C ₄ H | 10-9 $J=21/2-19/2$ | 0.08 | IRC+10216 | NRAO | 11m | Gue78 | Got83 |
| | 95169.44 (10) | CH ₃ OH | 8(0)-7(1) A + | 0.85 | OriMC-1 | NRAO | 11m | Lov76a | Lee68 |
| | 95188.94 *(2) | C ₄ H | 10-9 $J=19/2-17/2$ | 0.08 | IRC+10216 | NRAO | 11m | Gue78 | Got83 |
| U | 95442.482*(14) | CH ₃ CH ₂ CN | 11(1,11)-10(1,10) | 0.20 | OriMC-1 | NRAO | 11m | Joh77 | |
| | 95579. (1) | SiC ₂ | 4(2,2)-3(2,1) | 0.10 | IRC+10216 | NRAO | 11m | Cum80 | Tha84 |
| | 96368.05 (25) | CH ₃ CHO | 5(3,2)-4(3,1) E | b | Sgr B2 | NRAO | 11m | Got78a | Bau76 |
| | 96368.05 (25) | CH ₃ CHO | 5(3,3)-4(3,2) A | 0.07b | Sgr B2 | NRAO | 11m | Got78a | Bau76 |
| | 96371.60 (13) | CH ₃ CHO | 5(3,2)-4(3,1) A | b | Sgr B2 | NRAO | 11m | Got78a | Bau76 |

TABLE 2. Recommended rest frequencies for observed interstellar molecular lines — Continued

| Frequency unc. | Formula | Quantum numbers | $T_e^*(\text{K})$ | Source | Telescope | Astr. Ref. | Lab. Ref. | |
|----------------|----------------|------------------------------------|--|--------|-----------|------------|------------|--------|
| | | | $T_a^*(\text{K})$ | | | | | |
| | 96384.30 (13) | CH ₃ CHO | 5(3,3)-4(3,2) E | 0.1 | Sgr B2 | NRAO | 11m Got78a | Bau76 |
| | 96412.982*(13) | C ³⁴ S | 2-1 | 0.62 | OriMC-1 | NRAO | 11m Tur73 | |
| | 96475.50 (13) | CH ₃ CHO | 5(2,3)-4(2,2) E | 0.08 | Sgr B2 | NRAO | 11m Got78a | Bau76 |
| | 96492.13 (1) | CH ₃ OH $\nu_1=1$ | 2(1)-1(1) E | 0.13 | OriMC-1 | NRAO | 11m Hol83 | Lov82 |
| | 96493.58 (1) | CH ₃ OH $\nu_1=1$ | 2(0)-1(0) E | 0.12 | OriMC-1 | NRAO | 11m Hol83 | Lov82 |
| | 96506.66 (1) | CH ₃ OH $\nu_1=1$ | 2(-1)-1(-1) E | 0.06 | OriMC-1 | NRAO | 11m Hol83 | Lov82 |
| | 96513.70 (1) | CH ₃ OH $\nu_1=1$ | 2(0)-1(0) A+ | 0.08 | OriMC-1 | NRAO | 11m Hol83 | Lov82 |
| U | 96536. | unidentified | | 0.1 | OriMC-1 | NRAO | 11m Sny83 | |
| | 96739.39 (10) | CH ₃ OH | 2(-1)-1(-1) E | 0.96 | OriMC-1 | NRAO | 11m Hol83 | Lee68 |
| | 96741.42 (10) | CH ₃ OH | 2(0)-1(0) A+ | 1.13 | OriMC-1 | NRAO | 11m Hol83 | Lee68 |
| | 96744.58 (10) | CH ₃ OH | 2(0)-1(0) E | 0.88 | OriMC-1 | NRAO | 11m Hol83 | Lee68 |
| | 96755.51 (10) | CH ₃ OH | 2(1)-1(1) E | 0.54 | OriMC-1 | NRAO | 11m Hol83 | Lee68 |
| | 96797. (3) | unidentified | | 0.05 | Sgr B2 | NRAO | 11m Cla79 | |
| | 96847.25 (10) | CH ₃ OCH ₃ | 5(2,4)-5(1,5) AE+EA | 0.11 | OriMC-1 | NRAO | 11m Cla79 | Cla79 |
| | 96849.85 (10) | CH ₃ OCH ₃ | 5(2,4)-5(1,5) EE | 0.14 | OriMC-1 | NRAO | 11m Cla79 | Cla79 |
| | 96852.46 (10) | CH ₃ OCH ₃ | 5(2,4)-5(1,5) AA | 0.13 | OriMC-1 | NRAO | 11m Cla79 | Cla79 |
| | 96919.757*(14) | CH ₃ CH ₂ CN | 11(0,11)-10(0,10) | 0.08 | OriMC-1 | NRAO | 11m Joh77 | |
| | 96988.139*(9) | O ¹³ CS | 8-7 | 0.069 | Sgr B2 | BTL | 7m Gol81 | |
| | 97172.086*(13) | C ³³ S | 2-1 | 0.17 | Sgr B2 | BTL | 7m Cum85 | |
| | 97301.2085(2) | OCS | 8-7 | 0.85 | Sgr B2 | NRAO | 11m Sol73 | Dij71 |
| | 97582.83 (1) | CH ₃ OH | 2(1)-1(1) A- | ~2.5 | OriMC-1 | OSO | 20m Fri84 | Lee68 |
| | 97632.218*(21) | H ₂ ¹³ CS | 3(1,3)-2(1,2) | 0.04 | Sgr B2 | BTL | 7m Cum85 | |
| | 97702.359*(8) | SO ₂ | 7(3,5)-8(2,6) | ~0.3 | OriMC-1 | NRAO | 11m Sny75a | |
| | 97715.388*(38) | ³⁴ SO | 3(2)-2(1) | 0.14 | OriMC-1 | NRAO | 11m Got78 | |
| | 97980.968*(17) | CS | 2-1 | 6.94 | OriMC-1 | NRAO | 11m Tur73 | |
| | 97995.450 (60) | C ₃ H | ² II _{1/2} $J=9/2-7/2$ b | 0.116 | IRC+10216 | OSO | 20m Tha85 | Tha85 |
| | 98012.064 (60) | C ₃ H | ² II _{1/2} $J=9/2-7/2$ a | 0.089 | IRC+10216 | OSO | 20m Tha85 | Tha85 |
| | 98177.581*(14) | CH ₃ CH ₂ CN | 11(2,10)-10(2,9) | 0.15 | OriMC-1 | NRAO | 11m Joh77 | |
| U | 98230.2 | unidentified | | 0.02 | OriMC-1 | NRAO | 11m Kut80 | |
| U | 98239.7 | unidentified | | 0.03 | OriMC-1 | NRAO | 11m Kut80 | |
| U | 98257.7 | unidentified | | 0.03 | OriMC-1 | NRAO | 11m Kut80 | |
| U | 98265.9 (9) | unidentified | | 0.04 | Sgr B2 | BTL | 7m Cum85 | |
| | 98270.41 *(31) | HCOOCH ₃ | 8(6,2)-7(6,1) E | 0.06 | OriMC-1 | NRAO | 11m Kut80 | |
| | 98279.70 *(5) | HCOOCH ₃ | 8(6,3)-7(6,2) E+A | 0.12b | OriMC-1 | NRAO | 11m Kut80 | |
| | 98279.74 *(5) | HCOOCH ₃ | 8(6,2)-7(6,1) A | b | OriMC-1 | NRAO | 11m Kut80 | |
| U | 98333.9 | unidentified | | 0.02 | OriMC-1 | NRAO | 11m Kut80 | |
| U | 98351.9 | unidentified | | 0.02 | OriMC-1 | NRAO | 11m Kut80 | |
| | 98432.37 *(29) | HCOOCH ₃ | 8(5,4)-7(5,3) E | 0.04b | Sgr B2 | BTL | 7m Cum85 | |
| | 98432.73 *(5) | HCOOCH ₃ | 8(5,4)-7(5,3) A | b | Sgr B2 | BTL | 7m Cum85 | |
| | 98435.78 *(5) | HCOOCH ₃ | 8(5,3)-7(5,2) A | b | Sgr B2 | BTL | 7m Cum85 | |
| | 98512.522*(5) | HC ₃ N | 37-36 | 0.08 | OriMC-1 | NRAO | 11m Buj81 | |
| | 98523.880*(13) | CH ₃ CH ₂ CN | 11(6)-10(6) | 0.13 | OriMC-1 | NRAO | 11m Joh77 | |
| | 98524.661*(13) | CH ₃ CH ₂ CN | 11(7)-10(7) | 0.10 | OriMC-1 | NRAO | 11m Joh77 | |
| | 98532.070*(14) | CH ₃ CH ₂ CN | 11(8)-10(8) | 0.06 | OriMC-1 | NRAO | 11m Joh77 | |
| | 98533.985*(26) | CH ₃ CH ₂ CN | 11(5)-10(5) | 0.17 | OriMC-1 | NRAO | 11m Joh77 | |
| | 98564.834*(13) | CH ₃ CH ₂ CN | 11(4,8)-10(4,7) | 0.09 | OriMC-1 | NRAO | 11m Joh77 | |
| | 98566.799*(13) | CH ₃ CH ₂ CN | 11(4,7)-10(4,6) | 0.09 | OriMC-1 | NRAO | 11m Joh77 | |
| | 98606.87 *(27) | HCOOCH ₃ | 8(3,6)-7(3,5) E | 0.08b | Sgr B2 | BTL | 7m Cum85 | |
| | 98610.108*(13) | CH ₃ CH ₂ CN | 11(3,9)-10(3,8) | 0.14 | OriMC-1 | NRAO | 11m Joh77 | |
| | 98611.14 *(4) | HCOOCH ₃ | 8(3,6)-7(3,5) A | b | Sgr B2 | BTL | 7m Cum85 | |
| | 98682.59 *(4) | HCOOCH ₃ | 8(4,5)-7(4,4) A | 0.02 | Sgr B2 | BTL | 7m Cum85 | |
| | 98701.109*(13) | CH ₃ CH ₂ CN | 11(3,8)-10(3,7) | 0.12 | OriMC-1 | NRAO | 11m Joh77 | |
| | 98712.28 *(28) | HCOOCH ₃ | 8(4,5)-7(4,4) E | 0.04 | Sgr B2 | BTL | 7m Cum85 | |
| | 98747.88 *(28) | HCOOCH ₃ ? | 8(4,4)-7(4,3) E | 0.04 | Sgr B2 | BTL | 7m Cum85 | |
| | 98792.27 *(4) | HCOOCH ₃ ? | 8(4,4)-7(4,3) A | 0.05 | Sgr B2 | BTL | 7m Cum85 | |
| | 98862.65 *(98) | CH ₃ CHO | 5(1,4)-4(1,3) E | 0.23 | Sgr B2 | BTL | 7m Cum85 | |
| | 98900.87 *(5) | CH ₃ CHO | 5(1,4)-4(1,3) A | 0.18 | Sgr B2 | BTL | 7m Cum85 | |
| | 98940.02 *(2) | C ₃ N | 10-9 $J=21/2-19/2$ | 0.18 | IRC+10216 | NRAO | 11m Gue77 | Got83 |
| | 98958.78 *(2) | C ₃ N | 10-9 $J=19/2-17/2$ | 0.13 | IRC+10216 | NRAO | 11m Gue77 | Got83 |
| | 99118.6 (1) | NH ₂ D? | 5(2,4)-4(1,4) | 0.04 | Sgr B2 | BTL | 7m Cum85 | DeL75 |
| U | 99120. | unidentified | | 0.15 | OriMC-1 | OSO | 20m Fri84 | |
| | 99299.879*(38) | SO | 3(2)-2(1) | 1.59m | OriMC-1 | NRAO | 11m Got78 | |
| | 99311.195 (75) | NH ₂ CN | 5(1,5)-4(1,4) | 0.40 | Sgr B2 | BTL | 7m Cum85 | Joh76a |
| | 99325.25 (20) | CH ₃ OCH ₃ | 4(1,4)-3(0,3) EE | 0.2 | OriMC-1 | NRAO | 11m Cla79 | Lov79 |
| | 99392.645*(27) | SO ₂ | 29(4,26)-28(5,23) | ~0.50 | OriMC-1 | OSO | 20m Fri84 | |

TABLE 2. Recommended rest frequencies for observed interstellar molecular lines — Continued

| Frequency unc. | Formula | Quantum numbers | $T_r^*(\text{K})$ | $T_a^*(\text{K})$ | Source | Telescope | Astr. Ref. | Lab. Ref. |
|----------------|-----------------|-----------------------------------|-------------------|-------------------|------------|-----------|------------|-----------|
| | 99651.863*(11) | HC^{13}CCN | 11-10 | 0.13 | Sgr B2 | BTL | 7m | Cum85 |
| | 99661.471*(6) | HCC^{13}CN | 11-10 | 0.14 | Sgr B2 | BTL | 7m | Cum85 |
| | 99681.516*(14) | $\text{CH}_3\text{CH}_2\text{CN}$ | 11(2,9)-10(2,8) | 0.05 | Sgr B2 | BTL | 7m | Cum85 |
| U | 99727.0 (16) | unidentified | | 0.04 | Sgr B2 | BTL | 7m | Cum85 |
| | 99730.92 (1) | $\text{CH}_3\text{OH} \nu_1=1$ | 6(1)-5(0) | 0.20 | OriMC-1 | NRAO | 11m | Chu80 |
| | 99774.15 (5) | $\text{H}_2\text{C}^4\text{S}$ | 3(1,3)-2(1,2) | ~ 0.2 | OriMC-1 | OSO | 20m | Gar85 |
| U | 99867.0 (6) | unidentified | | 0.08 | Sgr B2 | BTL | 7m | Cum85 |
| | 99953.27 (6) | NH_2CN | 5(2,4)-4(2,3) | 0.08b | Sgr B2 | BTL | 7m | Cum85 |
| | 99956.60 (4) | NH_2CN | 5(2,3)-4(2,2) | b | Sgr B2 | BTL | 7m | Cum85 |
| | 99972.66 (8) | NH_2CN | 5(0,5)-4(0,4) | 0.12 | Sgr B2 | BTL | 7m | Joh76a |
| | 100029.569*(60) | SO | 4(5)-4(4) | 0.38m | OriMC-1 | NRAO | 11m | Got78 |
| | 100076.389*(2) | HC_3N | 11-10 | 1.28 | OriMC-1 | NRAO | 11m | Mor76 |
| | 100094.461*(51) | CH_2CO | 5(1,5)-4(1,4) | 0.17 | Sgr B2 | NRAO | 11m | Tur77 |
| | 100110.27 (10) | CH_3SH | 4(1)-3(1) A+ | 0.06 | Sgr B2 | BTL | 7m | Lin79 |
| U | 100157.0 | unidentified | | 0.07 | Sgr B2 | NRAO | 11m | Tur77 |
| U | 100197.2 (8) | unidentified | | 0.09 | Sgr B2 | BTL | 7m | Cum85 |
| U | 100200.4 | unidentified | | 0.09 | Sgr B2 | NRAO | 11m | Tur77 |
| | 100294.69 *(27) | $\text{HCOOCH}_3?$ | 8(3,5)-7(3,4) E | 0.03 | Sgr B2 | BTL | 7m | Cum85 |
| | 100308.158*(43) | HCOOCH_3 | 8(3,5)-7(3,4) A | 0.08 | OriMC-1 | BTL | 7m | Gol82 |
| | 100322.349*(29) | $\text{HC}_3\text{N} \nu_7=1$ | 11-10 1e | 0.07 | OriMC-1 | BTL | 7m | Gol82 |
| U | 100435. | unidentified | | 0.04 | OriMC-1 | NRAO | 11m | Wil81 |
| | 100463.11 (3) | CH_3OCH_3 | 6(2,5)-6(1,6) EE | 0.12 | OriMC-1 | NRAO | 11m | Wil81 |
| | 100466.106*(29) | $\text{HC}_3\text{N} \nu_7=1$ | 11-10 1f | ~ 0.2 | OriMC-1 | NRAO | 11m | Wil76 |
| | 100482.27 *(27) | HCOOCH_3 | 8(1,7)-7(1,6) E | 0.08 | OriMC-1 | BTL | 7m | Gol82 |
| U | 100490.661*(45) | HCOOCH_3 | 8(1,7)-7(1,6) A | 0.08 | OriMC-1 | BTL | 7m | Gol82 |
| | 100498.5 | unidentified | | 0.05 | OriMC-1 | NRAO | 11m | Wil81 |
| | 100529.127*(52) | NaOH | 4-3 | 0.05 | Sgr B2(OH) | NRAO | 11m | Hol82 |
| U | 100601.6 (3) | unidentified | | 0.19 | Sgr B2 | BTL | 7m | Cum85 |
| | 100614.295*(14) | $\text{CH}_3\text{CH}_2\text{CN}$ | 11(1,10)-10(1,9) | 0.10 | OriMC-1 | NRAO | 11m | Joh77 |
| | 100629.50 (12) | NH_2CN | 5(1,4)-4(1,3) | 0.17 | Sgr B2 | NRAO | 11m | Tur75a |
| | 100681.58 *(40) | HCOOCH_3 | 9(0,9)-8(0,8) E | 0.07b | Sgr B2 | NRAO | 11m | Chu80 |
| | 100683.331*(67) | HCOOCH_3 | 9(0,9)-8(0,8) A | b | Sgr B2 | NRAO | 11m | Chu80 |
| | 100708.837*(44) | $\text{HC}_3\text{N} \nu_7=2$ | 11-10 0 | 0.05b | Sgr B2 | BTL | 7m | Cum85 |
| | 100710.972*(52) | $\text{HC}_3\text{N} \nu_7=2$ | 11-10 2e | b | Sgr B2 | BTL | 7m | Cum85 |
| | 100714.306*(46) | $\text{HC}_3\text{N} \nu_7=2$ | 11-10 2f | b | Sgr B2 | BTL | 7m | Cum85 |
| | 100878.113*(6) | SO ₂ | 2(2,0)-3(1,3) | 0.08 | Sgr B2 | BTL | 7m | Cum85 |
| | 100989.940*(16) | $\text{CH}_3\text{CH}_2\text{OH}$ | 8(2,7)-8(1,8) | 0.05 | Sgr B2 | BTL | 7m | Lin79 |
| U | 101000. | unidentified | | 0.05 | Sgr B2 | BTL | 7m | Lin79 |
| | 101002.34 *(5) | $\text{CH}_2\text{CO}?$ | 5(3,3)-4(3,2) | 0.06b | Sgr B2 | BTL | 7m | Cum85 |
| | 101002.35 *(5) | $\text{CH}_2\text{CO}?$ | 5(3,2)-4(3,1) | b | Sgr B2 | BTL | 7m | Cum85 |
| | 101029.75 (5) | CH_3SH | 4(-1)-3(-1) E | ~ 0.1 | Sgr B2 | BTL | 7m | Lin79 |
| | 101036.56 *(6) | CH_2CO | 5(0,5)-4(0,4) | 0.1 | Sgr B2 | NRAO | 11m | Tur77 |
| | 101139.16 (5) | CH_3SH | 4(0)-3(0) A | 0.27b | Sgr B2 | BTL | 7m | Lin79 |
| | 101139.65 (4) | CH_3SH | 4(0)-3(0) E | b | Sgr B2 | BTL | 7m | Lin79 |
| | 101159.46 (10) | CH_3SH | 4(2)-3(2) A- | 0.03 | Sgr B2 | BTL | 7m | Cum85 |
| | 101167.15 (4) | CH_3SH | 4(-2)-3(-2) E | 0.13b | Sgr B2 | BTL | 7m | Cum85 |
| | 101168.34 (4) | CH_3SH | 4(2)-3(2) E | b | Sgr B2 | BTL | 7m | Cum85 |
| | 101174.679*(5) | HC_3N | 38-37 | 0.09 | Sgr B2 | BTL | 7m | Lin79 |
| | 101284.36 (4) | CH_3SH | 4(1)-3(1) E | 0.09 | Sgr B2 | BTL | 7m | Lin79 |
| | 101332.984*(17) | H_2CO | 6(1,5)-6(1,6) | ~ 0.1 | Sgr B2 | BTL | 7m | Lin79 |
| | 101341.0 *(15) | CH_3CHO | 3(1,3)-2(0,2) E | 0.08 | Sgr B2 | BTL | 7m | Cum85 |
| | 101477.753*(55) | H_2CS | 3(1,3)-2(1,2) | 0.49 | OriMC-1 | BTL | 7m | Van84 |
| | 101981.383*(51) | CH_2CO | 5(1,4)-4(1,3) | 0.22 | Sgr B2 | NRAO | 11m | Tur77 |
| | 102064.268*(8) | NH_2CHO | 5(1,5)-4(1,4) | 0.2 | Sgr B2 | NRAO | 11m | Tur78a |
| | 102202.49 (4) | CH_3SH | 4(1)-3(1) A- | 0.08 | Sgr B2 | BTL | 7m | Lin79 |
| U | 102217. | unidentified | | ~ 0.08 | Sgr B2 | BTL | 7m | Lin79 |
| | 102530.346*(1) | CH_2CCH | 6(3)-5(3) | 0.14 | OriMC-1 | NRAO | 11m | Chu83 |
| | 102540.144*(1) | CH_2CCH | 6(2)-5(2) | 0.23 | OriMC-1 | NRAO | 11m | Chu83 |
| | 102546.024*(1) | CH_2CCH | 6(1)-5(1) | 0.29 | OriMC-1 | NRAO | 11m | Chu83 |
| | 102547.984*(1) | CH_2CCH | 6(0)-5(0) | 0.33 | OriMC-1 | NRAO | 11m | Chu83 |
| | 102658.04 (10) | CH_3OH | 11(-2)-11(1) E | 0.15 | OriMC-1 | NRAO | 11m | Lov82 |
| U | 102812.0 (16) | unidentified | | 0.04 | Sgr B2 | BTL | 7m | Cum85 |
| | 103040.399*(53) | H_2CS | 3(0,3)-2(0,2) | 0.2 | Sgr B2 | NRAO | 11m | Got78a |
| | 103051.785*(58) | H_2CS | 3(2,1)-2(2,0) | 0.13 | Sgr B2 | BTL | 7m | Van84 |
| U | 103216.6 (12) | unidentified | | 0.04 | Sgr B2 | BTL | 7m | Cum85 |

TABLE 2. Recommended rest frequencies for observed interstellar molecular lines — Continued

| Frequency unc. | Formula | Quantum numbers | $T_e^*(\text{K})$ | Source | Telescope | Astr. Ref. | Lab. Ref. | |
|----------------|------------------|-------------------------------------|--------------------------|--------|-----------|------------|-----------|--------|
| | | | $T_a^*(\text{K})$ | | | | | |
| | 103319.611 (60) | C ₂ H | $^2\Pi_{3/2} J=9/2-7/2a$ | 0.054 | IRC+10216 | FCRAO | 14m | Tha85 |
| | 103372.658 (60) | C ₂ H | $^2\Pi_{3/2} J=9/2-7/2b$ | 0.078 | IRC+10216 | FCRAO | 14m | Tha85 |
| U | 103466.60 *(27) | HCOOCH ₃ | 8(2,6)-7(2,5) E | 0.07 | Sgr B2 | BTL | 7m | Cum85 |
| U | 103478.64 *(4) | HCOOCH ₃ | 8(2,6)-7(2,5) A | 0.04 | Sgr B2 | BTL | 7m | Cum85 |
| U | 103549.0 (19) | unidentified | | 0.04 | Sgr B2 | BTL | 7m | Cum85 |
| U | 103575.400*(18) | HC ₂ CHCN | 11(0,11)-10(0,10) | 0.07 | Sgr B2 | BTL | 7m | Cum85 |
| U | 103641.8 (11) | unidentified | | 0.05 | Sgr B2 | BTL | 7m | Cum85 |
| | 103702.810*(10) | CH ₃ CH ₂ OH? | 9(1,8)-8(2,7) | 0.04 | Sgr B2 | BTL | 7m | Cum85 |
| U | 103836.809*(5) | HC ₃ N | 39-38 | 0.05 | Sgr B2 | BTL | 7m | Cum85 |
| U | 103915. | unidentified | (H56γ?) | 0.1 | OriMC-1 | NRAO | 11m | Kui77 |
| | 104029.416*(5) | SO ₂ | 3(1,3)-2(0,2) | 3.0 | OriMC-1 | NRAO | 11m | Hol76a |
| | 104051.281*(14) | CH ₃ CH ₂ CN | 12(1,12)-11(1,11) | 0.08 | OriMC-1 | NRAO | 11m | Joh77 |
| U | 104060.76 (10) | CH ₃ OH | 13(-4)-12(-3) | 0.2 | OriMC-1 | NRAO | 11m | Kui77 |
| | 104200.1 (8) | unidentified | | 0.07 | Sgr B2 | BTL | 7m | Cum85 |
| | 104212.654*(16) | HC ₂ CHCN | 11(2,10)-10(2,9) | 0.06 | Sgr B2 | BTL | 7m | Cum85 |
| | 104239.293*(10) | SO ₂ | 10(1,9)-10(0,10) | 0.29 | Sgr B2 | BTL | 7m | Cum85 |
| | 104300.46 (10) | CH ₃ OH | 11(-1)-10(-2) E | 0.12 | Sgr B2 | BTL | 7m | Cum85 |
| | 104336.54 (5) | CH ₃ OH | 13(-2)-13(1) E | 0.03 | Sgr B2 | BTL | 7m | Cum85 |
| | 104354.85 (10) | CH ₃ OH | 10(4)-11(3) A- | 0.06 | Sgr B2 | BTL | 7m | Cum85 |
| | 104391.65 *(6) | ³⁴ SO ₂ | 10(1,9)-10(0,10) | 0.04 | Sgr B2 | BTL | 7m | Cum85 |
| | 104408.903*(13) | HC ₂ CHCN | 11(5)-10(5) | 0.08b | Sgr B2 | BTL | 7m | Cum85 |
| | 104410.48 (10) | CH ₃ OH | 10(4)-11(3) A+ | b | Sgr B2 | BTL | 7m | Cum85 |
| | 104411.262*(13) | HC ₂ CHCN | 11(4,8)-10(4,7) | b | Sgr B2 | BTL | 7m | Cum85 |
| | 104411.485*(13) | HC ₂ CHCN | 11(4,7)-10(4,6) | b | Sgr B2 | BTL | 7m | Cum85 |
| | 104419.308*(15) | HC ₂ CHCN | 11(6)-10(6) | b | Sgr B2 | BTL | 7m | Cum85 |
| | 104432.793*(15) | HC ₂ CHCN | 11(3,9)-10(3,8) | 0.04b | Sgr B2 | BTL | 7m | Cum85 |
| | 104437.516*(17) | HC ₂ CHCN | 11(7)-10(7) | b | Sgr B2 | BTL | 7m | Cum85 |
| | 104453.927*(15) | HC ₂ CHCN | 11(3,8)-10(3,7) | 0.06 | Sgr B2 | BTL | 7m | Cum85 |
| U | 104487.220*(9) | CH ₃ CH ₂ OH | 7(0,7)-6(1,6) | 0.20 | Sgr B2 | BTL | 7m | Cum85 |
| U | 104589. | unidentified | | 0.15x | Sgr B2 | NRAO | 11m | Lis78 |
| | 104616.975*(55) | H ₂ CS | 3(1,2)-2(1,1) | 0.77 | Sgr B2 | NRAO | 11m | Lis78 |
| | 104666.56 *(2) | C ₂ H | 11-10 $J=23/2-21/2$ | 0.10 | IRC+10216 | NRAO | 11m | Gue78 |
| | 104705.10 *(2) | C ₂ H | 11-10 $J=21/2-19/2$ | 0.10 | IRC+10216 | NRAO | 11m | Gue78 |
| | 104711.385*(20) | ¹³ C ¹⁸ O | 1-0 | n.r. | OriMC-2 | NRAO | 11m | Wan76 |
| U | 104808.620*(11) | CH ₃ CH ₂ OH | 5(1,5)-4(0,4) | 0.18 | Sgr B2 | NRAO | 11m | Zuc75 |
| U | 104874.8 (10) | unidentified | | 0.12 | Sgr B2 | BTL | 7m | Cum85 |
| | 104960.550*(16) | HC ₂ CHCN? | 11(2,9)-10(2,8) | 0.06 | Sgr B2 | BTL | 7m | Cum85 |
| | 105063.70 (10) | CH ₃ OH | 13(1)-12(2) | 0.55 | OriMC-1 | FCRAO | 14m | Gol83 |
| | 105464.221 (6) | NH ₂ CHO | 5(0,5)-4(0,4) | 0.31 | Sgr B2 | BTL | 7m | Cum85 |
| U | 105469.303*(14) | CH ₃ CH ₂ CN | 12(0,12)-11(0,11) | 0.2 | OriMC-1 | NRAO | 11m | Kui77 |
| U | 105540. | unidentified | | 0.05 | OriMC-1 | OSO | 20m | Joh84 |
| | 105558.077*(4) | HNCS | 9(0,9)-8(0,8) | 0.05 | Sgr B2 | BTL | 7m | Fre79 |
| U | 105576.35 (10) | CH ₃ OH | 14(-2)-14(1) E | 0.2n | OriMC-1 | NRAO | 11m | Kui77 |
| U | 105590. | unidentified | | 0.15 | OriMC-1 | OSO | 20m | Joh84 |
| | 105768.60 *(43) | CH ₃ OCH ₃ | 13(1,12)-13(0,13) EA+AE | b | OriMC-1 | OSO | 20m | Joh84 |
| | 105770.50 *(26) | CH ₃ OCH ₃ | 13(1,12)-13(0,13) EE | 0.20b | OriMC-1 | OSO | 20m | Joh84 |
| | 105772.41 *(12) | CH ₃ OCH ₃ | 13(1,12)-13(0,13) AA | b | OriMC-1 | OSO | 20m | Joh84 |
| | 105794.057*(58) | CH ₂ NH | 4(0,4)-3(1,3) | 0.27b | Sgr B2 | BTL | 7m | Cum85 |
| | 105799.093*(10) | H ¹³ CCCN | 12-11 | b | Sgr B2 | BTL | 7m | Cum85 |
| | 105799.093*(10) | H ¹³ CCCN | 12-11 | 0.10 | OriMC-1 | OSO | 20m | Joh84 |
| | 105972.601*(14) | NH ₂ CHO | 5(2,4)-4(2,3) | 0.1o | Sgr B2 | NRAO | 11m | Got78a |
| | 106134.430*(25) | NH ₂ CHO | 5(3,3)-4(3,2) | 0.10b | Sgr B2 | BTL | 7m | Cum85 |
| U | 106141.403*(25) | NH ₂ CHO | 5(3,2)-4(3,1) | b | Sgr B2 | BTL | 7m | Cum85 |
| U | 106348.0 (5) | unidentified | | 0.19 | Sgr B2 | BTL | 7m | Cum85 |
| | 106498.911*(5) | HC ₃ N | 40-39 | 0.04 | Sgr B2 | BTL | 7m | Cum85 |
| | 106541.683*(14) | NH ₂ CHO | 5(2,3)-4(2,2) | 0.15 | Sgr B2 | BTL | 7m | Cum85 |
| | 106641.394*(17) | HC ₂ CHCN | 11(1,10)-10(1,9) | 0.05 | Sgr B2 | BTL | 7m | Cum85 |
| | 106723.410*(18) | CH ₃ CH ₂ OH? | 9(2,8)-9(1,9) | 0.06 | Sgr B2 | BTL | 7m | Cum85 |
| | 106743.365*(36) | ³⁴ SO | 2(3)-1(2) | 0.16d | OriMC-1 | NRAO | 11m | Got78 |
| | 106777.52 *(15) | CH ₃ OCH ₃ | 9(1,8)-8(2,7) EE | 0.05 | Sgr B2 | BTL | 7m | Cum85 |
| | 106787.38 *(4) | OC ³⁴ S | 9-8 | 0.089 | Sgr B2 | BTL | 7m | Gol81 |
| | 106913.36 (19) | HOCO ⁺ | 5(0,5)-4(0,4) | 0.4 | Sgr B2 | BTL | 7m | Tha81 |
| | 106922.945* (49) | ²⁹ SiS | 6-5 | 0.012 | IRC+10216 | BTL | 7m | Hen85 |
| | 107013.85 (10) | CH ₃ OH | 3(1)-4(0) A+ | 4.5 | OriMC-1 | FCRAO | 14m | Gol83 |
| | 107043.524*(14) | CH ₃ CH ₂ CN | 12(2,11)-11(2,10) | 0.05 | Sgr B2 | BTL | 7m | Cum85 |

TABLE 2. Recommended rest frequencies for observed interstellar molecular lines — Continued

| Frequency unc. | Formula | Quantum numbers | $T_r^*(\text{K})$ | $T_a^*(\text{K})$ | Source | Telescope | Astr. Ref. | Lab. Ref. |
|----------------|-----------------|-------------------------------------|---|-------------------|-----------|-----------|------------|-----------|
| | 107060.323*(35) | SO ₂ | 27(3,25)-26(4,22) | 0.07 | Sgr B2 | BTL | 7m | Cum85 |
| | 107178.486*(31) | ¹³ CH ₃ CN | 6(3)-5(3) | 0.04b | Sgr B2 | BTL | 7m | Cum85 |
| | 107188.545*(31) | ¹³ CH ₃ CN | 6(2)-5(2) | b | Sgr B2 | BTL | 7m | Cum85 |
| | 107194.580*(32) | ¹³ CH ₃ CN | 6(1)-5(1) | b | Sgr B2 | BTL | 7m | Cum85 |
| | 107196.592*(32) | ¹³ CH ₃ CN | 6(0)-5(0) | 0.07b | Sgr B2 | BTL | 7m | Cum85 |
| | 107316.46 *(10) | CH ₃ SH | 3(-1)-3(0) A | 0.04 | Sgr B2 | BTL | 7m | Cum85 |
| | 107485.178*(13) | CH ₃ CH ₂ CN | 12(7,5)-11(7,4) | b | Sgr B2 | BTL | 7m | Cum85 |
| | 107485.178*(13) | CH ₃ CH ₂ CN | 12(7,6)-11(7,5) | 0.05b | Sgr B2 | BTL | 7m | Cum85 |
| | 107486.961*(13) | CH ₃ CH ₂ CN | 12(6,6)-11(6,5) | b | Sgr B2 | BTL | 7m | Cum85 |
| | 107486.961*(13) | CH ₃ CH ₂ CN | 12(6,7)-11(6,6) | b | Sgr B2 | BTL | 7m | Cum85 |
| | 107491.573*(14) | CH ₃ CH ₂ CN | 12(8,4)-11(8,3) | b | Sgr B2 | BTL | 7m | Cum85 |
| | 107491.573*(14) | CH ₃ CH ₂ CN | 12(8,5)-11(8,4) | b | Sgr B2 | BTL | 7m | Cum85 |
| | 107502.426*(13) | CH ₃ CH ₂ CN | 12(5,8)-11(5,7) | 0.05b | Sgr B2 | BTL | 7m | Cum85 |
| | 107502.474*(13) | CH ₃ CH ₂ CN | 12(5,7)-11(5,6) | b | Sgr B2 | BTL | 7m | Cum85 |
| | 107519.934*(17) | CH ₃ CH ₂ CN? | 12(10,2)-11(10,1) | 0.03b | Sgr B2 | BTL | 7m | Cum85 |
| | 107519.934*(17) | CH ₃ CH ₂ CN? | 12(10,3)-11(10,2) | b | Sgr B2 | BTL | 7m | Cum85 |
| | 107537.27 *(40) | HCOOCH ₃ | 9(2,8)-8(2,7) E | 0.07b | Sgr B2 | BTL | 7m | Cum85 |
| | 107543.66 *(7) | HCOOCH ₃ | 9(2,8)-8(2,7) A | b | Sgr B2 | BTL | 7m | Cum85 |
| | 107543.926*(13) | CH ₃ CH ₂ CN | 12(4,9)-11(4,8) | b | Sgr B2 | BTL | 7m | Cum85 |
| | 107547.601*(13) | CH ₃ CH ₂ CN | 12(4,8)-11(4,7) | b | Sgr B2 | BTL | 7m | Cum85 |
| | 107594.049*(14) | CH ₃ CH ₂ CN | 12(3,10)-11(3,9) | 0.06 | Sgr B2 | BTL | 7m | Cum85 |
| | 107734.741*(14) | CH ₃ CH ₂ CN | 12(3,9)-11(3,8) | 0.04 | Sgr B2 | BTL | 7m | Cum85 |
| | 107843.508*(11) | SO ₂ | 12(4,8)-13(3,11) | 0.06 | Sgr B2 | BTL | 7m | Cum85 |
| | 108126.71 *(1) | HCOOH | 5(1,5)-4(1,4) | 0.06 | Sgr B2 | BTL | 7m | Cum85 |
| | 108651.297 (50) | ¹³ CN | 1/2-1/2 $F=2-1, F_1=0, F_2=1-0$ | 0.07 | Sgr B2 | BTL | 7m | Ger84 |
| | 108657.646 (50) | ¹³ CN | 1/2-1/2 $F=2-2, F_1=1, F_2=1-1$ | 0.07b | Sgr B2 | BTL | 7m | Ger84 |
| | 108658.948 (50) | ¹³ CN | 1/2-1/2 $F=1-2, F_1=1, F_2=1-1$ | b | Sgr B2 | BTL | 7m | Ger84 |
| | 108710.523*(11) | HC ¹³ CCN | 12-11 | 0.15 | Sgr B2 | BTL | 7m | Cum85 |
| | 108721.008*(7) | HCC ¹³ CN | 12-11 | 0.15 | Sgr B2 | BTL | 7m | Cum85 |
| | 108780.201 (50) | ¹³ CN | 3/2-1/2 $F=3-2, F_1=1, F_2=2-1$ | 0.13b | Sgr B2 | BTL | 7m | Ger84 |
| | 108782.374 (50) | ¹³ CN | 3/2-1/2 $F=2-1, F_1=1, F_2=2-1$ | b | Sgr B2 | BTL | 7m | Ger84 |
| | 108786.982 (50) | ¹³ CN | 3/2-1/2 $F=1-0, F_1=1, F_2=2-1$ | b | Sgr B2 | BTL | 7m | Ger84 |
| | 108834.27 *(3) | C ₃ N | 11-10 $J=23/2-21/2$ | 0.45 | IRC+10216 | OSO | 20m | Joh84 |
| | 108853.02 *(3) | C ₃ N | 11-10 $J=21/2-19/2$ | 0.45 | IRC+10216 | OSO | 20m | Joh84 |
| | 108893.94 (10) | CH ₃ OH | 0(0)-1(-1) E | 0.98 | Sgr B2 | BTL | 7m | Cum85 |
| | 108924.267*(48) | SiS | 6-5 | 0.28 | IRC+10216 | NRAO | 11m | Lee68 |
| | 109110.844*(4) | O ¹³ CS | 9-8 | 0.08 | Sgr B2 | BTL | 7m | Cum85 |
| | 109136.81 (10) | CH ₃ OH | unassigned or 14(5)-15(4) E | 0.3 | OriMC-1 | FCRAO | 14m | Gol82 |
| | 109153.19 (10) | CH ₃ OH | 16(-2)-16(1) E | 0.3 | OriMC-1 | FCRAO | 14m | Gol82 |
| | 109160.984*(5) | HC ₃ N | 41-40 | 0.018 | IRC+10216 | NRAO | 11m | Jew84 |
| | 109173.634 (4) | HC ₃ N | 12-11 | 2.57 | Sgr B2 | NRAO | 11m | Mor76 |
| | 109252.184*(36) | SO | 2(3)-1(2) | 2.42m | OriMC-1 | MMWO | 4.9m | Got78 |
| | 109352.726*(38) | HC ₃ N $\nu_7=1$ | 12-11 1e | 0.02 | OriMC-1 | FCRAO | 14m | Gol84 |
| | 109441.944*(30) | HC ₃ N $\nu_7=1$ | 12-11 1e | 0.13 | OriMC-1 | FCRAO | 14m | Gol82 |
| | 109463.063*(1) | OCS | 9-8 | 0.70 | Sgr B2 | NRAO | 11m | Jef71 |
| | 109496.007*(4) | HNCO | 5(1,5)-4(1,4) | 0.16 | OriMC-1 | FCRAO | 14m | Gol82 |
| | 109598.751*(30) | HC ₃ N $\nu_7=1$ | 12-11 1f | 0.19 | OriMC-1 | FCRAO | 14m | Gol84 |
| | 109650.305*(14) | CH ₃ CH ₂ CN | 12(1,11)-11(1,10) | 0.07 | OriMC-1 | NRAO | 11m | Joh77 |
| U | 109738.5 | unidentified | | 0.02 | OriMC-1 | FCRAO | 14m | Gol83 |
| | 109753.504*(8) | NH ₂ CHO | 5(1,4)-4(1,3) | 0.3 | Sgr B2 | BTL | 7m | Lin81 |
| | 109757.633*(15) | SO ₂ | 17(5,13)-18(4,14) | 0.30 | OriMC-1 | FCRAO | 14m | Gol82 |
| U | 109770.5 | unidentified | | 0.03 | OriMC-1 | FCRAO | 14m | Gol83 |
| | 109782.160*(20) | C ¹⁸ O | 1-0 | 2.1 | OriMC-1 | NRAO | 11m | Uli76 |
| | 109833.489*(6) | HNCO | 5(3,3)-4(3,2) | b | OriMC-1 | FCRAO | 14m | Gol82 |
| | 109833.489*(6) | HNCO | 5(3,2)-4(3,1) | 0.03b | OriMC-1 | FCRAO | 14m | Gol82 |
| | 109862.828*(46) | HC ₃ N $\nu_7=2$ | 12-11 0 | 0.02b | OriMC-1 | FCRAO | 14m | Gol83 |
| | 109865.854*(55) | HC ₃ N $\nu_7=2$ | 12-11 2e | b | OriMC-1 | FCRAO | 14m | Gol83 |
| | 109872.366*(5) | HNCO | 5(2,4)-4(2,3) | 0.09b | OriMC-1 | FCRAO | 14m | Gol82 |
| | 109872.773*(5) | HNCO | 5(2,3)-4(2,2) | b | OriMC-1 | FCRAO | 14m | Gol82 |
| | 109905.753*(5) | HNCO | 5(0,5)-4(0,4) | 1.1 | Sgr B2 | NRAO | 11m | Sol73 |
| | 110152.084 (20) | NH ₂ D | 1(1,1) ⁻ -1(0,1) ⁰⁺ $F=0-1$ | b | DR21(OH) | OSO | 20m | Olb85 |
| | 110152.995 (20) | NH ₂ D | 1(1,1) ⁻ -1(0,1) ⁰⁺ $F=2-1$ | b | DR21(OH) | OSO | 20m | Olb85 |
| | 110153.599 (10) | NH ₂ D | 1(1,1) ⁻ -1(0,1) ⁰⁺ | 0.14 | OriMC-1 | NRAO | 11m | Kui78 |
| | 110153.599 (10) | NH ₂ D | 1(1,1) ⁻ -1(0,1) ⁰⁺ $F=2-2$ | 0.11b | DR21(OH) | OSO | 20m | Olb85 |
| | 110153.599 (10) | NH ₂ D | 1(1,1) ⁻ -1(0,1) ⁰⁺ $F=1-1$ | b | DR21(OH) | OSO | 20m | Olb85 |

TABLE 2. Recommended rest frequencies for observed interstellar molecular lines — Continued

| Frequency unc. | Formula | Quantum numbers | $T_r^*(\text{K})$ | Source | Telescope | Astr. Ref. | Lab. Ref. |
|----------------|------------------------------------|--|--------------------|-----------|--------------|------------|----------------|
| | | | $T_a^*(\text{K})$ | | | | |
| | NH ₂ D | 1(1,1)0 ⁻ -1(0,1)0 ⁺ $F=1-2$ | b | DR21(OH) | OSO | 20m | Olb85 Bes83 |
| | NH ₂ D | 1(1,1)0 ⁻ -1(0,1)0 ⁺ $F=1-0$ | b | DR21(OH) | OSO | 20m | Olb85 Bes83 |
| | ¹³ CO | 1-0 | 9.3 | OriMC-1 | NRAO | 11m | Uli76 |
| | HNCO | 5(1,4)-4(1,3) | 0.23 | Sgr B2 | BTL | 7m | Cum85 |
| | CH ₃ ¹³ CN | 6(1)-5(1) | b | Sgr B2 | BTL | 7m | Cum85 |
| | CH ₃ ¹³ CN | 6(0)-5(0) | b | Sgr B2 | BTL | 7m | Cum85 |
| | CH ₃ CN | 6(5)-5(5) $F=7-6$ | 0.2bk | Sgr B2 | NRAO | 11m | Sol71 |
| | CH ₃ CN | 6(5)-5(5) $F=5-4$ | b | Sgr B2 | NRAO | 11m | Sol71 |
| | CH ₃ CN | 6(4)-5(4) $F=7-6$ | 0.45b | Sgr B2 | NRAO | 11m | Sol73 |
| | CH ₃ CN | 6(4)-5(4) $F=5-4$ | b | Sgr B2 | NRAO | 11m | Sol73 |
| | CH ₃ CN | 6(3)-5(3) $F=7-6$ | 0.31b | Sgr B2 | NRAO | 11m | Sol73 |
| | CH ₃ CN | 6(3)-5(3) $F=5-4$ | b | Sgr B2 | NRAO | 11m | Sol73 |
| | CH ₃ CN | 6(2)-5(2) $F=7-6$ | 0.81 | Sgr B2 | NRAO | 11m | Sol73 |
| | CH ₃ CN | 6(1)-5(1) $F=7-6$ | 1.09b | Sgr B2 | NRAO | 11m | Sol73 |
| | CH ₃ CN | 6(0)-5(0) $F=7-6$ | b | Sgr B2 | NRAO | 11m | Sol73 |
| | HCOOCH ₃ | 9(7,2)-8(7,1) A | b | Sgr B2 | BTL | 7m | Cum85 |
| | HCOOCH ₃ | 9(7,3)-8(7,2) A | 0.03b | Sgr B2 | BTL | 7m | Cum85 |
| | HCOOCH ₃ | 9(7,3)-8(7,2) E | b | Sgr B2 | BTL | 7m | Cum85 |
| | CH ₃ CN $\nu_8=1$ | 6(1)-5(1) $\ell'=1$ | 0.06 | OriMC-1 | FCRAO | 14m | Gol83 |
| | CH ₃ CN | 9(6,3)-8(6,2) E | 0.10 | OriMC-1 | FCRAO | 14m | Gol83 |
| | CH ₃ CN | 9(6,4)-8(6,3) E | b | OriMC-1 | FCRAO | 14m | Gol83 |
| | SO ₂ ? | 28(4,24)-27(5,23) | 0.04 | Sgr B2 | BTL | 7m | Cum85 |
| | HCS ⁺ | 3-2 | 0.2 | OriMC-1 | BTL | 7m | Tha81 Bog84 |
| | NH ₂ CHO | 6(2,4)-5(2,3) | 0.16 | Sgr B2 | BTL | 7m | Cum85 |
| | HOCO ⁺ | 6(0,6)-5(0,5) | 0.4 | Sgr B2 | BTL | 7m | Tha81 |
| | SiO | 3-2 $\nu=2$ | 83e | OriMC-1 | NRAO | 11m | Sch82 |
| | SO ₂ | 12(2,10)-12(1,11) | 0.58 | OriMC-1 | MMWO | 4.9m | Lor84 |
| | C ₃ N | 13-12 $J=27/2-25/2$ | 0.097 | IRC+10216 | BTL | 7m | Hen85 Got83 |
| | ²⁹ SiO | 3-2 | 0.11 | OriMC-1 | MMWO | 4.9m | Lor84 |
| | C ₃ N | 13-12 $J=25/2-23/2$ | 0.093 | IRC+10216 | BTL | 7m | Hen85 Got83 |
| | ³⁴ SO ₂ | 8(2,6)-8(1,7) | 0.06 | OriMC-1 | MMWO | 4.9m | Lor84 |
| | CH ₃ CH ₂ OH | 6(3,3)-6(2,4) | 0.09b | Sgr B2 | BTL | 7m | Cum85 |
| | CH ₃ CN | 7(6)-6(6) | 0.07 | OriMC-1 | MMWO | 4.9m | Lor84 |
| | CH ₃ CN | 7(6)-6(6) | b | Sgr B2 | BTL | 7m | Cum85 |
| U | 128706. | unidentified | 0.06y | OriMC-1 | MMWO | 4.9m | Lor84 |
| | 128713.183*(30) | CH ₃ ¹³ CN | 7(1)-6(1) | 0.11b | Sgr B2 | BTL | 7m Cum85 |
| | 128715.649*(32) | CH ₃ ¹³ CN | 7(0)-6(0) | b | Sgr B2 | BTL | 7m Cum85 |
| | 128717.36 *(10) | CH ₃ CN | 7(5)-6(5) | 0.09 | OriMC-1 | MMWO | 4.9m Lor84 |
| | 128739.67 *(10) | CH ₃ CN | 7(4)-6(4) | 0.18 | OriMC-1 | MMWO | 4.9m Lor84 |
| | 128757.03 *(10) | CH ₃ CN | 7(3)-6(3) | 0.39 | OriMC-1 | MMWO | 4.9m Lor84 |
| | 128769.440*(60) | CH ₃ CN | 7(2)-6(2) | 0.38 | OriMC-1 | MMWO | 4.9m Lor84 |
| | 128776.886*(40) | CH ₃ CN | 7(1)-6(1) | 0.52 | OriMC-1 | MMWO | 4.9m Lor84 |
| | 128779.369*(40) | CH ₃ CN | 7(0)-6(0) | 0.62 | OriMC-1 | MMWO | 4.9m Lor84 |
| | 128812.86 (10) | HDCO | 2(0,2)-1(0,1) | 0.3 | L134N | BTL | 7m Lan79 Dan78 |
| | 129013.260*(4) | HNCS | 11(0,11)-10(0,10) | 0.06 | Sgr B2 | BTL | 7m Fre79 Yam79 |
| | 129077.570*(12) | CH ₃ CH ₂ OH | 3(2,2)-2(1,1) | 0.13 | Sgr B2 | BTL | 7m Cum85 |
| | 129105.799*(9) | SO ₂ | 12(1,11)-11(2,10) | 0.20 | Sgr B2 | BTL | 7m Cum85 |
| | 129138.898*(32) | SO | 3(3)-2(2) | 1.5 | ρ Oph A | MMWO | 4.9m Lor84b |
| | 129219.221*(16) | HC ₂ CHCN | 14(1,14)-13(1,13) | 0.05 | Sgr B2 | BTL | 7m Cum85 |
| | 129296.41 *(58) | HCOOCH ₃ | 10(2,8)-9(2,7) E | 0.03 | Sgr B2 | BTL | 7m Cum85 |
| | 129310.08 *(10) | HCOOCH ₃ | 10(2,8)-9(2,7) A | 0.05 | Sgr B2 | BTL | 7m Cum85 |
| | 129363.368*(35) | SiO | 3-2 $\nu=1$ | 0.9 | OriMC-1 | MMWO | 4.9m Dav74 |
| U | 129433.41 (10) | CH ₃ OH | 12(1)-11(2) A- | 0.07 | Sgr B2 | BTL | 7m Cum85 Lee68 |
| | 130010.11 *(80) | HCOOCH ₃ | 11(2,10)-10(2,9) E | 0.04b | Sgr B2 | BTL | 7m Cum85 |
| | 130016.66 *(14) | HCOOCH ₃ | 11(2,10)-10(2,9) A | b | Sgr B2 | BTL | 7m Cum85 |
| | 130171.446*(32) | H ₂ ¹³ CS | 4(1,4)-3(1,3) | 0.04 | Sgr B2 | BTL | 7m Cum85 |
| | 130268.702*(30) | SiO | 3-2 $\nu=0$ | 1.34 | OriMC-1 | MMWO | 4.9m Dic76 |
| | 131014.837*(15) | SO ₂ | 12(1,11)-12(0,12) | 0.25 | Sgr B2 | BTL | 7m Cum85 |
| | 131102.971*(12) | CH ₃ CH ₂ OH | 5(3,3)-5(2,4) | 0.04 | Sgr B2 | BTL | 7m Cum85 |
| | 131134.0 (7) | unidentified | | 0.06 | Sgr B2 | BTL | 7m Cum85 |
| | 131267.478*(17) | HC ₂ CHCN | 14(0,14)-13(0,13) | 0.09b | Sgr B2 | BTL | 7m Cum85 |
| | 131274.915*(17) | SO ₂ | 16(5,11)-17(4,14) | b | Sgr B2 | BTL | 7m Cum85 |
| | 131394.241*(5) | HNCO | 6(1,6)-5(1,5) | 0.18 | OriMC-1 | MMWO | 4.9m Lor84 |
| | 131405.84 *(2) | CH ₃ OCH ₃ | 6(1,6)-5(0,5) EE | 0.17 | OriMC-1 | MMWO | 4.9m Lor84 |
| | 131502.670*(15) | CH ₃ CH ₂ OH | 6(3,4)-6(2,5) | 0.05 | Sgr B2 | BTL | 7m Cum85 |

TABLE 2. Recommended rest frequencies for observed interstellar molecular lines — Continued

| Frequency unc. | Formula | Quantum numbers | $T_r^*(\text{K})$ | Source | Telescope | Astr. Ref. | Lab. Ref. |
|----------------|-----------------|-------------------------------------|---------------------|--------|---------------|------------|-------------|
| | | | $T_a^*(\text{K})$ | | | | |
| U | 131552.3 (14) | unidentified | 0.09 | Sgr B2 | BTL | 7m | Cum85 |
| | 131617.905*(13) | NH ₂ CHO | 6(1,5)-5(1,4) | 0.23 | Sgr B2 | BTL | 7m Cum85 |
| | 131799.292*(7) | HNCO | 6(3,4)-5(3,3) | 0.05b | Sgr B2 | BTL | 7m Cum85 |
| | 131799.292*(7) | HNCO | 6(3,3)-5(3,2) | b | Sgr B2 | BTL | 7m Cum85 |
| | 131845.880*(5) | HNCO | 6(2,5)-5(2,4) | 0.06b | Sgr B2 | BTL | 7m Cum85 |
| | 131846.590*(6) | HNCO | 6(2,4)-5(2,3) | b | Sgr B2 | BTL | 7m Cum85 |
| | 131885.740*(6) | HNCO | 6(0,6)-5(0,5) | 3.41 | Sgr B2 | BTL | 7m Cum85 |
| | 132089.902*(80) | H ₂ ¹³ CS | 4(0,4)-3(0,3) | 0.08 | Sgr B2 | BTL | 7m Cum85 |
| | 132105.6 *(11) | HCOOCH ₃ | 12(1,12)-11(1,11) E | 0.10b | Sgr B2 | BTL | 7m Cum85 |
| | 132107.03 *(19) | HCOOCH ₃ | 12(1,12)-11(1,11) A | b | Sgr B2 | BTL | 7m Cum85 |
| | 132113.983*(74) | ³⁴ SO ₂ ? | 12(1,11)-12(0,12) | b | Sgr B2 | BTL | 7m Cum85 |
| | 132245.2 *(11) | HCOOCH ₃ | 12(0,12)-11(0,11) E | 0.18b | Sgr B2 | BTL | 7m Cum85 |
| | 132246.385*(13) | H ¹³ CCCN | 15-14 | b | Sgr B2 | BTL | 7m Cum85 |
| | 132246.56 *(19) | HCOOCH ₃ | 12(0,12)-11(0,11) A | b | Sgr B2 | BTL | 7m Cum85 |
| | 132356.711*(5) | HNCO | 6(1,5)-5(1,4) | 0.19 | Sgr B2 | BTL | 7m Cum85 |
| | 132524.590*(15) | HC ₂ CHCN | 14(2,13)-13(2,12) | 0.15b | Sgr B2 | BTL | 7m Cum85 |
| | 132525.39 *(10) | CH ₃ OCH ₃ | 8(0,8)-7(1,7) EE | b | Sgr B2 | BTL | 7m Cum85 |
| | 132621.94 (10) | CH ₃ OH | 6(2)-7(1) A- | 0.12 | Sgr B2 | BTL | 7m Cum85 |
| | 132744.808*(22) | SO ₂ | 14(2,12)-14(1,13) | 0.57 | OriMC-1 | NRAO | 11m Pic79 |
| | 132890.79 (10) | CH ₃ OH | 6(-1)-5(0) E | 2.07 | Sgr B2 | BTL | 7m Cum85 |
| | 132917.762*(12) | HC ₂ CHCN | 14(4,11)-13(4,10) | 0.11b | Sgr B2 | BTL | 7m Cum85 |
| | 132919.017*(12) | HC ₂ CHCN | 14(4,10)-13(4,9) | b | Sgr B2 | BTL | 7m Cum85 |
| | 132921.92 *(80) | HCOOCH ₃ | 11(1,10)-10(1,9) E | b | Sgr B2 | BTL | 7m Cum85 |
| | 132928.60 *(14) | HCOOCH ₃ | 11(1,10)-10(1,9) A | b | Sgr B2 | BTL | 7m Cum85 |
| | 132935.070*(12) | CH ₃ CH ₂ OH | 3(2,1)-2(1,2) | b | Sgr B2 | BTL | 7m Cum85 |
| | 133605.50 (10) | CH ₃ OH | 5(-2)-6(-1) E | 0.19 | Sgr B2 | BTL | 7m Cum85 |
| | 133785.897*(1) | OCS | 11-10 | 1.49 | OriMC-1 | BTL | 7m Gol81 |
| | 133829.5 *(11) | CH ₃ CHO | 7(0,7)-6(0,6) E | 0.16 | Sgr B2 | BTL | 7m Cum85 |
| | 133853.87 *(15) | CH ₃ CHO | 7(0,7)-6(0,6) A | 0.15 | Sgr B2 | BTL | 7m Cum85 |
| | 134004.804*(11) | SO ₂ | 8(2,6)-8(1,7) | 0.65 | OriMC-1 | MMWO | 4.9m Pic79 |
| | 134231.12 (10) | CH ₃ OH | 12(-3)-13(-2) E | 0.24 | OriMC-1 | MMWO | 4.9m Lor84a |
| | 134284.91 *(17) | HDCO | 2(1,1)-1(1,0) | 0.19 | OriMC-1 | MMWO | 4.9m Lor84a |
| | 135298.134*(75) | H ₂ CS | 4(1,4)-3(1,3) | 0.64 | OriMC-1 | MMWO | 4.9m Van84 |
| | 135696.011*(8) | SO ₂ | 5(1,5)-4(0,4) | 1.5 | ρ Oph | MMWO | 4.9m Got78 |
| | 135775.633*(42) | ³⁴ SO | 4(3)-3(2) | 0.62 | ρ Oph A | MMWO | 4.9m Lor85 |
| | 135775.633*(42) | ³⁴ SO | 4(3)-3(2) | 0.6 | ρ Oph A | MMWO | 4.9m Lor84b |
| U | 136250.7 (11) | unidentified | | 0.04 | Sgr B2 | BTL | 7m Cum85 |
| | 136280.0 *(8) | HCOOCH ₃ | 11(4,8)-10(4,7) E | 0.12b | Sgr B2 | BTL | 7m Cum85 |
| | 136282.47 *(13) | HCOOCH ₃ | 11(4,8)-10(4,7) A | b | Sgr B2 | BTL | 7m Cum85 |
| U | 136387.8 (15) | unidentified | | 0.05 | Sgr B2 | BTL | 7m Cum85 |
| | 136464.400*(2) | HC ₃ N | 15-14 | 1.5 | Sgr B2 | MMWO | 4.9m Mor77 |
| | 136541.301*(14) | CH ₃ CH ₂ CN | 15(1,14)-14(1,13) | 0.10 | Sgr B2 | BTL | 7m Cum85 |
| | 136634.682*(68) | SO | 5(6)-5(5) | 0.4 | OriMC-1 | MMWO | 4.9m Mun84 |
| | 136704.502*(1) | CH ₃ CCH | 8(3)-7(3) | 0.17 | OriMC-1 | MMWO | 4.9m Mun84 |
| | 136717.560*(1) | CH ₃ CCH | 8(2)-7(2) | 0.20 | OriMC-1 | MMWO | 4.9m Mun84 |
| | 136725.397*(1) | CH ₃ CCH | 8(1)-7(1) | 0.41 | OriMC-1 | MMWO | 4.9m Mun84 |
| | 136728.010*(1) | CH ₃ CCH | 8(0)-7(0) | 0.42 | OriMC-1 | MMWO | 4.9m Mun84 |
| | 136799.703*(30) | HC ₃ N $\nu_7=1$ | 15-14 1e | 0.09 | Sgr B2 | BTL | 7m Cum85 |
| | 137180. (1) | SiC ₂ | 6(0,6)-5(0,5) | 0.138 | IRC+10216 | BTL | 7m Tha84 |
| | 137369.315*(98) | H ₂ CS | 4(3,2)-3(3,1) | 0.12b | OriMC-1 | MMWO | 4.9m Van84 |
| | 137369.346*(98) | H ₂ CS | 4(3,1)-3(3,0) | b | OriMC-1 | MMWO | 4.9m Van84 |
| | 137371.043*(84) | H ₂ CS | 4(0,4)-3(0,3) | 0.37 | OriMC-1 | MMWO | 4.9m Van84 |
| | 137381.956*(64) | H ₂ CS | 4(2,3)-3(2,2) | 0.10 | OriMC-1 | MMWO | 4.9m Van84 |
| | 137411.803*(64) | H ₂ CS | 4(2,2)-3(2,1) | 0.09 | OriMC-1 | MMWO | 4.9m Van84 |
| | 137449.959*(6) | H ₂ ¹³ CO | 2(1,2)-1(1,1) | 0.2 | OriMC-1 | MMWO | 4.9m Kut76 |
| | 137449.959*(6) | H ₂ ¹³ CO | 2(1,2)-1(1,1) | 0.31 | OriMC-1 | BTL | 7m Kah84 |
| | 137903.06 (10) | CH ₃ OH | 7(-4)-8(-3) E | 0.8 | OriMC-1 | BTL | 7m Woo84 |
| | 138178.648*(42) | SO | 4(3)-3(2) | 2.0 | OriMC-1 | MMWO | 4.9m Got73b |
| | 138284.2 *(11) | CH ₃ CHO | 7(1,6)-6(1,5) E | 0.15 | Sgr B2 | BTL | 7m Cum85 |
| | 138319.43 *(16) | CH ₃ CHO | 7(1,6)-6(1,5) A | 0.14 | Sgr B2 | BTL | 7m Cum85 |
| | 138351.055*(14) | CH ₃ CH ₂ CN? | 16(1,16)-15(1,15) | 0.15 | Sgr B2 | BTL | 7m Cum85 |
| | 138739.309*(29) | ¹³ CS | 3-2 | 0.5 | OriMC-1 | MMWO | 4.9m Wil71 |
| | 139483.466*(75) | H ₂ CS | 4(1,3)-3(1,2) | 0.17 | ρ Oph B1 | MMWO | 4.9m Lor84a |
| | 139953.62 *(72) | NH ₂ CN | 7(0,7)-6(0,6) | 0.08 | Sgr B2 | BTL | 7m Cum85 |
| | 140033.50 (10) | CH ₃ OH? | unassigned | 0.03 | Sgr B2 | BTL | 7m Cum85 |
| | | | | | | | Lee68 |

TABLE 2. Recommended rest frequencies for observed interstellar molecular lines — Continued

| Frequency unc. | Formula | Quantum numbers | $T_r^*(\text{K})$ | Source | Telescope | Astr. Ref. | Lab. Ref. |
|----------------|-----------------|------------------------------------|---|--------|-----------|------------|------------------|
| | | | $T_a^*(\text{K})$ | | | | |
| | 140127.473*(48) | CH ₂ CO | 7(1,7)-6(1,6) | 0.15 | Sgr B2 | BTL | 7m Cum85 |
| | 140151.08 (10) | CH ₃ OH | 18(0)-18(-1) E | 0.05 | Sgr B2 | BTL | 7m Cum85 Lee68 |
| | 140306.164*(9) | SO ₂ | 6(2,4)-6(1,5) | 0.75 | OriMC-1 | MMWO | 4.9m Pic79 |
| | 140423.83 (4) | ¹³ CH ₃ OH? | 3(1)-2(1) A + | 0.05b | Sgr B2 | BTL | 7m Cum85 Haq74 |
| | 140429.438*(17) | HC ₂ CHCN | 15(0,15)-14(0,14) | b | Sgr B2 | BTL | 7m Cum85 |
| U | 140687.3 (16) | unidentified | | 0.07 | Sgr B2 | BTL | 7m Cum85 |
| | 140740.379*(4) | HNCS | 12(0,12)-11(0,11) | 0.05 | Sgr B2 | BTL | 7m Fre79 Yam79 |
| | 140839.518*(7) | H ₂ CO | 2(1,2)-1(1,1) | 4.5 | OriMC-1 | MMWO | 4.9m Kut76 |
| | 140877.42 *(70) | NH ₂ CN | 7(1,6)-6(1,5) | 0.05 | Sgr B2 | BTL | 7m Cum85 |
| | 140902.2 (14) | unidentified | | 0.07 | Sgr B2 | BTL | 7m Cum85 |
| | 140918. (1) | SiC ₂ | 6(2,5)-5(2,4) | 0.123 | IRC+10216 | BTL | 7m Tha84 |
| | 141061.797*(15) | H ¹³ CCCN | 16-15 | 0.07 | Sgr B2 | BTL | 7m Cum85 |
| | 141244.04 *(80) | HCOOCH ₃ | 11(3,8)-10(3,7) E | 0.5 | OriMC-1 | NRAO | 11m Wil81 |
| | 141260.28 *(14) | HCOOCH ₃ | 11(3,8)-10(3,7) A | 0.4 | OriMC-1 | NRAO | 11m Wil81 |
| | 141595.48 (5) | ¹³ CH ₃ OH | 3(0)-2(0) E | 0.44b | Sgr B2 | BTL | 7m Cum85 Haq74 |
| | 141597.06 (5) | ¹³ CH ₃ OH | 3(-1)-2(-1) E | b | Sgr B2 | BTL | 7m Cum85 Haq74 |
| | 141602.53 (4) | ¹³ CH ₃ OH | 3(0)-2(0) A + | b | Sgr B2 | BTL | 7m Cum85 Haq74 |
| | 141636.055 (60) | C ₃ H | 2 ¹ Π _{1/2} $J=13/2-11/2$ | 0.042 | IRC+10216 | BTL | 7m Tha85 Tha85 |
| | 141709.128 (60) | C ₃ H | 2 ¹ Π _{1/2} $J=13/2-11/2$ | 0.062 | IRC+10216 | BTL | 7m Tha85 Tha85 |
| | 141751. (1) | SiC ₂ | 6(4,3)-5(4,2) | 0.064 | IRC+10216 | BTL | 7m Tha84 |
| | 141755. (1) | SiC ₂ | 6(4,2)-5(4,1) | 0.064 | IRC+10216 | BTL | 7m Tha84 |
| | 141983.748*(6) | H ₂ ¹³ CO | 2(0,2)-1(0,1) | 0.21 | OriMC-1 | BTL | 7m Kah84 |
| | 142285.061*(17) | CH ₃ CH ₂ OH | 9(0,9)-8(1,8) | 0.14 | Sgr B2 | BTL | 7m Cum85 |
| | 142346.314*(14) | CH ₃ CH ₂ CN | 16(2,15)-15(2,14) | 0.07 | Sgr B2 | BTL | 7m Cum85 |
| | 142379.431*(3) | OC ³⁴ S | 12-11 | 0.08 | Sgr B2 | BTL | 7m Cum85 |
| | 142399.489*(14) | HC ₂ CHCN | 15(5,11)-14(5,10) | 0.07b | Sgr B2 | BTL | 7m Cum85 |
| | 142399.510*(14) | HC ₂ CHCN | 15(5,10)-14(5,9) | b | Sgr B2 | BTL | 7m Cum85 |
| | 142401.867*(16) | HC ₂ CHCN | 15(6)-14(6) | b | Sgr B2 | BTL | 7m Cum85 |
| | 142419.704*(19) | HC ₂ CHCN | 15(7)-14(7) | 0.06b | Sgr B2 | BTL | 7m Cum85 |
| | 142424.454*(13) | HC ₂ CHCN | 15(4,12)-14(4,11) | b | Sgr B2 | BTL | 7m Cum85 |
| | 142426.506*(13) | HC ₂ CHCN | 15(4,11)-14(4,10) | b | Sgr B2 | BTL | 7m Cum85 |
| | 142447.936*(21) | HC ₂ CHCN? | 15(8)-14(8) | 0.07 | Sgr B2 | BTL | 7m Cum85 |
| | 142701.329*(18) | NH ₂ CHO | 7(1,7)-6(1,6) | 0.11 | Sgr B2 | BTL | 7m Cum85 |
| | 142733.7 *(10) | HCOOCH ₃ | 13(1,13)-12(1,12) E | 0.05b | Sgr B2 | BTL | 7m Cum85 Cum85 |
| | 142735.13 *(10) | HCOOCH ₃ | 13(1,13)-12(1,12) A | b | Sgr B2 | BTL | 7m Cum85 Plu84 |
| | 142768.884*(48) | CH ₂ CO | 7(1,6)-6(1,5) | 0.11 | Sgr B2 | BTL | 7m Cum85 |
| | 142807.66 (4) | ¹³ CH ₃ OH? | 3(1)-2(1) A - | b | Sgr B2 | BTL | 7m Cum85 Haq74 |
| | 142815.6 *(10) | HCOOCH ₃ | 13(0,13)-12(0,12) E | 0.04b | Sgr B2 | BTL | 7m Cum85 Cum85 |
| | 142817.02 *(10) | HCOOCH ₃ | 13(0,13)-12(0,12) A | b | Sgr B2 | BTL | 7m Cum85 Plu84 |
| | 143057.058*(28) | SO ₂ | 16(2,14)-16(1,15) | 0.57 | OriMC-1 | MMWO | 4.9m Pic79 |
| | 143603.06 *(14) | CH ₃ OCH ₃ | 7(3,4)-7(2,5) EE | 0.08 | Sgr B2 | BTL | 7m Cum85 |
| U | 143768.4 (15) | unidentified | | 0.07z | Sgr B2 | BTL | 7m Cum85 |
| | 143865.79 (10) | CH ₃ OH | 3(1)-2(1) A + | 1.27 | Sgr B2 | BTL | 7m Cum85 Lee68 |
| | 144077.321*(23) | DCO ⁺ | 2-1 | 0.3 | OriMC-1 | MMWO | 4.9m Gue77a |
| | 144241.96 (3) | DC ₂ | 2-1 $J=5/2-3/2$ $F=7/2-5/2$ | 0.13b | OriMC-1 | BTL | 7m Vrt85 Vrt85 |
| | 144243.05 (3) | DC ₂ | 2-1 $J=5/2-3/2$ $F=5/2-3/2$ | b | OriMC-1 | BTL | 7m Vrt85 Vrt85 |
| | 144243.05 (3) | DC ₂ | 2-1 $J=5/2-3/2$ $F=3/2-1/2$ | b | OriMC-1 | BTL | 7m Vrt85 Vrt85 |
| | 144244.5 | unidentified | | 0.15 | OriMC-1 | BTL | 7m Vrt85 Vrt85 |
| | 144244.8 | unidentified | | 0.13 | Sgr B2 | NRAO | 11m Hol81 |
| | 144296.72 (8) | DC ₂ | 2-1 $J=3/2-1/2$ $F=5/2-3/2$ | 0.09 | OriMC-1 | BTL | 7m Vrt85 Vrt85 |
| | 144617.147*(19) | C ³⁴ S | 3-2 | 1.2 | OriMC-1 | MMWO | 4.9m Wil76a |
| | 144826.573*(2) | DCN | 2-1 $F_1=2-2$ | b | OriMC-1 | MMWO | 4.9m Pen77 DeL69 |
| | 144826.8097(10) | DCN | 2-1 $F_1=1-0$ $F=2-1$ | b | OriMC-1 | MMWO | 4.9m Pen77 DeL69 |
| | 144826.8414(10) | DCN | 2-1 $F_1=1-0$ $F=1-1$ | b | OriMC-1 | MMWO | 4.9m Pen77 DeL69 |
| | 144828.000*(2) | DCN | 2-1 $F_1=2-1$ | 0.9b | OriMC-1 | MMWO | 4.9m Pen77 DeL69 |
| | 144828.109*(2) | DCN | 2-1 $F_1=3-2$ | b | OriMC-1 | MMWO | 4.9m Pen77 DeL69 |
| | 144830.336*(2) | DCN | 2-1 $F_1=1-1$ | b | OriMC-1 | MMWO | 4.9m Pen77 DeL69 |
| U | 145075.9 (5) | unidentified | | 0.25 | OriMC-1 | NRAO | 11m Hol81 |
| | 145093.75 (10) | CH ₃ OH | 3(0)-2(0) E | 1.25 | OriMC-1 | NRAO | 11m Kut73 Lee68 |
| | 145097.47 (10) | CH ₃ OH | 3(-1)-2(-1) E | 1.45 | OriMC-1 | NRAO | 11m Kut73 Lee68 |
| | 145103.23 (10) | CH ₃ OH | 3(0)-2(0) A + | 1.35 | OriMC-1 | NRAO | 11m Kut73 Lee68 |
| | 145124.41 (10) | CH ₃ OH | 3(2)-2(2) A - | 1.45b | OriMC-1 | NRAO | 11m Kut73 Lee68 |
| | 145126.37 (10) | CH ₃ OH | 3(2)-2(2) E, 3(-2)-3(-2) E | b | OriMC-1 | NRAO | 11m Kut73 Lee68 |
| | 145131.88 (10) | CH ₃ OH | 3(1)-2(1) E | 1.25b | OriMC-1 | NRAO | 11m Kut73 Lee68 |
| | 145133.46 (10) | CH ₃ OH | 3(2)-2(2) A + | b | OriMC-1 | NRAO | 11m Kut73 Lee68 |

TABLE 2. Recommended rest frequencies for observed interstellar molecular lines — Continued

| Frequency unc. | Formula | Quantum numbers | $T_e^*(\text{K})$ | $T_s^*(\text{K})$ | Source | Telescope | Astr. Ref. | Lab. Ref. |
|----------------|------------------------------------|------------------------------------|--|-------------------|---------------|-----------|------------|-----------|
| | SiS | 8-7 | 0.25 | | IRC + 10216 | BTL | 7m | Hen85 |
| | CH ₃ CH ₂ CN | 16(1,15)-15(1,14) | 0.1 | | OriMC-1 | BTL | 7m | Woo84 |
| | HC ₃ N | 16-15 | 0.8 | | Sgr B2 | MMWO | 4.9m | Mor77 |
| | H ₂ CO | 2(0,2)-1(0,1) | 1.9 | | OriMC-1 | NRAO | 11m | Tha71 |
| | CH ₃ OCH ₃ | 5(3,2)-5(2,3) EE | 0.1 | | OriMC-1 | BTL | 7m | Woo84 |
| | C ³³ S | 3-2 $F=9/2-7/2$ | 0.2b | | OriMC-1 | MMWO | 4.9m | Wil76a |
| | C ³³ S | 3-2 $F=7/2-5/2$ | b | | OriMC-1 | MMWO | 4.9m | Wil76a |
| | C ³³ S | 3-2 $F=5/2-3/2$ | b | | OriMC-1 | MMWO | 4.9m | Wil76a |
| | C ³³ S | 3-2 $F=3/2-1/2$ | b | | OriMC-1 | MMWO | 4.9m | Wil76a |
| | CH ₃ OH | 16(0)-16(-1) E | 0.4 | | OriMC-1 | BTL | 7m | Woo84 |
| | OCS | 12-11 | 0.45 | | Sgr B2 | NRAO | 11m | Sol73 |
| | H ₂ ¹³ CO | 2(1,1)-1(1,0) | n.r. | | OriMC-1 | MMWO | 4.9m | Wan76 |
| U | 146932.5 (10) | unidentified | 0.6 | | OriMC-1 | NRAO | 11m | Hol81 |
| | 146969.049*(23) | CS | 3-2 | 8.1 | OriMC-1 | MMWO | 4.9m | Lis75 |
| | 146977.7 *(11) | HCOOCH ₃ | 12(3,10)-11(3,9) E | ~0.08 | OriMC-1 | MMWO | 4.9m | Lor84 |
| | 146987.85 *(18) | HCOOCH ₃ | 12(3,10)-11(3,9) A | 0.11 | OriMC-1 | MMWO | 4.9m | Lor84 |
| | 147024.94 *(2) | CH ₃ OCH ₃ | 7(1,6)-6(0,6) EE | 0.20 | OriMC-1 | MMWO | 4.9m | Lor84 |
| | 147072.868 (64) | CH ₃ CN | 8(6)-7(6) $F=9-8, 7-6$ | 0.08 | OriMC-1 | MMWO | 4.9m | Lor84 |
| | 147103.873*(62) | CH ₃ CN | 8(5)-7(5) $F=9-8$ | 0.12 | OriMC-1 | MMWO | 4.9m | Lor84 |
| | 147129.323*(62) | CH ₃ CN | 8(4)-7(4) $F=9-8$ | 0.16 | OriMC-1 | MMWO | 4.9m | Lor84 |
| | 147149.128*(62) | CH ₃ CN | 8(3)-7(3) $F=9-8$ | 0.32 | OriMC-1 | MMWO | 4.9m | Lor84 |
| | 147163.249*(60) | CH ₃ CN | 8(2)-7(2) | 0.34 | OriMC-1 | MMWO | 4.9m | Lor84 |
| | 147171.757*(30) | CH ₃ CN | 8(1)-7(1) | 0.50 | OriMC-1 | MMWO | 4.9m | Lor84 |
| | 147174.594*(30) | CH ₃ CN | 8(0)-7(0) | 0.54 | OriMC-1 | MMWO | 4.9m | Lor84 |
| U | 147243. | unidentified | 0.12 | | OriMC-1 | MMWO | 4.9m | Lor84 |
| U | 150176.48 (4) | NO | $^2\Pi_{1/2} J=3/2-1/2 F=5/2-3/2(-+)$ | 0.25 | Sgr B2 | NRAO | 11m | Lis78a |
| U | 150328.0 (10) | unidentified | 0.14 | | Sgr B2 | NRAO | 11m | Hol81 |
| | 150381.139*(20) | SO ₂ | 15(5,11)-16(4,12) | 0.25 | Sgr B2 | NRAO | 11m | Hol80a |
| | 150439.12 (4) | NO | $^2\Pi_{1/2} J=3/2-1/2 F=3/2-3/2(+ -)$ | 0.15 | OriMC-1 | NRAO | 11m | Hol80a |
| | 150498.339*(7) | H ₂ CO | 2(1,1)-1(1,0) | 2.7 | OriMC-1 | NRAO | 11m | Tha71 |
| | 150546.52 (4) | NO | $^2\Pi_{1/2} J=3/2-1/2 F=5/2-3/2(+ -)$ | 0.25 | Sgr B2 | NRAO | 11m | Lis78a |
| | 150601.0 *(11) | HCOOCH ₃ | 12(4,8)-11(4,7) E | 0.2 | OriMC-1 | BTL | 7m | Woo84 |
| | 150618.10 *(18) | HCOOCH ₃ | 12(4,8)-11(4,7) A | 0.2 | OriMC-1 | BTL | 7m | Woo84 |
| | 150820.66 (3) | C ₃ H ₂ | 4(0,4)-3(1,3) | 0.3 | Sgr B2 | NRAO | 11m | Hol83a |
| | 150851.91 (2) | C ₃ H ₂ | 4(1,4)-3(0,3) | 0.3 | Sgr B2 | NRAO | 11m | Hol83a |
| | 150884.58 (10) | CH ₃ OH | 12(-1)-11(-2) E n,t | 1.5 | Sgr B2 | NRAO | 11m | Sny80 |
| | 151378.667*(8) | SO ₂ | 2(2,0)-2(1,1) | 0.32 | ρ Oph A | MMWO | 4.9m | Lor85 |
| | 152609.774 (50) | DNC | 2-1 | 0.5 | L134 | MMWO | 4.9m | Sne77 |
| | 153054.97 *(3) | CH ₃ OCH ₃ | 9(0,9)-8(1,8) EE | 0.39 | Sgr B2 | NRAO | 11m | Mer82 |
| | 153432.18 *(2) | NH ₂ CHO | 7(1,6)-6(1,5) | 0.15 | Sgr B2 | NRAO | 11m | Hol83a |
| U | 153487.5 (5) | unidentified | 0.13 | | Sgr B2 | NRAO | 11m | Hol81 |
| | 153512.0 (10) | HCOOCH ₃ | 13(1,12)-12(1,11) E | 0.1 | OriMC-1 | NRAO | 11m | Hol83a |
| | 153518.689*(46) | HCOOCH ₃ | 13(1,12)-12(1,11) A | 0.13 | OriMC-1 | NRAO | 11m | Hol83a |
| | 153553.2 *(11) | HCOOCH ₃ | 12(2,10)-11(2,9) E | 0.13 | OriMC-1 | NRAO | 11m | Hol83a |
| | 153566.72 *(11) | HCOOCH ₃ | 12(2,10)-11(2,9) A | 0.11 | OriMC-1 | NRAO | 11m | Hol83a |
| U | 153668.3 (10) | unidentified | 0.08 | | Sgr B2 | NRAO | 11m | Hol81 |
| | 153790.770*(2) | CH ₃ CCH | 9(3)-8(3) | 0.23 | Sgr B2 | NRAO | 11m | Hol81 |
| | 153805.458*(1) | CH ₃ CCH | 9(2)-8(2) | 0.18 | Sgr B2 | NRAO | 11m | Hol81 |
| | 153814.273*(1) | CH ₃ CCH | 9(1)-8(1) | b | Sgr B2 | NRAO | 11m | Hol81 |
| | 153817.212*(1) | CH ₃ CCH | 9(0)-8(0) | 0.59b | Sgr B2 | NRAO | 11m | Hol81 |
| | 154217.20 (15) | N ₂ D ⁺ | 2-1 | 0.25 | ρ Oph B2 | MMWO | 4.9m | Lor84b |
| | 154425.78 (10) | CH ₃ OH | 11(0)-11(-1) E | 1.42 | OriMC-1 | NRAO | 11m | Hol81 |
| | 154657.283*(1) | HC ₃ N | 17-16 | 1.54 | OriMC-1 | NRAO | 11m | Hol81 |
| | 156488.95 (10) | CH ₃ OH | 8(0)-8(-1) E | 1.1 | OriMC-1 | NRAO | 11m | Hol81 |
| | 156602.42 (10) | CH ₃ OH | 2(1)-3(0) A+ | 1.5 | OriMC-1 | NRAO | 11m | Hol81 |
| | 158971.814*(42) | SO | 3(4)-2(3) | 3.5 | OriMC-1 | NRAO | 11m | Hol81 |
| | 159888.873*(13) | CH ₃ CH ₂ CN | 18(2,17)-17(2,16) | 0.15 | Sgr B2 | NRAO | 11m | Hol81 |
| U | 159915.6 (10) | unidentified | 0.07 | | Sgr B2 | NRAO | 11m | Hol81 |
| | 160827.843*(9) | SO ₂ | 10(0,10)-9(1,9) | 2.4 | OriMC-1 | NRAO | 11m | Hol81 |
| | 163119.437*(21) | SO ₂ | 18(2,16)-17(3,15) | 0.20 | Sgr B2 | NRAO | 11m | Hol83a |
| | 163160.825*(53) | CH ₃ CO | 8(1,7)-7(1,6) | 0.20 | Sgr B2 | NRAO | 11m | Hol83a |
| | 163829.69 *(50) | HCOOCH ₃ | 14(1,13)-13(1,12) E | 0.35 | OriMC-1 | NRAO | 11m | Sny85a |
| | 163835.48 *(4) | HCOOCH ₃ | 14(1,13)-13(1,12) A | 0.40 | OriMC-1 | NRAO | 11m | Sny85a |
| U | 163873. (1) | unidentified | 0.15 | | OriMC-1 | NRAO | 11m | Sny85a |
| U | 163902. (1) | unidentified | 0.10 | | OriMC-1 | NRAO | 11m | Sny85a |

TABLE 2. Recommended rest frequencies for observed interstellar molecular lines — Continued

| Frequency unc. | Formula | Quantum numbers | $T_r^*(\text{K})$ | Source | Telescope | Astr. Ref. | Lab. Ref. | |
|----------------|-----------------|------------------------------------|---------------------------------|--------|-----------|------------|-----------|--------|
| | | | $T_a^*(\text{K})$ | | | | | |
| | 163927.31 *(5) | HCOOCH ₃ | 15(0,15)-14(1,14) A | 0.15 | OriMC-1 | NRAO | 11m | Sny85a |
| | 168762.76237(2) | H ₂ S | 1(1,0)-1(0,1) | 2.3 | OriMC-1 | NRAO | 11m | Tha72 |
| | 168815.101*(36) | ³⁴ SO | 4(3)-3(3) | 0.9 | OriMC-1 | NRAO | 11m | Hol81 |
| | 169335.34 (10) | CH ₃ OH | 10(1)-10(0) E | 0.7 | OriMC-1 | NRAO | 11m | Wil72 |
| | 170742. (1) | SiC ₂ | 7(2,5)-6(2,4) | 0.16 | IRC+10216 | NRAO | 11m | Tha84 |
| | 170876.405*(2) | CH ₃ CCH | 10(3)-9(3) | 0.2 | OriMC-1 | MMWO | 4.9m | Mun84 |
| | 170892.722*(2) | CH ₃ CCH | 10(2)-9(2) | 0.31 | OriMC-1 | MMWO | 4.9m | Mun84 |
| | 170902.514*(1) | CH ₃ CCH | 10(1)-9(1) | 0.51 | OriMC-1 | MMWO | 4.9m | Mun84 |
| | 170905.779*(1) | CH ₃ CCH | 10(0)-9(0) | 0.58 | OriMC-1 | MMWO | 4.9m | Mun84 |
| | 171275.166*(57) | SiO | 4-3 ν=2 | 87e | X-Cyg | NRAO | 11m | Sch82 |
| | 172107.956 (45) | HC ¹⁵ N | 2-1 | 0.45 | OriMC-1 | NRAO | 11m | Wil72 |
| | 172481.140*(45) | SiO | 4-3 ν=1 | 50e | X-Cyg | NRAO | 11m | Sch82 |
| | 172676.573 (50) | H ¹³ CN | 2-1 F=1-0,2-2 | b | OriMC-1 | NRAO | 11m | Wil72 |
| | 172677.959 (50) | H ¹³ CN | 2-1 F=2-1,3-2 | 0.91b | OriMC-1 | NRAO | 11m | Pea76 |
| | 172680.209 (50) | H ¹³ CN | 2-1 F=1-1 | b | OriMC-1 | NRAO | 11m | Wil72 |
| | 173377.38 *(10) | HCO | 2(0,2)-1(0,1) 5/2-3/2 F=3-2 | 0.12 | OriMC-2 | NRAO | 11m | Sny85a |
| | 173391.211*(16) | CH ₃ CH ₂ OH | 5(2,3)-4(1,4) | 0.05 | OriMC-2 | NRAO | 11m | Sny85a |
| | 173406.08 *(10) | HCO | 2(0,2)-1(0,1) 5/2-3/2 F=2-1 | 0.05 | OriMC-2 | NRAO | 11m | Sny85a |
| | 173443.06 *(10) | HCO | 2(0,2)-1(0,1) 3/2-1/2 F=2-1 | 0.06 | OriMC-2 | NRAO | 11m | Sny85a |
| | 173688.254*(41) | SiO | 4-3 ν=0 | 65e | OriMC-1 | NRAO | 11m | Sch82 |
| | 183310.0906(15) | H ₂ O | 3(1,3)-2(2,0) | 10 | OriMC-1 | KAO | 1m | Wat77 |
| | 195954.249*(29) | CS | 4-3 | 3.3 | NGC2024 | MMWO | 4.9m | Mun84a |
| U | 202688. | unidentified | | 0.65 | OriMC-1 | NRAO | 12m | Tur84a |
| U | 202763.47 *(5) | H ¹³ CCCN | 23-22 | 0.1 | OriMC-1 | NRAO | 12m | Tur84a |
| U | 202815. | unidentified | | 0.15 | OriMC-1 | NRAO | 12m | Tur84a |
| U | 203391.488*(15) | SO ₂ | 12(0,12)-11(1,11) | 2.0 | OriMC-1 | MMWO | 4.9m | Eri84 |
| U | 205757. | unidentified | | 0.17 | OriMC-1 | NRAO | 12m | Tur84a |
| | 206131.627*(6) | H ₂ ¹³ CO | 3(1,2)-2(1,2) | 3.00 | OriMC-1 | FCRAO | 14m | Eri84c |
| | 206176.015*(40) | SO | 4(5)-3(4) | 9.00 | OriMC-1 | FCRAO | 14m | Eri84c |
| | 208700.338*(11) | SO ₂ | 3(2,2)-2(1,1) | 0.5 | ρ Oph A | MMWO | 4.9m | Lor84a |
| | 209230.221*(26) | HC ₃ N | 23-22 | 0.7 | OriMC-1 | MMWO | 4.9m | Lor81 |
| | 211013.011*(36) | ³⁴ SO | 5(5)-4(4) | 0.45 | OriMC-1 | MMWO | 4.9m | Tha84a |
| | 211211.452*(9) | H ₂ CO | 3(1,3)-2(1,2) | 1.9 | ρ Oph B | MMWO | 4.9m | Lor83 |
| | 213293.594*(29) | H ₂ ¹³ CO | 3(2,1)-2(2,0) | ~0.5 | OriMC-1 | BTL | 7m | Tha81 |
| U | 213360.55 (8) | HCS ⁺ | 5-4 | 0.6 | OriMC-1 | BTL | 7m | Tha81 |
| | 213376. | unidentified | H ₂ ³⁴ S? | 0.7 | OriMC-1 | BTL | 7m | Bog84 |
| | 214088.570*(69) | SiO | 5-4 ν=2 | 110e | VX Sgr | MMWO | 4.9m | Cle83 |
| | 215039.723*(14) | CH ₃ CH ₂ CN | 24(9,16)-23(9,15) | 1.1b | OriMC-1 | OVRO | 10.4m | Sut85 |
| | 215039.723*(14) | CH ₃ CH ₂ CN | 24(9,15)-23(9,14) | b | OriMC-1 | OVRO | 10.4m | Sut85 |
| | 215041.89 *(2) | CH ₃ CH ₂ CN | 24(10,14)-23(10,13) | b | OriMC-1 | OVRO | 10.4m | Sut85 |
| | 215041.89 *(2) | CH ₃ CH ₂ CN | 24(10,15)-23(10,14) | b | OriMC-1 | OVRO | 10.4m | Sut85 |
| | 215058.02 *(1) | CH ₃ CH ₂ CN | 24(3,22)-23(3,21) | 1.4b | OriMC-1 | OVRO | 10.4m | Sut85 |
| | 215058.58 *(1) | CH ₃ CH ₂ CN | 24(8,16)-23(8,15) | b | OriMC-1 | OVRO | 10.4m | Sut85 |
| | 215058.58 *(1) | CH ₃ CH ₂ CN | 24(8,17)-23(8,16) | b | OriMC-1 | OVRO | 10.4m | Sut85 |
| | 215059.23 *(2) | CH ₃ CH ₂ CN | 24(11,14)-23(11,13) | b | OriMC-1 | OVRO | 10.4m | Sut85 |
| | 215059.23 *(2) | CH ₃ CH ₂ CN | 24(11,13)-23(11,12) | b | OriMC-1 | OVRO | 10.4m | Sut85 |
| | 215088.23 *(2) | CH ₃ CH ₂ CN | 24(12,12)-23(12,11) | b | OriMC-1 | OVRO | 10.4m | Sut85 |
| | 215088.23 *(2) | CH ₃ CH ₂ CN | 24(12,13)-23(12,12) | 0.6b | OriMC-1 | OVRO | 10.4m | Sut85 |
| | 215109.05 *(1) | CH ₃ CH ₂ CN | 24(7,17)-23(7,16) | b | OriMC-1 | OVRO | 10.4m | Sut85 |
| | 215109.05 *(1) | CH ₃ CH ₂ CN | 24(7,18)-23(7,17) | 1.2b | OriMC-1 | OVRO | 10.4m | Sut85 |
| | 215119.22 *(2) | CH ₃ CH ₂ CN | 25(0,25)-24(0,24) | 1.1 | OriMC-1 | OVRO | 10.4m | Sut85 |
| | 215126.72 *(2) | CH ₃ CH ₂ CN | 24(13,12)-23(13,11) | 0.5b | OriMC-1 | OVRO | 10.4m | Sut85 |
| | 215126.72 *(2) | CH ₃ CH ₂ CN | 24(13,11)-23(13,10) | b | OriMC-1 | OVRO | 10.4m | Sut85 |
| | 215173.25 *(2) | CH ₃ CH ₂ CN | 24(14,11)-23(14,10) | 0.3b | OriMC-1 | OVRO | 10.4m | Sut85 |
| | 215173.25 *(2) | CH ₃ CH ₂ CN | 24(14,10)-23(14,9) | b | OriMC-1 | OVRO | 10.4m | Sut85 |
| | 215211.53 *(1) | CH ₃ CH ₂ CN | 24(6,19)-23(6,18) | b | OriMC-1 | OVRO | 10.4m | Sut85 |
| | 215212.47 *(1) | CH ₃ CH ₂ CN | 24(6,18)-23(6,17) | b | OriMC-1 | OVRO | 10.4m | Sut85 |
| | 215220.649*(36) | SO | 5(5)-4(4) | 3.0 | OriMC-1 | MMWO | 4.9m | Cle84 |
| | 215302.23 (5) | CH ₃ OH | ν ₁ =1 6(1)-7(2) A + | 1.3 | OriMC-1 | OVRO | 10.4m | Sut85 |
| | 215400.81 *(1) | CH ₃ CH ₂ CN | 24(5,20)-23(5,19) | 0.8 | OriMC-1 | OVRO | 10.4m | Sut85 |
| | 215427.98 *(1) | CH ₃ CH ₂ CN | 24(5,19)-23(5,18) | 1.0 | OriMC-1 | OVRO | 10.4m | Sut85 |
| | 215596.040*(55) | SiO | 5-4 ν=1 | 150e | VX Sgr | MMWO | 4.9m | Cle83 |
| | 215620.19 *(1) | CH ₃ CH ₂ CN | 24(4,21)-23(4,20) | 0.6 | OriMC-1 | OVRO | 10.4m | Sut85 |
| | 215839.903*(38) | ³⁴ SO | 6(5)-5(4) | 0.50 | OriMC-1 | MMWO | 4.9m | Sne84a |
| U | 215886. | unidentified | | 0.9 | OriMC-1 | OVRO | 10.4m | Sut85 |

TABLE 2. Recommended rest frequencies for observed interstellar molecular lines — Continued

| Frequency unc. | Formula | Quantum numbers | $T_r^*(\text{K})$ | Source | Telescope | Astr. Ref. | Lab. Ref. |
|----------------|------------------------------------|-------------------------|-------------------|-------------|-----------|------------|-----------|
| | | | $T_r^*(\text{K})$ | | | | |
| | CH ₃ CH ₂ CN | 25(1,25)-24(0,24) | 0.3 | OriMC-1 | OVRO | 10.4m | Sut85 * |
| | ³⁴ SO ₂ | 14(3,11)-14(2,12) | 0.7 | OriMC-1 | OVRO | 10.4m | Sut85 |
| | CH ₃ CH ₂ CN | 24(4,20)-23(4,19) | 0.7 | OriMC-1 | OVRO | 10.4m | Sut85 |
| | HCOOCH ₃ | 19(2,18)-18(2,17) E | 0.9 | OriMC-1 | OVRO | 10.4m | Sut85 |
| | DCO ⁺ | 3-2 | 2.5 | ρ -Oph | MMWO | 4.9m | Lor82 |
| | HCOOCH ₃ | 19(2,18)-18(2,17) A | 1.1 | OriMC-1 | OVRO | 10.4m | Sut85 |
| | HCOOCH ₃ | 19(1,16)-18(1,17) E | 0.8 | OriMC-1 | OVRO | 10.4m | Sut85 |
| | HCOOCH ₃ | 19(1,16)-18(1,17) A | 0.9 | OriMC-1 | OVRO | 10.4m | Bla84 |
| | DC ₂ | 1-0 $F=9/2-7/2$ | 0.27b | OriMC-1 | MMWO | 4.9m | Com85 |
| | DC ₂ | 1-0 $F=7/2-5/2,5/2-3/2$ | b | OriMC-1 | MMWO | 4.9m | Com85 |
| | H ₂ CO | 9(1,8)-9(1,9) | 1.3 | OriMC-1 | OVRO | 10.4m | Sut85 |
| | SO ₂ | 22(2,20)-22(1,21) | 0.3 | OriMC-1 | MMWO | 4.9m | Lor84a |
| | H ₂ S | 2(2,0)-2(1,1) | 0.32 | OriMC-1 | MMWO | 4.9m | Lor84a |
| | CH ₃ CH ₂ CN | 26(1,25)-25(2,24) | 0.17 | OriMC-1 | MMWO | 4.9m | Hui71 |
| | HCOOCH ₃ | 18(2,16)-17(2,15) E | 1.2 | OriMC-1 | OVRO | 10.4m | Sut85 |
| | HCOOCH ₃ | 18(2,16)-17(2,15) A | 1.1 | OriMC-1 | OVRO | 10.4m | Sut85 |
| | HC ₂ CHCN | 23(2,22)-22(2,21) | 0.6 | OriMC-1 | OVRO | 10.4m | Sut85 |
| | CH ₃ OH | 4(2)-5(1) E | 3.1 | OriMC-1 | OVRO | 10.4m | Sas84 |
| | HCOOCH ₃ | 20(1,20)-19(1,19) E | 2.0b | OriMC-1 | OVRO | 10.4m | Sut85 |
| | HCOOCH ₃ | 20(1,20)-19(1,19) A | b | OriMC-1 | OVRO | 10.4m | Sut85 |
| | HCOOCH ₃ | 20(0,20)-19(0,19) E | b | OriMC-1 | OVRO | 10.4m | Sut85 |
| | HCOOCH ₃ | 20(0,20)-19(0,19) A | b | OriMC-1 | OVRO | 10.4m | Bla84 |
| | SiO | 5-4 $\nu=0$ | 1.6 | OriMC-1 | MMWO | 4.9m | Lor84a |
| | DCN | 3-2 | 0.7 | OriMC-1 | NRAO | 11m | Phi74 |
| | SiS | 12-11 | 0.66 | IRC+10216 | MMWO | 4.9m | Sah84 |
| | C ₃ H ₂ | 6(0,6)-5(1,5) | 0.23 | OriMC-1 | MMWO | 4.9m | Lor84 |
| | C ₃ H ₂ | 6(1,6)-5(0,5) | 0.23 | OriMC-1 | MMWO | 4.9m | Tha85a |
| | ³³ SO | 6(5)-5(4) $F=9/2-7/2$ | b | OriMC-1 | MMWO | 4.9m | Lor84 |
| | ³³ SO | 6(5)-5(4) $F=11/2-9/2$ | b | OriMC-1 | MMWO | 4.9m | Lor84 |
| | ³³ SO | 6(5)-5(4) $F=13/2-11/2$ | 0.15b | OriMC-1 | MMWO | 4.9m | Lor84 |
| | ³³ SO | 6(5)-5(4) $F=15/2-13/2$ | b | OriMC-1 | MMWO | 4.9m | Lor84 |
| | CH ₃ OH | unassigned | 0.9 | OriMC-1 | OVRO | 10.4m | Sut85 |
| | O ¹³ CS | 18-17 | 0.5 | OriMC-1 | OVRO | 10.4m | Sut85 |
| | H ₂ CO | 3(0,3)-2(0,2) | 4.0 | OriMC-1 | MMWO | 4.9m | Dub80 |
| | HCOOCH ₃ | 17(3,14)-16(3,13) E | 1.0 | OriMC-1 | OVRO | 10.4m | Sut85 |
| | HCOOCH ₃ | 17(3,14)-16(3,13) A | 1.2 | OriMC-1 | OVRO | 10.4m | Bla84 |
| | HC ₃ N | 24-23 | 0.9 | OriMC-1 | MMWO | 4.9m | Lor81 |
| | CH ₃ CH ₂ CN | 24(3,21)-23(3,20) | 0.8 | OriMC-1 | OVRO | 10.4m | Sut85 |
| | HC ₂ CHCN | 23(7,17)-22(7,16) | b | OriMC-1 | OVRO | 10.4m | Sut85 |
| | HC ₂ CHCN | 23(7,16)-22(7,15) | b | OriMC-1 | OVRO | 10.4m | Sut85 |
| | HC ₂ CHCN | 23(6,18)-22(6,17) | b | OriMC-1 | OVRO | 10.4m | Sut85 |
| | HC ₂ CHCN | 23(6,17)-22(6,16) | 0.4b | OriMC-1 | OVRO | 10.4m | Sut85 |
| | HC ₂ CHCN | 23(8,16)-22(8,15) | 0.3b | OriMC-1 | OVRO | 10.4m | Sut85 |
| | HC ₂ CHCN | 23(8,15)-22(8,14) | b | OriMC-1 | OVRO | 10.4m | Sut85 |
| | CH ₃ OH | 4(2)-3(1) E | 1.7 | OriMC-1 | MMWO | 4.9m | Sas84 |
| | HC ₂ CHCN | 23(5,19)-22(5,18) | 0.2b | OriMC-1 | OVRO | 10.4m | Sut85 |
| | HC ₂ CHCN | 23(5,18)-22(5,17) | b | OriMC-1 | OVRO | 10.4m | Sut85 |
| | H ₂ CO | 3(2,2)-2(2,1) | 1.8 | OriMC-1 | MMWO | 4.9m | Lor84b |
| | HC ₂ CHCN | 23(4,20)-22(4,19) | 0.3 | OriMC-1 | OVRO | 10.4m | Sut85 |
| | HC ₂ CHCN | 23(3,21)-22(3,20) | 0.3 | OriMC-1 | OVRO | 10.4m | Sut85 |
| | HC ₂ CHCN | 23(4,19)-22(4,18) | 0.2 | OriMC-1 | OVRO | 10.4m | Sut85 |
| | H ₂ CO | 3(2,1)-2(2,0) | 1.5 | OriMC-1 | MMWO | 4.9m | Lor84a |
| | C ₄ H | 23-22 $J=47/2-45/2$ | 0.06 | IRC+10216 | MMWO | 4.9m | Lor84a |
| | HC ₃ N $\nu_7=1$ | 24-23 1e | 0.6 | OriMC-1 | OVRO | 10.4m | Sut85 |
| | C ₄ H | 23-22 $J=45/2-43/2$ | 0.06 | IRC+10216 | MMWO | 4.9m | Lor84a |
| | OCS | 18-17 | 2.8 | OriMC-1 | BTL | 7m | Gol81 |
| | HNCO | 10(1,10)-9(1,9) | 0.24 | OriMC-1 | MMWO | 4.9m | Dub80 |
| U | 219002. | unidentified | 0.1u | OriMC-1 | MMWO | 4.9m | Arm84a |
| | HC ₃ N $\nu_7=1$ | 24-23 1f | 0.6 | OriMC-1 | OVRO | 10.4m | Sut85 |
| | SO ₂ | 22(7,15)-23(6,16) | 0.3 | OriMC-1 | OVRO | 10.4m | Sut85 |
| | ³⁴ SO ₂ | 11(1,11)-10(0,10) | 1.3 | OriMC-1 | OVRO | 10.4m | Sut85 |
| | HC ₂ CHCN | 23(3,20)-22(3,19) | 0.3 | OriMC-1 | OVRO | 10.4m | Sut85 |
| | CH ₃ CH ₂ CN | 22(2,21)-21(1,20) | 0.3 | OriMC-1 | OVRO | 10.4m | Sut85 |
| | CH ₃ CH ₂ CN | 24(2,22)-23(2,21) | 0.9 | OriMC-1 | OVRO | 10.4m | Sut85 |
| | HNCO | 10(4,7)-9(4,6) | 0.4b | OriMC-1 | OVRO | 10.4m | Sut85 |

TABLE 2. Recommended rest frequencies for observed interstellar molecular lines — Continued

| Frequency unc. | Formula | Quantum numbers | T_r '(K) T_s '(K) | Source | Telescope | Astr. Ref. | Lab. Ref. | |
|----------------|-----------------|------------------------------------|--------------------------|--------|-----------|---------------|--------------|--------|
| | 219547.105*(11) | HNCO | 10(4,6)-9(4,5) | b | OriMC-1 | OVRO | 10.4m | Sut85 |
| | 219560.319*(46) | C ¹⁸ O | 2-1 | 3.5 | DR 21 | NRAO | 11m | Phi77 |
| | 219656.805*(11) | HNCO | 10(3,7)-9(3,6) | b | OriMC-1 | OVRO | 10.4m | Sut85 |
| | 219656.805*(11) | HNCO | 10(3,8)-9(3,7) | 0.4b | OriMC-1 | OVRO | 10.4m | Sut85 |
| | 219733.824*(11) | HNCO | 10(2,9)-9(2,8) | 0.6 | OriMC-1 | OVRO | 10.4m | Sut85 |
| | 219737.175*(13) | HNCO | 10(2,8)-9(2,7) | 0.8 | OriMC-1 | OVRO | 10.4m | Sut85 |
| | 219798.282*(8) | HNCO | 10(0,10)-9(0,9) | 0.3 | OriMC-1 | MMWO | 4.9m | Arm84 |
| | 219908.489*(6) | H ₂ ¹³ CO | 3(1,2)-2(1,1) | 0.5 | OriMC-1 | MMWO | 4.9m | Arm84a |
| | 219949.391*(38) | SO | 6(5)-5(4) | 4.3 | OriMC-1 | MMWO | 4.9m | Lor84a |
| | 220037.96 *(1) | HCOOH | 10(0,10)-9(0,9) | 0.3 | OriMC-1 | OVRO | 10.4m | Sut85 |
| | 220078.6 (1) | CH ₃ OH | 7(1)-8(0) E | 6.1 | OriMC-1 | OVRO | 10.4m | Sut85 |
| | 220166.6 *(1) | HCOOCH ₃ | 17(4,13)-16(4,12) E | 1.3 | OriMC-1 | OVRO | 10.4m | Sut85 |
| | 220177.52 *(18) | CH ₂ CO | 11(1,11)-10(1,10) | 1.0 | OriMC-1 | OVRO | 10.4m | Sut85 |
| | 220190.20 *(10) | HCOOCH ₃ | 17(4,13)-16(4,12) A | 1.3 | OriMC-1 | OVRO | 10.4m | Sut85 |
| | 220398.686*(23) | ¹³ CO | 2-1 | 17 | OriMC-1 | NRAO | 11m | Phi77 |
| | 220475.815*(3) | CH ₃ CN | 12(8)-11(8) | 0.5 | OriMC-1 | OVRO | 10.4m | Sut85 |
| | 220539.330*(30) | CH ₃ CN | 12(7)-11(7) | 0.10 | OriMC-1 | MMWO | 4.9m | Lor84 |
| | 220561.33 *(7) | HC ₂ CHCN | 24(1,24)-23(1,23) | 0.4 | OriMC-1 | OVRO | 10.4m | Sut85 |
| | 220584.762*(12) | HNCO | 10(1,9)-9(1,8) | 0.13 | OriMC-1 | MMWO | 4.9m | Lor84 |
| | 220594.43 *(10) | CH ₃ CN | 12(6)-11(6) | 0.23 | OriMC-1 | MMWO | 4.9m | Lor84 |
| | 220599.94 *(14) | CH ₃ ¹³ CN | 12(3)-11(3) | b | OriMC-1 | OVRO | 10.4m | Sut85 |
| | 220621.08 *(15) | CH ₃ ¹³ CN | 12(2)-11(2) | 0.5 | OriMC-1 | OVRO | 10.4m | Sut85 |
| | 220633.77 *(16) | CH ₃ ¹³ CN | 12(1)-11(1) | 0.5b | OriMC-1 | OVRO | 10.4m | Sut85 |
| | 220641.09 *(10) | CH ₃ CN | 12(5)-11(5) | 0.29 | OriMC-1 | MMWO | 4.9m | Lor84 |
| | 220660.91 *(2) | CH ₃ CH ₂ CN | 25(2,24)-24(2,23) | 0.7 | OriMC-1 | OVRO | 10.4m | Sut85 |
| U | 220664.5 | unidentified | | 0.14 | OriMC-1 | MMWO | 4.9m | Lor84 |
| | 220679.291*(70) | CH ₃ CN | 12(4)-11(4) | 0.37 | OriMC-1 | MMWO | 4.9m | Lor84 |
| | 220709.020*(50) | CH ₃ CN | 12(3)-11(3) | 0.80 | OriMC-1 | MMWO | 4.9m | Lor84 |
| | 220730.263*(20) | CH ₃ CN | 12(2)-11(2) | 0.67 | OriMC-1 | MMWO | 4.9m | Lor84 |
| | 220743.013*(20) | CH ₃ CN | 12(1)-11(1) | 0.84 | OriMC-1 | MMWO | 4.9m | Lor84 |
| | 220747.263*(20) | CH ₃ CN | 12(0)-11(0) | 0.99 | OriMC-1 | MMWO | 4.9m | Lor84 |
| | 220792.5 | unidentified | | 0.17u | OriMC-1 | MMWO | 4.9m | Lor84 |
| | 220811.6 *(1) | HCOOCH ₃ | 18(3,16)-17(2,15) E | 0.4 | OriMC-1 | OVRO | 10.4m | Sut85 |
| | 220815.19 *(10) | HCOOCH ₃ | 18(3,16)-17(2,15) A | 0.4 | OriMC-1 | OVRO | 10.4m | Bla84 |
| | 220889.02 *(10) | HCOOCH ₃ | 18(17,1)-17(17,0) A | b | OriMC-1 | OVRO | 10.4m | Bla84 |
| U | 220889.02 *(10) | HCOOCH ₃ | 18(17,2)-17(17,1) A | 0.4b | OriMC-1 | OVRO | 10.4m | Bla84 |
| | 220926.20 *(10) | HCOOCH ₃ | 18(16,2)-17(16,1) A | b | OriMC-1 | OVRO | 10.4m | Bla84 |
| | 220926.20 *(10) | HCOOCH ₃ | 18(16,3)-17(16,2) A | 0.5b | OriMC-1 | OVRO | 10.4m | Bla84 |
| | 220977.84 *(10) | HCOOCH ₃ | 18(15,4)-17(15,3) A | b | OriMC-1 | OVRO | 10.4m | Bla84 |
| | 220977.84 *(10) | HCOOCH ₃ | 18(15,3)-17(15,2) A | 0.5b | OriMC-1 | OVRO | 10.4m | Bla84 |
| | 221047.67 *(10) | HCOOCH ₃ | 18(14,5)-17(14,4) A | b | OriMC-1 | OVRO | 10.4m | Sut85 |
| | 221047.67 *(10) | HCOOCH ₃ | 18(14,4)-17(14,3) A | 0.5b | OriMC-1 | OVRO | 10.4m | Bla84 |
| | 221050.0 *(1) | HCOOCH ₃ | 18(14,4)-17(14,3) E | b | OriMC-1 | OVRO | 10.4m | Sut85 |
| | 221066.3 *(1) | HCOOCH ₃ | 18(14,5)-17(14,4) E | 0.3 | OriMC-1 | OVRO | 10.4m | Sut85 |
| | 221123.82 *(4) | HC ₂ CHCN | 23(1,22)-22(1,21) | 0.4 | OriMC-1 | OVRO | 10.4m | Sut85 |
| U | 221141.02 *(30) | HCOOCH ₃ | 18(13,5)-17(13,4) E | b | OriMC-1 | OVRO | 10.4m | Sut85 |
| | 221141.02 *(10) | HCOOCH ₃ | 18(13,5)-17(13,4) A | 0.7b | OriMC-1 | OVRO | 10.4m | Bla84 |
| | 221141.02 *(10) | HCOOCH ₃ | 18(13,6)-17(13,5) A | b | OriMC-1 | OVRO | 10.4m | Sut85 |
| | 221158.4 *(1) | HCOOCH ₃ | 18(13,6)-17(13,5) E | 0.2 | OriMC-1 | OVRO | 10.4m | Sut85 |
| | 221198.962*(90) | CH ₃ CN $\nu_8=1$ | 12(1)-11(1) $\ell=1$ | 0.7 | OriMC-1 | OVRO | 10.4m | Sut85 |
| | 221252.388*(83) | CH ₃ CN $\nu_8=1$ | 12(5)-11(5) $\ell=-1$ | 0.3 | OriMC-1 | OVRO | 10.4m | Sut85 |
| | 221260.9 *(1) | HCOOCH ₃ | 18(12,6)-17(12,5) E | 0.4 | OriMC-1 | OVRO | 10.4m | Sut85 |
| | 221265.59 *(10) | HCOOCH ₃ | 18(12,6)-17(12,5) A | 0.6b | OriMC-1 | OVRO | 10.4m | Bla84 |
| | 221265.59 *(10) | HCOOCH ₃ | 18(12,7)-17(12,6) A | b | OriMC-1 | OVRO | 10.4m | Sut85 |
| | 221280.8 *(1) | HCOOCH ₃ | 18(12,7)-17(12,6) E | 0.4 | OriMC-1 | OVRO | 10.4m | Bla84 |
| U | 221299.576*(80) | CH ₃ CN $\nu_8=1$ | 12(4)-11(4) $\ell=-1$ | 0.2 | OriMC-1 | OVRO | 10.4m | Sut85 |
| | 221311.925*(78) | CH ₃ CN $\nu_8=1$ | 12(6)-11(6) $\ell=1$ | 0.2 | OriMC-1 | OVRO | 10.4m | Sut85 |
| | 221338.038*(90) | CH ₃ CN $\nu_8=1$ | 12(3)-11(3) $\ell=-1$ | 0.3 | OriMC-1 | OVRO | 10.4m | Sut85 |
| | 221350.329*(81) | CH ₃ CN $\nu_8=1$ | 12(5)-11(5) $\ell=1$ | 0.2 | OriMC-1 | OVRO | 10.4m | Sut85 |
| | 221367.512*(90) | CH ₃ CN $\nu_8=1$ | 12(2)-11(2) $\ell=-1$ | 0.6 | OriMC-1 | OVRO | 10.4m | Sut85 |
| | 221380.61 *(10) | CH ₃ CN $\nu_8=1$ | 12(4)-11(4) $\ell=1$ | 0.6 | OriMC-1 | OVRO | 10.4m | Sut85 |
| | 221387.33 *(10) | CH ₃ CN $\nu_8=1$ | 12(1)-11(1) $\ell=-1$ | 0.4 | OriMC-1 | OVRO | 10.4m | Sut85 |
| | 221394.13 *(15) | CH ₃ CN $\nu_8=1$ | 12(0)-11(0) $\ell=1$ | 0.5 | OriMC-1 | OVRO | 10.4m | Sut85 |
| | 221403.51 *(11) | CH ₃ CN $\nu_8=1$ | 12(3)-11(3) $\ell=1$ | 0.3 | OriMC-1 | OVRO | 10.4m | Sut85 |
| | 221422.34 *(16) | CH ₃ CN $\nu_8=1$ | 12(2)-11(2) $\ell=1$ | 0.3b | OriMC-1 | OVRO | 10.4m | Sut85 |

TABLE 2. Recommended rest frequencies for observed interstellar molecular lines — Continued

| Frequency unc. | Formula | Quantum numbers | $T_e^*(\text{K})$ | Source | Telescope | Astr. Ref. | Lab. Ref. | |
|----------------|------------------|------------------------------------|----------------------|--------|-----------|------------|-----------|--------|
| | | | $T_a^*(\text{K})$ | | | | | |
| | 221424.7 *(1) | HCOOCH ₃ | 18(11,7)-17(11,6) E | 0.8 | OriMC-1 | OVRO | 10.4m | Sut85 |
| | 221432.95 *(10) | HCOOCH ₃ | 18(11,7)-17(11,6) A | 0.9b | OriMC-1 | OVRO | 10.4m | Sut85 |
| | 221432.95 *(10) | HCOOCH ₃ | 18(11,8)-17(11,7) A | b | OriMC-1 | OVRO | 10.4m | Bla84 |
| | 221445.5 *(1) | HCOOCH ₃ | 18(11,8)-17(11,7) E | 0.6 | OriMC-1 | OVRO | 10.4m | Sut85 |
| | 221626.04 *(9) | CH ₃ CN $v_8=1$ | 12(1)-11(1) $\ell=1$ | 0.4 | OriMC-1 | OVRO | 10.4m | Sut85 |
| | 221649.7 *(1) | HCOOCH ₃ | 18(10,8)-17(10,7) E | 0.5 | OriMC-1 | OVRO | 10.4m | Sut85 |
| | 221660.4 *(1) | HCOOCH ₃ | 18(4,15)-17(4,14) E | 1.5b | OriMC-1 | OVRO | 10.4m | Sut85 |
| | 221661.06 *(10) | HCOOCH ₃ | 18(10,9)-17(10,8) A | b | OriMC-1 | OVRO | 10.4m | Sut85 |
| | 221661.06 *(10) | HCOOCH ₃ | 18(10,8)-17(10,7) A | b | OriMC-1 | OVRO | 10.4m | Bla84 |
| | 221670.5 *(1) | HCOOCH ₃ | 18(10,9)-17(10,8) E | 0.4 | OriMC-1 | OVRO | 10.4m | Sut85 |
| | 221674.62 *(10) | HCOOCH ₃ | 18(4,15)-17(4,14) A | 0.8 | OriMC-1 | OVRO | 10.4m | Sut85 |
| | 221735.67 *(12) | 34SO ₂ | 13(2,12)-13(1,13) | 1.0 | OriMC-1 | OVRO | 10.4m | Sut85 |
| | 221765.98 *(6) | HC ₂ CHCN | 24(0,24)-23(0,23) | 0.4 | OriMC-1 | OVRO | 10.4m | Sut85 |
| | 221965.21 *(2) | SO ₂ | 11(1,11)-10(0,10) | 13.9 | OriMC-1 | OVRO | 10.4m | Sut85 |
| | 222099.152 *(10) | CH ₃ CCH | 13(4)-12(4) | 0.2 | OriMC-1 | OVRO | 10.4m | Sut85 |
| | 222128.814 *(6) | CH ₃ CCH | 13(3)-12(3) | 0.13 | OriMC-1 | MMWO | 4.9m | Lor84d |
| | 222150.009 *(3) | CH ₃ CCH | 13(2)-12(2) | 0.30 | OriMC-1 | MMWO | 4.9m | Lor84d |
| | 222153.45 *(5) | HC ₂ CHCN | 23(2,21)-22(2,20) | 0.4 | OriMC-1 | OVRO | 10.4m | Sut85 |
| | 222162.729 *(2) | CH ₃ CCH | 13(1)-12(1) | 0.27 | OriMC-1 | MMWO | 4.9m | Lor84d |
| | 222166.970 *(2) | CH ₃ CCH | 13(0)-12(0) | 0.41 | OriMC-1 | MMWO | 4.9m | Lor84d |
| U | 222177. | unidentified | | 0.4 | OriMC-1 | OVRO | 10.4m | Sut85 |
| | 222197.65 *(28) | CH ₂ CO | 11(0,11)-10(0,10) | 0.6 | OriMC-1 | OVRO | 10.4m | Sut85 |
| | 222228.61 *(20) | CH ₂ CO | 11(2,10)-10(2,9) | 0.2 | OriMC-1 | OVRO | 10.4m | Sut85 |
| | 222238.67 *(35) | CH ₃ OCH ₃ | 4(3,2)-3(2,1) EA | 0.02 | OriMC-1 | OVRO | 10.4m | Sut85 |
| | 222247.48 *(19) | CH ₃ OCH ₃ | 4(3,2)-3(2,1) AE | 1.3b | OriMC-1 | OVRO | 10.4m | Sut85 |
| | 222247.60 *(21) | CH ₃ OCH ₃ | 4(3,2)-3(2,1) EE | b | OriMC-1 | OVRO | 10.4m | Sut85 |
| | 222254.74 *(9) | CH ₃ OCH ₃ | 4(3,2)-3(2,1) AA | 1.0 | OriMC-1 | OVRO | 10.4m | Sut85 |
| U | 222259. | unidentified | | 0.6 | OriMC-1 | OVRO | 10.4m | Sut85 |
| | 222314.40 *(20) | CH ₂ CO | 11(2,9)-10(2,8) | 0.2 | OriMC-1 | OVRO | 10.4m | Sut85 |
| | 222421.6 *(1) | HCOOCH ₃ | 18(8,10)-17(8,9) E | 1.0 | OriMC-1 | OVRO | 10.4m | Sut85 |
| | 222426.82 *(19) | CH ₃ OCH ₃ | 4(3,1)-3(2,2) AE | 0.3 | OriMC-1 | OVRO | 10.4m | Sut85 |
| | 222433.96 *(10) | CH ₃ OCH ₃ | 4(3,1)-3(2,2) EE | 1.5b | OriMC-1 | OVRO | 10.4m | Sut85 |
| | 222434.08 *(9) | CH ₃ OCH ₃ | 4(3,1)-3(2,2) AA | b | OriMC-1 | OVRO | 10.4m | Sut85 |
| | 222435.63 *(13) | CH ₃ OCH ₃ | 4(3,1)-3(2,2) EA | b | OriMC-1 | OVRO | 10.4m | Sut85 |
| | 222438.23 *(10) | HCOOCH ₃ | 18(8,10)-17(8,9) A | 1.2b | OriMC-1 | OVRO | 10.4m | Sut85 |
| | 222440.34 *(10) | HCOOCH ₃ | 18(8,11)-17(8,10) A | b | OriMC-1 | OVRO | 10.4m | Sut85 |
| | 222441.9 *(1) | HCOOCH ₃ | 18(8,10)-17(8,9) E | b | OriMC-1 | OVRO | 10.4m | Sut85 |
| | 222707.22 *(2) | CH ₃ CH ₂ CN | 26(0,26)-25(1,25) | 0.3 | OriMC-1 | OVRO | 10.4m | Sut85 |
| | 222723. | CH ₃ OH | unassigned | 0.6 | OriMC-1 | OVRO | 10.4m | Sut85 |
| | 222918.17 *(2) | CH ₃ CH ₂ CN | 25(1,24)-24(1,23) | 0.9 | OriMC-1 | OVRO | 10.4m | Sut85 |
| | 223038.3 *(1) | HCOOCH ₃ | 19(2,17)-18(3,16) E | 0.3 | OriMC-1 | OVRO | 10.4m | Sut85 |
| | 223119.20 *(10) | HCOOCH ₃ | 18(7,12)-17(7,11) A | 1.1 | OriMC-1 | OVRO | 10.4m | Bla84 |
| | 223125.1 *(1) | HCOOCH ₃ | 18(7,12)-17(7,11) E | 1.0 | OriMC-1 | OVRO | 10.4m | Sut85 |
| | 223134.9 *(1) | HCOOCH ₃ | 18(7,11)-17(7,10) E | 1.0 | OriMC-1 | OVRO | 10.4m | Sut85 |
| | 223163.69 *(10) | HCOOCH ₃ | 18(7,11)-17(7,10) A | 0.8 | OriMC-1 | OVRO | 10.4m | Bla84 |
| | 223200.13 *(24) | CH ₃ OCH ₃ | 8(2,7)-7(1,6) AE | b | OriMC-1 | OVRO | 10.4m | Sut85 |
| | 223200.13 *(24) | CH ₃ OCH ₃ | 8(2,7)-7(1,6) EA | b | OriMC-1 | OVRO | 10.4m | Sut85 |
| | 223202.32 *(17) | CH ₃ OCH ₃ | 8(2,7)-7(1,6) EA | 1.1b | OriMC-1 | OVRO | 10.4m | Sut85 |
| | 223204.51 *(11) | CH ₃ OCH ₃ | 8(2,7)-7(1,6) EA | b | OriMC-1 | OVRO | 10.4m | Sut85 |
| | 223385.32 *(2) | CH ₃ CH ₂ CN | 26(1,26)-25(1,25) | 0.9 | OriMC-1 | OVRO | 10.4m | Sut85 |
| | 223434.43 *(6) | SO ₂ | 27(6,20)-28(7,21) | 0.3 | OriMC-1 | OVRO | 10.4m | Sut85 |
| | 223553.58 *(2) | CH ₃ CH ₂ CN | 26(0,26)-25(0,25) | 0.6 | OriMC-1 | OVRO | 10.4m | Sut85 |
| | 223650.3 *(1) | CH ₃ CHO | 12(1,12)-11(1,11) E | 0.2 | OriMC-1 | OVRO | 10.4m | Sut85 |
| | 223660.8 *(1) | CH ₃ CHO | 12(1,12)-11(1,11) A | 0.3 | OriMC-1 | OVRO | 10.4m | Sut85 |
| | 223883.64 *(2) | SO ₂ | 6(4,2)-7(3,5) | 1.4 | OriMC-1 | OVRO | 10.4m | Sut85 |
| | 223915.56 *(1) | HCOOH | 10(2,9)-9(2,8) | 0.3 | OriMC-1 | OVRO | 10.4m | Sut85 |
| | 223933.73 *(2) | CH ₃ CH ₂ CN | 25(3,23)-24(3,22) | 0.6 | OriMC-1 | OVRO | 10.4m | Sut85 |
| | 224002.12 *(2) | CH ₃ CH ₂ CN | 25(10,15)-24(10,14) | b | OriMC-1 | OVRO | 10.4m | Sut85 |
| | 224002.12 *(2) | CH ₃ CH ₂ CN | 25(10,16)-24(10,15) | b | OriMC-1 | OVRO | 10.4m | Sut85 |
| | 224003.44 *(2) | CH ₃ CH ₂ CN | 25(9,17)-24(9,16) | b | OriMC-1 | OVRO | 10.4m | Sut85 |
| | 224003.44 *(2) | CH ₃ CH ₂ CN | 25(9,16)-24(9,15) | 0.9b | OriMC-1 | OVRO | 10.4m | Sut85 |
| | 224017.54 *(2) | CH ₃ CH ₂ CN | 25(11,15)-24(11,14) | 0.6b | OriMC-1 | OVRO | 10.4m | Sut85 |
| | 224017.54 *(2) | CH ₃ CH ₂ CN | 25(11,14)-24(11,13) | b | OriMC-1 | OVRO | 10.4m | Sut85 |
| | 224021.4 *(1) | HCOOCH ₃ | 18(6,13)-17(6,12) E | 1.0b | OriMC-1 | OVRO | 10.4m | Sut85 |
| | 224024.05 *(10) | HCOOCH ₃ | 18(6,13)-17(6,12) A | b | OriMC-1 | OVRO | 10.4m | Bla84 |

TABLE 2. Recommended rest frequencies for observed interstellar molecular lines — Continued

| Frequency unc. | Formula | Quantum numbers | $T_e^*(\text{K})$ | Source | Telescope | Astr. Ref. | Lab. Ref. |
|----------------|-----------------|--|-------------------|---------|-----------|------------|-----------|
| | | | $T_e^*(\text{K})$ | | | | |
| | 224028.14 *(2) | CH ₃ CH ₂ CN 25(6,18)–24(6,17) | 0.8b | OriMC-1 | OVRO | 10.4m | Sut85 |
| | 224028.14 *(2) | CH ₃ CH ₂ CN 25(6,17)–24(6,16) | b | OriMC-1 | OVRO | 10.4m | Sut85 |
| | 224045.75 *(2) | CH ₃ CH ₂ CN 25(12,13)–24(12,12) | 0.3b | OriMC-1 | OVRO | 10.4m | Sut85 |
| | 224045.75 *(2) | CH ₃ CH ₂ CN 25(12,14)–24(12,13) | b | OriMC-1 | OVRO | 10.4m | Sut85 |
| | 224084.28 *(2) | CH ₃ CH ₂ CN 25(13,12)–24(13,11) | b | OriMC-1 | OVRO | 10.4m | Sut85 |
| | 224084.28 *(2) | CH ₃ CH ₂ CN 25(13,13)–24(13,12) | b | OriMC-1 | OVRO | 10.4m | Sut85 |
| | 224088.19 *(2) | CH ₃ CH ₂ CN 25(7,19)–24(7,18) | b | OriMC-1 | OVRO | 10.4m | Sut85 |
| | 224088.23 *(2) | CH ₃ CH ₂ CN 25(7,18)–24(7,17) | 0.8b | OriMC-1 | OVRO | 10.4m | Sut85 |
| | 224131.51 *(2) | CH ₃ CH ₂ CN 25(14,12)–24(14,11) | 0.2b | OriMC-1 | OVRO | 10.4m | Sut85 |
| | 224131.51 *(2) | CH ₃ CH ₂ CN 25(14,11)–24(14,10) | b | OriMC-1 | OVRO | 10.4m | Sut85 |
| | 224186.35 *(2) | CH ₃ CH ₂ CN 25(15,11)–24(15,10) | 0.2b | OriMC-1 | OVRO | 10.4m | Sut85 |
| | 224186.35 *(2) | CH ₃ CH ₂ CN 25(15,10)–24(15,9) | b | OriMC-1 | OVRO | 10.4m | Sut85 |
| | 224206.60 *(2) | CH ₃ CH ₂ CN 25(6,20)–24(6,19) | 0.7b | OriMC-1 | OVRO | 10.4m | Sut85 |
| | 224208.08 *(2) | CH ₃ CH ₂ CN 25(6,19)–24(6,18) | b | OriMC-1 | OVRO | 10.4m | Sut85 |
| | 224264.90 *(3) | SO ₂ 20(2,16)–19(3,17) | 2.6 | OriMC-1 | OVRO | 10.4m | Sut85 |
| | 224312.9 *(1) | HCOOCH ₃ 18(5,14)–17(5,13) E | 0.8 | OriMC-1 | OVRO | 10.4m | Sut85 |
| | 224327.21 *(18) | CH ₃ CO 11(1,10)–10(1,9) | b | OriMC-1 | OVRO | 10.4m | Sut85 |
| | 224328.25 *(10) | HCOOCH ₃ 18(5,14)–17(5,13) A | 0.8b | OriMC-1 | OVRO | 10.4m | Sut85 |
| | 224419.82 *(2) | CH ₃ CH ₂ CN 25(5,21)–24(5,20) | 0.4 | OriMC-1 | OVRO | 10.4m | Sut85 |
| | 224458.85 *(2) | CH ₃ CH ₂ CN 25(5,20)–24(5,19) | 0.7 | OriMC-1 | OVRO | 10.4m | Sut85 |
| | 224469.02 *(3) | CH ₃ CH ₂ CN 25(19,7)–24(19,6) | 0.3b | OriMC-1 | OVRO | 10.4m | Sut85 |
| | 224469.02 *(3) | CH ₃ CH ₂ CN 25(19,6)–24(19,5) | b | OriMC-1 | OVRO | 10.4m | Sut85 |
| U | 224493. | unidentified | 0.5 | OriMC-1 | OVRO | 10.4m | Sut85 |
| | 224583.0 *(1) | HCOOCH ₃ 18(6,12)–17(6,11) E | 0.8 | OriMC-1 | OVRO | 10.4m | Sut85 |
| | 224609.31 *(10) | HCOOCH ₃ 18(6,12)–17(6,11) A | 0.8 | OriMC-1 | OVRO | 10.4m | Sut85 |
| | 224638.70 *(2) | CH ₃ CH ₂ CN 25(4,22)–24(4,21) | 0.6b | OriMC-1 | OVRO | 10.4m | Sut85 |
| | 224643.26 *(5) | CH ₃ CH ₂ CN 25(21,5)–24(21,4) | b | OriMC-1 | OVRO | 10.4m | Sut85 |
| | 224643.26 *(5) | CH ₃ CH ₂ CN 25(21,4)–24(21,3) | b | OriMC-1 | OVRO | 10.4m | Sut85 |
| | 224699. | CH ₃ OH unassigned | 0.7 | OriMC-1 | OVRO | 10.4m | Sut85 |
| | 224714.368*(30) | C ¹⁷ O 2-1 | 1.5 | OriMC-1 | OVRO | 10.4m | Bla85a |
| | 224895. | unidentified | 0.7 | OriMC-1 | OVRO | 10.4m | Sut85 |
| U | 225153.69 *(2) | SO ₂ 13(2,12)–13(1,13) | 6.3 | OriMC-1 | OVRO | 10.4m | Sut85 |
| | 225236.11 *(2) | CH ₃ CH ₂ CN 25(4,21)–24(4,20) | 0.8 | OriMC-1 | OVRO | 10.4m | Sut85 |
| | 225413.638 (30) | OC ³⁴ S 19–18 | 0.7 | OriMC-1 | OVRO | 10.4m | Sut85 |
| | 225512.54 *(1) | HCOOH 10(3,7)–9(3,6) | 0.4 | OriMC-1 | OVRO | 10.4m | Sut85 |
| | 225599.14 *(15) | CH ₃ OCH ₃ 12(1,12)–11(0,11) EE | 0.7 | OriMC-1 | MMWO | 4.9m | Woo84 |
| | 225608.7 *(1) | HCOOCH ₃ 19(3,17)–18(3,16) E | 1.1 | OriMC-1 | OVRO | 10.4m | Sut85 |
| | 225618.66 *(10) | HCOOCH ₃ 19(3,17)–18(3,16) A | 1.3 | OriMC-1 | OVRO | 10.4m | Bla84 |
| | 225625. | unidentified | 1.0 | OriMC-1 | OVRO | 10.4m | Sut85 |
| | 225697.772*(9) | H ₂ CO 3(1,2)–2(1,1) | 5.0 | OriMC-1 | MMWO | 4.9m | Eva79 |
| | 225896.720 (38) | HDO 3(1,2)–2(2,1) | 2.3 | OriMC-1 | OVRO | 10.4m | Sut85 |
| U | 225928.56 *(10) | HCOOCH ₃ 6(6,0)–5(5,1) A | b | OriMC-1 | OVRO | 10.4m | Bla84 |
| | 225928.56 *(10) | HCOOCH ₃ 6(6,1)–5(5,0) A | 0.4b | OriMC-1 | OVRO | 10.4m | Bla84 |
| | 226256.83 *(5) | HC ₃ CHCN 24(2,23)–23(2,22) | 0.2 | OriMC-1 | OVRO | 10.4m | Sut85 |
| | 226300.00 *(4) | SO ₂ 14(3,11)–14(2,12) | 5.8 | OriMC-1 | OVRO | 10.4m | Sut85 |
| | 226332.519*(20) | CN 2-1 $J = 3/2$ – $3/2$ $F = 3/2$ – $5/2$ | 0.3 | OriMC-1 | OVRO | 10.4m | Sut85 |
| | 226341.919*(20) | CN 2-1 $J = 3/2$ – $3/2$ $F = 5/2$ – $3/2$ | 0.3 | OriMC-1 | OVRO | 10.4m | Woo82 |
| | 226346.00 *(13) | CH ₃ OCH ₃ 14(1,13)–13(2,12) AA | b | OriMC-1 | OVRO | 10.4m | Sut85 |
| | 226346.89 *(25) | CH ₃ OCH ₃ 14(1,13)–13(2,12) EE | 1.6b | OriMC-1 | OVRO | 10.4m | Sut85 |
| | 226347.78 *(37) | CH ₃ OCH ₃ 14(1,13)–13(2,12) EA | b | OriMC-1 | OVRO | 10.4m | Sut85 |
| | 226347.78 *(37) | CH ₃ OCH ₃ 14(1,13)–13(2,12) AE | b | OriMC-1 | OVRO | 10.4m | Sut85 |
| U | 226359.987*(20) | CN 2-1 $J = 3/2$ – $3/2$ $F = 5/2$ – $5/2$ | 1.2 | OriMC-1 | OVRO | 10.4m | Woo82 |
| | 226384. | unidentified | 0.5 | OriMC-1 | OVRO | 10.4m | Sut85 |
| | 226436. | unidentified | 0.4 | OriMC-1 | OVRO | 10.4m | Sut85 |
| | 226551.5 (1) | CH ₃ CHO 12(0,12)–11(0,11) E | 0.3 | OriMC-1 | OVRO | 10.4m | Sut85 |
| | 226592.8 (1) | CH ₃ CHO 12(0,12)–11(0,11) A | 0.2 | OriMC-1 | OVRO | 10.4m | Sut85 |
| | 226616.520*(20) | CN 2-1 $J = 3/2$ – $1/2$ $F = 1/2$ – $3/2$ | 0.2 | OriMC-1 | OVRO | 10.4m | Ska83 |
| | 226632.176*(20) | CN 2-1 $J = 3/2$ – $1/2$ $F = 3/2$ – $3/2$ | 1.4 | OriMC-1 | OVRO | 10.4m | Ska83 |
| | 226659.543*(20) | CN 2-1 $J = 3/2$ – $1/2$ $F = 5/2$ – $3/2$ | 4.3 | OriMC-1 | OVRO | 10.4m | Ska83 |
| | 226663.685*(20) | CN 2-1 $J = 3/2$ – $1/2$ $F = 1/2$ – $1/2$ | 1.5 | OriMC-1 | OVRO | 10.4m | Ska83 |
| | 226679.341*(20) | CN 2-1 $J = 3/2$ – $1/2$ $F = 3/2$ – $1/2$ | 1.9 | OriMC-1 | OVRO | 10.4m | Ska83 |
| | 226713.1 *(1) | HCOOCH ₃ 20(2,19)–19(2,18) E | 0.9 | OriMC-1 | OVRO | 10.4m | Sut85 |
| | 226718.69 (5) | HCOOCH ₃ 20(2,19)–19(2,18) A | 0.5 | OriMC-1 | OVRO | 10.4m | Bla84 |
| | 226773.2 *(1) | HCOOCH ₃ 20(1,19)–19(1,18) E | 0.9 | OriMC-1 | OVRO | 10.4m | Sut85 |
| | 226778.75 (5) | HCOOCH ₃ 20(1,19)–19(1,18) A | 1.0 | OriMC-1 | OVRO | 10.4m | Sut85 |

TABLE 2. Recommended rest frequencies for observed interstellar molecular lines — Continued

| Frequency unc. | Formula | Quantum numbers | T_r '(K) T_a '(K) | Source | Telescope | Astr. Ref. | Lab. Ref. |
|-----------------|------------------------------------|-----------------------------|--------------------------|---------|-----------|---------------|--------------|
| 226856.5 *(1) | HCOOCH ₃ | 20(2,19)-19(1,18) E | 0.5 | OriMC-1 | OVRO | 10.4m | Sut85 |
| 226862.19 *(10) | HCOOCH ₃ | 20(2,19)-19(1,18) A | 0.6 | OriMC-1 | OVRO | 10.4m | Sut85 |
| 226874.183*(20) | CN | 2-1 $J=5/2-3/2$ $F=5/2-3/2$ | b | OriMC-1 | OVRO | 10.4m | Bla84 |
| 226874.764*(20) | CN | 2-1 $J=5/2-3/2$ $F=7/2-5/2$ | 8.0b | OriMC-1 | OVRO | 10.4m | Woo82 |
| 226875.896*(20) | CN | 2-1 $J=5/2-3/2$ $F=3/2-1/2$ | b | OriMC-1 | OVRO | 10.4m | Woo82 |
| 226887.399*(20) | CN | 2-1 $J=5/2-3/2$ $F=3/2-3/2$ | 1.0b | OriMC-1 | OVRO | 10.4m | Woo82 |
| 226892.151*(20) | CN | 2-1 $J=5/2-3/2$ $F=5/2-5/2$ | b | OriMC-1 | OVRO | 10.4m | Woo82 |
| 227019.6 *(1) | HCOOCH ₃ | 19(2,17)-18(2,16) E | 1.0 | OriMC-1 | OVRO | 10.4m | Sut85 |
| 227028.06 *(10) | HCOOCH ₃ | 19(2,17)-18(2,16) A | 1.2 | OriMC-1 | OVRO | 10.4m | Sut85 |
| 227031.94 *(11) | ³⁴ SO ₂ | 12(3,9)-12(2,10) | 0.7 | OriMC-1 | OVRO | 10.4m | Sut85 |
| 227095. | CH ₃ OH | unassigned | 0.9 | OriMC-1 | OVRO | 10.4m | Sut85 |
| 227418.957*(46) | HC ₃ N | 25-24 | 3.5 | OriMC-1 | OVRO | 10.4m | Sut85 |
| 227561.1 *(1) | HCOOCH ₃ | 21(0,21)-20(0,20) E | b | OriMC-1 | OVRO | 10.4m | Sut85 |
| 227561.9 *(1) | HCOOCH ₃ | 21(1,21)-20(1,20) E | b | OriMC-1 | OVRO | 10.4m | Sut85 |
| 227561.95 *(10) | HCOOCH ₃ | 21(1,21)-20(1,20) A | b | OriMC-1 | OVRO | 10.4m | Sut85 |
| 227562.77 *(10) | HCOOCH ₃ | 21(0,21)-20(0,20) A | 2.1b | OriMC-1 | OVRO | 10.4m | Sut85 |
| 227780.97 *(2) | CH ₃ CH ₂ CN | 25(3,22)-24(3,21) | 0.5 | OriMC-1 | OVRO | 10.4m | Sut85 |
| 227815. | CH ₃ OH | unassigned | 1.4 | OriMC-1 | OVRO | 10.4m | Sut85 |
| 227897.52 *(11) | HC ₂ CHCN | 24(7,17)-23(7,16) | b | OriMC-1 | OVRO | 10.4m | Sut85 |
| 227897.52 *(11) | HC ₂ CHCN | 24(7,18)-23(7,17) | 0.5b | OriMC-1 | OVRO | 10.4m | Sut85 |
| 227906.61 *(9) | HC ₂ CHCN | 24(6,19)-23(6,18) | 0.5b | OriMC-1 | OVRO | 10.4m | Sut85 |
| 227906.64 *(9) | HC ₂ CHCN | 24(6,18)-23(6,17) | b | OriMC-1 | OVRO | 10.4m | Sut85 |
| 227918.54 *(13) | HC ₂ CHCN | 24(8,17)-23(8,16) | b | OriMC-1 | OVRO | 10.4m | Sut85 |
| 227918.54 *(13) | HC ₂ CHCN | 24(8,16)-23(8,15) | 0.5b | OriMC-1 | OVRO | 10.4m | Sut85 |
| 227960.07 *(15) | HC ₂ CHCN | 24(9,15)-23(9,14) | b | OriMC-1 | OVRO | 10.4m | Sut85 |
| 227960.07 *(15) | HC ₂ CHCN | 24(9,16)-23(9,15) | b | OriMC-1 | OVRO | 10.4m | Sut85 |
| 227965.97 *(7) | HC ₂ CHCN | 24(5,20)-23(5,19) | b | OriMC-1 | OVRO | 10.4m | Sut85 |
| 227967.52 *(7) | HC ₂ CHCN | 24(5,19)-23(5,18) | 0.5b | OriMC-1 | OVRO | 10.4m | Sut85 |
| 227977.074*(68) | HC ₃ N $\nu_1=1$ | 25-24 1e | 0.7 | OriMC-1 | OVRO | 10.4m | Sut85 |
| 228090.48 *(5) | HC ₂ CHCN | 24(3,22)-23(3,21) | 0.4 | OriMC-1 | OVRO | 10.4m | Sut85 |
| 228104.55 *(6) | HC ₂ CHCN | 24(4,21)-23(4,20) | 0.5 | OriMC-1 | OVRO | 10.4m | Sut85 |
| 228302.988*(68) | HC ₃ N $\nu_1=1$ | 25-24 1f | 0.8 | OriMC-1 | OVRO | 10.4m | Sut85 |
| 228483.14 *(2) | CH ₃ CH ₂ CN | 25(2,23)-24(2,22) | 0.9 | OriMC-1 | OVRO | 10.4m | Sut85 |
| 228544.07 *(1) | HCOOH | 10(2,8)-9(2,7) | 0.4 | OriMC-1 | OVRO | 10.4m | Sut85 |
| 228629.1 *(1) | HCOOCH ₃ | 18(5,13)-17(5,12) E | 1.2 | OriMC-1 | OVRO | 10.4m | Sut85 |
| 228651.34 *(10) | HCOOCH ₃ | 18(5,13)-17(5,12) A | 1.2 | OriMC-1 | OVRO | 10.4m | Sut85 |
| 228797.47 *(4) | CH ₃ CH ₂ CN | 14(2,12)-13(1,13) | 0.3 | OriMC-1 | OVRO | 10.4m | Sut85 |
| 228910.46 *(10) | DNC | 3-2 | 0.23 | OriMC-1 | MMWO | 4.9m | Lor84b |
| 228978.76 *(58) | CH ₃ OCH ₃ | 7(7,1)-8(6,2) EA | 0.2 | OriMC-1 | OVRO | 10.4m | Sut85 |
| 228983.24 *(48) | CH ₃ OCH ₃ | 7(7,1)-8(6,2) EE | 0.2b | OriMC-1 | OVRO | 10.4m | Sut85 |
| 228984.83 *(48) | CH ₃ OCH ₃ | 7(7,1)-8(6,2) AE | b | OriMC-1 | OVRO | 10.4m | Sut85 |
| 228984.83 *(48) | CH ₃ OCH ₃ | 7(7,0)-8(6,3) AE | b | OriMC-1 | OVRO | 10.4m | Sut85 |
| 228987.74 *(37) | CH ₃ OCH ₃ | 7(7,1)-8(6,2) AA | b | OriMC-1 | OVRO | 10.4m | Sut85 |
| 228987.74 *(37) | CH ₃ OCH ₃ | 7(7,0)-8(6,3) AA | b | OriMC-1 | OVRO | 10.4m | Sut85 |
| 228989.33 *(40) | CH ₃ OCH ₃ | 7(7,0)-8(6,3) EE | b | OriMC-1 | OVRO | 10.4m | Sut85 |
| 228990.91 *(44) | CH ₃ OCH ₃ | 7(7,0)-8(6,3) EA | b | OriMC-1 | OVRO | 10.4m | Sut85 |
| 229086.99 *(5) | HC ₂ CHCN | 24(3,21)-23(3,20) | 0.3 | OriMC-1 | OVRO | 10.4m | Sut85 |
| 229265.16 *(2) | CH ₃ CH ₂ CN | 26(2,25)-25(2,24) | 0.7 | OriMC-1 | OVRO | 10.4m | Sut85 |
| 229347.73 *(3) | SO ₂ | 11(5,7)-12(4,8) | 1.9 | OriMC-1 | OVRO | 10.4m | Sut85 |
| 229404.9 *(1) | HCOOCH ₃ | 18(3,15)-17(3,14) E | 1.2 | OriMC-1 | OVRO | 10.4m | Sut85 |
| 229420.30 *(10) | HCOOCH ₃ | 18(3,15)-17(3,14) A | 1.3 | OriMC-1 | OVRO | 10.4m | Bla84 |
| 229474.6 *(1) | HCOOCH ₃ | 20(3,17)-19(4,16) E | 0.3 | OriMC-1 | OVRO | 10.4m | Sut85 |
| 229504.59 *(10) | HCOOCH ₃ | 20(3,17)-19(4,16) A | 0.3 | OriMC-1 | OVRO | 10.4m | Bla84 |
| 229590. | CH ₃ OH | unassigned | 1.3 | OriMC-1 | OVRO | 10.4m | Sut85 |
| 229647.75 *(9) | HC ₂ CHCN | 25(1,25)-24(1,24) | 0.2 | OriMC-1 | OVRO | 10.4m | Sut85 |
| 229758.76 (5) | CH ₃ OH | 8(-1)-7(0) E | 10.6 | OriMC-1 | OVRO | 10.4m | Sut85 |
| 229857.66 *(11) | ³⁴ SO ₂ | 4(2,2)-3(1,3) | 1.1 | OriMC-1 | OVRO | 10.4m | Sut85 |
| 229864.19 (5) | CH ₃ OH | 19(5)-20(4) A+ | 0.4 | OriMC-1 | OVRO | 10.4m | Sas84 |
| 229939.18 (5) | CH ₃ OH | 19(5)-20(4) A- | 0.5 | OriMC-1 | OVRO | 10.4m | Sas84 |
| 230027.06 (5) | CH ₃ OH | 3(-2)-4(-1) E | 5.1 | OriMC-1 | OVRO | 10.4m | Sas84 |
| U 230233. | unidentified | | 0.6 | OriMC-1 | OVRO | 10.4m | Sut85 |
| 230317.527 (30) | O ¹³ CS | 19-18 | 0.5 | OriMC-1 | OVRO | 10.4m | Sut85 |
| 230368.69 (5) | CH ₃ OH | 22(4)-21(5) E | 0.2 | OriMC-1 | OVRO | 10.4m | Sut85 |
| 230465.75 *(71) | CH ₃ OCH ₃ | 10(8,3)-11(7,4) EA | b | OriMC-1 | OVRO | 10.4m | Sut85 |
| 230467.78 *(64) | CH ₃ OCH ₃ | 10(8,3)-11(7,4) EE | 0.4b | OriMC-1 | OVRO | 10.4m | Sut85 |

TABLE 2. Recommended rest frequencies for observed interstellar molecular lines — Continued

| Frequency unc. | Formula | Quantum numbers | $T_r^*(\text{K})$ | Source | Telescope | Astr. Ref. | Lab. Ref. | | |
|----------------|-----------------------------------|----------------------|-----------------------------------|---------------------|-----------|------------|-----------|-------|-------|
| | | | $T_a^*(\text{K})$ | | | | | | |
| | CH_3OCH_3 | 10(8,2)-11(7,5) AA | b | OriMC-1 | OVRO | 10.4m | Sut85 | | |
| | CH_3OCH_3 | 10(8,3)-11(7,4) AA | b | OriMC-1 | OVRO | 10.4m | Sut85 | | |
| | CH_3OCH_3 | 10(8,2)-11(7,5) AE | b | OriMC-1 | OVRO | 10.4m | Sut85 | | |
| | CH_3OCH_3 | 10(8,3)-11(7,4) AE | b | OriMC-1 | OVRO | 10.4m | Sut85 | | |
| | CH_3OCH_3 | 10(8,2)-11(7,5) EE | b | OriMC-1 | OVRO | 10.4m | Sut85 | | |
| | CH_3OCH_3 | 10(8,2)-11(7,5) EA | b | OriMC-1 | OVRO | 10.4m | Sut85 | | |
| | CO | 2-1 | 70 | OriMC-1 | NRAO | 11m | Phi77 | | |
| | HC_2CHCN | 25(0,25)-24(0,24) | 0.4 | OriMC-1 | OVRO | 10.4m | Sut85 | | |
| | OCS | 19-18 | 0.80 | OriMC-1 | FCRAO | 14m | Sch84 | | |
| | HCOOCH_3 | 21(9,12)-21(8,13) A | 0.3 | OriMC-1 | OVRO | 10.4m | Sut85 | | |
| | ^{13}CS | 5-4 | 0.7 | OriMC-1 | MMWO | 4.9m | Mun84a | | |
| | HCOOCH_3 | 21(9,13)-21(8,14) A | 0.4 | OriMC-1 | OVRO | 10.4m | Sut85 | | |
| | CH_3OH | 10(2)-9(3) A- | 0.4 | OriMC-1 | MMWO | 4.9m | Mun84a | | |
| | $\text{CH}_3\text{CH}_2\text{CN}$ | 26(1,25)-25(1,24) | b | OriMC-1 | OVRO | 10.4m | Sut85 | | |
| | $\text{CH}_3\text{CH}_2\text{CN}$ | 27(0,27)-26(1,26) | 0.9b | OriMC-1 | OVRO | 10.4m | Sut85 | | |
| | $\text{CH}_3\text{CH}_2\text{CN}$ | 24(2,23)-23(1,22) | b | OriMC-1 | OVRO | 10.4m | Sut85 | | |
| | N_2D^+ | 3-2 | 0.17 | ρ Oph B2 | MMWO | 4.9m | Lor85 | | |
| | HCOOH | 10(1,9)-9(1,8) | 0.8 | OriMC-1 | OVRO | 10.4m | Sut85 | | |
| | $\text{CH}_3\text{CH}_2\text{CN}$ | 27(1,27)-26(1,26) | 1.1 | OriMC-1 | OVRO | 10.4m | Sut85 | | |
| | HC_2CHCN | 24(2,22)-23(2,21) | 0.3 | OriMC-1 | OVRO | 10.4m | Sut85 | | |
| | HCOOCH_3 | 20(9,11)-20(8,12) A | 0.4 | OriMC-1 | OVRO | 10.4m | Sut85 | | |
| | CH_3OCH_3 | 13(0,13)-12(1,12) AA | b | OriMC-1 | OVRO | 10.4m | Sut85 | | |
| | CH_3OCH_3 | 13(0,13)-12(1,12) EE | 3.2b | OriMC-1 | OVRO | 10.4m | Sut85 | | |
| | CH_3OCH_3 | 13(0,13)-12(1,12) AE | b | OriMC-1 | OVRO | 10.4m | Sut85 | | |
| | CH_3OCH_3 | 13(0,13)-12(1,12) EA | b | OriMC-1 | OVRO | 10.4m | Sut85 | | |
| | $\text{CH}_3\text{CH}_2\text{CN}$ | 27(0,27)-26(0,26) | 1.1 | OriMC-1 | OVRO | 10.4m | Sut85 | | |
| U | 232163. | unidentified | 0.8 | OriMC-1 | OVRO | 10.4m | Sut85 | | |
| | $^{13}\text{CH}_3\text{CN}$ | 13(3)-12(3) | 0.7 | OriMC-1 | OVRO | 10.4m | Sut85 | | |
| | $^{13}\text{CH}_3\text{CN}$ | 13(2)-12(2) | 0.5 | OriMC-1 | OVRO | 10.4m | Sut85 | | |
| | $^{13}\text{CH}_3\text{CN}$ | 13(1)-12(1) | 0.5 | OriMC-1 | OVRO | 10.4m | Sut85 | | |
| | $^{13}\text{CH}_3\text{CN}$ | 13(0)-12(0) | 0.6 | OriMC-1 | OVRO | 10.4m | Sut85 | | |
| | S^{18}O | 5(6)-4(5) | 0.3 | OriMC-1 | OVRO | 10.4m | Sut85 | | |
| | CH_3OH | 10(2)-9(3) A+ | 3.9 | OriMC-1 | OVRO | 10.4m | Sut85 | | |
| | CH_3OH | 18(3)-17(4) A+ | 1.4 | OriMC-1 | OVRO | 10.4m | Sut85 | | |
| | $\text{CH}_3\text{CH}_2\text{CN}$ | 26(3,24)-25(3,23) | 1.1 | OriMC-1 | OVRO | 10.4m | Sut85 | | |
| | CH_3OH | unassigned | 3.0 | OriMC-1 | OVRO | 10.4m | Sut85 | | |
| | $\text{CH}_3\text{CH}_2\text{CN}$ | 26(10,16)-25(10,15) | b | OriMC-1 | OVRO | 10.4m | Sut85 | | |
| | $\text{CH}_3\text{CH}_2\text{CN}$ | 26(10,17)-25(10,16) | b | OriMC-1 | OVRO | 10.4m | Sut85 | | |
| | $\text{CH}_3\text{CH}_2\text{CN}$ | 26(9,18)-25(9,17) | b | OriMC-1 | OVRO | 10.4m | Sut85 | | |
| | $\text{CH}_3\text{CH}_2\text{CN}$ | 26(9,17)-25(9,16) | 1.2b | OriMC-1 | OVRO | 10.4m | Sut85 | | |
| | $\text{CH}_3\text{CH}_2\text{CN}$ | 26(11,16)-25(11,15) | b | OriMC-1 | OVRO | 10.4m | Sut85 | | |
| | $\text{CH}_3\text{CH}_2\text{CN}$ | 26(11,15)-25(11,14) | 0.8b | OriMC-1 | OVRO | 10.4m | Sut85 | | |
| | $\text{CH}_3\text{CH}_2\text{CN}$ | 26(8,19)-25(8,18) | 1.1b | OriMC-1 | OVRO | 10.4m | Sut85 | | |
| | $\text{CH}_3\text{CH}_2\text{CN}$ | 26(8,18)-25(8,17) | b | OriMC-1 | OVRO | 10.4m | Sut85 | | |
| | $\text{CH}_3\text{CH}_2\text{CN}$ | 26(12,15)-25(12,14) | b | OriMC-1 | OVRO | 10.4m | Sut85 | | |
| | $\text{CH}_3\text{CH}_2\text{CN}$ | 26(12,14)-25(12,13) | b | OriMC-1 | OVRO | 10.4m | Sut85 | | |
| | $\text{CH}_3\text{CH}_2\text{CN}$ | 26(13,13)-25(13,12) | b | OriMC-1 | OVRO | 10.4m | Sut85 | | |
| | $\text{CH}_3\text{CH}_2\text{CN}$ | 26(13,14)-25(13,13) | 0.4b | OriMC-1 | OVRO | 10.4m | Sut85 | | |
| U | 233069.31 * | (2) | $\text{CH}_3\text{CH}_2\text{CN}$ | 26(7,20)-25(7,19) | 1.0b | OriMC-1 | OVRO | 10.4m | Sut85 |
| | 233069.31 * | (2) | $\text{CH}_3\text{CH}_2\text{CN}$ | 26(7,19)-25(7,18) | b | OriMC-1 | OVRO | 10.4m | Sut85 |
| | 233088.07 * | (2) | $\text{CH}_3\text{CH}_2\text{CN}$ | 26(14,13)-25(14,12) | b | OriMC-1 | OVRO | 10.4m | Sut85 |
| | 233088.07 * | (2) | $\text{CH}_3\text{CH}_2\text{CN}$ | 26(14,12)-25(14,11) | 0.5b | OriMC-1 | OVRO | 10.4m | Sut85 |
| | 233144.82 * | (2) | $\text{CH}_3\text{CH}_2\text{CN}$ | 26(15,12)-25(15,11) | b | OriMC-1 | OVRO | 10.4m | Sut85 |
| | 233144.82 * | (2) | $\text{CH}_3\text{CH}_2\text{CN}$ | 26(15,11)-25(15,10) | 0.4b | OriMC-1 | OVRO | 10.4m | Sut85 |
| | 233205.05 * | (2) | $\text{CH}_3\text{CH}_2\text{CN}$ | 26(6,21)-25(6,20) | 1.5b | OriMC-1 | OVRO | 10.4m | Sut85 |
| | 233207.32 * | (2) | $\text{CH}_3\text{CH}_2\text{CN}$ | 26(6,20)-25(6,19) | b | OriMC-1 | OVRO | 10.4m | Sut85 |
| | 233208.07 * | (2) | $\text{CH}_3\text{CH}_2\text{CN}$ | 26(16,11)-25(16,10) | b | OriMC-1 | OVRO | 10.4m | Sut85 |
| | 233208.07 * | (2) | $\text{CH}_3\text{CH}_2\text{CN}$ | 26(16,10)-25(16,9) | b | OriMC-1 | OVRO | 10.4m | Sut85 |
| | 233213. | unidentified | 0.2 | OriMC-1 | MMWO | 4.9m | Eri81 | | |
| | 233226.73 * | (10) | HCOOCH_3 | 19(4,16)-18(4,15) A | 1.1 | OriMC-1 | OVRO | 10.4m | Sut85 |
| | 233310.00 * | (10) | HCOOCH_3 | 19(15,4)-18(15,3) A | 0.4b | OriMC-1 | OVRO | 10.4m | Bla84 |
| | 233310.00 * | (10) | HCOOCH_3 | 19(15,5)-18(15,4) A | b | OriMC-1 | OVRO | 10.4m | Sut85 |
| | 233394.55 * | (10) | HCOOCH_3 | 19(14,5)-18(14,4) A | 0.4b | OriMC-1 | OVRO | 10.4m | Sut85 |
| | 233394.55 * | (10) | HCOOCH_3 | 19(14,6)-18(14,5) A | b | OriMC-1 | OVRO | 10.4m | Bla84 |
| | 233443.09 * | (2) | $\text{CH}_3\text{CH}_2\text{CN}$ | 26(5,22)-25(5,21) | 0.7 | OriMC-1 | OVRO | 10.4m | Sut85 |

TABLE 2. Recommended rest frequencies for observed interstellar molecular lines -- Continued

| Frequency unc. | Formula | Quantum numbers | $T_r^*(\text{K})$ | Source | Telescope | Astr. Ref. | Lab. Ref. | |
|----------------|-----------------|------------------------------------|----------------------|--------|-------------|------------|-----------|--------|
| | | | $T_a^*(\text{K})$ | | | | | |
| | 233498.29 *(2) | CH ₃ CH ₂ CN | 26(5,21)-25(5,20) | 0.8 | OriMC-1 | OVRO | 10.4m | Sut85 |
| | 233506.59 *(10) | HCOOCH ₃ | 19(13,6)-18(13,5) A | 0.8b | OriMC-1 | OVRO | 10.4m | Sut85 |
| | 233506.59 *(10) | HCOOCH ₃ | 19(13,7)-18(13,6) A | b | OriMC-1 | OVRO | 10.4m | Sut85 |
| | 233523.54 *(4) | CH ₃ CH ₂ CN | 26(20,6)-25(20,5) | b | OriMC-1 | OVRO | 10.4m | Sut85 |
| | 233523.54 *(4) | CH ₃ CH ₂ CN | 26(20,7)-25(20,6) | 0.5b | OriMC-1 | OVRO | 10.4m | Sut85 |
| | 233524.6 *(1) | HCOOCH ₃ | 19(13,6)-18(13,5) E | 0.4 | OriMC-1 | OVRO | 10.4m | Sut85 |
| | 233627.06 *(10) | HCOOCH ₃ | 17(9,8)-17(8,9) A | 0.4b | OriMC-1 | OVRO | 10.4m | Sut85 |
| | 233628.39 *(10) | HCOOCH ₃ | 17(9,9)-17(8,10) A | b | OriMC-1 | OVRO | 10.4m | Sut85 |
| | 233649.9 *(1) | HCOOCH ₃ | 19(12,7)-18(12,6) E | 0.5 | OriMC-1 | OVRO | 10.4m | Sut85 |
| | 233654.07 *(2) | CH ₃ CH ₂ CN | 26(4,23)-25(4,22) | 1.1 | OriMC-1 | OVRO | 10.4m | Sut85 |
| | 233655.27 *(10) | HCOOCH ₃ | 19(12,8)-18(12,7) A | b | OriMC-1 | OVRO | 10.4m | Sut85 |
| | 233655.27 *(10) | HCOOCH ₃ | 19(12,7)-18(12,6) A | 1.1b | OriMC-1 | OVRO | 10.4m | Sut85 |
| | 233671.0 *(1) | HCOOCH ₃ | 19(12,6)-18(12,7) E | 0.3 | OriMC-1 | OVRO | 10.4m | Sut85 |
| | 233754.1 *(1) | HCOOCH ₃ | 18(4,14)-17(4,13) E | 0.8 | OriMC-1 | OVRO | 10.4m | Sut85 |
| | 233777.45 *(10) | HCOOCH ₃ | 18(4,14)-17(4,13) A | 0.8 | OriMC-1 | OVRO | 10.4m | Sut85 |
| | 233795.75 (5) | CH ₃ OH | 18(3)-17(4) A- | 1.0 | OriMC-1 | OVRO | 10.4m | Sut85 |
| | 233845.3 *(1) | HCOOCH ₃ | 19(11,8)-18(11,7) E | 0.5 | OriMC-1 | OVRO | 10.4m | Sut85 |
| | 233854.23 *(10) | HCOOCH ₃ | 19(11,8)-18(11,7) A | 0.7b | OriMC-1 | OVRO | 10.4m | Sut85 |
| | 233854.23 *(10) | HCOOCH ₃ | 19(11,9)-18(11,8) A | b | OriMC-1 | OVRO | 10.4m | Sut85 |
| | 233867.1 *(1) | HCOOCH ₃ | 19(11,9)-18(11,8) E | 0.4 | OriMC-1 | OVRO | 10.4m | Sut85 |
| | 234011.34 *(10) | HCOOCH ₃ | 16(9,7)-16(8,8) A | b | OriMC-1 | OVRO | 10.4m | Sut85 |
| | 234011.58 (5) | ¹³ CH ₃ OH | 5(1)-4(1) A+ | 0.76b | OriMC-1 | OVRO | 10.4m | Bla84 |
| | 234011.81 *(10) | HCOOCH ₃ | 16(9,8)-16(8,9) A | b | OriMC-1 | OVRO | 10.4m | Sut85 |
| | 234112.3 *(1) | HCOOCH ₃ | 19(10,9)-18(10,8) E | 0.3 | OriMC-1 | OVRO | 10.4m | Sut85 |
| | 234124.84 *(10) | HCOOCH ₃ | 19(10,9)-18(10,8) A | 0.6b | OriMC-1 | OVRO | 10.4m | Sut85 |
| | 234124.84 *(10) | HCOOCH ₃ | 19(10,10)-18(10,9) A | b | OriMC-1 | OVRO | 10.4m | Sut85 |
| | 234134.6 *(1) | HCOOCH ₃ | 19(10,10)-18(10,9) E | 0.6 | OriMC-1 | OVRO | 10.4m | Sut85 |
| | 234187.12 *(7) | SO ₂ | 28(3,25)-28(2,26) | 1.6 | OriMC-1 | OVRO | 10.4m | Sut85 |
| U | 234291. | unidentified | | 0.6 | OriMC-1 | OVRO | 10.4m | Sut85 |
| | 234421.67 *(4) | SO ₂ | 16(6,10)-17(5,13) | 1.5 | OriMC-1 | OVRO | 10.4m | Sut85 |
| | 234423.95 *(2) | CH ₃ CH ₂ CN | 26(4,22)-25(4,21) | b | OriMC-1 | OVRO | 10.4m | Sut85 |
| | 234486.4 *(1) | HCOOCH ₃ | 19(9,10)-18(9,9) E | 0.6 | OriMC-1 | OVRO | 10.4m | Sut85 |
| | 234502.20 *(10) | HCOOCH ₃ | 19(9,11)-18(9,10) A | 1.1b | OriMC-1 | OVRO | 10.4m | Sut85 |
| | 234502.42 *(10) | HCOOCH ₃ | 19(9,10)-18(9,9) A | b | OriMC-1 | OVRO | 10.4m | Sut85 |
| | 234508.5 *(1) | HCOOCH ₃ | 19(9,11)-18(9,10) E | 0.6 | OriMC-1 | OVRO | 10.4m | Sut85 |
| | 234683.39 (5) | CH ₃ OH | 4(2)-5(1) A- | 2.6 | OriMC-1 | OVRO | 10.4m | Sas84 |
| | 234698.45 (5) | CH ₃ OH | 5(-4)-6(-3) E | 1.2 | OriMC-1 | OVRO | 10.4m | Sut85 |
| | 234739.03 *(10) | HCOOCH ₃ | 20(2,18)-19(3,17) A | 0.5 | OriMC-1 | OVRO | 10.4m | Bla84 |
| U | 234936. | unidentified | | 0.4 | OriMC-1 | OVRO | 10.4m | Sut85 |
| | 235029.9 *(1) | HCOOCH ₃ | 19(8,11)-18(8,10) E | 1.2 | OriMC-1 | OVRO | 10.4m | Sut85 |
| | 235043.2 *(1) | HCOOCH ₃ | 19(8,12)-18(8,11) E | 0.6b | OriMC-1 | OVRO | 10.4m | Sut85 |
| | 235046.48 *(10) | HCOOCH ₃ | 19(8,12)-18(8,11) A | b | OriMC-1 | OVRO | 10.4m | Bla84 |
| | 235051.37 *(10) | HCOOCH ₃ | 19(8,11)-18(8,10) A | 1.2 | OriMC-1 | OVRO | 10.4m | Sut85 |
| | 235151.719*(12) | SO ₂ | 4(2,2)-3(1,3) | 1.0 | OriMC-1 | MMWO | 4.9m | Lor84a |
| | 235261. | unidentified | | 0.7 | OriMC-1 | OVRO | 10.4m | Sut85 |
| | 235563.82 *(6) | HC ₂ CHCN | 25(2,24)-24(2,23) | 0.3 | OriMC-1 | OVRO | 10.4m | Sut85 |
| | 235844.50 (5) | HCOOCH ₃ | 19(7,13)-18(7,12) A | 0.54 | OriMC-1 | OVRO | 10.4m | Bla84 |
| | 235865.87 (10) | HCOOCH ₃ | 19(7,13)-18(7,12) E | 0.48 | OriMC-1 | OVRO | 10.4m | Bla84 |
| U | 235881.17 (5) | ¹³ CH ₃ OH | 5(0)-4(0) E | 0.60 | OriMC-1 | OVRO | 10.4m | Bla84 |
| | 235887.18 (10) | HCOOCH ₃ | 19(7,12)-18(7,11) E | 0.54 | OriMC-1 | OVRO | 10.4m | Bla84 |
| | 235927.55 *(11) | ³⁴ SO ₂ | 5(2,4)-4(1,3) | 0.59 | OriMC-1 | OVRO | 10.4m | Bla84 |
| | 235932.34 (5) | HCOOCH ₃ | 19(7,12)-18(7,11) A | 0.47 | OriMC-1 | OVRO | 10.4m | Plu84 |
| | 235938.22 (5) | ¹³ CH ₃ OH | 5(-1)-4(-1) E | 0.68 | OriMC-1 | OVRO | 10.4m | Bla84 |
| | 235951.98 *(10) | ³⁴ SO ₂ | 10(3,7)-10(2,8) | 0.71 | OriMC-1 | OVRO | 10.4m | Bla84 |
| | 235960.37 (5) | ¹³ CH ₃ OH | 5(0)-4(0) A+ | 0.71 | OriMC-1 | OVRO | 10.4m | Bla84 |
| | 235960.94 *(59) | SiS | 13-12 | 0.39 | IRC + 10216 | MMWO | 4.9m | Sah84 |
| | 235971.07 (5) | ¹³ CH ₃ OH | 5(4)-4(4) A+- | 0.25 | OriMC-1 | OVRO | 10.4m | Bla84 |
| | 235978.62 (5) | ¹³ CH ₃ OH | 5(-4)-4(-4) E | 0.12 | OriMC-1 | OVRO | 10.4m | Bla84 |
| Bla | 235994.42 (5) | ¹³ CH ₃ OH | 5(4)-4(4) E | b | OriMC-1 | OVRO | 10.4m | Bla84 |
| | 235997.23 (5) | ¹³ CH ₃ OH | 5(3)-4(3) A+- | 0.72b | OriMC-1 | OVRO | 10.4m | Bla84 |
| | 236006.10 (5) | ¹³ CH ₃ OH | 5(3)-4(3) E | 0.35 | OriMC-1 | OVRO | 10.4m | Bla84 |
| | 236008.39 (5) | ¹³ CH ₃ OH | 5(2)-4(2) A- | 0.65 | OriMC-1 | OVRO | 10.4m | Bla84 |
| | 236016.55 (5) | ¹³ CH ₃ OH | 5(-3)-4(-3) E | 0.36 | OriMC-1 | OVRO | 10.4m | Bla84 |
| | 236041.40 (5) | ¹³ CH ₃ OH | 5(1)-4(1) E | 0.56 | OriMC-1 | OVRO | 10.4m | Bla84 |
| | 236042.2 *(10) | ¹³ CH ₃ OH | 5(1)-4(1) E | 0.3 | OriMC-1 | MMWO | 4.9m | Eri84 |
| | | | | | | | | Lee84 |

TABLE 2. Recommended rest frequencies for observed interstellar molecular lines — Continued

| Frequency unc. | Formula | Quantum numbers | $T_r^*(\text{K})$ | Source | Telescope | Astr. Ref. | Lab. Ref. | |
|-----------------|-----------------------------|-----------------------------------|---------------------|---------|-----------|------------|-----------|--------|
| | | | $T_s^*(\text{K})$ | | | | | |
| 236049.52 (5) | $^{13}\text{CH}_3\text{OH}$ | 5(2)-4(2) A+ | 0.41 | OriMC-1 | OVRO | 10.4m | Bla84 | |
| 236062.00 (5) | $^{13}\text{CH}_3\text{OH}$ | 5(-2)-4(-2) E | b | OriMC-1 | OVRO | 10.4m | Bla84 | |
| 236062.85 (5) | $^{13}\text{CH}_3\text{OH}$ | 5(2)-4(2) E | 0.92b | OriMC-1 | OVRO | 10.4m | Bla84 | |
| 236216.724*(24) | SO_2 | 16(1,15)-15(2,14) | 1.1 | OriMC-1 | MMWO | 4.9m | Lor81a | |
| 236355.9 *(1) | HCOOCH_3 | 20(3,18)-19(3,17) E | 0.9 | OriMC-1 | OVRO | 10.4m | Sut85 | |
| 236365.52 *(10) | HCOOCH_3 | 20(3,18)-19(3,17) A | 0.7 | OriMC-1 | OVRO | 10.4m | Sut85 | |
| 236452.304*(58) | SO | 1(2)-2(1) | 0.4 | OriMC-1 | OVRO | 10.4m | Sut85 | |
| 236512.850*(61) | HC_3N | 26-25 | 0.8 | OriMC-1 | MMWO | 4.9m | Lor81 | |
| 236717.20 *(1) | HCOOH | 11(1,11)-10(1,10) | 0.4 | OriMC-1 | OVRO | 10.4m | Sut85 | |
| 236726.27 *(38) | H_2CS | 7(1,7)-6(1,6) | 1.1 | OriMC-1 | MMWO | 4.9m | Lor84a | |
| 236743.72 *(1) | HCOOCH_3 | 19(5,15)-18(5,14) E | 0.6 | OriMC-1 | OVRO | 10.4m | Sut85 | |
| 236759.63 *(10) | HCOOCH_3 | 19(5,15)-18(5,14) A | 0.6 | OriMC-1 | OVRO | 10.4m | Bla84 | |
| 236800.5 *(1) | HCOOCH_3 | 19(6,14)-18(6,13) E | 0.6 | OriMC-1 | OVRO | 10.4m | Sut85 | |
| 236810.28 *(10) | HCOOCH_3 | 19(6,14)-18(6,13) A | 0.8 | OriMC-1 | OVRO | 10.4m | Bla84 | |
| 236936.13 (5) | CH_3OH | 14(1)-13(2) A- | 2.3 | OriMC-1 | OVRO | 10.4m | Sut85 | |
| U | 236977. | unidentified | 0.9 | OriMC-1 | OVRO | 10.4m | Sut85 | |
| | 237046.34 *(21) | CH_3OCH_3 | 7(2,5)-6(1,6) AE | b | OriMC-1 | OVRO | 10.4m | Sut85 |
| | 237046.34 *(21) | CH_3OCH_3 | 7(2,5)-6(1,6) EA | b | OriMC-1 | OVRO | 10.4m | Sut85 |
| | 237049.03 *(15) | CH_3OCH_3 | 7(2,5)-6(1,6) EE | 1.5b | OriMC-1 | OVRO | 10.4m | Sut85 |
| | 237051.72 *(9) | CH_3OCH_3 | 7(2,5)-6(1,6) AA | b | OriMC-1 | OVRO | 10.4m | Sut85 |
| | 237068.826*(28) | SO_2 | 12(3,9)-12(2,10) | 0.9 | OriMC-1 | MMWO | 4.9m | Lei84a |
| | 237093.183*(79) | $\text{HC}_3\text{N} \nu_7=1$ | 26-25 1e | 0.8 | OriMC-1 | OVRO | 10.4m | Sut85 |
| | 237131. | CH_3OH | unassigned | 0.7 | OriMC-1 | OVRO | 10.4m | Sut85 |
| | 237170.44 *(2) | $\text{CH}_3\text{CH}_2\text{CN}$ | 26(3,23)-25(3,22) | 0.9 | OriMC-1 | OVRO | 10.4m | Bla84 |
| | 237266.91 *(10) | HCOOCH_3 | 21(1,20)-20(2,19) A | 0.4 | OriMC-1 | OVRO | 10.4m | Sut85 |
| | 237273.635 (30) | OC^{34}S | 20-19 | 0.5 | OriMC-1 | OVRO | 10.4m | Dub80 |
| | 237297.5 *(1) | HCOOCH_3 | 20(2,18)-19(2,17) E | 0.8 | OriMC-1 | OVRO | 10.4m | Sut85 |
| | 237305.97 (5) | HCOOCH_3 | 20(2,18)-19(2,17) A | 1.1b | OriMC-1 | OVRO | 10.4m | Bla84 |
| | 237309.5 *(1) | HCOOCH_3 | 21(2,20)-20(2,19) E | b | OriMC-1 | OVRO | 10.4m | Sut85 |
| | 237315.08 (5) | HCOOCH_3 | 21(2,20)-20(2,19) A | 1.1 | OriMC-1 | OVRO | 10.4m | Bla84 |
| | 237344.8 *(1) | HCOOCH_3 | 21(1,20)-20(1,19) E | 0.8 | OriMC-1 | OVRO | 10.4m | Sut85 |
| | 237350.39 (5) | HCOOCH_3 | 21(1,20)-20(1,19) A | 0.7 | OriMC-1 | OVRO | 10.4m | Bla84 |
| | 237405.18 *(2) | $\text{CH}_3\text{CH}_2\text{CN}$ | 26(2,24)-25(2,23) | 0.7 | OriMC-1 | OVRO | 10.4m | Sut85 |
| | 237432.049*(79) | $\text{HC}_3\text{N} \nu_7=1$ | 26-25 1f | 0.7 | OriMC-1 | OVRO | 10.4m | Sut85 |
| | 237456.25 *(19) | HC_2CHCN | 25(9,16)-24(9,15) | b | OriMC-1 | OVRO | 10.4m | Sut85 |
| | 237456.25 *(19) | HC_2CHCN | 25(9,17)-24(9,16) | 0.2b | OriMC-1 | OVRO | 10.4m | Sut85 |
| | 237482.77 *(9) | HC_2CHCN | 25(5,21)-24(5,20) | 0.3b | OriMC-1 | OVRO | 10.4m | Sut85 |
| | 237485.01 *(9) | HC_2CHCN | 25(5,20)-24(5,19) | b | OriMC-1 | OVRO | 10.4m | Sut85 |
| | 237591.40 *(6) | HC_2CHCN | 25(3,23)-24(3,22) | 0.4 | OriMC-1 | OVRO | 10.4m | Sut85 |
| | 237618.87 *(27) | CH_3OCH_3 | 9(2,8)-8(1,7) AE | b | OriMC-1 | OVRO | 10.4m | Sut85 |
| | 237618.87 *(27) | CH_3OCH_3 | 9(2,8)-8(1,7) EA | b | OriMC-1 | OVRO | 10.4m | Sut85 |
| | 237620.96 *(20) | CH_3OCH_3 | 9(2,8)-8(1,7) EE | 0.9b | OriMC-1 | OVRO | 10.4m | Sut85 |
| | 237623.05 *(13) | CH_3OCH_3 | 9(2,8)-8(1,7) AA | b | OriMC-1 | OVRO | 10.4m | Sut85 |
| | 237711.89 *(7) | HC_2CHCN | 25(4,21)-24(4,20) | 0.3 | OriMC-1 | OVRO | 10.4m | Sut85 |
| | 237807.6 *(1) | HCOOCH_3 | 19(6,13)-18(6,12) E | 0.5 | OriMC-1 | OVRO | 10.4m | Sut85 |
| | 237829.78 *(10) | HCOOCH_3 | 19(6,13)-18(6,12) A | 0.6 | OriMC-1 | OVRO | 10.4m | Bla84 |
| | 237851.85 *(2) | $\text{CH}_3\text{CH}_2\text{CN}$ | 27(2,26)-26(2,25) | 0.4 | OriMC-1 | OVRO | 10.4m | Sut85 |
| | 237859.71 *(7) | C_2H | 25-24 $J=51/2-49/2$ | 0.053 | IRC+10216 | MMWO | 4.9m | Lor84a |
| | 237898.03 *(7) | C_2H | 25-24 $J=49/2-47/2$ | 0.055 | IRC+10216 | MMWO | 4.9m | Lor84a |
| | 237983.38 (5) | $^{13}\text{CH}_3\text{OH}$ | 5(1)-4(1) A- | 0.84 | OriMC-1 | OVRO | 10.4m | Bla84 |
| U | 238017. | unidentified | 0.4 | OriMC-1 | OVRO | 10.4m | Bla84 | |
| | 238156.2 *(1) | HCOOCH_3 | 22(1,22)-21(1,21) E | b | OriMC-1 | OVRO | 10.4m | Sut85 |
| | 238156.6 *(1) | HCOOCH_3 | 22(0,22)-21(0,21) E | 2.7b | OriMC-1 | OVRO | 10.4m | Sut85 |
| | 238156.84 *(10) | HCOOCH_3 | 22(1,22)-21(1,21) A | b | OriMC-1 | OVRO | 10.4m | Bla84 |
| | 238157.27 *(10) | HCOOCH_3 | 22(0,22)-21(0,21) A | b | OriMC-1 | OVRO | 10.4m | Bla84 |
| | 238190.06 *(10) | HCOOCH_3 | 7(6,2)-6(5,1) A | 0.2b | OriMC-1 | OVRO | 10.4m | Sut85 |
| | 238190.23 *(10) | HCOOCH_3 | 7(6,1)-6(5,2) A | b | OriMC-1 | OVRO | 10.4m | Sut85 |
| | 238726.70 *(12) | HC_2CHCN | 26(1,26)-25(1,25) | 0.2 | OriMC-1 | OVRO | 10.4m | Sut85 |
| | 238766.166*(4) | CH_3CN | 13(9)-12(9) | 0.4 | OriMC-1 | OVRO | 10.4m | Sut85 |
| | 238796.22 *(7) | HC_2CHCN | 25(3,22)-24(3,21) | 0.2 | OriMC-1 | OVRO | 10.4m | Sut85 |
| | 238844.019*(4) | CH_3CN | 13(8)-12(8) | 0.6 | OriMC-1 | OVRO | 10.4m | Sut85 |
| | 238912.787*(4) | CH_3CN | 13(7)-12(7) | 0.7 | OriMC-1 | OVRO | 10.4m | Sut85 |
| | 238926.8 *(1) | HCOOCH_3 | 20(3,18)-19(2,17) E | 0.3 | OriMC-1 | OVRO | 10.4m | Sut85 |
| | 238972.44 *(10) | CH_3CN | 13(6)-12(6) | 0.31 | OriMC-1 | MMWO | 4.9m | Lor84 |
| | 238992.562*(54) | SO_2 | 21(7,15)-22(6,16) | ~0.12 | OriMC-1 | MMWO | 4.9m | Lor84 |

TABLE 2. Recommended rest frequencies for observed interstellar molecular lines — Continued

| Frequency unc. | Formula | Quantum numbers | $T_r^*(\text{K})$ | Source | Telescope | Astr. Ref. | Lab. Ref. | |
|-----------------|-----------------------------------|-----------------------------------|-------------------|---------|-----------|------------|-----------|--------|
| | | | $T_a^*(\text{K})$ | | | | | |
| 239001.21 *(21) | $\text{CH}_3^{13}\text{CN}$ | 12(2)-11(2) | 0.3 | OriMC-1 | OVRO | 10.4m | Sut85 | |
| 239014.95 *(21) | $\text{CH}_3^{13}\text{CN}$ | 12(1)-11(1) | 0.5b | OriMC-1 | OVRO | 10.4m | Sut85 | |
| 239019.53 *(21) | $\text{CH}_3^{13}\text{CN}$ | 12(0)-11(0) | b | OriMC-1 | OVRO | 10.4m | Sut85 | |
| 239022.93 *(10) | CH_3CN | 13(5)-12(5) | 0.33 | OriMC-1 | MMWO | 4.9m | Lor84 | |
| 239064.299*(70) | CH_3CN | 13(4)-12(4) | 0.39 | OriMC-1 | MMWO | 4.9m | Lor84 | |
| 239096.496*(50) | CH_3CN | 13(3)-12(3) | 0.68 | OriMC-1 | MMWO | 4.9m | Lor84 | |
| 239119.503*(20) | CH_3CN | 13(2)-12(2) | 0.54 | OriMC-1 | MMWO | 4.9m | Lor84 | |
| 239133.311*(20) | CH_3CN | 13(1)-12(1) | 0.73 | OriMC-1 | MMWO | 4.9m | Lor84 | |
| 239137.914*(20) | CH_3CN | 13(0)-12(0) | 0.83 | OriMC-1 | MMWO | 4.9m | Lor84 | |
| 239179.284*(15) | CH_3CCH | 14(4)-13(4) | 0.16 | OriMC-1 | MMWO | 4.9m | Lor84a | |
| 239211.218*(4) | CH_3CCH | 14(3)-13(3) | 0.24 | OriMC-1 | MMWO | 4.9m | Lor84a | |
| 239234.036*(4) | CH_3CCH | 14(2)-13(2) | 0.19 | OriMC-1 | MMWO | 4.9m | Lor84a | |
| 239247.731*(4) | CH_3CCH | 14(1)-13(1) | 0.36 | OriMC-1 | MMWO | 4.9m | Lor84a | |
| 239252.296*(4) | CH_3CCH | 14(0)-13(0) | 0.37 | OriMC-1 | MMWO | 4.9m | Lor84a | |
| 239627.16 *(12) | $\text{CH}_3\text{CN} \nu_8=1$ | 13(1)-12(1) $\ell=1$ | 0.4 | OriMC-1 | OVRO | 10.4m | Sut85 | |
| 239682.80 *(2) | $\text{CH}_3\text{CH}_2\text{CN}$ | 27(1,26)-26(1,25) | 0.7 | OriMC-1 | OVRO | 10.4m | Sut85 | |
| 239708.28 *(11) | HC_2CHCN | 26(0,26)-25(0,25) | 0.1 | OriMC-1 | OVRO | 10.4m | Sut85 | |
| 239732. | CH_3OH | unassigned | 0.6 | OriMC-1 | OVRO | 10.4m | Sut85 | |
| 239746.253 (12) | CH_3OH | 4(1)-4(1) A+ | 7.4 | OriMC-1 | OVRO | 10.4m | Sut85 | |
| 239777.19 *(11) | $\text{CH}_3\text{CN} \nu_8=1$ | 13(3)-12(3) $\ell=-1$ | 0.3 | OriMC-1 | OVRO | 10.4m | Sut85 | |
| 239791.76 *(11) | $\text{CH}_3\text{CN} \nu_8=1$ | 13(5)-12(5) $\ell=1$ | 0.2 | OriMC-1 | OVRO | 10.4m | Sut85 | |
| 239808.91 *(12) | $\text{CH}_3\text{CN} \nu_8=1$ | 13(2)-12(2) $\ell=-1$ | 0.6 | OriMC-1 | OVRO | 10.4m | Sut85 | |
| 239816.08 *(5) | HC_2CHCN | 25(1,24)-24(1,23) | 0.5 | OriMC-1 | OVRO | 10.4m | Sut85 | |
| 239824.78 *(12) | $\text{CH}_3\text{CN} \nu_8=1$ | 13(4)-12(4) $\ell=1$ | 0.8 | OriMC-1 | OVRO | 10.4m | Sut85 | |
| 239829.96 *(13) | $\text{CH}_3\text{CN} \nu_8=1$ | 13(1)-12(1) $\ell=-1$ | 0.5 | OriMC-1 | OVRO | 10.4m | Sut85 | |
| 239836.06 *(18) | $\text{CH}_3\text{CN} \nu_8=1$ | 13(0)-12(0) $\ell=1$ | 0.5 | OriMC-1 | OVRO | 10.4m | Sut85 | |
| 239850.01 *(14) | $\text{CH}_3\text{CN} \nu_8=1$ | 13(3)-12(3) $\ell=1$ | 0.7 | OriMC-1 | OVRO | 10.4m | Sut85 | |
| 239871.67 *(29) | $\text{CH}_3\text{CN} \nu_8=1$ | 13(2)-12(2) $\ell=1$ | 0.4 | OriMC-1 | OVRO | 10.4m | Sut85 | |
| 240020.4 *(5) | HCOOCH_3 | 19(3,16)-18(3,5) E | 0.16 | OriMC-1 | NRAO | 12m | Tur84a | |
| 240021.4 *(1) | HCOOCH_3 | 19(3,16)-18(3,15) E | 1.0 | OriMC-1 | OVRO | 10.4m | Sut85 | |
| 240034.61 *(6) | HCOOCH_3 | 19(3,16)-18(3,5) A | 0.10 | OriMC-1 | NRAO | 12m | Tur84a | |
| 240089.83 *(12) | $\text{CH}_3\text{CN} \nu_8=1$ | 13(1)-12(1) $\ell=1$ | 0.6 | OriMC-1 | OVRO | 10.4m | Sut85 | |
| U | 240097. | unidentified | 0.1 | OriMC-1 | NRAO | 12m | Tur84a | |
| | 240185.77 *(26) | CH_2CO | 12(1,12)-11(1,11) | 0.5 | OriMC-1 | OVRO | 10.4m | Sut85 |
| | 240241.50 (5) | CH_3OH | 5(3)-6(2) E | 0.55 | OriMC-1 | MMWO | 4.9m | Lor84a |
| | 240266.16 *(40) | H_2CS | 7(0,7)-6(0,6) | 0.55 | OriMC-1 | MMWO | 4.9m | Lor84a |
| | 240319.338*(21) | $\text{CH}_3\text{CH}_2\text{CN}$ | 28(1,28)-27(1,27) | 0.16 | OriMC-1 | MMWO | 4.9m | Lor84a |
| | 240331.44 *(26) | H_2CS | 7(4,3)-6(4,2) | b | OriMC-1 | MMWO | 4.9m | Lor84a |
| | 240331.44 *(26) | H_2CS | 7(4,4)-6(4,3) | 0.07b | OriMC-1 | MMWO | 4.9m | Lor84a |
| | 240381.27 *(33) | H_2CS | 7(2,6)-6(2,5) | 0.16 | OriMC-1 | MMWO | 4.9m | Lor84a |
| | 240392.29 *(26) | H_2CS | 7(3,5)-6(3,4) | 0.38b | OriMC-1 | MMWO | 4.9m | Lor84a |
| | 240392.96 *(26) | H_2CS | 7(3,4)-6(3,3) | b | OriMC-1 | MMWO | 4.9m | Lor84a |
| U | 240429.183*(21) | $\text{CH}_3\text{CH}_2\text{CN}$ | 28(0,28)-27(0,27) | 0.12 | OriMC-1 | MMWO | 4.9m | Lor84a |
| | 240473.4 | unidentified | 0.11 | OriMC-1 | MMWO | 4.9m | Lor84a | |
| | 240548.29 *(33) | H_2CS | 7(2,5)-6(2,4) | 0.16 | OriMC-1 | MMWO | 4.9m | Lor84a |
| | 240875.735*(16) | HNCO | 11(1,11)-10(1,10) | 1.0 | OriMC-1 | OVRO | 10.4m | Sut85 |
| | 240942.793*(37) | SO_2 | 18(1,17)-18(0,18) | 0.8 | OriMC-1 | MMWO | 4.9m | Lei84 |
| | 240960.56 (5) | $\text{CH}_3\text{OH} \nu_i=1$ | 5(1)-4(2) A+ | 0.9 | OriMC-1 | OVRO | 10.4m | Sut85 |
| | 240978.15 *(33) | CH_3OCH_3 | 5(3,3)-4(2,2) EA | 0.2 | OriMC-1 | OVRO | 10.4m | Sut85 |
| | 240982.94 *(21) | CH_3OCH_3 | 5(3,3)-4(2,2) AE | b | OriMC-1 | OVRO | 10.4m | Sut85 |
| | 240985.15 *(19) | CH_3OCH_3 | 5(3,3)-4(2,2) EE | 1.0b | OriMC-1 | OVRO | 10.4m | Sut85 |
| | 240990.14 *(10) | CH_3OCH_3 | 5(3,3)-4(2,2) AA | 0.7 | OriMC-1 | OVRO | 10.4m | Sut85 |
| S | 241016.176*(29) | C^{34}S | 5-4 | 0.83 | OriMC-2 | MMWO | 4.9m | Sne84 |
| | 241146.20 *(1) | HCOOH | 11(0,11)-10(0,10) | 0.2 | OriMC-1 | OVRO | 10.4m | Sut85 |
| | 241159.13 (5) | $\text{CH}_3\text{OH} \nu_i=1$ | 5(4)-4(4) E | 0.7 | OriMC-1 | OVRO | 10.4m | Sut85 |
| | 241166.53 (5) | $\text{CH}_3\text{OH} \nu_i=1$ | 5(3)-4(3) E | 0.8 | OriMC-1 | OVRO | 10.4m | Sas84 |
| | 241178.42 (5) | $\text{CH}_3\text{OH} \nu_i=1$ | 5(4)-4(4) A+- | 1.3b | OriMC-1 | OVRO | 10.4m | Sut85 |
| | 241179.90 (5) | $\text{CH}_3\text{OH} \nu_i=1$ | 5(-3)-4(-3) E | b | OriMC-1 | OVRO | 10.4m | Sut85 |
| | 241184.08 (5) | $\text{CH}_3\text{OH} \nu_i=1$ | 5(-4)-4(-4) E | 1.1 | OriMC-1 | OVRO | 10.4m | Sut85 |
| | 241187.40 (5) | $\text{CH}_3\text{OH} \nu_i=1$ | 5(-2)-4(-2) E | 1.4 | OriMC-1 | OVRO | 10.4m | Sut85 |
| | 241192.81 (5) | $\text{CH}_3\text{OH} \nu_i=1$ | 5(2)-4(2) A+ | 1.9 | OriMC-1 | OVRO | 10.4m | Sas84 |
| | 241196.35 (5) | $\text{CH}_3\text{OH} \nu_i=1$ | 5(2)-4(2) A- | 2.1b | OriMC-1 | OVRO | 10.4m | Sut85 |
| S | 241198.29 (5) | $\text{CH}_3\text{OH} \nu_i=1$ | 5(3)-4(3) A+- | b | OriMC-1 | OVRO | 10.4m | Sas84 |
| | 241203.69 (5) | $\text{CH}_3\text{OH} \nu_i=1$ | 5(1)-4(1) E | b | OriMC-1 | OVRO | 10.4m | Sut85 |
| | 241205.99 (5) | $\text{CH}_3\text{OH} \nu_i=1$ | 5(0)-4(0) E | 2.8 | OriMC-1 | OVRO | 10.4m | Sas84 |
| | | | | | | | | |

TABLE 2. Recommended rest frequencies for observed interstellar molecular lines — Continued

| Frequency unc. | Formula | Quantum numbers | $T_r^*(\text{K})$ | Source | Telescope | Astr. Ref. | Lab. Ref. | | |
|----------------|-----------------|--|----------------------|---------|-----------|------------|-----------|--------|-------|
| U | 241210.68 (5) | $\text{CH}_3\text{OH} \nu_t=1$ 5(2)-4(2) E | 1.2b | OriMC-1 | OVRO | 10.4m | Sut85 | Sas84 | |
| | 241238.16 (5) | $\text{CH}_3\text{OH} \nu_t=1$ 5(-1)-4(-1) E | 0.7 | OriMC-1 | OVRO | 10.4m | Sut85 | Sas84 | |
| | 241267.88 (5) | $\text{CH}_3\text{OH} \nu_t=1$ 5(0)-4(0) A | 0.4 | OriMC-1 | OVRO | 10.4m | Sut85 | Sas84 | |
| | 241441.24 (5) | $\text{CH}_3\text{OH} \nu_t=1$ 5(1)-4(1) A- | 1.5 | OriMC-1 | OVRO | 10.4m | Sut85 | Sas84 | |
| | 241509.05 *(10) | $^{34}\text{SO}_2$ 16(1,15)-15(2,14) | 0.9 | OriMC-1 | OVRO | 10.4m | Sut85 | | |
| | 241523.98 *(20) | CH_3OCH_3 5(3,2)-4(2,3) AE | 0.9 | OriMC-1 | OVRO | 10.4m | Sut85 | | |
| | 241528.76 *(11) | CH_3OCH_3 5(3,2)-4(2,3) EA | b | OriMC-1 | OVRO | 10.4m | Sut85 | | |
| | 241528.97 *(11) | CH_3OCH_3 5(3,2)-4(2,3) EE | 1.7b | OriMC-1 | OVRO | 10.4m | Sut85 | | |
| | 241531.18 *(10) | CH_3OCH_3 5(3,2)-4(2,3) AA | b | OriMC-1 | OVRO | 10.4m | Sut85 | | |
| | 241534. | unidentified | 0.4 | OriMC-1 | MMWO | 4.9m | Eri84b | | |
| | 241561.550 (37) | HDO | 2(1,1)-2(1,2) | 1.0 | OriMC-1 | MMWO | 4.9m | Bec82 | DeL71 |
| | 241561.550 (37) | HDO | 2(1,1)-2(1,2) | 1.9 | OriMC-1 | OVRO | 10.4m | Sut85 | DeL71 |
| | 241615.795*(13) | SO_2 | 5(2,4)-4(1,3) | 1.4 | OriMC-1 | MMWO | 4.9m | Lor84e | |
| | 241700.219 (12) | CH_3OH | 5(0)-4(0) E | 1.7 | OriMC-1 | MMWO | 4.9m | Lor84 | Pic81 |
| | 241767.224 (12) | CH_3OH | 5(-1)-4(-1) E | 1.8 | OriMC-1 | MMWO | 4.9m | Lor84 | Pic81 |
| | 241774.037*(10) | HNCO | 11(0,11)-10(0,10) | 3.1 | OriMC-1 | OVRO | 10.4m | Sut85 | |
| | 241791.431 (12) | CH_3OH | 5(0)-4(0) A+ | 1.8 | OriMC-1 | MMWO | 4.9m | Lor84 | Pic81 |
| | 241806.507 (12) | CH_3OH | 5(4)-4(4) A+ | 0.8b | OriMC-1 | MMWO | 4.9m | Lor84 | Pic81 |
| | 241806.508 (12) | CH_3OH | 5(4)-4(4) A- | b | OriMC-1 | MMWO | 4.9m | Lor84 | Pic81 |
| | 241813.257 (12) | CH_3OH | 5(-4)-4(-4) E | 0.7 | OriMC-1 | MMWO | 4.9m | Lor84 | Pic81 |
| | 241829.646 (12) | CH_3OH | 5(4)-4(4) E | ~0.7 | OriMC-1 | MMWO | 4.9m | Lor84 | Pic81 |
| | 241832.951 (12) | CH_3OH | 5(3)-4(3) A+,A- | 1.6 | OriMC-1 | MMWO | 4.9m | Lor84 | Pic81 |
| | 241842.23 (12) | CH_3OH | 5(2)-4(2) A- | b | OriMC-1 | MMWO | 4.9m | Lor84 | Pic81 |
| | 241843.646 (12) | CH_3OH | 5(3)-4(3) E | 1.7b | OriMC-1 | MMWO | 4.9m | Lor84 | Pic81 |
| | 241852.352 (12) | CH_3OH | 5(-3)-4(-3) E | 0.9 | OriMC-1 | MMWO | 4.9m | Lor84 | Pic81 |
| | 241879.073 (12) | CH_3OH | 5(1)-4(1) E | 1.4 | OriMC-1 | MMWO | 4.9m | Lor84 | Pic81 |
| | 241887.704 (12) | CH_3OH | 5(2)-4(2) A+ | 1.2 | OriMC-1 | MMWO | 4.9m | Lor84 | Pic81 |
| | 241904.119 (50) | CH_3OH | 5(2)-4(2) E | 1.2b | OriMC-1 | MMWO | 4.9m | Lor81a | Pic81 |
| | 241904.407 (50) | CH_3OH | 5(-2)-4(-2) E | b | OriMC-1 | MMWO | 4.9m | Lor81a | Pic81 |
| | 241922.55 *(2) | $\text{CH}_3\text{CH}_2\text{CN}$ | 27(10,17)-26(10,16) | b | OriMC-1 | OVRO | 10.4m | Sut85 | |
| | 241922.55 *(2) | $\text{CH}_3\text{CH}_2\text{CN}$ | 27(10,18)-26(10,17) | 0.9b | OriMC-1 | OVRO | 10.4m | Sut85 | |
| | 241932.18 *(2) | $\text{CH}_3\text{CH}_2\text{CN}$ | 27(9,18)-26(9,17) | b | OriMC-1 | OVRO | 10.4m | Sut85 | |
| | 241932.18 *(2) | $\text{CH}_3\text{CH}_2\text{CN}$ | 27(9,19)-26(9,18) | 1.3b | OriMC-1 | OVRO | 10.4m | Sut85 | |
| | 241933.16 *(2) | $\text{CH}_3\text{CH}_2\text{CN}$ | 27(11,17)-26(11,16) | b | OriMC-1 | OVRO | 10.4m | Sut85 | |
| | 241933.16 *(2) | $\text{CH}_3\text{CH}_2\text{CN}$ | 27(11,16)-26(11,15) | b | OriMC-1 | OVRO | 10.4m | Sut85 | |
| | 241946.86 *(15) | CH_3OCH_3 | 13(1,13)-12(0,12) EE | 0.5 | OriMC-1 | MMWO | 4.9m | Lor81a | |
| | 241959.06 *(2) | $\text{CH}_3\text{CH}_2\text{CN}$ | 27(12,15)-26(12,14) | 0.7b | OriMC-1 | OVRO | 10.4m | Sut85 | |
| | 241959.06 *(2) | $\text{CH}_3\text{CH}_2\text{CN}$ | 27(12,16)-26(12,15) | b | OriMC-1 | OVRO | 10.4m | Sut85 | |
| | 241970.44 *(2) | $\text{CH}_3\text{CH}_2\text{CN}$ | 27(6,19)-26(6,18) | b | OriMC-1 | OVRO | 10.4m | Sut85 | |
| | 241970.44 *(2) | $\text{CH}_3\text{CH}_2\text{CN}$ | 27(6,20)-26(6,19) | 0.8b | OriMC-1 | OVRO | 10.4m | Sut85 | |
| | 241985.51 *(10) | $^{34}\text{SO}_2$ | 8(3,5)-8(2,5) | 1.4 | OriMC-1 | OVRO | 10.4m | Sut85 | |
| | 241997.11 *(2) | $\text{CH}_3\text{CH}_2\text{CN}$ | 27(13,14)-26(13,13) | b | OriMC-1 | OVRO | 10.4m | Sut85 | |
| | 241997.11 *(2) | $\text{CH}_3\text{CH}_2\text{CN}$ | 27(13,15)-26(13,14) | 0.5b | OriMC-1 | OVRO | 10.4m | Sut85 | |
| | 242045.30 *(2) | $\text{CH}_3\text{CH}_2\text{CN}$ | 27(14,13)-26(14,12) | b | OriMC-1 | OVRO | 10.4m | Sut85 | |
| | 242045.30 *(2) | $\text{CH}_3\text{CH}_2\text{CN}$ | 27(14,14)-26(14,13) | b | OriMC-1 | OVRO | 10.4m | Sut85 | |
| | 242052.48 *(2) | $\text{CH}_3\text{CH}_2\text{CN}$ | 27(7,21)-26(7,20) | b | OriMC-1 | OVRO | 10.4m | Sut85 | |
| | 242052.58 *(2) | $\text{CH}_3\text{CH}_2\text{CN}$ | 27(7,20)-26(7,19) | 0.8b | OriMC-1 | OVRO | 10.4m | Sut85 | |
| | 242102.24 *(2) | $\text{CH}_3\text{CH}_2\text{CN}$ | 27(15,13)-26(15,12) | 0.8b | OriMC-1 | OVRO | 10.4m | Sut85 | |
| | 242102.24 *(2) | $\text{CH}_3\text{CH}_2\text{CN}$ | 27(15,12)-26(15,11) | b | OriMC-1 | OVRO | 10.4m | Sut85 | |
| | 242166.96 *(2) | $\text{CH}_3\text{CH}_2\text{CN}$ | 27(16,12)-26(16,11) | 0.2b | OriMC-1 | OVRO | 10.4m | Sut85 | |
| | 242166.96 *(2) | $\text{CH}_3\text{CH}_2\text{CN}$ | 27(16,11)-26(16,10) | b | OriMC-1 | OVRO | 10.4m | Sut85 | |
| | 242206.97 *(2) | $\text{CH}_3\text{CH}_2\text{CN}$ | 27(6,22)-26(6,21) | 1.3b | OriMC-1 | OVRO | 10.4m | Sut85 | |
| | 242210.41 *(2) | $\text{CH}_3\text{CH}_2\text{CN}$ | 27(6,21)-26(6,20) | b | OriMC-1 | OVRO | 10.4m | Sut85 | |
| | 242375.82 *(38) | CH_2CO | 12(0,12)-11(0,11) | 0.5 | OriMC-1 | OVRO | 10.4m | Sut85 | |
| | 242398.66 *(23) | CH_2CO | 12(3,10)-11(3,9) | 0.6b | OriMC-1 | OVRO | 10.4m | Sut85 | |
| | 242399.16 *(23) | CH_2CO | 12(3,9)-11(3,8) | b | OriMC-1 | OVRO | 10.4m | Sut85 | |
| | 242424.66 *(28) | CH_2CO | 12(2,11)-11(2,10) | 0.2 | OriMC-1 | OVRO | 10.4m | Sut85 | |
| | 242446.21 (5) | CH_3OH | 13(-2)-14(-1) E | 3.3 | OriMC-1 | OVRO | 10.4m | Sut85 | Sas84 |
| | 242470.39 *(2) | $\text{CH}_3\text{CH}_2\text{CN}$ | 27(5,23)-26(5,22) | 0.9 | OriMC-1 | OVRO | 10.4m | Sut85 | |
| | 242490.3 (1) | CH_3OH | 24(-3)-24(2) A | 0.7 | OriMC-1 | OVRO | 10.4m | Sut85 | Sut85 |
| | 242536.16 *(28) | CH_2CO | 12(2,10)-11(2,9) | 0.4 | OriMC-1 | OVRO | 10.4m | Sut85 | |
| | 242547.32 *(2) | $\text{CH}_3\text{CH}_2\text{CN}$ | 27(5,22)-26(5,21) | 0.7 | OriMC-1 | OVRO | 10.4m | Sut85 | |
| | 242639.717*(16) | HNCO | 11(1,10)-10(1,9) | 1.1 | OriMC-1 | OVRO | 10.4m | Sut85 | |
| | 242664.68 *(2) | $\text{CH}_3\text{CH}_2\text{CN}$ | 27(4,24)-26(4,23) | 1.0 | OriMC-1 | OVRO | 10.4m | Sut85 | |
| | 242872.2 *(1) | HCOOCH_3 | 19(5,14)-18(5,13) E | 1.1 | OriMC-1 | OVRO | 10.4m | Sut85 | Sut85 |

TABLE 2. Recommended rest frequencies for observed interstellar molecular lines -- Continued

| Frequency unc. | Formula | Quantum numbers | $T_r^*(\text{K})$ | $T_a^*(\text{K})$ | Source | Telescope | Astr. Ref. | Lab. Ref. |
|----------------|------------------------------------|------------------------------------|-----------------------|-------------------|---------|-----------|------------|-----------|
| | HCOOCH ₃ | 19(5,14)-18(5,13) A | 1.1 | | OriMC-1 | OVRO | 10.4m | Sut85 |
| | C ³³ S | 5-4 | 1.5 | | OriMC-1 | OVRO | 10.4m | Sut85 |
| | S ¹⁸ O | 7(5)-6(5) | 0.4 | | OriMC-1 | OVRO | 10.4m | Sut85 |
| | SO ₂ | 5(4,2)-6(3,3) | 1.4 | | OriMC-1 | OVRO | 10.4m | Sut85 |
| | OCS | 20-19 | 0.67 | | OriMC-1 | MMWO | 4.9m | Lor84a |
| | CH ₃ OH | 18(6)-19(5) A+ | 1.6 | | OriMC-1 | OVRO | 10.4m | Sut85 |
| | CH ₃ OH | 23(-3)-23(2) A | 0.9 | | OriMC-1 | OVRO | 10.4m | Sut85 |
| | SO ₂ $\nu_2=1$ | 14(0,14)-13(1,13) | 0.6 | | OriMC-1 | OVRO | 10.4m | Sut85 |
| | CH ₃ CH ₂ CN | 27(4,23)-26(4,22) | 0.9 | | OriMC-1 | OVRO | 10.4m | Sut85 |
| U | 243740. | unidentified | 0.8 | | OriMC-1 | OVRO | 10.4m | Sut85 |
| | 243747. | unidentified | 1.1 | | OriMC-1 | OVRO | 10.4m | Sut85 |
| | 243915.826 (12) | CH ₃ OH | 5(1)-4(1) A- | 8.1 | OriMC-1 | OVRO | 10.4m | Sut85 |
| | 243935.88 *(21) | ³⁴ SO ₂ | 18(1,17)-18(0,18) | 0.4 | OriMC-1 | OVRO | 10.4m | Sut85 |
| | 244047.75 *(48) | H ₂ CS | 7(1,6)-6(1,5) | 0.91 | OriMC-1 | MMWO | 4.9m | Lor84a |
| | 244254.228*(24) | SO ₂ | 14(0,14)-13(1,13) | 1.5 | OriMC-1 | MMWO | 4.9m | Lor84b |
| | 244330.5 (1) | CH ₃ OH | 22(-3)-22(2) A | 1.1 | OriMC-1 | OVRO | 10.4m | Sut85 |
| | 244338.02 (5) | CH ₃ OH $\nu_1=1$ | 9(1)-8(0) E | 1.2 | OriMC-1 | OVRO | 10.4m | Sut85 |
| | 244481.54 *(11) | ³⁴ SO ₂ | 14(0,14)-13(1,13) | 1.4 | OriMC-1 | OVRO | 10.4m | Sut85 |
| | 244580.7 *(1) | HCOOCH ₃ | 20(4,17)-19(4,16) E | 1.3 | OriMC-1 | OVRO | 10.4m | Sut85 |
| | 244593.98 *(10) | HCOOCH ₃ | 20(4,17)-19(4,16) A | 1.1 | OriMC-1 | OVRO | 10.4m | Sut85 |
| | 244712.24 *(26) | CH ₃ CO | 12(1,11)-11(1,10) | 0.8 | OriMC-1 | OVRO | 10.4m | Sut85 |
| | 244857.39 *(7) | HC ₂ CHCN | 26(2,25)-25(2,24) | 0.5 | OriMC-1 | OVRO | 10.4m | Sut85 |
| | 244935.606*(33) | CS | 5-4 | 5.5 | OriMC-2 | MMWO | 4.9m | Sne84 |
| | 245178.68 *(16) | ³⁴ SO ₂ | 15(2,14)-15(1,15) | 0.8 | OriMC-1 | OVRO | 10.4m | Sut85 |
| | 245223.0 (1) | CH ₃ OH | 21(-3)-21(2) A | 1.3 | OriMC-1 | OVRO | 10.4m | Sut85 |
| | 245302.30 *(11) | ³⁴ SO ₂ | 6(3,3)-6(2,4) | 0.9 | OriMC-1 | OVRO | 10.4m | Sut85 |
| | 245339.40 *(5) | SO ₂ | 26(3,23)-25(4,22) | 1.7 | OriMC-1 | OVRO | 10.4m | Sut85 |
| | 245563.43 *(2) | SO ₂ | 10(3,7)-10(2,8) | 7.8 | OriMC-1 | OVRO | 10.4m | Sut85 |
| | 245606.406*(78) | HC ₃ N | 27-26 | 0.7 | OriMC-1 | MMWO | 4.9m | Lor81 |
| | 245651.09 *(10) | HCOOCH ₃ | 20(15,6)-19(15,5) A | 0.6b | OriMC-1 | OVRO | 10.4m | Sut85 |
| | 245651.09 *(10) | HCOOCH ₃ | 20(15,5)-19(15,4) A | b | OriMC-1 | OVRO | 10.4m | Bla84 |
| | 245752.17 *(10) | HCOOCH ₃ | 20(14,6)-19(14,5) A | 0.7b | OriMC-1 | OVRO | 10.4m | Bla84 |
| | 245752.17 *(10) | HCOOCH ₃ | 20(14,7)-19(14,6) A | b | OriMC-1 | OVRO | 10.4m | Sut85 |
| | 245754.3 *(1) | HCOOCH ₃ | 20(14,6)-19(14,5) E | b | OriMC-1 | OVRO | 10.4m | Sut85 |
| | 245772.1 *(1) | HCOOCH ₃ | 20(14,7)-19(14,6) E | 0.5 | OriMC-1 | OVRO | 10.4m | Sut85 |
| | 245883.2 *(1) | HCOOCH ₃ | 20(13,8)-19(13,7) E | 0.2 | OriMC-1 | OVRO | 10.4m | Sut85 |
| | 245885.14 *(10) | HCOOCH ₃ | 20(13,7)-19(13,6) A | 0.8b | OriMC-1 | OVRO | 10.4m | Sut85 |
| | 245885.14 *(10) | HCOOCH ₃ | 20(13,8)-19(13,7) A | b | OriMC-1 | OVRO | 10.4m | Bla84 |
| | 245903.5 *(1) | HCOOCH ₃ | 20(13,7)-19(13,6) E | 0.2 | OriMC-1 | OVRO | 10.4m | Sut85 |
| | 246055.1 *(1) | HCOOCH ₃ | 20(12,9)-19(12,8) E | 0.5 | OriMC-1 | OVRO | 10.4m | Sut85 |
| | 246060.75 *(10) | HCOOCH ₃ | 20(12,9)-19(12,8) A | b | OriMC-1 | OVRO | 10.4m | Bla84 |
| | 246060.75 *(10) | HCOOCH ₃ | 20(12,8)-19(12,7) A | 0.8b | OriMC-1 | OVRO | 10.4m | Sut85 |
| | 246074.65 (5) | CH ₃ OH | 20(-3)-20(2) A | 1.6 | OriMC-1 | OVRO | 10.4m | Sut85 |
| | 246268.73 *(2) | CH ₃ CH ₂ CN | 27(2,25)-26(2,24) | 0.9 | OriMC-1 | OVRO | 10.4m | Sas84 |
| | 246285.4 *(1) | HCOOCH ₃ | 20(11,9)-19(11,8) E | 0.4 | OriMC-1 | OVRO | 10.4m | Sut85 |
| | 246295.06 *(10) | HCOOCH ₃ | 20(11,10)-19(11,9) A | 1.3b | OriMC-1 | OVRO | 10.4m | Bla84 |
| | 246295.06 *(10) | HCOOCH ₃ | 20(11,9)-19(11,8) A | b | OriMC-1 | OVRO | 10.4m | Bla84 |
| | 246308.6 *(1) | HCOOCH ₃ | 20(11,10)-19(11,9) E | 0.4 | OriMC-1 | OVRO | 10.4m | Sut85 |
| | 246421.91 *(2) | CH ₃ CH ₂ CN | 28(2,27)-27(2,26) | 0.6 | OriMC-1 | OVRO | 10.4m | Sut85 |
| | 246548.69 *(2) | CH ₃ CH ₂ CN | 27(3,24)-26(3,23) | 0.6 | OriMC-1 | OVRO | 10.4m | Sut85 |
| | 246560.749*(91) | HC ₃ N $\nu_7=1$ | 27-26 1f | 1.1 | OriMC-1 | OVRO | 10.4m | Sut85 |
| | 246600.2 *(1) | HCOOCH ₃ | 20(10,11)-19(10,10) E | 0.7 | OriMC-1 | OVRO | 10.4m | Sut85 |
| | 246613.34 *(10) | HCOOCH ₃ | 20(10,11)-19(10,10) A | 1.1b | OriMC-1 | OVRO | 10.4m | Bla84 |
| | 246613.38 *(10) | HCOOCH ₃ | 20(10,10)-19(10,9) A | b | OriMC-1 | OVRO | 10.4m | Bla84 |
| | 246623.1 *(1) | HCOOCH ₃ | 20(10,10)-19(10,9) E | 0.8 | OriMC-1 | OVRO | 10.4m | Sut85 |
| | 246663.390*(38) | ³⁴ SO | 5(6)-4(5) | 2.9 | OriMC-1 | OVRO | 10.4m | Sut85 |
| | 246686.18 *(13) | ³⁴ SO ₂ | 4(3,1)-4(2,2) | 0.3 | OriMC-1 | OVRO | 10.4m | Sut85 |
| | 246873.34 (5) | CH ₃ OH | 19(3)-19(2) A-+ | 0.30 | OriMC-1 | MMWO | 4.9m | Lor84b |
| | 246891.1 *(1) | HCOOCH ₃ | 19(4,15)-18(4,14) E | 1.2 | OriMC-1 | OVRO | 10.4m | Sas84 |
| | 246896.87 *(16) | HC ₂ CHCN | 26(7,20)-25(7,19) | 0.5b | OriMC-1 | OVRO | 10.4m | Sut85 |
| | 246896.87 *(16) | HC ₂ CHCN | 26(7,19)-25(7,18) | b | OriMC-1 | OVRO | 10.4m | Sut85 |
| | 246914.59 *(10) | HCOOCH ₃ | 19(4,15)-18(4,14) A | 1.2 | OriMC-1 | OVRO | 10.4m | Sut85 |
| | 246924.65 *(31) | HDCO | 4(1,4)-3(1,3) | 0.40 | OriMC-1 | MMWO | 4.9m | Bla84 |
| | 246945.87 *(93) | HCOOCH ₃ | 10(5,6)-9(4,6) E | 0.16 | OriMC-1 | MMWO | 4.9m | Lor84b |
| | 246952.14 *(23) | HC ₂ CHCN | 26(9,17)-25(9,16) | b | OriMC-1 | OVRO | 10.4m | Sut85 |

TABLE 2. Recommended rest frequencies for observed interstellar molecular lines — Continued

| Frequency unc. | Formula | Quantum numbers | $T_r^*(\text{K})$ $T_a^*(\text{K})$ | Source | Telescope | Astr. Ref. | Lab. Ref. |
|-----------------|------------------------------------|---|--|---------|-----------|---------------|--------------|
| | HC ₂ CHCN | 26(9,18)-25(9,17) | 0.6b | OriMC-1 | OVRO | 10.4m | Sut85 |
| 246952.14 *(23) | HC ₂ CHCN | 26(5,22)-25(5,21) | 0.2b | OriMC-1 | OVRO | 10.4m | Bla85 |
| 247001.71 *(11) | HC ₂ CHCN | 26(5,21)-25(5,20) | b | OriMC-1 | OVRO | 10.4m | Bla85 |
| 247004.92 *(11) | HC ₂ CHCN | 20(9,11)-19(9,10) E | 0.6 | OriMC-1 | OVRO | 10.4m | Bla85 |
| 247040.8 *(1) | HCOOCH ₃ | 20(3,19)-19(3,18) E | 1.1 | OriMC-1 | OVRO | 10.4m | Bla85 |
| 247044.1 *(1) | HCOOCH ₃ | 21(5,17)-20(5,16) | 0.27 | OriMC-1 | MMWO | 4.9m | Lor84b |
| 247053.45 (5) | HCOOCH ₃ | 20(3,19)-19(3,18) A | 1.2 | OriMC-1 | OVRO | 10.4m | Bla85 |
| 247057.25 *(10) | HCOOCH ₃ | 20(9,12)-19(9,11) A | 1.2b | OriMC-1 | OVRO | 10.4m | Plu84 |
| 247057.70 *(10) | HCOOCH ₃ | 20(9,11)-19(9,10) A | b | OriMC-1 | OVRO | 10.4m | Plu84 |
| 247063.5 *(5) | HCOOCH ₃ | 20(9,12)-19(9,11) E | 0.5 | OriMC-1 | OVRO | 10.4m | Bla85 |
| 247086.93 *(8) | HC ₂ CHCN | 26(3,24)-25(3,23) | 0.2 | OriMC-1 | OVRO | 10.4m | Bla85 |
| 247162.1 (1) | CH ₃ OH | unassigned | 1.6 | OriMC-1 | OVRO | 10.4m | Bla85 |
| 247228.693 (24) | CH ₃ OH | 4(2)-5(1) A + | 3.9 | OriMC-1 | OVRO | 10.4m | Bla85 |
| 247270.64 *(9) | HC ₂ CHCN | 26(4,22)-25(4,21) | 0.3 | OriMC-1 | OVRO | 10.4m | Pic81 |
| 247440.36 *(12) | ³⁴ SO ₂ | 5(3,3)-5(2,4) | 0.7 | OriMC-1 | OVRO | 10.4m | Bla85 |
| U 247469. | unidentified | | 0.6 | OriMC-1 | OVRO | 10.4m | Bla85 |
| U 247610.96 (5) | CH ₃ OH | 18(3)-18(2) A-+ | 1.1 | OriMC-1 | OVRO | 10.4m | Bla85 |
| U 247630. | unidentified | | 0.4 | OriMC-1 | OVRO | 10.4m | Bla85 |
| U 247636. | unidentified | | 0.4 | OriMC-1 | OVRO | 10.4m | Bla85 |
| 247656.8 *(5) | HCOOCH ₃ | 20(2,19)-19(2,18) E | 1.4 | OriMC-1 | OVRO | 10.4m | Bla85 |
| 247665.34 *(10) | HCOOCH ₃ | 20(2,19)-19(2,18) A | 1.2 | OriMC-1 | OVRO | 10.4m | Plu84 |
| 247682.7 *(1) | HCOOCH ₃ | 20(8,12)-19(8,11) E | 0.2 | OriMC-1 | OVRO | 10.4m | Bla85 |
| 247697.19 *(10) | HCOOCH ₃ | 20(8,13)-19(8,12) A | 0.7 | OriMC-1 | OVRO | 10.4m | Plu84 |
| 247704.3 *(1) | HCOOCH ₃ | 20(8,13)-19(8,12) E | 0.8 | OriMC-1 | OVRO | 10.4m | Bla85 |
| 247707.95 *(10) | HCOOCH ₃ | 20(8,12)-19(8,11) A | 1.1 | OriMC-1 | OVRO | 10.4m | Bla85 |
| 247798.55 *(15) | HC ₂ CHCN | 27(1,27)-26(1,26) | 0.3 | OriMC-1 | OVRO | 10.4m | Plu84 |
| U 247840.2 (1) | CH ₃ OH | unassigned | 1.0 | OriMC-1 | OVRO | 10.4m | Bla85 |
| U 247875. | unidentified | | 0.7 | OriMC-1 | OVRO | 10.4m | Bla85 |
| 247901.6 *(1) | HCOOCH ₃ | 22(8,21)-21(8,20) E | 0.7 | OriMC-1 | OVRO | 10.4m | Bla85 |
| 247907.12 *(10) | HCOOCH ₃ | 22(2,21)-21(2,20) A | 0.6 | OriMC-1 | OVRO | 10.4m | Plu84 |
| U 247911. | unidentified | | 0.5 | OriMC-1 | OVRO | 10.4m | Bla85 |
| 247922.2 *(1) | HCOOCH ₃ | 22(1,21)-21(1,20) E | 0.6 | OriMC-1 | OVRO | 10.4m | Bla85 |
| 247927.69 *(10) | HCOOCH ₃ | 22(1,21)-21(1,20) A | 0.5 | OriMC-1 | OVRO | 10.4m | Bla85 |
| 248057.385*(31) | SO ₂ | 15(2,14)-15(1,15) | 6.1 | OriMC-1 | OVRO | 10.4m | Bla85 |
| 248242.5 (1) | CH ₃ OH | 17(3)-17(2) A-+ | 2.2 | OriMC-1 | OVRO | 10.4m | Bla85 |
| 248364.82 *(11) | ³⁴ SO ₂ | 7(3,5)-7(2,6) | 0.9 | OriMC-1 | OVRO | 10.4m | Bla85 |
| 248436.900*(33) | SO ₂ | 13(3,11)-14(0,14) | 0.6 | OriMC-1 | OVRO | 10.4m | Bla85 |
| 248528.95 *(78) | HC ₂ CHCN | 26(3,23)-25(3,22) | 0.4 | OriMC-1 | OVRO | 10.4m | Bla85 |
| 248617.41 *(10) | HCOOCH ₃ | 20(7,14)-19(7,13) A | 1.0 | OriMC-1 | OVRO | 10.4m | Plu84 |
| 248633.8 *(1) | HCOOCH ₃ | 20(7,14)-19(7,13) E | 1.0 | OriMC-1 | OVRO | 10.4m | Bla85 |
| 249887.47 (5) | CH ₃ OH | 14(3)-14(2) A-+ | 3.6 | OriMC-1 | OVRO | 10.4m | Bla85 |
| 249924.31 *(28) | CH ₃ OCH ₃ | 15(1,14)-14(2,13) EE | 1.1 | OriMC-1 | OVRO | 10.4m | Sas84 |
| 250050.21 *(24) | ¹³ CH ₃ CN | 14(3)-13(3) | 0.6 | OriMC-1 | OVRO | 10.4m | Bau80 |
| 250073.68 *(24) | ¹³ CH ₃ CN | 14(2)-13(2) | 0.5 | OriMC-1 | OVRO | 10.4m | Bau80 |
| 250087.76 *(25) | ¹³ CH ₃ CN | 14(1)-13(1) | 0.3 | OriMC-1 | OVRO | 10.4m | Bau80 |
| 250092.46 *(25) | ¹³ CH ₃ CN | 14(0)-13(0) | 0.4 | OriMC-1 | OVRO | 10.4m | Bau80 |
| 250246.5 *(1) | HCOOCH ₃ | 20(3,17)-19(3,16) E | 1.0 | OriMC-1 | OVRO | 10.4m | Bla85 |
| 250258.34 *(10) | HCOOCH ₃ | 20(3,17)-19(3,16) A | 0.9 | OriMC-1 | OVRO | 10.4m | Plu84 |
| 250291.18 (5) | CH ₃ OH | 13(3)-13(2) A-+ | 4.2 | OriMC-1 | OVRO | 10.4m | Bla85 |
| 250358.42 *(10) | ³⁴ SO ₂ | 9(3,7)-9(2,8) | 0.9 | OriMC-1 | OVRO | 10.4m | Sas84 |
| 250440.328*(20) | CH ₃ CH ₂ CN | 28(3,26)-27(3,25) | 1.7w | OriMC-1 | OVRO | 10.4m | Bla85 |
| 250482.94 (2) | NO | ² Π _{1/2} , <i>J,F</i> =5/2,5/2-3/2,3/2 e | 0.3 | OriMC-1 | OVRO | 10.4m | Poy80 |
| 250506.98 (5) | CH ₃ OH | 11(0)-10(1) A + | 5.8 | OriMC-1 | OVRO | 10.4m | Sas84 |
| 250635.207 (12) | CH ₃ OH | 12(3)-12(2) A-+ | 5.9 | OriMC-1 | OVRO | 10.4m | Pic81 |
| 251738.520 (12) | CH ₃ OH | 6(3)-6(2) A-+ | 2.0 | OriMC-1 | MMWO | 4.9m | Cle84 |
| 251811.882 (12) | CH ₃ OH | 5(3)-5(2) A-+ | 1.2 | OriMC-1 | MMWO | 4.9m | Cle84 |
| 251825.762*(39) | SO | 5(6)-4(5) | 3.3 | OriMC-1 | MMWO | 4.9m | Cle84 |
| 251866.579 (12) | CH ₃ OH | 4(3)-4(2) A-+ | 1.5 | OriMC-1 | MMWO | 4.9m | Cle84 |
| 251890.901 (12) | CH ₃ OH | 5(3)-5(2) A + - | 1.8 | OriMC-1 | MMWO | 4.9m | Cle84 |
| 251895.728 (12) | CH ₃ OH | 6(3)-6(2) A + - | 2.1 | OriMC-1 | MMWO | 4.9m | Cle84 |
| 251900.495 (12) | CH ₃ OH | 4(3)-4(2) A + - | 1.7 | OriMC-1 | MMWO | 4.9m | Cle84 |
| 251905.812 (12) | CH ₃ OH | 3(3)-3(2) A-+ | 1.0 | OriMC-1 | MMWO | 4.9m | Cle84 |
| 251917.042 (12) | CH ₃ OH | 3(3)-3(2) A + - | 1.1 | OriMC-1 | MMWO | 4.9m | Cle84 |
| 251923.631 (12) | CH ₃ OH | 7(3)-7(2) A + - | 1.8 | OriMC-1 | MMWO | 4.9m | Cle84 |
| U 251953. | unidentified | | 1.2 | OriMC-1 | MMWO | 4.9m | Cle84 |

TABLE 2. Recommended rest frequencies for observed interstellar molecular lines — Continued

| Frequency unc. | Formula | Quantum numbers | T_r '(K) | Source | Telescope | Astr. Ref. | Lab. Ref. | |
|----------------|-----------------|------------------------------------|---------------------|--------|-----------|------------|-----------|--------|
| | | | T_a '(K) | | | | | |
| | 252803.377 (24) | CH ₃ OH | 12(3)-12(2) A+- | 4.1 | OriMC-1 | OVRO | 10.4m | Bla85 |
| | 252896.045*(20) | CH ₃ CH ₂ CN | 28(4,24)-27(4,23) | 0.7 | OriMC-1 | OVRO | 10.4m | Bla85 |
| | 253207.011*(32) | ³⁴ SO | 6(6)-5(5) | 3.0 | OriMC-1 | OVRO | 10.4m | Bla85 |
| | 253221.39 (5) | CH ₃ OH | 13(3)-13(2) A+- | 3.1 | OriMC-1 | OVRO | 10.4m | Bla85 |
| | 253755.85 (5) | CH ₃ OH | 14(3)-14(-2) A+- | 0.73 | OriMC-1 | MMWO | 4.9m | Lor84b |
| | 254015.34 (5) | CH ₃ OH | 2(0)-1(-1) E | 0.95 | OriMC-1 | MMWO | 4.9m | Lor84 |
| | 254102.68 *(74) | SiS | 14-13 | 0.85 | IRC+10216 | MMWO | 4.9m | Sas84 |
| | 254216.241*(67) | ³⁰ SiO | 6-5 ν=0 | 0.6 | OriMC-1 | MMWO | 4.9m | Lor84b |
| | 254423.58 (5) | CH ₃ OH | 15(3)-15(2) A+- | 3.0b | OriMC-1 | OVRO | 10.4m | Bla85 |
| | 254423.58 (5) | CH ₃ OH | 11(5)-11(4) E | b | OriMC-1 | OVRO | 10.4m | Bla85 |
| | 254573.657*(10) | SO | 8(9)-8(8) | 0.39 | OriMC-1 | MMWO | 4.9m | Lor84 |
| | 254699.62 *(10) | HC ₃ N | 28-27 | 5.0 | OriMC-1 | OVRO | 10.4m | Bla85 |
| | 254959.5 (1) | CH ₃ OH | unassigned | 1.2 | OriMC-1 | OVRO | 10.4m | Bla85 |
| | 254976.344*(20) | CH ₃ CH ₂ CN | 29(2,28)-28(2,27) | 1.5 | OriMC-1 | OVRO | 10.4m | Bla85 |
| | 255050.260 (59) | HDO | 5(2,3)-4(3,2) | 2.1 | OriMC-1 | OVRO | 10.4m | Bla85 |
| | 255121.0 (1) | CH ₃ OH | unassigned | 1.7 | OriMC-1 | OVRO | 10.4m | Bla85 |
| | 255173.0 (1) | CH ₃ OH | unassigned | 1.2 | OriMC-1 | OVRO | 10.4m | Bla85 |
| | 255192.5 (1) | CH ₃ OH | unassigned | 1.8b | OriMC-1 | OVRO | 10.4m | Bla85 |
| | 255193.5 (1) | CH ₃ OH | unassigned | b | OriMC-1 | OVRO | 10.4m | Bla85 |
| | 255203.8 (1) | CH ₃ OH | unassigned | 1.3 | OriMC-1 | OVRO | 10.4m | Bla85 |
| | 255214.9 (1) | CH ₃ OH | unassigned | 1.1 | OriMC-1 | OVRO | 10.4m | Bla85 |
| | 255220.9 (1) | CH ₃ OH | unassigned | 0.9 | OriMC-1 | OVRO | 10.4m | Bla85 |
| | 255241.97 (5) | CH ₃ OH | 16(3)-16(2) A+- | 3.8 | OriMC-1 | OVRO | 10.4m | Bla85 |
| | 255265.7 (1) | CH ₃ OH | unassigned | 1.4 | OriMC-1 | OVRO | 10.4m | Bla85 |
| | 255324.34 *(11) | HC ₃ N $\nu_7=1$ | 28-27 1e | 1.0 | OriMC-1 | OVRO | 10.4m | Bla85 |
| | 255374.453*(2) | OCS | 21-20 | 6.5 | OriMC-1 | OVRO | 10.4m | Bla85 |
| | 255479.39 *(8) | HC ¹⁸ O ⁺ | 3-2 | 1.0 | OriMC-1 | OVRO | 10.4m | Bla85 |
| | 255553.328*(14) | SO ₂ | 4(3,1)-4(2,2) | 7.4 | OriMC-1 | OVRO | 10.4m | Bla85 |
| | 255595.35 *(13) | SO _{2?} | 51(7,45)-50(8,42) | 0.4v | OriMC-1 | OVRO | 10.4m | Bla85 |
| U | 255651. | unidentified | | 1.2 | OriMC-1 | OVRO | 10.4m | Bla85 |
| | 255689.08 *(11) | HC ₃ N $\nu_7=1$ | 28-27 1f | 1.1 | OriMC-1 | OVRO | 10.4m | Bla85 |
| | 255776.1 *(1) | HCOOCH ₃ | 21(4,18)-20(4,17) E | 1.0 | OriMC-1 | OVRO | 10.4m | Bla85 |
| | 255789.41 *(10) | HCOOCH ₃ | 21(4,18)-20(4,17) A | 1.0 | OriMC-1 | OVRO | 10.4m | Bla85 |
| | 255906.469*(20) | CH ₃ CH ₂ CN | 28(3,25)-27(3,24) | 0.9 | OriMC-1 | OVRO | 10.4m | Bla85 |
| | 255958.073*(15) | SO ₂ | 3(3,1)-3(2,2) | >3. | OriMC-1 | BTL | 7m | Tha81 |
| | 256027.12 (8) | HCS ⁺ | 6-5 | ~1. | OriMC-1 | BTL | 7m | Tha81 |
| | 256228.80 (5) | CH ₃ OH | 17(3)-17(2) A+- | 1.7 | OriMC-1 | OVRO | 10.4m | Bla85 |
| | 256246.969*(14) | SO ₂ | 5(3,3)-5(2,4) | 1.2 | OriMC-1 | MMWO | 4.9m | Lor84b |
| | 256292.639*(13) | CH ₃ CCH | 15(3)-14(3) | 0.3 | OriMC-1 | MMWO | 4.9m | Lor84b |
| | 256317.079*(8) | CH ₃ CCH | 15(2)-14(2) | 0.3 | OriMC-1 | MMWO | 4.9m | Lor84b |
| | 256331.746*(6) | CH ₃ CCH | 15(1)-14(1) | 0.4 | OriMC-1 | MMWO | 4.9m | Lor84b |
| | 256336.637*(6) | CH ₃ CCH | 15(0)-14(0) | 0.4 | OriMC-1 | MMWO | 4.9m | Lor84b |
| | 256395.926*(22) | CH ₃ CH ₂ CN | 29(1,28)-28(1,27) | 1.0 | OriMC-1 | OVRO | 10.4m | Bla85 |
| | 256409.07 *(29) | HC ₂ CHCN | 27(8,20)-26(8,19) | 0.7b | OriMC-1 | OVRO | 10.4m | Bla85 |
| | 256409.07 *(29) | HC ₂ CHCN | 27(8,19)-26(8,18) | b | OriMC-1 | OVRO | 10.4m | Bla85 |
| | 256425.85 *(16) | HC ₂ CHCN | 27(6,22)-26(6,21) | 0.7b | OriMC-1 | OVRO | 10.4m | Bla85 |
| | 256425.95 *(16) | HC ₂ CHCN | 27(6,21)-26(6,20) | b | OriMC-1 | OVRO | 10.4m | Bla85 |
| | 256447.75 *(28) | HC ₂ CHCN | 27(9,19)-26(9,18) | 0.4b | OriMC-1 | OVRO | 10.4m | Bla85 |
| | 256447.75 *(28) | HC ₂ CHCN | 27(9,18)-26(9,17) | b | OriMC-1 | OVRO | 10.4m | Bla85 |
| | 256522.86 *(13) | HC ₂ CHCN | 27(5,23)-26(5,22) | 0.8 | OriMC-1 | OVRO | 10.4m | Bla85 |
| | 256527.36 *(13) | HC ₂ CHCN | 27(5,22)-26(5,21) | 0.5 | OriMC-1 | OVRO | 10.4m | Bla85 |
| | 256585.34 *(33) | HDCO | 4(0,4)-3(0,3) | 0.54 | OriMC-1 | MMWO | 4.9m | Lor84b |
| | 256711.75 *(11) | HC ₂ CHCN | 27(4,24)-26(4,23) | 0.3 | OriMC-1 | OVRO | 10.4m | Bla85 |
| | 256837.22 *(11) | HC ₂ CHCN | 27(4,23)-26(4,22) | 0.3 | OriMC-1 | OVRO | 10.4m | Bla85 |
| | 256877.802*(32) | ³⁴ SO | 7(6)-6(5) | 0.79 | OriMC-1 | MMWO | 4.9m | Lor84 |
| | 256966.885*(25) | CH ₃ CH ₂ CN | 30(0,30)-29(1,29) | 0.2 | OriMC-1 | OVRO | 10.4m | Bla85 |
| | 257033.46 *(2) | CH ₃ CN | 14(10)-13(10) | 0.3 | OriMC-1 | OVRO | 10.4m | Bla85 |
| | 257099.982*(14) | SO ₂ | 7(3,5)-7(2,6) | 7.9 | OriMC-1 | OVRO | 10.4m | Bla85 |
| | 257127.05 *(2) | CH ₃ CN | 14(9)-13(9) | 0.6 | OriMC-1 | OVRO | 10.4m | Bau80 |
| | 257210.08 *(2) | CH ₃ CN | 14(8)-13(8) | 0.6 | OriMC-1 | OVRO | 10.4m | Bau80 |
| | 257226.5 *(1) | HCOOCH ₃ | 20(5,15)-19(5,14) E | 0.8 | OriMC-1 | OVRO | 10.4m | Bla85 |
| | 257239.855*(25) | CH ₃ CH ₂ CN | 30(1,30)-29(1,29) | 0.4 | OriMC-1 | OVRO | 10.4m | Bla85 |
| | 257252.59 *(10) | HCOOCH ₃ | 20(5,15)-19(5,14) A | 0.9 | OriMC-1 | OVRO | 10.4m | Bla85 |
| | 257255.002*(67) | ²⁹ SiO | 6-5 | 1.6 | OriMC-1 | OVRO | 10.4m | Plu84 |
| | 257284.04 *(2) | CH ₃ CN | 14(7)-13(7) | 1.0 | OriMC-1 | OVRO | 10.4m | Bau80 |

TABLE 2. Recommended rest frequencies for observed interstellar molecular lines — Continued

| Frequency unc. | Formula | Quantum numbers | $T_r^*(\text{K})$ | Source | Telescope | Astr. Ref. | Lab. Ref. | |
|----------------|-----------------|-----------------------------------|-----------------------|--------|-----------|------------|-----------|--------|
| | | | $T_a^*(\text{K})$ | | | | | |
| | 257310.641*(25) | $\text{CH}_3\text{CH}_2\text{CN}$ | 30(0,30)-29(0,29) | 0.8 | OriMC-1 | OVRO | 10.4m | Bla85 |
| | 257349.18 *(2) | CH_3CN | 14(6)-13(6) | 1.8 | OriMC-1 | OVRO | 10.4m | Bla85 |
| | 257380.15 *(27) | $\text{CH}_3^{13}\text{CN}$ | 14(2)-13(2) | 0.3 | OriMC-1 | OVRO | 10.4m | Bau80 |
| | 257402.19 *(5) | CH_3OH | 18(3)-18(2) A+- | 2.8b | OriMC-1 | OVRO | 10.4m | Bla85 |
| | 257403.58 *(10) | CH_3CN | 14(5)-13(5) | 0.5 | OriMC-1 | MMWO | 4.9m | Lor84 |
| | 257420.24 *(14) | $\text{SO}_2 \nu_2=1$ | 24(2,22)-24(1,23) | 0.4 | OriMC-1 | OVRO | 10.4m | Bla85 |
| | 257448.122*(80) | CH_3CN | 14(4)-13(4) | 0.5 | OriMC-1 | MMWO | 4.9m | Lor84 |
| | 257482.784*(50) | CH_3CN | 14(3)-13(3) | 1.1 | OriMC-1 | MMWO | 4.9m | Lor84 |
| | 257507.553*(50) | CH_3CN | 14(2)-13(2) | 0.85 | OriMC-1 | MMWO | 4.9m | Lor84 |
| | 257522.418*(20) | CH_3CN | 14(1)-13(1) | 1.15 | OriMC-1 | MMWO | 4.9m | Lor84 |
| | 257527.374*(20) | CH_3CN | 14(0)-13(0) | 1.2 | OriMC-1 | MMWO | 4.9m | Lor84 |
| | 257583.611*(25) | $\text{CH}_3\text{CH}_2\text{CN}$ | 30(1,30)-29(0,29) | 0.3 | OriMC-1 | OVRO | 10.4m | Bla85 |
| | 257646.01 *(19) | HC_2CHCN | 28(0,28)-27(0,27) | 0.5 | OriMC-1 | OVRO | 10.4m | Bla85 |
| | 257690.3 *(1) | HCOOCH_3 | 22(3,20)-21(3,19) E | 1.4 | OriMC-1 | OVRO | 10.4m | Bla85 |
| | 257699.44 *(10) | HCOOCH_3 | 22(3,20)-21(3,19) A | 0.9 | OriMC-1 | OVRO | 10.4m | Plu84 |
| | 257747.05 *(3) | HDCO | 4(2,3)-3(2,2) | 0.6 | OriMC-1 | OVRO | 10.4m | Bla85 |
| U | 257912. | unidentified | | 1.0 | OriMC-1 | OVRO | 10.4m | Bla85 |
| | 257975.01 *(1) | HCOOH | 12(1,12)-11(1,11) | 0.3 | OriMC-1 | OVRO | 10.4m | Bla85 |
| | 258054.14 *(15) | $\text{CH}_3\text{CN} \nu_8=1$ | 14(1)-13(1) $\ell=1$ | 1.1 | OriMC-1 | OVRO | 10.4m | Bau80 |
| | 258070.96 *(6) | HDCO | 4(3,2)-3(3,1) | 0.3 | OriMC-1 | OVRO | 10.4m | Dan78 |
| | 258081.0 *(1) | HCOOCH_3 | 22(2,20)-21(2,19) E | 1.2 | OriMC-1 | OVRO | 10.4m | Bla85 |
| | 258089.50 *(10) | HCOOCH_3 | 22(2,20)-21(2,19) A | 1.1 | OriMC-1 | OVRO | 10.4m | Plu84 |
| | 258121.06 *(10) | HCOOCH_3 | 21(14,8)-20(14,7) A | 1.0b | OriMC-1 | OVRO | 10.4m | Plu84 |
| | 258121.06 *(10) | HCOOCH_3 | 21(14,7)-20(14,6) A | b | OriMC-1 | OVRO | 10.4m | Plu84 |
| | 258123.0 *(1) | HCOOCH_3 | 21(14,7)-20(14,6) E | b | OriMC-1 | OVRO | 10.4m | Bla85 |
| | 258157.02 *(47) | HC^{15}N | 3-2 | 5.2 | OriMC-1 | OVRO | 10.4m | Bla85 |
| | 258186.99 *(13) | $\text{CH}_3\text{CN} \nu_8=1$ | 14(6)-13(5) $\ell=1$ | 0.3 | OriMC-1 | OVRO | 10.4m | Bla85 |
| | 258255.828*(32) | SO | 6(6)-5(5) | 4.0 | OriMC-1 | MMWO | 4.9m | Cle84 |
| | 258295.60 *(18) | $\text{CH}_3\text{CN} \nu_8=1$ | 14(3)-13(3) $\ell=1$ | 1.1 | OriMC-1 | OVRO | 10.4m | Bau80 |
| | 258320.39 *(25) | $\text{CH}_3\text{CN} \nu_8=1$ | 14(2)-13(2) $\ell=1$ | 0.7 | OriMC-1 | OVRO | 10.4m | Bau80 |
| | 258360.05 *(7) | HC_2CHCN | 27(1,26)-26(1,25) | 0.6 | OriMC-1 | OVRO | 10.4m | Bla85 |
| | 258388.81 *(12) | SO_2 | 32(4,28)-32(3,29) | 1.5 | OriMC-1 | OVRO | 10.4m | Bla85 |
| | 258476.6 *(1) | HCOOCH_3 | 21(12,9)-20(12,8) E | 0.9 | OriMC-1 | OVRO | 10.4m | Bla85 |
| | 258482.92 *(10) | HCOOCH_3 | 21(12,10)-20(12,9) A | 1.0 | OriMC-1 | OVRO | 10.4m | Plu84 |
| | 258490.8 *(1) | HCOOCH_3 | 23(2,22)-22(2,21) E | 1.0 | OriMC-1 | OVRO | 10.4m | Bla85 |
| | 258496.27 *(10) | HCOOCH_3 | 23(2,23)-22(2,21) A | 1.1 | OriMC-1 | OVRO | 10.4m | PLU84 |
| | 258499.0 *(1) | HCOOCH_3 | 21(12,10)-20(12,9) E | 0.8 | OriMC-1 | OVRO | 10.4m | BLA85 |
| | 258502.7 *(1) | HCOOCH_3 | 23(1,22)-22(1,21) E | 1.0 | OriMC-1 | OVRO | 10.4m | BLA85 |
| | 258508.14 *(10) | HCOOCH_3 | 23(1,22)-22(1,21) A | 1.0 | OriMC-1 | OVRO | 10.4m | Plu84 |
| | 258549.04 *(20) | CH_3OCH_3 | 14(1,14)-13(0,13) EE | 3.2b | OriMC-1 | OVRO | 10.4m | Bla85 |
| | 258549.30 *(19) | CH_3OCH_3 | 14(1,14)-13(0,13) AA | b | OriMC-1 | OVRO | 10.4m | Bla85 |
| | 258552.40 *(15) | $\text{CH}_3\text{CN} \nu_8=1$ | 14(1)-13(1) $\ell=1$ | 0.6b | OriMC-1 | OVRO | 10.4m | Bau80 |
| | 258667.002*(61) | SO_2 | 20(7,13)-21(6,16) | 0.7 | OriMC-1 | OVRO | 10.4m | Bla85 |
| | 258746.4 *(1) | HCOOCH_3 | 21(11,10)-20(11,9) E | 0.5 | OriMC-1 | OVRO | 10.4m | Bla85 |
| | 258756.63 *(10) | HCOOCH_3 | 21(11,11)-20(11,10) A | b | OriMC-1 | OVRO | 10.4m | Plu84 |
| | 258756.63 *(10) | HCOOCH_3 | 21(11,10)-20(11,9) A | 0.7b | OriMC-1 | OVRO | 10.4m | Plu84 |
| | 258769.7 *(1) | HCOOCH_3 | 21(11,11)-20(11,10) E | 0.4 | OriMC-1 | OVRO | 10.4m | Bla85 |
| | 258780.38 *(5) | CH_3OH | 19(3)-19(2) A+- | 1.8 | OriMC-1 | OVRO | 10.4m | Bla85 |
| | 258942.207*(18) | SO_2 | 9(3,7)-9(2,8) | 0.9 | OriMC-1 | MMWO | 4.9m | Lor84b |
| | 259011.79 *(55) | H^{13}CN | 3-2 | 2.3 | OriMC-1 | MMWO | 4.9m | Lor84b |
| | 259035.13 *(33) | HDCO | 4(2,2)-3(2,1) | 0.18 | OriMC-1 | MMWO | 4.9m | Lor84b |
| | 259114.2 *(1) | HCOOCH_3 | 21(10,11)-20(10,10) E | 0.6 | OriMC-1 | OVRO | 10.4m | Bla85 |
| | 259128.13 *(10) | HCOOCH_3 | 21(10,12)-20(10,11) A | b | OriMC-1 | OVRO | 10.4m | Plu84 |
| | 259128.17 *(10) | HCOOCH_3 | 21(10,11)-20(10,10) A | 1.1b | OriMC-1 | OVRO | 10.4m | Plu84 |
| | 259137.7 *(1) | HCOOCH_3 | 21(10,12)-20(10,11) E | 0.3 | OriMC-1 | OVRO | 10.4m | Bla85 |
| | 259232.721*(21) | $\text{CH}_3\text{CH}_2\text{CN}$ | 29(3,27)-28(3,26) | 0.7 | OriMC-1 | OVRO | 10.4m | Bla85 |
| | 259273.7 *(1) | CH_3OH | unassigned | 1.0 | OriMC-1 | OVRO | 10.4m | Bla85 |
| U | 259285. | unidentified | | 0.8 | OriMC-1 | OVRO | 10.4m | Bla85 |
| | 259311. | unidentified | | 0.6 | OriMC-1 | OVRO | 10.4m | Bla85 |
| | 259341.9 *(1) | HCOOCH_3 | 24(1,24)-23(1,23) E | 2.0b | OriMC-1 | OVRO | 10.4m | Bla85 |
| | 259342.0 *(1) | HCOOCH_3 | 24(0,24)-23(0,23) E | b | OriMC-1 | OVRO | 10.4m | Bla85 |
| | 259342.84 *(10) | HCOOCH_3 | 24(1,24)-23(1,23) A | b | OriMC-1 | OVRO | 10.4m | Plu84 |
| | 259342.95 *(10) | HCOOCH_3 | 24(0,24)-23(0,23) A | b | OriMC-1 | OVRO | 10.4m | Plu84 |
| | 259484.90 *(28) | CH_3OCH_3 | 6(3,4)-5(2,3) EA | 0.7b | OriMC-1 | OVRO | 10.4m | Bla85 |
| | 259486.79 *(22) | CH_3OCH_3 | 6(3,4)-5(2,3) AE | b | OriMC-1 | OVRO | 10.4m | Bla85 |

TABLE 2. Recommended rest frequencies for observed interstellar molecular lines — Continued

| Frequency unc. | Formula | Quantum numbers | $T_r^*(\text{K})$ | $T_a^*(\text{K})$ | Source | Telescope | Astr. Ref. | Lab. Ref. |
|----------------|-----------------------------------|-----------------------------------|-----------------------|-------------------|---------|-----------|------------|-----------|
| | CH_3OCH_3 | 6(3,4)-5(2,3) EE | 1.3 | | OriMC-1 | OVRO | 10.4m | Bla85 |
| | CH_3OCH_3 | 6(3,4)-5(2,3) AA | 0.6 | | OriMC-1 | OVRO | 10.4m | Bla85 |
| | HCOOCH_3 | 20(4,16)-19(4,15) E | 0.8 | | OriMC-1 | OVRO | 10.4m | Bla85 |
| | HCOOCH_3 | 20(4,16)-19(4,15) A | 1.0 | | OriMC-1 | OVRO | 10.4m | Bla85 |
| | SO_2 | 30(4,26)-30(3,27) | 1.5 | | OriMC-1 | OVRO | 10.4m | Bla85 |
| | $^{34}\text{SO}_2$ | 13(3,11)-13(2,12) | 1.0 | | OriMC-1 | OVRO | 10.4m | Bla85 |
| | HCOOCH_3 | 21(9,12)-20(9,11) E | 0.6 | | OriMC-1 | OVRO | 10.4m | Bla85 |
| | HCOOCH_3 | 21(9,13)-20(9,12) A | 0.8b | | OriMC-1 | OVRO | 10.4m | Bla85 |
| | HCOOCH_3 | 21(9,12)-20(9,11) A | b | | OriMC-1 | OVRO | 10.4m | Bla85 |
| | HCOOCH_3 | 21(9,13)-20(9,12) E | 0.5 | | OriMC-1 | OVRO | 10.4m | Bla85 |
| U | 259690. | unidentified | 0.5 | | OriMC-1 | OVRO | 10.4m | Bla85 |
| U | 259733. | unidentified | 0.7 | | OriMC-1 | OVRO | 10.4m | Bla85 |
| | $\text{CH}_3\text{CH}_2\text{CN}$ | 29(10,19)-28(10,18) | 1.0b | | OriMC-1 | OVRO | 10.4m | Bla85 |
| | $\text{CH}_3\text{CH}_2\text{CN}$ | 29(10,20)-28(10,19) | b | | OriMC-1 | OVRO | 10.4m | Bla85 |
| | $\text{CH}_3\text{CH}_2\text{CN}$ | 29(11,19)-28(11,18) | 0.9b | | OriMC-1 | OVRO | 10.4m | Bla85 |
| | $\text{CH}_3\text{CH}_2\text{CN}$ | 29(11,18)-28(11,17) | b | | OriMC-1 | OVRO | 10.4m | Bla85 |
| | $\text{CH}_3\text{CH}_2\text{CN}$ | 29(9,21)-28(9,20) | 0.9b | | OriMC-1 | OVRO | 10.4m | Bla85 |
| | $\text{CH}_3\text{CH}_2\text{CN}$ | 29(9,20)-28(9,19) | b | | OriMC-1 | OVRO | 10.4m | Bla85 |
| | $\text{CH}_3\text{CH}_2\text{CN}$ | 29(12,18)-28(12,17) | 0.6b | | OriMC-1 | OVRO | 10.4m | Bla85 |
| | $\text{CH}_3\text{CH}_2\text{CN}$ | 29(12,17)-28(12,16) | b | | OriMC-1 | OVRO | 10.4m | Bla85 |
| | $\text{CH}_3\text{CH}_2\text{CN}$ | 29(13,17)-28(13,16) | 0.5b | | OriMC-1 | OVRO | 10.4m | Bla85 |
| | $\text{CH}_3\text{CH}_2\text{CN}$ | 29(13,16)-28(13,15) | b | | OriMC-1 | OVRO | 10.4m | Bla85 |
| | $\text{CH}_3\text{CH}_2\text{CN}$ | 29(8,22)-28(8,21) | 1.0b | | OriMC-1 | OVRO | 10.4m | Bla85 |
| | $\text{CH}_3\text{CH}_2\text{CN}$ | 29(8,21)-28(8,20) | b | | OriMC-1 | OVRO | 10.4m | Bla85 |
| | $\text{CH}_3\text{CH}_2\text{CN}$ | 29(14,16)-28(14,15) | 0.4b | | OriMC-1 | OVRO | 10.4m | Bla85 |
| | $\text{CH}_3\text{CH}_2\text{CN}$ | 29(14,15)-28(14,14) | b | | OriMC-1 | OVRO | 10.4m | Bla85 |
| U | 259986. | unidentified | 0.8 | | OriMC-1 | OVRO | 10.4m | Bla85 |
| | $\text{CH}_3\text{CH}_2\text{CN}$ | 29(15,15)-28(15,14) | 0.5b | | OriMC-1 | OVRO | 10.4m | Bla85 |
| | $\text{CH}_3\text{CH}_2\text{CN}$ | 29(15,14)-28(15,13) | b | | OriMC-1 | OVRO | 10.4m | Bla85 |
| | $\text{CH}_3\text{CH}_2\text{CN}$ | 29(7,23)-28(7,22) | 0.8b | | OriMC-1 | OVRO | 10.4m | Bla85 |
| | $\text{CH}_3\text{CH}_2\text{CN}$ | 29(7,23)-28(7,22) | b | | OriMC-1 | OVRO | 10.4m | Bla85 |
| | 260060.33 (10) | HCO | 3(0,3)-2(0,2) $F=4-3$ | 0.09 | OriMC-2 | MMWO | 4.9m | Sny85a |
| | 260081.055*(33) | $\text{CH}_3\text{CH}_2\text{CN}$ | 29(16,14)-28(16,13) | 0.3b | OriMC-1 | OVRO | 10.4m | Bla85 |
| | 260081.055*(33) | $\text{CH}_3\text{CH}_2\text{CN}$ | 29(16,13)-28(16,12) | b | OriMC-1 | OVRO | 10.4m | Bla85 |
| | 260156.377*(37) | $\text{CH}_3\text{CH}_2\text{CN}$ | 29(17,13)-28(17,12) | 0.4b | OriMC-1 | OVRO | 10.4m | Bla85 |
| | 260156.377*(37) | $\text{CH}_3\text{CH}_2\text{CN}$ | 29(17,12)-28(17,11) | b | OriMC-1 | OVRO | 10.4m | Bla85 |
| | 260191.99 *(36) | CH_3CO | 13(1,13)-12(1,12) | 0.6 | OriMC-1 | OVRO | 10.4m | Bla85 |
| | 260221.648*(21) | $\text{CH}_3\text{CH}_2\text{CN}$ | 29(6,24)-28(6,23) | 0.9b | OriMC-1 | OVRO | 10.4m | Bla85 |
| | 260229.152*(21) | $\text{CH}_3\text{CH}_2\text{CN}$ | 29(6,23)-28(6,22) | b | OriMC-1 | OVRO | 10.4m | Bla85 |
| | 260244.4 *(1) | HCOOCH_3 | 21(3,18)-20(3,17) E | 0.8 | OriMC-1 | OVRO | 10.4m | Bla85 |
| | 260255.06 (5) | HCOOCH_3 | 21(3,18)-20(3,17) A | 2.1b | OriMC-1 | OVRO | 10.4m | Bla85 |
| | 260255.48 *(20) | H^{13}CO^+ | 3-2 | 0.95 | OriMC-1 | MMWO | 4.9m | Woo84a |
| | 260327.00 *(22) | $^{34}\text{SO}_2$ | 24(2,22)-24(1,23) | 1.0 | OriMC-1 | OVRO | 10.4m | Bla85 |
| | 260381.56 (5) | CH_3OH | 20(3)-20(2) A+- | 1.8b | OriMC-1 | OVRO | 10.4m | Sas84 |
| | 260384.2 *(1) | HCOOCH_3 | 21(8,13)-20(8,12) E | 1.6b | OriMC-1 | OVRO | 10.4m | Bla85 |
| | 260392.73 *(10) | HCOOCH_3 | 21(8,14)-20(8,13) A | 1.0 | OriMC-1 | OVRO | 10.4m | Bla85 |
| | 260404.2 *(1) | HCOOCH_3 | 21(8,14)-20(8,13) E | 1.8 | OriMC-1 | OVRO | 10.4m | Bla85 |
| | 260415.31 *(10) | HCOOCH_3 | 21(8,13)-20(8,12) A | 0.7 | OriMC-1 | OVRO | 10.4m | Bla84 |
| U | 260440. | unidentified | 1.2 | | OriMC-1 | OVRO | 10.4m | Bla85 |
| | 260518.027*(67) | SiO | 6-5 $\nu=0$ | 2.9 | OriMC-1 | MMWO | 4.9m | Lor84b |
| | 260664.770*(21) | $\text{CH}_3\text{CH}_2\text{CN}$ | 29(4,26)-28(4,25) | 0.9b | OriMC-1 | OVRO | 10.4m | Bla85 |
| | 260667.111*(30) | $\text{CH}_3\text{CH}_2\text{CN}$ | 11(4,7)-10(3,6) | b | OriMC-1 | OVRO | 10.4m | Bla85 |
| | 260679.039*(21) | $\text{CH}_3\text{CH}_2\text{CN}$ | 29(5,24)-28(5,23) | 0.8 | OriMC-1 | OVRO | 10.4m | Bla85 |
| U | 260726. | unidentified | 1.2 | | OriMC-1 | OVRO | 10.4m | Bla85 |
| | 260758.61 *(14) | CH_3OCH_3 | 6(3,3)-5(2,4) EE | 1.9 | OriMC-1 | OVRO | 10.4m | Bla85 |
| | 260761.70 *(10) | CH_3OCH_3 | 6(3,3)-5(2,4) AA | 1.5 | OriMC-1 | OVRO | 10.4m | Bla85 |
| | 261061.36 (5) | CH_3OH | 21(-4)-20(-5) E | 0.5 | OriMC-1 | OVRO | 10.4m | Bla85 |
| | 261148.8 *(1) | HCOOCH_3 | 21(5,17)-20(5,16) E | 1.4 | OriMC-1 | OVRO | 10.4m | Sas84 |
| | 261149.3 | HCOOCH_3 | 21(5,17)-20(5,16) | 0.22 | OriMC-1 | MMWO | 4.9m | Lor84b |
| | 261165.41 *(10) | HCOOCH_3 | 21(5,17)-20(5,16) A | 1.2 | OriMC-1 | OVRO | 10.4m | Bla85 |
| | 261247.64 *(56) | CH_3OCH_3 | 15(5,10)-15(4,11) EE | 1.5 | OriMC-1 | OVRO | 10.4m | Plu84 |
| | 261250.17 *(46) | CH_3OCH_3 | 15(5,10)-15(4,11) AA | 0.8 | OriMC-1 | OVRO | 10.4m | Bla85 |
| | 261263.39 *(10) | HN^{13}C | 3-2 | 0.2 | OriMC-1 | MMWO | 4.9m | Lor84b |
| | 261433.75 *(10) | HCOOCH_3 | 21(7,15)-20(7,14) A | 0.9 | OriMC-1 | OVRO | 10.4m | Bla85 |
| | 261436.8 *(1) | HCOOCH_3 | 21(7,15)-20(7,14) E | 1.3 | OriMC-1 | OVRO | 10.4m | Plu84 |

TABLE 2. Recommended rest frequencies for observed interstellar molecular lines — Continued

| Frequency unc. | Formula | Quantum numbers | $T_r^*(\text{K})$ | Source | Telescope | Astr. Ref. | Lab. Ref. |
|----------------|-----------------|---|-------------------|-----------|-----------|------------|-----------|
| | | | $T_a^*(\text{K})$ | | | | |
| U | 261564. | unidentified | 1.1 | OriMC-1 | OVRO | 10.4m | Bla85 |
| | 261704.44 (5) | CH_3OH 12(6)-11(5) E | 0.9 | OriMC-1 | OVRO | 10.4m | Bla85 |
| | 261715.4 *(1) | HCOOCH_3 21(7,14)-20(7,13) E | 1.1 | OriMC-1 | OVRO | 10.4m | Bla85 |
| | 261746.56 *(10) | HCOOCH_3 21(7,14)-20(7,13) A | 1.1 | OriMC-1 | OVRO | 10.4m | Bla85 |
| | 261805.71 (5) | CH_3OH 2(1)-1(0) E | 1.0 | OriMC-1 | MMWO | 4.9m | Lor84b |
| | 261843.715*(36) | SO 7(6)-6(5) | 4.2 | OriMC-1 | MMWO | 4.9m | Lor84b |
| | 261897.33 *(6) | CH_3OCH_3 14(5,9)-14(4,10) EE | 0.23 | OriMC-1 | MMWO | 4.9m | Lor84b |
| | 261955.99 *(14) | CH_3OCH_3 15(5,11)-15(4,12) EE | 0.28 | OriMC-1 | MMWO | 4.9m | Lor84b |
| | 261959.30 *(45) | CH_3OCH_3 15(5,11)-15(4,12) AA | 1.1 | OriMC-1 | OVRO | 10.4m | Bla85 |
| | 262004.26 (5) | HC_2 3-2 $J=7/2-5/2 F=4-3$ | 3.5 | OriMC-1 | MMWO | 4.9m | Ziu82 |
| | 262006.48 (5) | HC_2 3-2 $J=7/2-5/2 F=3-2$ | 3.0 | OriMC-1 | MMWO | 4.9m | Ziu82 |
| | 262064.99 (5) | HC_2 3-2 $J=5/2-3/2 F=3-2$ | 2.8 | OriMC-1 | MMWO | 4.9m | Ziu82 |
| | 262067.46 (5) | HC_2 3-2 $J=5/2-3/2 F=2-1$ | 2.4 | OriMC-1 | MMWO | 4.9m | Ziu82 |
| | 262078.89 *(30) | HC_2 3-2 $J=5/2-3/2 F=2-2$ | 0.8 | OriMC-1 | OVRO | 10.4m | Bla85 |
| | 262103.48 *(1) | HCOOH 12(0,12)-11(0,11) | 0.4 | OriMC-1 | OVRO | 10.4m | Bla85 |
| | 262183.742*(22) | $\text{CH}_3\text{CH}_2\text{CN}$ 29(4,25)-28(4,24) | 0.7 | OriMC-1 | OVRO | 10.4m | Bla85 |
| | 262208.61 *(30) | HC_2 3-2 $J=5/2-3/2 F=3-3$ | ~0.8 | OriMC-1 | OVRO | 10.4m | Bla85 |
| | 262224.2 (1) | CH_3OH 21(3)-21(2) A+- | 1.3 | OriMC-1 | OVRO | 10.4m | Bla85 |
| | 262256.904*(25) | SO ₂ 11(3,9)-11(2,10) | 1.7 | OriMC-1 | MMWO | 4.9m | Eri84a |
| | 262307.30 *(81) | CH_3OCH_3 14(5,10)-14(4,11) EA | 0.8b | OriMC-1 | OVRO | 10.4m | Bla85 |
| | 262310.27 *(63) | CH_3OCH_3 14(5,10)-14(4,11) AE | b | OriMC-1 | OVRO | 10.4m | Bla85 |
| | 262312.45 *(56) | CH_3OCH_3 14(5,10)-14(4,11) EE | 1.0 | OriMC-1 | OVRO | 10.4m | Bla85 |
| | 262316.39 *(39) | CH_3OCH_3 14(5,10)-14(4,11) AA | 0.9 | OriMC-1 | OVRO | 10.4m | Bla85 |
| | 262324.7 *(1) | HCOOCH_3 21(6,16)-20(6,15) E | 1.2 | OriMC-1 | OVRO | 10.4m | Bla85 |
| | 262340.53 *(10) | HCOOCH_3 21(6,16)-20(6,15) A | 1.0 | OriMC-1 | OVRO | 10.4m | Bla85 |
| | 262393.39 *(36) | CH_3OCH_3 13(5,8)-13(4,9) EE | 1.3b | OriMC-1 | OVRO | 10.4m | Bla85 |
| | 262394.92 *(33) | CH_3OCH_3 13(5,8)-13(4,9) AA | b | OriMC-1 | OVRO | 10.4m | Bla85 |
| | 262548.36 *(51) | CH_2CO 13(0,13)-12(0,12) | 0.5 | OriMC-1 | OVRO | 10.4m | Bla85 |
| | 262624.70 *(51) | CH_3OCH_3 13(5,9)-13(4,10) EE | 1.6 | OriMC-1 | OVRO | 10.4m | Bla85 |
| | 262629.54 *(33) | CH_3OCH_3 13(5,9)-13(4,10) AA | 0.6 | OriMC-1 | OVRO | 10.4m | Bla85 |
| | 262768.94 *(29) | CH_3OCH_3 12(5,7)-12(4,6) EE | 1.3b | OriMC-1 | OVRO | 10.4m | Bla85 |
| | 262769.484*(20) | HNCO 12(1,12)-11(1,11) | 1.3b | OriMC-1 | OVRO | 10.4m | Bla85 |
| | 262769.72 *(28) | CH_3OCH_3 12(5,7)-12(4,6) AA | b | OriMC-1 | OVRO | 10.4m | Bla85 |
| | 262774.25 *(18) | CH_3OCH_3 8(2,6)-7(1,7) EE | 0.7 | OriMC-1 | OVRO | 10.4m | Bla85 |
| | 262889.46 *(47) | CH_3OCH_3 12(5,8)-11(4,9) EE | 0.5 | OriMC-1 | OVRO | 10.4m | Bla85 |
| | 262895.29 *(28) | CH_3OCH_3 12(5,8)-11(4,9) AA | 0.5 | OriMC-1 | OVRO | 10.4m | Bla85 |
| | 263050.03 *(24) | CH_3OCH_3 11(5,6)-11(4,7) EE | 1.1b | OriMC-1 | OVRO | 10.4m | Bla85 |
| | 263050.33 *(23) | CH_3OCH_3 11(5,6)-11(4,7) AA | b | OriMC-1 | OVRO | 10.4m | Bla85 |
| U | 263065. | unidentified | 0.9 | OriMC-1 | OVRO | 10.4m | Bla85 |
| | 263107.25 *(39) | CH_3OCH_3 11(5,7)-11(4,8) EE | 0.3 | OriMC-1 | OVRO | 10.4m | Bla85 |
| | 263113.70 *(23) | CH_3OCH_3 11(5,7)-11(4,8) AA | 1.2 | OriMC-1 | OVRO | 10.4m | Bla85 |
| | 263748.630*(13) | HNCO 12(0,12)-11(0,11) | 0.3 | OriMC-1 | MMWO | 4.9m | Arm84 |
| | 263792.47 *(12) | HC_3N 29-28 | 0.6 | OriMC-1 | MMWO | 4.9m | Arm84 |
| U | 265698. | unidentified | 0.16 | OriMC-1 | MMWO | 4.9m | Lor84a |
| | 265759.48 *(4) | C_2H_2 4(4,1)-3(3,0) | 0.21 | OriMC-1 | MMWO | 4.9m | Lor84a |
| | 265852.68 (5) | HCN 3-2 $\nu_2=1, \ell=1c$ | 1.5 | OriMC-1 | NRAO | 12m | Ziu85a |
| | 265886.432*(10) | HCN 3-2 | 20 | OriMC-1 | Hale | 5m | Hug79 |
| | 266838.13 (5) | CH_3OH 5(2)-4(1) E | 1.7 | OriMC-1 | MMWO | 4.9m | Joh84 |
| | 267199.37 (5) | HCN 3-2 $\nu_2=1, \ell=1d$ | 1.5 | OriMC-1 | NRAO | 12m | Ziu85a |
| | 267403.44 (5) | CH_3OH 9(0)-8(1) E | 1.8 | OriMC-1 | UKIRT | 3.8m | Den84 |
| | 267530.218 (20) | OCS 22-21 | r | OriMC-1 | MMWO | 4.9m | Lor84b |
| | 267537.440*(33) | SO ₂ 13(3,11)-13(2,12) | r | OriMC-1 | MMWO | 4.9m | Lor84b |
| | 267557.625*(17) | HCO^+ 3-2 | 12 | OriMC-1 | Hale | 5m | Hug79 |
| | 271981.067*(50) | HNC 3-2 | 10 | OriMC-1 | Hale | 5m | Hug79 |
| | 272242.40 *(91) | SiS 15-14 | 0.48 | IRC+10216 | MMWO | 4.9m | Sah84 |
| | 272884.95 *(15) | HC_3N 30-29 | 0.8 | OriMC-1 | MMWO | 4.9m | Lor81 |
| | 275240.166*(43) | SO ₂ 15(3,13)-15(2,14) | 1.7 | OriMC-1 | MMWO | 4.9m | Lor84c |
| | 275724.69 *(14) | CH_3CN 15(6)-14(6) | 0.47 | OriMC-1 | MMWO | 4.9m | Lor84 |
| | 275782.96 *(10) | CH_3CN 15(5)-14(5) | 0.39 | OriMC-1 | MMWO | 4.9m | Lor84 |
| | 275830.668*(80) | CH_3CN 15(4)-14(4) | 0.42 | OriMC-1 | MMWO | 4.9m | Lor84 |
| | 275867.792*(50) | CH_3CN 15(3)-14(3) | 0.96 | OriMC-1 | MMWO | 4.9m | Lor84 |
| | 275894.321*(50) | CH_3CN 15(2)-14(2) | 0.83 | OriMC-1 | MMWO | 4.9m | Lor84 |
| | 275910.243*(50) | CH_3CN 15(1)-14(1) | 1.17 | OriMC-1 | MMWO | 4.9m | Lor84 |
| | 275915.550*(50) | CH_3CN 15(0)-14(0) | 1.24 | OriMC-1 | MMWO | 4.9m | Lor84 |
| U | 278263. | unidentified | 1.0 | OriMC-1 | MMWO | 4.9m | Lor84c |

TABLE 2. Recommended rest frequencies for observed interstellar molecular lines — Continued

| Frequency unc. | Formula | Quantum numbers | T_r (K) T_s (K) | Source | Telescope | Astr. Ref. | Lab. Ref. | |
|-----------------|-------------------------------|---------------------|-------------------------|--------------|-------------|---------------|--------------|--------|
| 278304.51 (5) | CH ₃ OH | 9(-1)-8(0) E | 1.5 | OriMC-1 | MMWO | 4.9m | Lor84c | |
| 278886.49 *(59) | H ₂ CS | 8(1,7)-7(1,6) | 0.8 | OriMC-1 | MMWO | 4.9m | Lor84f | |
| 279511.732*(77) | N ₂ H ⁺ | 3-2 | 0.9 | OriMC-1 | MMWO | 4.9m | Lor84g | |
| 281526.922*(12) | H ₂ CO | 4(1,4)-3(1,3) | 1.4 | ρ Oph B | MMWO | 4.9m | Lor83 | |
| 281762.598*(38) | SO ₂ | 15(1,15)-14(0,14) | 1.0 | OriMC-1 | MMWO | 4.9m | Lor84c | |
| U | 281958. | unidentified | 0.8 | OriMC-1 | MMWO | 4.9m | Lor81 | |
| | 281977.05 *(18) | HC ₃ N | 31-30 | OriMC-1 | MMWO | 4.9m | Lor81 | |
| | 282036.560*(14) | SO ₂ | 6(2,4)-5(1,5) | 1.6 | OriMC-1 | MMWO | 4.9m | Lor81 |
| | 282292.795*(51) | SO ₂ | 20(1,19)-20(0,20) | 0.7 | OriMC-1 | MMWO | 4.9m | Lor84f |
| U | 286342.45 | unidentified | 0.36 | OriMC-1 | MMWO | 4.9m | Lor85 | |
| | 286416.390*(45) | SO ₂ | 22(2,20)-21(3,19) | 0.22 | OriMC-1 | MMWO | 4.9m | Lor85 |
| | 288143.912*(28) | DCO ⁺ | 4-3 | ~ 1.3 | ρ -Oph | MMWO | 4.9m | Lor82 |
| | 289209.179*(39) | C ³⁴ S | 6-5 | 0.8 | OriMC-1 | MMWO | 4.9m | Lor85 |
| | 289644.897*(20) | DCN | 4-3 | 0.77 | OriMC-1 | MMWO | 4.9m | Woo85 |
| | 289939.477 (14) | CH ₃ OH | 6(0)-5(0) E | 2.1 | OriMC-1 | MMWO | 4.9m | Pla82 |
| | 290380.0 *(11) | SiS | 16-15 | 0.22 | IRC+10216 | MMWO | 4.9m | Sah84 |
| | 290479.934*(17) | CH ₃ CCH | 17(2)-16(2) | 0.14 | OriMC-1 | MMWO | 4.9m | Lor84b |
| | 290496.545*(14) | CH ₃ CCH | 17(1)-16(1) | 0.32 | OriMC-1 | MMWO | 4.9m | Lor84b |
| | 290502.083*(14) | CH ₃ CCH | 17(0)-16(0) | 0.3 | OriMC-1 | MMWO | 4.9m | Lor84b |
| | 290562.242*(38) | ³⁴ SO | 6(7)-5(6) | 0.4 | OriMC-1 | MMWO | 4.9m | Lor84b |
| | 290623.416*(13) | H ₂ CO | 4(0,4)-3(0,3) | 3.8 | OriMC-1 | MMWO | 4.9m | Lor84b |
| | 291237.770*(22) | H ₂ CO | 4(2,3)-3(2,2) | 2.2 | OriMC-1 | MMWO | 4.9m | Lor84a |
| | 291380.452*(32) | H ₂ CO | 4(3,2)-3(3,1) | 2.3b | OriMC-1 | MMWO | 4.9m | Lor84a |
| | 291384.371*(32) | H ₂ CO | 4(3,1)-3(3,0) | b | OriMC-1 | MMWO | 4.9m | Lor84a |
| U | 291839.652*(5) | OCS | 24-23 | 0.53 | OriMC-1 | MMWO | 4.9m | Lor84b |
| | 291948.072*(22) | H ₂ CO | 4(2,2)-3(2,1) | 1.9 | OriMC-1 | MMWO | 4.9m | Lor84a |
| | 292414. | unidentified | 0.36 | OriMC-1 | MMWO | 4.9m | Woo85 | |
| | 293463.99 (5) | CH ₃ OH | 3(2)-4(1) A+ | 0.95 | OriMC-1 | MMWO | 4.9m | Lor84b |
| | 293912.160*(39) | CS | 6-5 | 3.3 | OriMC-2 | MMWO | 4.9m | Sne84 |
| | 294098.85 *(10) | CH ₃ CN | 16(6)-15(6) | 0.29 | OriMC-1 | MMWO | 4.9m | Lor84a |
| | 294160.98 *(10) | CH ₃ CN | 16(5)-15(5) | 0.16 | OriMC-1 | MMWO | 4.9m | Lor84a |
| | 294211.84 *(10) | CH ₃ CN | 16(4)-15(4) | 0.29 | OriMC-1 | MMWO | 4.9m | Lor84a |
| | 298576.296*(24) | SO ₂ | 9(2,8)-8(1,7) | 2.0 | OriMC-1 | MMWO | 4.9m | Eri84 |
| | 300836.635*(12) | H ₂ CO | 4(1,3)-3(1,2) | 3.9 | OriMC-1 | MMWO | 4.9m | Lor84b |
| | 301286.126*(32) | SO | 7(7)-6(6) | 2.7 | OriMC-1 | MMWO | 4.9m | Lor84b |
| U | 330587.957*(23) | ¹³ CO | 3-2 | 27. | OriMC-1 | UM/UCSD | 1.5m | Hug81 |
| | 335582.005 (15) | CH ₃ OH | 7(1)-6(1) A+ | 1.2 | OriMC-1 | MMWO | 4.9m | Lor85 |
| | 337396.602*(55) | C ³⁴ S | 7-6 | 0.8 | OriMC-1 | MMWO | 4.9m | Lor85 |
| | 338408.681 (15) | CH ₃ OH | 7(0)-6(0) A | 1.3 | OriMC-1 | MMWO | 4.9m | Lor85 |
| | 338414.113*(69) | HCOOCH ₃ | 27(7,21)-26(7,20) A | 1.2 | OriMC-1 | MMWO | 4.9m | Lor85 |
| | 338486.337 (14) | CH ₃ OH | 7(5)-6(5) A+ | 1.1b | OriMC-1 | MMWO | 4.9m | Lor85 |
| | 338486.338 (14) | CH ₃ OH | 7(5)-6(5) A- | b | OriMC-1 | MMWO | 4.9m | Pic81 |
| | 338512.762 (48) | CH ₃ OH | 7(4)-6(4) A+ | b | OriMC-1 | MMWO | 4.9m | Lor85 |
| | 338512.762 (48) | CH ₃ OH | 7(4)-6(4) A- | b | OriMC-1 | MMWO | 4.9m | Pic81 |
| | 338512.762 (29) | CH ₃ OH | 7(2)-6(2) A- | 1.7b | OriMC-1 | MMWO | 4.9m | Lor85 |
| | 338540.795 (15) | CH ₃ OH | 7(3)-6(3) A+ | 1.0b | OriMC-1 | MMWO | 4.9m | Pic81 |
| | 338543.204 (15) | CH ₃ OH | 7(3)-6(3) A- | b | OriMC-1 | MMWO | 4.9m | Pic81 |
| | 338559.928 (24) | CH ₃ OH | 7(-3)-6(-3) E | 1.2 | OriMC-1 | MMWO | 4.9m | Pic81 |
| | 338583.195 (17) | CH ₃ OH | 7(3)-6(3) E | 1.3 | OriMC-1 | MMWO | 4.9m | Pic81 |
| | 338614.999 (17) | CH ₃ OH | 7(1)-6(1) E | 1.7 | OriMC-1 | MMWO | 4.9m | Pic81 |
| | 340031.567*(40) | CN | 3-2 J=5/2-3/2 F=7/2-5/2 | 1.6b | OriMC-1 | MMWO | 4.9m | Sha83 |
| | 340035.281*(50) | CN | 3-2 J=5/2-3/2 F=3/2-1/2 | b | OriMC-1 | MMWO | 4.9m | Sha83 |
| | 340035.525*(50) | CN | 3-2 J=5/2-3/2 F=5/2-3/2 | b | OriMC-1 | MMWO | 4.9m | Sha83 |
| | 340247.625*(50) | CN | 3-2 J=7/2-5/2 F=7/2-5/2 | 3.1b | OriMC-1 | MMWO | 4.9m | Sha83 |
| | 340247.874*(50) | CN | 3-2 J=7/2-5/2 F=9/2-7/2 | b | OriMC-1 | MMWO | 4.9m | Sha83 |
| | 340248.573*(50) | CN | 3-2 J=7/2-5/2 F=5/2-3/2 | b | OriMC-1 | MMWO | 4.9m | Sha83 |
| | 340714.294*(48) | SO | 7(8)-6(7) | 2.7 | OriMC-1 | MMWO | 4.9m | Lor85 |
| | 342882.949*(50) | CS | 7-6 | 5.5 | OriMC-1 | MMWO | 4.9m | Lor85 |
| | 342882.949*(50) | CS | 7-6 | 3.00 | M17 | MMT | | Eri84d |
| | 344310.728*(54) | SO | 8(8)-7(7) | 7.00 | OriMC-1 | MMT | | Eri84d |
| U | 345338.519*(44) | SO ₂ | 13(2,12)-12(1,11) | 2.4b | OriMC-1 | MMWO | 4.9m | Lor85 |
| | 345339.7 *(12) | H ¹³ CN | 4-3 | b | OriMC-1 | MMWO | 4.9m | Lor85 |
| | 345795.975*(24) | CO | 3-2 | 80 | OriMC-1 | Hale | 5m | Phi77a |
| | 346528.562*(74) | SO | 9(8)-8(7) | 4.0 | OriMC-1 | MMWO | 4.9m | Lor85 |
| | 347330.58 *(11) | SiO | 8-7 | 1.6 | OriMC-1 | MMWO | 4.9m | Lor85 |

TABLE 2. Recommended rest frequencies for observed interstellar molecular lines — Continued

| Frequency unc. | Formula | Quantum numbers | $T_r^*(\text{K})$ $T_s^*(\text{K})$ | Source | Telescope | Astr. Ref. | Lab. Ref. | |
|------------------|-------------------------------|------------------------------------|--|---------|-----------|---------------|--------------|--------|
| 349338.10 (50) | HC ₂ | 4-3 $J=9/2-7/2$ $F=4-3$ | b | M17 | MMWO | 4.9m | Lor85 | Sas81a |
| 349338.10 (50) | HC ₂ | 4-3 $J=9/2-7/2$ $F=5-4$ | 1.2b | M17 | MMWO | 4.9m | Lor85 | Sas81a |
| 349400.61 (50) | HC ₂ | 4-3 $J=7/2-5/2$ $F=3-2$ | b | M17 | MMWO | 4.9m | Lor85 | Sas81a |
| 349400.61 (50) | HC ₂ | 4-3 $J=7/2-5/2$ $F=4-3$ | 1.0b | M17 | MMWO | 4.9m | Lor85 | Sas81a |
| 350905.119 (17) | CH ₃ OH | 1(1)-0(0) A+ | 2.0 | OriMC-1 | MMWO | 4.9m | Lor85 | Pic81 |
| 351768.639*(18) | H ₂ CO | 5(1,5)-4(1,4) | 4.5 | OriMC-1 | MMWO | 4.9m | Lor85 | |
| 351873.896*(43) | SO ₂ | 14(4,10)-14(3,11) | 0.9 | OriMC-1 | MMWO | 4.9m | Lor85 | |
| 354505.47 *(2) | HCN | 4-3 | 10. | OriMC-1 | UKIRT | 3.8m | Pad80 | |
| 354505.472*(20) | HCN | 4-3 | 9.4 | OriMC-1 | MMWO | 4.9m | Lor85 | |
| 356734.49 *(26) | HCO ⁺ | 4-3 | 8.6 | OriMC-1 | UKIRT | 3.8m | Pad82 | |
| 372421.34 (20) | H ₂ D ⁺ | 1(1,0)-1(1,1) | 0.23 | NGC2264 | KAO | 1m | Phi85 | Bog84b |
| 380197.372*(25) | H ₂ O | 4(1,4)-3(2,1) | 12. | OriMC-1 | KAO | 1m | Phi80 | |
| 461040.766*(60) | CO | 4-3 | 60. | OriMC-1 | KAO | 1m | Phi80 | |
| 572498.15 (10) | NH ₃ | 1(0)-0(0) | 3.5 | OriMC-1 | KAO | 1m | Kee83 | |
| 691473.048*(42) | CO | 6-5 | 100. | OriMC-1 | IRTF | 3m | Gol81a | |
| 806651.770*(46) | CO | 7-6 | 110. | OriMC-1 | IRTF | 3m | Sch85b | |
| 1956018.18 *(23) | CO | 17-16 | 0.7 q | OriMC-1 | KAO | 1m | Sta82 | |
| 2413917.30 *(40) | CO | 21-20 | 0.85q | OriMC-1 | KAO | 1m | Wat80 | |
| 2509947.7 *(30) | OH | $^2\Pi_{1/2} J=5/2-3/2$ $F=3+/-2-$ | n.r. | Sgr B2 | KAO | 1m | Sto81 | Bro82 |
| 2514315.5 *(30) | OH | $^2\Pi_{1/2} J=5/2-3/2$ $F=3--2+$ | n.r. | Sgr B2 | KAO | 1m | Sto81 | Bro82 |
| 2528172.31 *(45) | CO | 22-21 | 1.4 q | OriMC-1 | KAO | 1m | Wat80 | |
| 3097910.1 *(7) | CO | 27-26 | 0.43q | OriMC-1 | KAO | 1m | Sto81a | |
| 3438365.8 *(8) | CO | 30-29 | 0.16q | OriMC-1 | KAO | 1m | Sto81a | |

- a) The asterisk (*) following a rest frequency indicates that the frequency is a calculated value. A question mark (?) following the formula indicates that the identification was uncertain in the astronomical reference. The symbol n. r. in the intensity column means that the intensity was not reported.
- b) Blended with adjacent transitions, see astronomical reference.
- c) Line-to-continuum ratio (T_L/T_c) = 0.0095.
- d) Blended with a recombination line.
- e) In flux units (fu). 1 fu = 10^{-26} W m⁻² Hz⁻¹ = Jansky (Jy).
- f) This observation has not been confirmed.
- g) Beam brightness temperature.
- h) See astronomical reference.
- i) Intensity varies with time.
- j) Astronomical reference shows partially resolved hyperfine structure.
- k) Blended with CH₃¹³CN.
- l) Peak line radiation temperature.
- m) Only the strongest of several velocity components is listed.
- n) Reported as unidentified in astronomical reference.
- o) The acetaldehyde and formamide lines were observed in different sidebands and are blended in this observation.
- p) The frequency for this unidentified line reported by Clark et al. (1979) was in error. The correct frequency is 93.780 GHz as shown here.
- q) Units are 10^{-16} W/cm².
- r) Blended with HCO⁺ $J=3-2$.
- s) Originally attributed to NH₂CHO, however this assignment seems inconsistent with other observations. (Cum84)
- t) Assignment from Cum84.
- u) Not observed in Orion survey by Sutton et al. (Sut85).
- v) This line may be blended with NS $J=11/2-9/2$.
- w) This line may be blended with NO $J=5/2-3/2$.
- x) Not seen in BTL survey at ~ 0.04 K (Cum85).
- y) Although this line is reported in a table of Lor84, it is not apparent in Fig. 2 of this reference.
- z) The $J=54-53$ of HC₃N is calculated at 143764.97(10) MHz.

References to Table 2

- Aka74 K. Akabane, M. Morimoto, K. Nagane, K. Miyazawa, T. Miyaji, H. Tabara, H. Hirabayashi, N. Kaifu, and Y. Chikada, *Publ. Astr. Soc. Japan* **26**, 1 (1974).
- All78 M. Allen and G.R. Knapp, *Astrophys. J.* **225**, 843 (1978).
- And77 T.G. Anderson, T.A. Dixon, N.D. Piltch, R.J. Saykally, P.G. Szanto, and R.C. Woods, *Astrophys. J. (Letters)* **216**, L85 (1977).
- Arm84 T. Armstrong (see Lor84a).
- Arm84a T. Armstrong and R.B. Loren (see Lor84a).
- Ave76 L.W. Avery, N.W. Broten, J.M. MacLeod, T. Oka, and H.W. Kroto, *Astrophys. J. (Letters)* **205**, L173 (1976).
- Ave79 L.W. Avery, T. Oka, N.W. Broten, and J.M. MacLeod, *Astrophys. J.* **231**, 48 (1979).
- Bal70 J.A. Ball, C.A. Gottlieb, A.E. Lilley, and H.E. Radford, *Astrophys. J. (Letters)* **162**, L203 (1970).
- Bal71 J.A. Ball, C.A. Gottlieb, M.L. Meeks, and H.E. Radford, *Astrophys. J. (Letters)* **163**, L33 (1971).
- Bar71 A.H. Barrett, P.R. Schwartz, and J.W. Waters, *Astrophys. J. (Letters)* **168**, L101 (1971).
- Bar75 A.H. Barrett, P. Ho, and R.N. Martin, *Astrophys. J. (Letters)* **198**, L119 (1975).
- Bar77 A.H. Barrett, P.T.P. Ho, and P.C. Myers, *Astrophys. J. (Letters)* **211**, L39 (1977).
- Bau76 A. Bauder, F.J. Lovas, and D.R. Johnson, *J. Phys. Chem. Ref. Data* **5**, 53 (1976).
- Bau79 A. Bauder, *J. Phys. Chem. Ref. Data* **8**, 583 (1979).
- Bea78 R.A. Beaudet, and R.L. Poynter, *J. Phys. Chem. Ref. Data* **7**, 311 (1978).
- Bec82 J.E. Beckman, G.D. Watt, G.J. White, J.P. Phillips, R.L. Frost, and J.H. Davis, *M.N.R.A.S.* **201**, 357 (1982).
- Bel82 M.B. Bell, P.A. Feldman, S. Kwok, ad H.E. Matthews, *Nature* **295**, 389 (1982).
- Bel83 M.B. Bell, P.A. Feldman, and H.E. Matthews, *Astrophys. J. (Letters)* **273**, L35 (1983).
- Bel83a M.B. Bell, H.E. Matthews, and T.J. Sears, *Astron. Astrophys.* **127**, 241 (1983).
- Bel83b M.B. Bell, H.E. Matthews, and P.A. Feldman, *Astron. Astrophys.* **127**, 420 (1983).
- Bel85 M.B. Bell, and H.E. Matthews, *Astrophys. J. (Letters)* **291**, L63 (1985).
- Bes83 M. Bester, S. Urban, K. Yamada, and G. Winnewisser, *Astron. Astrophys.* **121**, L13 (1983).
- Bla77 G.L. Blackman, R.D. Brown, P.D. Godfrey, M.P. Bassez, A.L. Ottrey, D. Winkler, and B.J. Robinson, *M.N.R.A.S.* **180**, 1p (1977).
- Bla84 G.A. Blake, E.C. Sutton, C.R. Masson, T.G. Phillips, E. Herbst, G. M. Plummer and F.C. DeLucia, *Astrophys. J.* **286**, 586 (1984).
- Bla84a G.A. Blake, K.V.L.N. Sastry, and F.C. DeLucia, *J. Chem. Phys.* **80**, 95 (1984).
- Bla85 G.A. Blake, E.C. Sutton, C.R. Masson, and T.G. Phillips, *Astrophys. J.* **58**, 341 (1985).
- Bla85a G.A. Blake, and H. Pickett, *Private communication*, 1985.
- Bog81 M. Bogey, C. Demuynck, and J.L. Destombes, *Chem. Phys. Lett.* **81**, 256 (1981).
- Bog84 M. Bogey, C. Demuynck, and J.L. Destombes, and B. Lemoine, *J. Mol. Spectrosc.* **107**, 417 (1984).
- Bog84a M. Bogey, C. Demuynck, and J.L. Destombes, *Can. J. Phys.* **62**, 1248 (1984).
- Bog84b M. Bogey, C. Demuynck, M. Denis, J. L. Destombes, and B. Lemoine, *Astron. Astrophys.* **137**, L15 (1984).
- Bog85 M. Bogey, C. Demuynck, and J.L. Destombes, *Astron. Astrophys.* **144**, L15 (1985).
- Bro75 R.D. Brown, J.G. Crofts, F.F. Gardner, P.D. Godfrey, B.J. Robinson, and J.B. Whiteoak, *Astrophys. J. (Letters)* **197**, L29 (1975).
- Bro76 N.W. Broten, J.M. MacLeod, T. Oka, L.W. Avery, J.W. Brooks, R.X. McGee, and L.M. Newton, *Astrophys. J. (Letters)* **309**, L143 (1976).
- Bro77 R.D. Brown, P.D. Godfrey, H.J. Gunn, G.L. Blackman, and J.W.V. Storey, *M.N.R.A.S.* **180**, 87p (1977).
- Bro78 N.W. Broten, T. Oka, L.W. Avery, J.M. MacLeod, and H. Kroto, *Astrophys. J. (Letters)* **223**, L105 (1978).
- Bro80 R.D. Brown, P.D. Godfrey, and D.A. Winkler, *M.N.R.A.S.* **190**, 1 (1980).
- Bro81 R.L. Brown, *Astrophys. J. (Letters)* **248**, L119 (1981).
- Bro82 J.M. Brown, J.E. Schubert, K.M. Evenson, and H.E. Radford, *Astrophys. J.* **258**, 899 (1982).
- Bro83 R.D. Brown, F.W. Eastwood, P.S. Elms, and P.D. Godfrey, *J. Am. Chem. Soc.* **105**, 6496 (1983).
- Bro84 N.W. Broten, J.M. MacLeod, L.W. Avery, W.M. Irvine, B. Höglund, P. Friberg, and Å. Hjalmarsson, *Astrophys. J. (Letters)* **276**, L25 (1984).
- Bro85 R.D. Brown, P.D. Godfrey, D.M. Cragg, E.H.N. Rice, W.M. Irvine, P. Friberg, H. Suzuki, M. Ohishi, N. Kaifu, and M. Morimoto, *297*, 302 (1985).
- Buh74 D. Buhl, L.E. Snyder, F.J. Lovas, and D.R. Johnson, *Astrophys. J. (Letters)* **192**, L97 (1974).
- Buj81 V. Bujarrabal, M. Guélin, M. Morris, and P. Thaddeus, *Astron. Astrophys.* **99**, 239 (1981).
- Cer84 J. Cernicharo, M. Guélin, and J. Askne, *Astron. Astrophys.* **138**, 371 (1984).
- Chu75 E. Churchwell and G. Winnewisser, *Astron. Astrophys.* **45**, 229 (1975).
- Chu77 E. Churchwell, C.M. Walmsley, and G. Winnewisser, *Astron. Astrophys.* **54**, 925 (1977).
- Chu80 E. Churchwell, A. Nash, J. Rahe, C.M. Walmsley, O. Lochner and G. Winnewisser, *Astrophys. J. (Letters)* **241**, L169 (1980).
- Chu83 E. Churchwell and J. M. Hollis, *Astrophys. J.* **272**, 591 (1983).
- Cla74 F.O. Clark and D.R. Johnson, *Astrophys. J. (Letters)* **191**, L87 (1974).
- Cla76 F.O. Clark, R.D. Brown, P.D. Godfrey, J.W.V. Storey, and D.R. Johnson, *Astrophys. J. (Letters)* **210**, L139 (1976).
- Cla77 F.O. Clark and F.J. Lovas, *Astrophys. J. (Letters)* **217**, L47 (1977).
- Cla78 F.O. Clark, D.R. Johnson, C.E. Heiles, and T.H. Troland, *Astrophys. J.* **226**, 824 (1978).
- Cla79 F.O. Clark, F.J. Lovas, and D.R. Johnson, *Astrophys. J.* **229**, 553 (1979).
- Cla81 F.O. Clark, T.H. Troland, F.J. Lovas, and P.R. Schwartz, *Astrophys. J. (Letters)* **244**, L99 (1981).
- Cle83 D.P. Clemens and A.P. Lane, *Astrophys. J. (Letters)* **266**, L117 (1983).
- Cle84 D.P. Clemens (see Lor84a).
- Cre76 R.A. Creswell, E.F. Pearson, M. Winnewisser, and G. Winnewisser, *Z. Naturforsch.* **31a**, 221 (1976).
- Com85 F. Combes, F. Boulanger, P.J. Encrenaz, M. Gerin, M. Bogey, C. Demuynck, and J.L. Destombes, *Astron. Astrophys.* **147**, L25 (1985).
- Cum80 S.E. Cummins, M. Morris, and P. Thaddeus, *Astrophys. J.* **235**, 886 (1980).
- Cum84 S.E. Cummins, *(private communication*, 1984).
- Cum85 S.E. Cummins, R.A. Linke, and P. Thaddeus, *Astrophys. J. Suppl.* (1985).
- Cup68 R.E. Cupp, R.A. Kempf, and J.J. Gallagher, *Phys. Rev.* **171**, 60 (1968).
- Dan78 D. Dangoisse, E. Willemot, and J. Bellet, *J. Mol. Spectrosc.* **71**, 414 (1978).
- Dav74 J.H. Davis, G.N. Blair, H. Van Till, and P. Thaddeus, *Astrophys. J. (Letters)* **190**, L117 (1974).
- DeL69 F.C. DeLucia and W. Gordy, *Phys. Rev.* **187**, 58 (1969).
- DeL71 F.C. DeLucia, R.L. Cook, P. Helminger, and W. Gordy, *J. Chem. Phys.* **55**, 5334 (1971).
- DeL75 F.C. DeLucia and P. Helminger, *J. Mol. Spectrosc.* **54**, 200 (1975).
- DeL77 F.C. DeLucia and P. Helminger, *J. Chem. Phys.* **67**, 4262 (1977).

- Den84 W.R.F. Dent, L.T.L. Little, P.W. Riley, and D. Vizard, (private communication, 1984).
- deZ71 R.L. deZafra, *Astrophys. J.* **170**, 165 (1971).
- Dic72 D.F. Dickinson, *Astrophys. Lett.* **12**, 235 (1972).
- Dic76 D.F. Dickinson, C.A. Gottlieb, E.W. Gottlieb, and M.M. Litvak, *Astrophys. J.* **206**, 79 (1976).
- Dij71 F.A. Dijk, Ph.D. Dissertation, Katholieke Universiteit, Nijmegen, Netherlands (1971).
- Dix77 T.A. Dixon and R.C. Woods, *J. Chem. Phys.* **67**, 3956 (1977).
- Doh74 L.H. Doherty, J.M. MacLeod, and T. Oka, *Astrophys. J. (Letters)* **192**, L157 (1974).
- Dow82 D. Downes, R. Genzel, Å. Hjalmarson, L.A. Nyman, and B. Rönnäng, *Astrophys. J. (Letters)* **252**, L29 (1982).
- Dub80 A. Dubrulle, J. Demaison, J. Burie, and D. Boucher, *Z. Naturforsch.* **35a**, 471 (1980).
- Ell80 J. Elldér, P. Freiberg, Å. Hjalmarson, B. Höglund, W.M. Irvine, L.E.B. Johansson, H. Olofsson, G. Rydbeck, and O.E.H. Rydbeck, *Astrophys. J. (Letters)* **242**, L93 (1980).
- Eri81 N.R. Erickson, R.L. Snell, R.B. Loren, L. Mundy, and R.L. Plambeck, *Astrophys. J. (Letters)* **245**, L83 (1981).
- Eri84 N.R. Erickson and R.L. Plambeck (see Lor84a).
- Eri84a N.R. Erickson and R.B. Loren (see Lor84a).
- Eri84b N.R. Erickson (see Lor84a).
- Eri84c N. Erickson and R.L. Snell, (private communication, 1984).
- Eri84d N. Erickson, R.L. Snell, P.F. Goldsmith, C. Lada, R.N. Martin, and A. Schultz, (private communication, 1984).
- Eva70 N.J. Evans, II, A.C. Cheung, and R.M. Sloanaker, *Astrophys. J. (Letters)* **159**, L9 (1970).
- Eva79 N.J. Evans, II, R.L. Plambeck, and J.H. Davis, *Astrophys. J. (Letters)* **227**, L25 (1979).
- Fou74 N. Fourikis, M.W. Sinclair, B.J. Robinson, P.D. Godfrey, and R.D. Brown, *Aust. J. Phys.* **27**, 425 (1974).
- Fou74a N. Fourikis, K. Takagi, and M. Morimoto, *Astrophys. J. (Letters)* **191**, L139 (1974).
- Fou77 N. Fourikis, K. Takagi, and S. Saito, *Astrophys. J. (Letters)* **212**, L33 (1977).
- Fre79 M.A. Frerking, R.A. Linke, and P. Thaddeus, *Astrophys. J. (Letters)* **234**, L143 (1979).
- Fre79a M.A. Frerking, and W.D. Langer, and R.W. Wilson, *Astrophys. J. (Letters)* **232**, L65 (1979).
- Fre81 M.A. Frerking, and W.D. Langer, *J. Chem. Phys.* **74**, 6990 (1981).
- Fri80 P. Friberg, Å. Hjalmarson, and W.M. Irvine, *Astrophys. J. (Letters)* **241**, L99 (1980).
- Fri84 P. Friberg, *Astron. Astrophys.* **132**, 265 (1984).
- Gai74 L. Gaines, K.H. Casleton, and S.G. Kukolich, *Astrophys. J. (Letters)* **191**, L99 (1974).
- Gar64 F.F. Gardner, B.J. Robinson, J.G. Bolton, and K.J. van Damme, *Phys. Rev. Lett.* **13**, 3 (1964).
- Gar70 F.F. Gardner, R.X. McGee, and M.W. Sinclair, *Astrophys. Letters* **5**, 67 (1970).
- Gar71 F.F. Gardner and J.C. Ribes, *Astrophys. Lett.* **9**, 175 (1971).
- Gar71a F.F. Gardner, J.C. Ribes, and B.F.C. Cooper, *Astrophys. Lett.* **9**, 181 (1971).
- Gar75 F.F. Gardner and G. Winnewisser, *Astrophys. J. (Letters)* **195**, L127 (1975).
- Gar76 F.F. Gardner and J.B. Whiteoak, *M.N.R.A.S.* **176**, 57p (1976).
- Gar78 F.F. Gardner, J.B. Whiteoak, and G. Winnewisser, *Astron. Astrophys.* **67**, L23 (1978).
- Gar78a F.F. Gardner and G. Winnewisser, *M.N.R.A.S.* **185**, 57P (1978).
- Gar80 F.F. Gardner, P.D. Godfrey, and D.R. Williams, *M.N.R.A.S.* **193**, 713 (1980).
- Gar83 F.F. Gardner and J. Martin-Pintado, *M.N.R.A.S.* **204**, 709 (1983).
- Gar85 F.F. Gardner, B. Höglund, C. Shurke, A. Stark, and T.L. Wilson, *Astron. Astrophys.* **146**, 303 (1985).
- Ger84 M. Gerin, F. Combes, P. Encrenaz, R. Linke, J.L. Destombes, and C. Demuynck, *Astron. Astrophys.* **136**, L17 (1984).
- Gil76 W. Gilmore, M. Morris, D.R. Johnson, F.J. Lovas, B. Zuckerman, B.E. Turner, and P. Palmer, *Astrophys. J.* **204**, 43 (1976).
- God73 P.D. Godfrey, R.D. Brown, B.J. Robinson, and M.W. Sinclair, *Astrophys. Lett.* **13**, 119 (1973).
- God77 P.D. Godfrey, R.D. Brown, H.I. Gunn, G.L. Blackman, and J.W.V. Storey, *M.N.R.A.S.* **180**, 83p (1977).
- God84 P.D. Godfrey, L.M. Tack, and W.M. Irvine, (private communication, 1984).
- Gol81 P.F. Goldsmith and R.A. Linke, *Astrophys. J.* **245**, 482 (1981).
- Gol81a P.F. Goldsmith, N.R. Erickson, H.R. Fetterman, B.J. Clifton, D.D. Peck, P.E. Tannenwald, G.A. Koepf, D. Buhl, and N. McAvoy, *Astrophys. J. (Letters)* **243**, L79 (1981).
- Gol81b P.F. Goldsmith, W.D. Langer, J. Elldér, W. Irvine, and E. Kollberg, *Astrophys. J.* **249**, 524 (1981).
- Gol82 P.F. Goldsmith, R.L. Snell, S. Deguchi, and R. Krotkov, *Astrophys. J.* **260**, 147 (1982).
- Gol83 P.F. Goldsmith, R. Krotkov, R.L. Snell, R.D. Brown, and P. Godfrey, *Astrophys. J.* **274**, 184 (1983).
- Gol84 P.F. Goldsmith, (private communication, 1984).
- Got73 C.A. Gottlieb, "Molecules in the Galactic Environment", Eds. M.A. Gordon and L.E. Snyder (New York: Wiley-Interscience, p. 181 1973).
- Got73a C.A. Gottlieb, P. Palmer, L.J. Richard, and B. Zuckerman, *Astrophys. J.* **182**, 699 (1973).
- Got73b C.A. Gottlieb and J.A. Ball, *Astrophys. J. (Letters)* **184**, L59 (1973).
- Got74 C.A. Gottlieb, H.E. Radford, and B.P. Smith, (unpublished data, 1974).
- Got75 C.A. Gottlieb, J.A. Ball, E.W. Gottlieb, C.J. Lada, and H. Penfield, *Astrophys. J. (Letters)* **200**, L147 (1975).
- Got78 C.A. Gottlieb, E.W. Gottlieb, M.M. Litvak, J.A. Ball, and H. Penfield, *Astrophys. J.* **219**, 77 (1978).
- Got78a C.A. Gottlieb, (private communication, 1978).
- Got79 C.A. Gottlieb, J.A. Ball, E.W. Gottlieb, and D.F. Dickinson, *Astrophys. J.* **227**, 422 (1979).
- Got83 C.A. Gottlieb, E.W. Gottlieb, P. Thaddeus, and H. Kawamura, *Astrophys. J.* **275**, 916 (1983).
- Got83a C.A. Gottlieb, E.W. Gottlieb, and P. Thaddeus, *Astrophys. J.* **264**, 740 (1983).
- Gra81 M. Grasshoff, E. Tiemann, and C. Henkel, *Astrophys. J.* **101**, 238 (1981).
- Gud81 C.S. Gudeman, N.H. Haesse, N.D. Pritch, and R.C. Woods, *Astrophys. J. (Letters)* **246**, L47 (1981).
- Gud82 C.S. Gudeman and R.C. Woods, *Phys. Rev. Lett.* **48**, 1344 (1982).
- Gud82a C.S. Gudeman, Ph.D. Thesis (Univ. of Wisconsin, 1982).
- Gue77 M. Guélin and P. Thaddeus, *Astrophys. J. (Letters)* **212**, L81 (1977).
- Gue77a M. Guélin, W.D. Langer, R.L. Snell, and H.A. Wootten, *Astrophys. J. (Letters)* **217**, L165 (1977).
- Gue78 M. Guélin, S. Green, and P. Thaddeus, *Astrophys. J. (Letters)* **224**, L27 (1978).
- Gue82 M. Guélin, J. Cernicharo, and R.A. Linke, *Astrophys. J. (Letters)* **263**, L89 (1982).
- Gue82a M. Guélin, P. Friberg, and A. Mezaoui, *Astron. Astrophys.* **109**, 23 (1982).
- Gue82b M. Guélin, W.D. Langer, and R.W. Wilson, *Astron. Astrophys.* **107**, 107 (1982).
- Haq74 S.S. Haque, R.M. Lees, J.M. Saint Clair, Y. Beers, and D.R. Johnson, *Astrophys. J. (Letters)* **187**, L15 (1974).
- Hel70 P. Helminger, F.C. DeLucia, and W. Gordy, *Phys. Rev. Lett.* **25**, 1397 (1970).
- Hel71 P. Helminger, F.C. DeLucia, and W. Gordy, *J. Mol. Spectrosc.* **39**, 94 (1971).
- Hen83 C. Henkel, H.E. Matthews, and M. Morris, *Astrophys. J.* **267**, 184 (1983).
- Hen83a C. Henkel, T.L. Wilson, C.M. Walmsley, and T. Pauls, *Astron. Astrophys.* **127**, 388 (1983).

- Hen85 C. Henkel, H.E. Matthews, M. Morris, S. Terebey, and M. Fich, *Astron. Astrophys.* **147**, 143 (1985).
- Her85 W. Hermsen, T.L. Wilson, C.M. Walmsley and W. Batrla *Astron. Astrophys.* **146**, 134 (1985).
- Her85a W. Hermsen, (private communication, 1985)
- Heu73 J.E.M. Heuvel and A. Dymanus, *J. Mol. Spectrosc.* **45**, 282 (1973).
- Hja84 Å. Hjalmarson and L. Johansson, (private communication, 1984).
- Ho77 P.T.P. Ho, R.N. Martin, P.C. Myers, and A.H. Barrett, *Astrophys. J. (Letters)* **215**, L29 (1977).
- Hol76 J.M. Hollis, L.E. Snyder, F.J. Lovas, and D. Buhl, *Astrophys. J. (Letters)* **209**, L83 (1976).
- Hol76a J.M. Hollis and P.J. Rhodes, NRAO Documentation Memo No. 1, Tucson, Arizona.
- Hol77 J.M. Hollis and B.L. Ulich, *Astrophys. J.* **214**, 699 (1977).
- Hol80 J.M. Hollis, L.E. Snyder, R.D. Suenram, and F.J. Lovas, *Astrophys. J.* **241**, 1001 (1980).
- Hol80a J.M. Hollis, L.E. Snyder, F.J. Lovas, and B.L. Ulich, *Astrophys. J.* **241**, 158 (1980).
- Hol81 J.M. Hollis, L.E. Snyder, D.H. Blake, F.J. Lovas, R.D. Suenram, and B.L. Ulich, *Astrophys. J.* **251**, 541 (1981).
- Hol82 J.M. Hollis and P.J. Rhodes, *Astrophys. J. (Letters)* **262**, L1 (1982).
- Hol83 J.M. Hollis, F.J. Lovas, R.D. Suenram, P.R. Jewell, and L.E. Snyder, *Astrophys. J.* **264**, 543 (1983).
- Hol83a J.M. Hollis, R.D. Suenram, F.J. Lovas, and L.E. Snyder, *Astron. Astrophys.* **126**, 393 (1983).
- Hug79 P.J. Huggins, T.G. Phillips, G. Neugebauer, M.W. Werner, P.G. Wannier, and D. Ennis, *Astrophys. J.* **227**, 441 (1979).
- Hug81 P.J. Huggins, T.G. Phillips, G.N. Blair, and P.M. Solomon, *Astrophys. J.* **244**, 863 (1981).
- Hui71 C. Huiszoon, *Rev. Sci. Instrum.* **42**, 477 (1971).
- Irv81 W.M. Irvine, B. Höglund, P. Friberg, J. Askne, and J. Eildér, *Astrophys. J. (Letters)* **248**, L113 (1981).
- Irv83 W.M. Irvine, J.C. Good, and F.P. Schloerb, *Astron. Astrophys.* **127**, L10 (1983).
- Irv83a W.M. Irvine and Å. Hjalmarson, "Cosmochemistry and the Origin of Life." Ed. C. Ponnamperuma, (Dordrecht: D. Reidel p 113, 1983).
- Irv84 W.M. Irvine and P. Friberg, (private communication, 1984).
- Jef70 K.B. Jefferts, A.A. Penzias, and R.W. Wilson, *Astrophys. J. (Letters)* **161**, L87 (1970).
- Jef71 K.B. Jefferts, A.A. Penzias, R.W. Wilson, and P.M. Solomon, *Astrophys. J. (Letters)* **168**, L111 (1971).
- Jen79 D.E. Jennings and K. Fox, *Astrophys. J.* **227**, 433 (1979).
- Jen82 D.E. Jennings and K. Fox, *Astrophys. J.* **254**, 111 (1982).
- Jew84 P.R. Jewell and L.E. Snyder, *Astrophys. J.* **278**, 176 (1984).
- Joh72 D.R. Johnson, (private communication, 1972).
- Joh76 D.R. Johnson, L.E. Snyder, and F.J. Lovas, *Bull AAS* **8**, 349 (1976).
- Joh76a D.R. Johnson, R.D. Suenram, and W.J. Lafferty, *Astrophys. J.* **208**, 245 (1976).
- Joh77 D.R. Johnson, F.J. Lovas, C.A. Gottlieb, E.W. Gottlieb, M.M. Litvak, M. Guélin, and P. Thaddeus, *Astrophys. J.* **218**, 370 (1977).
- Joh84 L.E.B. Johansson, C. Andersson, J. Eildér, P. Friberg, Å. Hjalmarson, B. Höglund, W.M. Irvine, H. Olofsson, and G. Rydbeck, *Astron. Astrophys.* **130**, 227 (1984).
- Kah84 C. Kahane, M.A. Frerking, W.D. Langer, P. Encrenaz, and R. Lucas, *Astron. Astrophys.* **137**, 211 (1984).
- Kai74 N. Kaifu, M. Morimoto, K. Nagane, K. Akabane, T. Iguchi, and K. Takagi, *Astrophys. J. (Letters)* **191**, L135 (1974).
- Kai75 N. Kaifu, K. Takagi, and T. Kojima, *Astrophys. J. (Letters)* **198**, L85 (1975).
- Kak75 R.K. Kakar and R.L. Poynter, *J. Mol. Spectrosc.* **54**, 475 (1975).
- Kau79 V.K. Kaushik and K. Takagi, *Publ. Astron. Soc. Japan* **31**, 423 (1979).
- Kee83 J. Keene, G.A. Blake, and T.G. Phillips, *Astrophys. J. (Letters)* **271**, L27 (1983).
- Kro78 H.W. Kroto, C. Kirby, D.R.M. Walton, L.W. Avery, N.W. Broton, J.M. MacLeod, and T. Oka, *Astrophys. J. (Letters)* **219**, L133 (1978).
- Kui75 E.N.R. Kuiper and T.B.H. Kuiper, (private communication, 1975).
- Kui77 E.N.R. Kuiper, T.B.H. Kuiper, B. Zuckerman, and R.K. Kakar, *Astrophys. J.* **214**, 394 (1977).
- Kui78 E.N.R. Kuiper, B. Zuckerman, and T.B.H. Kuiper, *Astrophys. J. (Letters)* **219**, L49 (1978).
- Kui84 T.B.H. Kuiper, E.N.R. Kuiper, D.F. Dickinson, B.E. Turner and B. Zuckerman, *Astrophys. J.* **276**, 211 (1984).
- Kuk65 S.G. Kukolich, *Phys. Rev.* **138**, A1322 (1965).
- Kuk67 S.G. Kukolich, *Phys. Rev.* **156**, 83 (1967).
- Kuk68 S.G. Kukolich, *Phys. Rev.* **172**, 59 (1968).
- Kuk69 S.G. Kukolich, *J. Chem. Phys.* **50**, 3751 (1969).
- Kuk70 S.G. Kukolich and S.G. Wofsky, *J. Chem. Phys.* **52**, 5477 (1970).
- Kuk71 S.G. Kukolich, A.C. Nelson, and B.S. Yamanashi, *J. Am. Chem. Soc.* **93**, 6769 (1971).
- Kuk75 S.G. Kukolich, *J. Am. Chem. Soc.* **97**, 5704 (1975).
- Kut73 M.L. Kutner, P. Thaddeus, A.A. Penzias, R.W. Wilson, and K.B. Jefferts, *Astrophys. J. (Letters)* **183**, L27 (1973).
- Kut76 M.L. Kutner, N.J. Evans, II, and K.D. Tucker, *Astrophys. J.* **209**, 452 (1976).
- Kut80 M.L. Kutner, D.E. Machnik, K.D. Tucker, and R.L. Dickman, *Astrophys. J.* **242**, 541 (1980).
- Lan78 W.D. Langer, R.W. Wilson, P.S. Henry, and M. Guélin, *Astrophys. J. (Letters)* **225**, L139 (1978).
- Lan79 W.D. Langer, M.A. Frerking, R.A. Linke, and R.W. Wilson, *Astrophys. J. (Letters)* **232**, L169 (1979).
- Lan80 W.D. Langer, F.P. Schloerb, R.L. Snell, and J.S. Young, *Astrophys. J. (Letters)* **239**, L125 (1980).
- Lee68 R.M. Lees and J.G. Baker, *J. Chem. Phys.* **48**, 5299 (1968).
- Lee73 R.M. Lees, F.J. Lovas, W.H. Kirchhoff, and D.R. Johnson, *J. Phys. Chem. Ref. Data* **2**, 205 (1973).
- Lee80 R.M. Lees and M.A. Mohammadi, *Can. J. Phys.* **58**, 1640 (1980).
- Lee84 R.M. Lees, (private communication, 1984).
- Lei84 D.T. Leisawitz (see Lor84a).
- Lei84a D.T. Leisawitz, R.B. Loren, and J.H. Davis (see Lor84a).
- Lin77 R.A. Linke, P.F. Goldsmith, P.G. Wannier, R.W. Wilson, and A.A. Penzias, *Astrophys. J.* **214**, 50 (1977).
- Lin79 R.A. Linke, M.A. Frerking, and P. Thaddeus, *Astrophys. J. (Letters)* **234**, L139 (1979).
- Lin81 R.A. Linke, A.A. Stark, and M.A. Frerking, *Astrophys. J.* **243**, 147 (1981).
- Lin83 R.A. Linke, M. Guélin, and W.D. Langer, *Astrophys. J. (Letters)* **271**, L85 (1983).
- Lis75 H.S. Liszt and R.A. Linke, *Astrophys. J.* **196**, 709 (1975).
- Lis78 H.S. Liszt, *Astrophys. J.* **219**, 454 (1978).
- Lis78a H.S. Liszt and B.E. Turner, *Astrophys. J. (Letters)* **224**, L73 (1978).
- Lit77 L.T. Little, P.W. Riley, and D.N. Matheson, *M.N.R.A.S.* **181**, 33p (1977).
- Lit78 L.T. Little, G.H. Macdonald, P.W. Riley, and D.N. Matheson, *M.N.R.A.S.* **183**, 45p (1978).
- Lor81 R.B. Loren, N.R. Erickson, R.L. Snell, L. Mundy, and J.H. Davis, *Astrophys. J. (Letters)* **244**, L107 (1981).
- Lor81a R.B. Loren, L. Mundy, and N.R. Erickson, *Astrophys. J.* **250**, 573 (1981).
- Lor82 R.B. Loren and A. Wootten, Proc. 16th ESLAB Symposium on Galactic and Extragalactic Infrared Spectroscopy. Toledo, Spain Dec. (ESA SP-192 pp. 93-99 1982).
- Lor83 R.B. Loren, Aa. Sandqvist, and A. Wootten, *Astrophys. J.* **270**, 620 (1983).
- Lor84 R.B. Loren and L.G. Mundy, *Astrophys. J.* **286**, 232 (1984).
- Lor84a R.B. Loren, Tech. Rep. AST 8116403-1 June 1984.
- Lor84b R.B. Loren and A. Wootten (see Lor84a).
- Lor84c R.B. Loren and N.R. Erickson (see Lor84a).
- Lor84d R.B. Loren and L.G. Mundy (see Lor84a).
- Lor84e R.B. Loren and D.T. Leisawitz (see Lor84a).

- Lor84f R.B. Loren and W.L. Peters (see Lor84a).
 Lor84g R.B. Loren, N.R. Erickson, and L.G. Mundy (see Lor84a),
 Lov74 F.J. Lovas and E. Tiemann, *J. Phys. Chem. Ref. Data* **3**, 609
 (1974).
 Lov76 F.J. Lovas, L.E. Snyder, and D. Buhl, (private communication, 1976).
 Lov76a F.J. Lovas, D.R. Johnson, D. Buhl, and L.E. Snyder, *Astrophys. J.* **209**, 770 (1976).
 Lov78 F.J. Lovas and R.D. Suenram, (unpublished measurements, 1978).
 Lov79 F.J. Lovas, H. Dreizler, and H. Lutz, *J. Phys. Chem. Ref. Data* **8**, 1051 (1979).
 Lov82 F.J. Lovas, R.D. Suenram, L.E. Snyder, J.M. Hollis, and R.M. Lees, *Astrophys. J.* **253**, 149 (1982).
 Lov82a F.J. Lovas and R.D. Suenram, *J. Mol. Spectrosc.* **93**, 416
 (1982).
 Lov84 F.J. Lovas, (unpublished measurements, 1984).
 Lov85 F.J. Lovas, (unpublished measurements, 1985).
 Mac75 J.M. MacLeod and L.H. Doherty, *Bull AAS* **7**, 265 (1975).
 Mac81 J.M. MacLeod, L.W. Avery, and N.W. Broten, *Astrophys. J. (Letters)* **251**, L33 (1981).
 Mac81a J.M. MacLeod, N.W. Broten, T. Oka, and L.W. Avery,
 (private communication, 1981).
 Mak74 A.G. Maki, *J. Phys. Chem. Ref. Data* **3**, 221 (1974).
 Man71 R.N. Manchester and M.A. Gordon, *Astrophys. J.* **169**, 507
 (1971).
 Mat80 D.N. Matsakis, A.C. Cheung, M.C.H. Wright, J.I.H. Askne,
 C.H. Townes, and W.J. Welch, *Astrophys. J.* **236**, 481
 (1980).
 Mat83 H.E. Matthews and T.J. Sears, *Astrophys. J. Letters* **267**,
 L53 (1983).
 Mat83a H.E. Matthews and T.J. Sears, *Astrophys. J.* **272** 149 (1983).
 Mat84 H.E. Matthews, W.M. Irvine, P. Friberg, R.D. Brown, and
 P.D. Godfrey, *Nature* **310**, 125 (1984).
 Mat85 H.E. Matthews, P. Friberg, and W.M. Irvine, *Astrophys. J.*
 240, 609 (1985).
 Mat85a H.E. Matthews, and W.M. Irvine, *Astrophys. J. (Letters)*
 298, L61 (1985).
 Mau85 R. Mauersberger, T.L. Wilson, C. Henkel, C.M. Walmsley,
 and W. Hermse, *Astron. Astrophys.* (1985).
 Men85 K.M. Menten, K.J. Johnston, T.L. Wilson, C.M. Walmsley,
 R. Mauersberger , and C. Henkel, *Astrophys. J. (Letters)*
 293, L83 (1985).
 McG77 R.X. McGee, M. Balister, and L.M. Newton, *M.N.R.A.S.*
 180, 585 (1977).
 Mee75 W.L. Meerts and H. Dymanus, *Can. J. Phys.* **53**, 2123 (1975).
 Mer82 A.J. Merer, C.M. Walmsley, and E. Churchwell, *Astrophys. J.* **256**, 151 (1982).
 Moc55 R.C. Mockler and G.R. Bird, *Phys. Rev.* **98**, 1837 (1955).
 Mor73 J.M. Moran, G.D. Papadopoulos, B.F. Burke, K.Y. Lo, P.R.
 Schwartz, D.L. Thacker, K.J. Johnson, S.H. Knowles,
 A.C. Reisz and I.I. Shapiro, *Astrophys. J. (Letters)* **185**, 535
 (1973).
 Mor73a M. Morris, B. Zuckerman, P. Palmer, and B.E. Turner, *Astrophys. J.* **186**, 501 (1973).
 Mor75 M. Morris, W. Gilmore, P. Palmer, B.E. Turner, and B.
 Zuckerman, *Astrophys. J. (Letters)* **199**, L47 (1975).
 Mor76 M. Morris, B.E. Turner, P. Palmer, and B. Zuckerman, *Astrophys. J.* **205**, 82 (1976).
 Mor77 M. Morris, R.L. Snell, and P. Vanden Bout, *Astrophys. J.* **216**, 738 (1977).
 Mor85 M. Morimoto, M. Ohishi, and T. Kanzawa, *Astrophys. J. (Letters)* **288**, L11 (1985).
 Mun84 L.G. Mundy and R.B. Loren (see Lor84a).
 Mun84a L.G. Mundy (see Lor84a).
 Nys78 H.J. Nystrom, P. Palmer, and B. Zuckerman, *Bull. AAS* **10**,
 393 (1978).
 Olb85 M. Olberg, M. Bester, G. Rao, T. Pauls, G. Winnewisser,
 L.E.B. Johansson, and Å. Hjalmarson, *Astron. Astrophys.*
 142, L1 (1985).
 Olo84 H. Olofsson, *Astron. Astrophys.* **134**, 36 (1984).
 Pad80 R. Padman, R.E. Hills, N.J. Cronin, and W.B. Rose,
 M.N.R.A.S. **192**, 87p (1980).
 Pad82 R. Padman, P.F. Scott, and A.S. Webster, *M.N.R.A.S.* **200**,
 183 (1982).
 Pal69 P. Palmer, B. Zuckerman, D. Buhl, and L.E. Snyder, *Astrophys. J. (Letters)* **156**, L147 (1969).
 Pea76 E.F. Pearson, R.A. Creswell, M. Winnewisser, and G.
 Winnewisser, *Z. Naturforsch.* **31a**, 1394 (1976).
 Pea77 R. Pearson,Jr., and F.J. Lovas, *J. Chem. Phys.* **66**, 4149
 (1977).
 Pen74 A.A. Penzias, R.W. Wilson, and K.B. Jefferts, *Phys. Rev. Lett.* **32**, 701 (1974).
 Pen77 A.A. Penzias, P.G. Wannier, R.W. Wilson, and R.A. Linke,
 Astrophys. J. **211**, 108 (1977).
 Phi74 T.G. Phillips, K.B. Jefferts, and P.G. Wannier, *Astrophys. J. (Letters)* **192**, L153 (1974).
 Phi77 T.G. Phillips and P.J. Huggins, *Astrophys. J.* **211**, 798
 (1977).
 Phi77a T.G. Phillips, P.J. Huggins, G. Neugebauer, and M.W.
 Werner, *Astrophys. J. (Letters)* **217**, L161 (1977).
 Phi80 T.G. Phillips, J. Kwan, and P.J. Huggins, "Interstellar Molecules", ed. B.H. Andrew, (Dordrecht: D. Reidel p 21, 1980).
 Phi85 T.G. Phillips, G.A. Blake, J. Keene, R.C. Woods, and E.
 Churchwell, *Astrophys. J. (Letters)* **294**, L145 (1985).
 Pic78 H.M. Pickett and T.L. Boyd, *Chem. Phys. Lett.* **58**, 446
 (1978).
 Pic79 H.M. Pickett and J.H. Davis, *Astrophys. J.* **227**, 446 (1979).
 Pic81 H.M. Pickett, E.A. Cohen, D.B. Brinza, and M.M. Schaefer,
 J. Mol. Spectrosc. **89**, 542 (1981).
 Pla82 R.L. Plambeck and N.R. Erickson, *Astrophys. J.* **262**, 606
 (1982).
 Plu84 G.M. Plummer, E. Herbst, F.C. DeLucia, and G.A. Blake,
 Astrophys. J. Suppl. **55**, 633 (1984).
 Poy75 R.L. Poynter and R.K. Kakar, *Astrophys. J. Suppl.* **29**, 87
 (1975).
 Poy80 R.L. Poynter and H.M. Pickett, *JPL Pub.* 80-23, magnetic
 tape catalogue.
 Rad68 H.E. Radford, *Rev. Sci. Instrum.* **39**, 1687 (1968).
 Rad71 H.E. Radford, *Astrophys. J.* **174**, 207 (1972).
 Rib73 J.C. Ribes, J.G. Ables, P.D. Godfrey, and R.D. Brown,
 Aust. J. Phys. **26**, 79 (1973).
 Rob74 B.J. Robinson, J.W. Brooks, P.D. Godfrey, and R.D.
 Brown, *Aust. J. Phys.* **27**, 865 (1974).
 Rod80 L.F. Rodriguez and E.J. Chaisson, *M.N.R.A.S.* **192**, 651
 (1980).
 Ros58 B. Rosenblum, A.H. Nethercot, and C.H. Townes, *Phys. Rev.* **109**, 400 (1958).
 Rub71 R.H. Rubin, G.W. Swenson, Jr., R.C. Benson, H.L.
 Tigelaar, and W.H. Flygare, *Astrophys. J. (Letters)* **169**, L39
 (1971).
 Ryd74 O.E.H. Rydbeck, J. Elldér, W.M. Irvine, A. Sume, and Å.
 Hjalmarson, *Astron. Astrophys.* **34**, 479 (1974).
 Ryd76 O.E.H. Rydbeck, E. Kollberg, Å. Hjalmarson, A. Sume, J.
 Elldér, and W.M. Irvine, *Astrophys. J. Suppl.* **31**, 333 (1976).
 Ryd77 O.E.H. Rydbeck, A. Sume, Å. Hjalmarson, J. Elldér, B.O.
 Rönnäng, and E. Kollberg, *Astrophys. J. (Letters)* **215**, L35
 (1977).
 Ryd80 O.E.H. Rydbeck, W.M. Irvine, Å. Hjalmarson, G. Rydbeck,
 J. Elldér, and E. Kollberg, *Astrophys. J. (Letters)* **235**, L171
 (1980).
 Sah84 R. Sahai, A. Wootten, and R.E.S. Clegg, *Astrophys. J.* **284**,
 144 (1984).
 Sai72 S. Saito and K. Takagi, *Astrophys. J. (Letters)* **175**, L47
 (1972).
 Sas81 K.V.L.N. Sastry, P. Helminger, E. Herbst, and F.C.
 DeLucia, *Chem. Phys. Letters* **84**, 286 (1981).
 Sas81a K.V.L.N. Sastry, P. Helminger, A. Charo, E. Herbst, and
 F.C. DeLucia, *Astrophys. J. (Letters)* **251**, L119 (1981).

- Sas84 K.V.L.N. Sastry, R.M. Lees, and F.C. DeLucia, *J. Mol. Spectrosc.* **103**, 486 (1984).
- Say76 R.J. Saykally, P.G. Szanto, T.G. Anderson, and R.C. Woods, 31st Symposium on Molecular Spectroscopy, Columbus, Ohio (1976).
- Sca78 E. Scalise, Jr. and J.R.D. Lepine, *Astron. Astrophys.* **65**, L7 (1978).
- Sch81 F.P. Schloerb, R.L. Snell, W.D. Langer, and Y.S. Young, *Astrophys. J. (Letters)* **251**, L37 (1981).
- Sch82 P.R. Schwartz, B. Zuckerman, and J.M. Bologna, *Astrophys. J. (Letters)* **256**, L55 (1982).
- Sch83 F.P. Schloerb, P. Friberg, Å. Hjalmarson, B. Höglund, and W.M. Irvine, *Astrophys. J.* **264**, 161 (1983).
- Sch83a E. Schäfer and M. Winnewisser, *Ber. Bunsenges. Phys. Chem.* **87**, 327 (1983).
- Sch84 F.P. Schloerb and R.L. Snell, (private communication, 1984).
- Sch85 M.S. Schenewerk, P.R. Jewell, L.E. Snyder, L.W. Buxton, E.J. Campbell, and W.H. Flygare, *Astrophys. J.* **296**, 218 (1985).
- Sch85a M.S. Schenewerk, L.E. Snyder, and A. Hjalmarson, (private communication, 1985).
- Sch85b G.V. Schultz, E.J. Durwen, H.P. Roser, W.A. Sherwood, and R. Wattenbach, *Astrophys. J. (Letters)* **291**, L59 (1985).
- Sco78 N.Z. Scoville, and P.M. Solomon, *Astrophys. J. (Letters)* **220**, L103 (1978).
- Sin73 M.W. Sinclair, N. Fourikis, J.C. Ribes, B.J. Robinson, R.D. Brown, and P.D. Godfrey, *Aust. J. Phys.* **26**, 85 (1973).
- Ska83 D.D. Skatrud, F.C. DeLucia, G.A. Blake, and K.V.L.N. Sastry, *J. Mol. Spectrosc.* **99**, 35 (1983).
- Sne77 R.L. Snell and H.A. Wootten, *Astrophys. J. (Letters)* **216**, L111 (1977).
- Sne81 R.L. Snell, F.P. Schloerb, J.S. Young, Å. Hjalmarson, and P. Friberg, *Astrophys. J.* **244**, 45 (1981).
- Sne84 R.L. Snell, L.G. Mundy, P.F. Goldsmith, N.J. Evans, II., and N.R. Erickson, *Astrophys. J.* **276**, 625 (1984).
- Sne84a R.L. Snell, N.Z. Scoville, and F.P. Schloerb, (private communication, 1984).
- Sny69 L.E. Snyder, D. Buhl, B. Zuckerman, and P. Palmer, *Phys. Rev. Lett.* **22**, 679 (1969).
- Sny71 L.E. Snyder and D. Buhl, *Bull. AAS* **3**, 388 (1971).
- Sny72 L.E. Snyder and D. Buhl, (private communication, 1972).
- Sny73 L.E. Snyder and D. Buhl, *Nature Phys. Sci.* **243**, 45 (1973).
- Sny74 L.E. Snyder, D. Buhl, P.R. Schwartz, F.O. Clark, D.R. Johnson, F.J. Lovas, and P.T. Giguere, *Astrophys. J. (Letters)* **191**, L79 (1974).
- Sny74a L.E. Snyder and D. Buhl, *Astrophys. J. (Letters)* **189**, L31 (1974).
- Sny75 L.E. Snyder and D. Buhl, *Astrophys. J.* **197**, 329 (1975).
- Sny75a L.E. Snyder, J.M. Hollis, B.L. Ulich, F.J. Lovas, D.R. Johnson, and D. Buhl, *Astrophys. J. (Letters)* **198**, L81 (1975).
- Sny76 L.E. Snyder, J.M. Hollis, and B.L. Ulich, *Astrophys. J. (Letters)* **208**, L91 (1976).
- Sny76a L.E. Snyder, J.M. Hollis, F.J. Lovas, and B.L. Ulich, *Astrophys. J.* **209**, 67 (1976).
- Sny77 L.E. Snyder, J.M. Hollis, D. Buhl, and W.D. Watson, *Astrophys. J. (Letters)* **218**, L61 (1977).
- Sny77a L.E. Snyder, J.M. Hollis, and D. Buhl, *Astrophys. J. (Letters)* **215**, L87 (1977).
- Sny78 L.E. Snyder, D.F. Dickinson, L.W. Brown, and D. Buhl, *Astrophys. J.* **224**, 512 (1978).
- Sny79 L.E. Snyder and J.M. Hollis, (private communication, 1979).
- Sny80 L.E. Snyder, (private communication, 1980).
- Sny83 L.E. Snyder, J.M. Hollis, R.D. Suenram, F.J. Lovas, L.W. Brown, and D. Buhl, *Astrophys. J.* **268**, 123 (1983).
- Sny85 L.E. Snyder, C. Henkel, J.M. Hollis, and F.J. Lovas, *Astrophys. J. (Letters)* **290**, L29 (1985).
- Sny85a L.E. Snyder, M.S. Schenewerk, and J.M. Hollis, **298**, 360 (1985).
- Sny85b L.E. Snyder, T.L. Wilson, K.M. Menten, C.M. Walmsley, P.R. Jewell, J.M. Hollis, and F.J. Lovas, (manuscript in prep. 1985).
- Sol71 P.M. Solomon, K.B. Jefferts, A.A. Penzias, and R.W. Wilson, *Astrophys. J. (Letters)* **168**, L107 (1971).
- Sol73 P.M. Solomon, A.A. Penzias, K.B. Jefferts, and R.W. Wilson, *Astrophys. J. (Letters)* **185**, L63 (1973).
- Sta82 G.J. Stacey, N.T. Kurtz, S.D. Smyers, M. Harwit, R.W. Russell, and G. Melnick, *Astrophys. J. (Letters)* **257**, L37 (1982).
- Sto81 J.W.V. Storey, D.M. Watson, and C.H. Townes *Astrophys. J. (Letters)* **244**, L27 (1981).
- Sto81a J.W.V. Storey, D.M. Watson, C.H. Townes, E.E. Haller, and W.L. Hansen, *Astrophys. J.* **247**, 136 (1981).
- Sut85 E.C. Sutton, G.A. Blake, C.R. Masson, and T.G. Phillips, *Astrophys. J. Suppl.* **58**, 341 (1985).
- Suz84 H. Suzuki, N. Kaifu, T. Miyaji, M. Morimoto, M. Ohishi, and S. Saito, *Astrophys. J. (Letters)* **282**, 197 (1984).
- Suz84a H. Suzuki, M. Ohishi, M. Morimoto, N. Kaifu, P. Friberg, M.W. Irvine, H.E. Matthews, and S. Saito, "The Search for Extraterrestrial Life", ed. M. Papagiannis (Dordrecht: D. Reidel, 1984).
- Suz85 H. Suzuki, N. Kaifu, M. Ohishi, M. Morimoto, and T. Miyaji, (private communication, 1985).
- Tak59 H. Takuma, T. Schimizu, and K. Shimoda, *J. Phys. Soc. Japan* **14**, 1595 (1959).
- Tak73 K. Takagi and T. Kojima, *Astrophys. J. (Letters)* **181**, L91 (1973).
- ter72 J.J. ter Meulen and A. Dymanus, *Astrophys. J. (Letters)* **172**, L21 (1972).
- ter76 J.J. ter Meulen, W.L. Meerts, G.W.M. van Mierlo, and A. Dymanus, *Phys. Rev. Lett.* **36**, 1031 (1976).
- Tha70 D.L. Thacker, W.J. Wilson, and A.H. Barrett, *Astrophys. J. (Letters)* **161**, L191 (1970).
- Tha71 P. Thaddeus, R.W. Wilson, M. Kutner, A.A. Penzias, and K.B. Jefferts, *Astrophys. J. (Letters)* **168**, L59 (1971).
- Tha72 P. Thaddeus, M.L. Kutner, A.A. Penzias, R.W. Wilson, and K.B. Jefferts, *Astrophys. J. (Letters)* **176**, L73 (1972).
- Tha81 P. Thaddeus, M. Guélin, and R.A. Linke, *Astrophys. J. (Letters)* **246**, L41 (1981).
- Tha84 P. Thaddeus, S.E. Cummins, and R.A. Linke, *Astrophys. J. (Letters)* **283**, L45 (1984).
- Tha84a P. Thaddeus (see Lor84a).
- Tha85 P. Thaddeus, C.A. Gottlieb, Å. Hjalmarson, L.E.B. Johansson, W.M. Irvine, P. Friberg, and R.A. Linke, *Astrophys. J. (Letters)* **294**, L49 (1985).
- Tha85a P. Thaddeus, J.M. Vrtilek, and C.A. Gottlieb, *Astrophys. J. (Letters)* (1985).
- Tie76 E. Tiemann, *J. Phys. Chem. Ref. Data* **5**, 1147 (1976).
- Tol81 F. Tölle, H. Ungerechts, C.M. Walmsley, G. Winnewisser, and E. Churchwell, *Astron. Astrophys.* **95**, 143 (1981).
- Tow83 C.H. Townes, R. Genzel, D.M. Watson, and J.W.V. Storey, *Astrophys. J. (Letters)* **269**, L11 (1983).
- Tuc71 K.D. Tucker, G.R. Tomasevich, and P. Thaddeus, *Astrophys. J.* **169**, 429 (1971).
- Tuc78 K.D. Tucker, and M.L. Kutner, *Astrophys. J.* **222**, 859 (1978).
- Tur70 B.E. Turner, P. Palmer, and B. Zuckerman, *Astrophys. J. (Letters)* **160**, L125 (1970).
- Tur73 B.E. Turner, B. Zuckerman, P. Palmer, and M. Morris, *Astrophys. J.* **186**, 123 (1973).
- Tur75 B.E. Turner and R.H. Gammon, *Astrophys. J.* **198**, 71 (1975).
- Tur75a B.E. Turner, A.G. Kislyakov, H.S. Liszt, and N. Kaifu, *Astrophys. J. (Letters)* **201**, L149 (1975).
- Tur75b B.E. Turner, B. Zuckerman, N. Fourikis, M. Morris, and P. Palmer, *Astrophys. J. (Letters)* **198**, L125 (1975).
- Tur77 B.E. Turner, *Astrophys. J. (Letters)* **213**, L75 (1975).
- Tur78 B.E. Turner, B. Zuckerman, M. Morris, and P. Palmer, *Astrophys. J. (Letters)* **219**, L43 (1978).
- Tur78a B.E. Turner, (private communication, 1978).

- Tur75b B.E. Turner, B. Zuckerman, N. Fourikis, M. Morris, and P. Palmer, *Astrophys. J. (Letters)* **198**, L125 (1975).
- Tur77 B.E. Turner, *Astrophys. J. (Letters)* **213**, L75 (1975).
- Tur78 B.E. Turner, B. Zuckerman, M. Morris, and P. Palmer, *Astrophys. J. (Letters)* **219**, L43 (1978).
- Tur78a B.E. Turner, (private communication, 1978).
- Tur84 B.E. Turner and L.J. Rickard, *Astrophys. J.* (in preparation).
- Tur84a B.E. Turner and T.C. Steimle, (private communication, 1984).
- Uli76 B.L. Ulich and R.W. Haas, *Astrophys. J. Suppl.* **30**, 247 (1976).
- Uli77 B.L. Ulich, J.M. Hollis, and L.E. Snyder, *Astrophys. J. (Letters)* **217**, L105 (1977).
- Uli78 B.L. Ulich, (private communication, 1978).
- Van84 P. Vanden Bout (see Lor84a).
- Vrt85 J.M. Vrtilek, C.A. Gottlieb, W.D. Langer, P. Thaddeus, and R.W. Wilson *Astrophys. J. (Letters)* **296**, L35 (1985).
- Wal84 C.M. Walmsley, P.R. Jewell, L.E. Snyder, and G. Winnewisser, *Astron. Astrophys.* **134**, L11 (1984).
- Wan73 J.H.S. Wang, D.E. Oates, A. Ben-Reuven, and S.G. Kukolich, *J. Chem. Phys.* **59**, 5268 (1973).
- Wan76 P.G. Wannier, A.A. Penzias, R.A. Linke, and R.W. Wilson, *Astrophys. J.* **204**, 26 (1976).
- Wan78 P.G. Wannier and R.A. Linke, *Astrophys. J.* **226**, 817 (1978).
- Wat77 J.W. Waters, J.J. Gustinic, R.K. Kakar, T.B.H. Kuiper, P.N. Swanson, A.R. Kerr, and P. Thaddeus, *Bull. AAS* **9**, 564 (1977).
- Wat80 D.M. Watson, J.W.V. Storey, C.H. Townes, E.E. Haller, and W.L. Hansen, *Astrophys. J. (Letters)* **239**, L129 (1980).
- Wei63 S. Weinreb, A.A. Barrett, M.S. Meeks, and J.C. Henry, *Nature* **200**, 829 (1963).
- Wel70 W.J. Welch, *Bull. AAS* **2**, 355 (1970).
- Whi81 J.B. Whiteoak and F.F. Gardner, *M.N.R.A.S.* **197**, 39p (1981).
- Wil71 R.W. Wilson, A.A. Penzias, K.B. Jefferts, M. Kutner, and P. Thaddeus, *Astrophys. J. (Letters)* **167**, L97 (1971).
- Wil72 R.W. Wilson, A.A. Penzias, K.B. Jefferts, P. Thaddeus, and M.L. Kutner, *Astrophys. J. (Letters)* **176**, L77 (1972).
- Wil73 R.W. Wilson, A.A. Penzias, K.B. Jefferts, and P.M. Solomon, *Astrophys. J. (Letters)* **179**, L107 (1973).
- Wil76 W.J. Wilson and R. Kakar, (private communication, 1976).
- Wil76a R.W. Wilson, A.A. Penzias, P.G. Wannier, and R. Linke, *Astrophys. J. (Letters)* **204**, L135 (1976).
- Wil76b T.L. Wilson, J. Biegling, D. Downes, and F.F. Gardner, *Astron. Astrophys.* **51**, 303 (1976).
- Wil79 T.L. Wilson and T. Pauls, *Astron. Astrophys.* **73**, L10 (1979).
- Wil80 E. Willemot, D. Dangoisse, W. Mannanteuil, and J. Bellet, *J. Phys. Chem. Ref. Data* **9**, 59 (1980).
- Wil81 W.J. Wilson and L.E. Snyder, *Astrophys. J.* **246**, 86 (1981).
- Wil81a D.R. Williams and F.F. Gardner, *Pub. Astron. Soc. Proc.* **93**, 82 (1981).
- Wil84 T.L. Wilson, C.M. Walmsley, L.E. Snyder, and P.R. Jewell, *Astron. Astrophys.* **134**, L7 (1984).
- Wil85 T.L. Wilson, C.M. Walmsley, K.M. Menten, and W. Hermsen, *Astron. Astrophys.* **147**, L19 (1985).
- Win75 G. Winnewisser and E. Churchwell, *Astrophys. J. (Letters)* **200**, L33 (1975).
- Win76 G. Winnewisser and F.F. Gardner, *Astron. Astrophys.* **48**, 159 (1976).
- Win78 A. Winnberg, C.M. Walmsley, and E. Churchwell, *Astron. Astrophys.* **66**, 431 (1978).
- Woo82 A. Wootten, S.M. Lichten, R. Sahai, and P.G. Wannier, *Astrophys. J.* **257**, 151 (1982).
- Woo83 R.C. Woods, C.S. Gudeman, R.L. Dickman, P.F. Goldsmith, G.R. Huguenin, W.M. Irvine, Å. Hjalmarson, L. Nyman, and H. Olofsson, *Astrophys. J.* **270**, 583 (1983).
- Woo84 A. Wootten, R.B. Loren, and J. Bally, *Astrophys. J.* **277**, 189 (1984).
- Woo84a A. Wootten (see Lor84a).
- Yam79 K. Yamada, M. Winnewisser, G. Winnewisser, L.B. Szalanski, and M.C.L. Gerry, *J. Mol. Spectrosc.* **78**, 189 (1979).
- Ziu81 L.M. Ziurys, R.N. Martin, T.A. Pauls, and T.L. Wilson, *Astron. Astrophys.* **104**, 288 (1981).
- Ziu82 L.M. Ziurys, R.J. Saykally, R.L. Plambeck, and N.R. Erickson, *Astrophys. J.* **254**, 94 (1982).
- Ziu84 L.M. Ziurys, D.P. Clemens, R.J. Saykally, M. Calvin, and H.F. Schaefer, *Astrophys. J.* **281**, 219 (1984).
- Ziu85 L.M. Ziurys and B.E. Turner, *Astrophys. J. (Letters)* **292**, L25 (1985).
- Ziu85a L.M. Ziurys and B.E. Turner, (private communication, 1985).
- Zuc68 B. Zuckerman, P. Palmer, H. Penfield, and A.E. Lilley, *Astrophys. J. (Letters)* **153**, L69 (1968).
- Zuc69 B. Zuckerman, P. Palmer, L.E. Snyder, and D. Buhl, *Astrophys. J. (Letters)* **157**, L167 (1969).
- Zuc71 B. Zuckerman, J.A. Ball, and C.A. Gottlieb, *Astrophys. J. (Letters)* **163**, L41 (1971).
- Zuc72 B. Zuckerman, B.E. Turner, D.R. Johnson, P. Palmer, and M. Morris, *Astrophys. J.* **177**, 601 (1972).
- Zuc72a B. Zuckerman, J.L. Yen, C.A. Gottlieb, and P. Palmer, *Astrophys. J.* **177**, 59 (1972).
- Zuc75 B. Zuckerman, B.E. Turner, D.R. Johnson, F.O. Clark, F.J. Lovas, N. Fourikis, A.E. Lilley, J.A. Ball, C.A. Gottlieb, M.M. Litvak, and H. Penfield, *Astrophys. J. (Letters)* **196**, L99 (1975).

TABLE 3. List of telescope abbreviations employed in Table 2

| Abbreviation | Name location |
|------------------------|--|
| ARO 46 m..... | Algonquin Radio Observatory Lake Traverse Ontario, Canada |
| Arecibo 350 m..... | Arecibo Observatory Puerto Rico |
| BTL 7 m..... | Bell Telephone Laboratory Holmdel, New Jersey |
| FCRAO 14 m..... | Five College Radio Astronomy Observatory Massachusetts |
| Hale 5 m..... | Hale Telescope Mount Palomar, California |
| IRTF 3 m..... | Infrared Telescope Facility Mauna Kea, Hawaii |
| IRT 13.7 m..... | Itapetinga Radio Telescope Sao Paulo, Brazil |
| KAO 1 m..... | G. P. Kuiper Airborne Observatory |
| MMT | Multiple Mirror Telescope Mt. Lemmon, Arizona |
| MMWO 4.9 m..... | McDonald Millimeter Wave Observatory Fort Davis, Texas |
| MPI 100 m..... | Max-Planck-Institut fur Radioastronomie Effelsberg, Germany |
| NEROC 37 m (120 ft)... | Northeast Radio Observatory Corporation Haystack Observatory Westford, Massachusetts |
| NRAO 11 m (36 ft).... | National Radio Astronomy Observatory Kitt Peak, Arizona |
| NRAO 43 m (140 ft).... | National Radio Astronomy Observatory Greenbank, West Virginia |
| NRL 26 m (85 ft).... | Naval Research Laboratory Maryland Point Observatory, Maryland |
| NRO 45 m..... | Nobeyama Radio Observatory University of Tokyo Nobeyama, Japan |
| OSO 26.6 m..... | Onsala Space Observatory Onsala, Sweden |
| OSO 20 m..... | Onsala Space Observatory Onsala, Sweden |
| OVRO 10.4 m..... | Owens Valley Radio Observatory Owens Valley, California |
| Parkes 64 m..... | Division of Radiophysics CSIRO Parkes, Australia |
| SRCAL 25 m..... | SRC Appleton Laboratory Chilbolton Observatory Stockbridge, Hants, England |
| TAO 6 m..... | Tokyo Astronomical Observatory Tokyo, Japan |
| UKIRT 3.8 m..... | UK Infrared Telescope Mauna Kea, Hawaii |
| UM/UCSD 1.5 m..... | University of Minnesota/UCSD 60 in Mt. Lemmon, Arizona |