Microwave spectra of molecules of astrophysical interest XII. Hydroxyl radical

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Microwave Spectra of Molecules of Astrophysical Interest

XII. Hydroxyl Radical

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The available data on the microwave spectrum of the hydroxyl radical are critically reviewed for information applicable to radio astronomy. Molecular properties such as the rotational constants, spin-orbit, spin-spin and hyperfine coupling constants and centrifugal distortion parameters employed in or derived from the analysis are tabulated. All the observed and predicted transitions of ^{16}OH, ^{16}OD, and ^{18}OH below 300 GHz and lower state energy levels less than 4000 cm^{-1} are presented for the ground vibrational state. The laboratory data on ^{17}OH is included, but no predicted transitions are presented due to the limited data available. In addition to the transition frequencies the table contains the calculated line strengths and energies of the levels involved in the transition. An extensive bibliography of laboratory and astronomical studies of the hydroxyl radical is presented as an aid to workers in both fields.

Key words: Hydroxyl radical; interstellar molecules; line strengths; microwave spectra; molecular properties; radio astronomy.

Contents

1. Introduction

This study is one in a series of critical reviews of the available literature on the microwave spectra of molecules of interest in radio astronomy. The tables include a refitting of the spectra of OH and OD to all the available data. Though little data are available on ^{18}OH most of the molecular parameters could be estimated by isotopic scaling of the known parameters in ^{16}OH and ^{16}OD. The few most critical molecular parameters were then fit to the observed transitions. The data available on ^{17}OH are also included, but no attempt has been made to fit molecular parameters since very little experimental data are available; however, the observed transitions have been included. All the observed and predicted transitions of ^{16}OH, ^{16}OD, and ^{18}OH below 300 GHz are listed for the lowest vibrational state. Since OH has been observed in stars, a 4000 cm^{-1} limit was set on the lower energy level.

In order to prevent transcription errors, the tables of spectra have been directly reproduced from the computer printouts. The literature has been searched up to September 1976 for both laboratory and astrophysical data relating to OH. The bibliography is more voluminous than those of prior studies, but it was felt that a complete bibliography was advantageous to all workers in the field.

1.1. Molecular Parameter Tables

The theory of the rotational spectrum of $^2\Pi$ molecules has been described in the literature. Unlike the customary microwave absorption resulting from pure rotational transitions the OH spectra originate from transitions between the lambda doublets. The bulk of the theoretical studies on both NO and OH are pertinent to $^2\Pi$ molecules. The theory as applied to OH was first presented by Dousmanis, Sanders, and Townes [1].[1] While these workers solved the Hamiltonian by perturbation theory, we have numerically diagonalized the 3 × 3 matrices containing the $^2\Pi_{3/2}$, $^2\Pi_{1/2}$, and $^2\Sigma_{1/2}$ states.

Rather than using the method of Meerts and Dymanus [2] or Mizushima [3] to obtain more precise fits, we have depended on the expansion of the number of molecular parameters by including centrifugal distortion constants. We felt that such an approach is physically more meaningful though it is more intuitive.

The hyperfine structure of $^2\Pi$ molecules was first treated by Frosch and Foley [4]. A more general treatment can be obtained by using Freed's method [5]. It was found impossible to fit all hyperfine structures to a set of parameters originating from the magnetic interactions unless a centrifugal distortion effect in the d term and a nuclear spin rotational term were invoked [6]. Second order hyperfine interactions could not account for these deviations. The Hamiltonian which was finally used is:

$$\mathcal{H} = \mathcal{H}_\lambda + \mathcal{H}_{hf}$$

$$\mathcal{H}_\lambda = A\, L_z \cdot S_z + B(\mathbf{J} - \mathbf{L} - \mathbf{S})^2$$

$$\mathcal{H}_{hf} = a\mathbf{I}\cdot\mathbf{L} + (b+c)\, I_z S_z + \tfrac{1}{2} b\,(I_+ S_- + I_- S_+) + \tfrac{1}{2} d'(e^{2i\Phi} I_- S_- + e^{-2i\Phi} I_+ S_+) + C(\mathbf{I}\cdot\mathbf{J}).$$

where the following centrifugal distortion terms are defined,

$$A = A_0 - D_A J(J+1)$$

$$B_{\Pi} = B_{\Pi 0} - D_{\Pi B} J(J+1)$$

$$B_\Sigma = B_{\Sigma 0} - D_{\Sigma B} J(J+1)$$

$$\langle AL_y\rangle = \langle \Sigma|AL_y|\Pi\rangle = \langle AL_y\rangle_0 - D_\alpha J(J+1) + D_{\alpha\alpha} J^2(J+1)^2$$

$$\langle BL_y\rangle = \langle \Sigma|BL_y|\Sigma\rangle = \langle BL_y\rangle_0 - D_\beta J(J+1) + D_{\beta\beta} J^2(J+1)^2$$

$$d' = d - d_J(J+\tfrac{1}{2})^2.$$

For ^{16}OD, the additional electric quadrupole term, $\mathcal{H}_{eq} = -\mathbf{Q}\cdot\nabla\mathbf{E}$ was added [7].

The parameters were fit by a least squares program which also gave the standard deviations in the parameters and calculated lines [8]. The experimental data were weighted inversely by the square of the reported experimental errors. The molecular parameters resulting in the best fits for ^{16}OH and ^{16}OD are given in table I. The parameters which were held fixed are indicated. The calculated frequencies were found to be insensitive to these parameters. The values employed were obtained by M. Geller [6] from a refit of the optical data [9,10]. These tables contain the standard deviations of the parameters derived from the least square fitting procedure. The estimated error for any confidence level can be calculated by the usual techniques by assuming a student's t distribution [11,12]. However, as many digits as necessary to reproduce the observed frequencies to within experimental uncertainties have been kept, though we realize that these numbers are not significant according to the standard deviations. Also, table I contains the parameters for ^{18}OH which were obtained by isotopic scaling of most of the parameters and fitting the five most sensitivie parameters, A_0, $\langle AL_y\rangle$, $\langle BL_y\rangle$, a, and d to the observed transitions. Such a procedure is necessary since very few transitions have been observed.

1.2. Microwave Spectral Tables

The OH spectra observed in the microwave region originate from transitions between the even and odd components of the lambda doublets in the ground $^2\Pi$ state. The J quantum number is identical for the two levels. The electronic states involved are the ground $^2\Pi_{3/2}$ and $^2\Pi_{1/2}$ and the lowest excited $^2\Sigma_{1/2}$ state. The two Π states are essentially split about 140 cm^{-1} by the spin orbit coupling in a Hund's case (a) approximation. Though the molecules are very light, the $\Omega = 3/2$ and $\Omega = 1/2$ states are significantly mixed by the rotational terms and the actual levels are intermediate between case (a) and case (b). The high J levels approach Hund's pure case (b).

Interaction of the Π state with the excited Σ level through the $\langle\Sigma|AL_y|\Pi\rangle$ or $\langle\Sigma|BL_y|\Pi\rangle$ terms affects the even and odd levels differently to split the lambda degeneracy. Hence the energy levels are best calculated by directly diagonalizing the 3×3 matrix for the even or odd symmetry levels of the $^2\Pi_{1/2}$, $^2\Pi_{3/2}$, and $^2\Sigma_{1/2}$ levels for each J value.

The nuclear spin of hydrogen interacts with the electronic angular momentum through a magnetic interaction. With deuterium, there is also a nuclear quadrupole interaction. The F quantum number is the vector sum of $\mathbf{I} + \mathbf{J}$. The two levels are characterized only as upper or lower to avoid confusion about the meaning of the even and odd levels of the lambda doublet.

Tables II, III, and IV contain both observed and calculated microwave transitions in ^{16}OH, ^{16}OD, and ^{18}OH, respectively. Table V contains only the observed transitions of ^{17}OH. The uncertainties given for the observed frequencies are quoted from the original

sources. Those given for the calculated frequencies were derived from the variance-covariance matrix of the least square fit [8,11].

The energy levels of the upper and lower states involved in each transition are also given. However, note that the lowest level is not zero but has a negative value due to the spin orbit coupling term.

The line strengths given in the tables were obtained by calculating the dipole moment matrix in the diagonal representation which is intermediate between Hund's case (a) and (b). The line strength given is defined in the normal way as

$$S(J',J'') = \frac{(2J''+1)}{|\mu|^2} \sum_{m',m'',G} |(F'J'M'|\mu_{Gz}|F''J''M'')|^2.$$

The relative intensities of the hyperfine elements have been included in the strengths. The treatment of these strengths have been described extensively [13].

Calculated transitions with energy levels above 4000 cm^{-1} or frequencies above 300,000 MHz are not included.

1.3. List of Symbols and Conversion Factors

a. Symbols

A_0	Spin orbit coupling constant (MHz).
B_Σ	Rotational constant of Σ state.
B_Π	Rotational constant of π state.
$D_{\Pi B}$	Centrifugal distortion correction to B_Π.
$D_{\Sigma B}$	Centrifugal distortion correction to B_Σ.
$\langle\Sigma\|BL_y\|\Pi\rangle \equiv \langle BL_y\rangle$	Off diagonal matrix element contributing to the lambda doubling.
$\langle\Sigma\|AL_y\|\Pi\rangle \equiv \langle AL_y\rangle$	Off diagonal matrix element contributing to the lambda doubling.
D_α, $D_{\alpha\alpha}$	Centrifugal distortion corrections to $\langle AL_y\rangle$.
D_β, $D_{\beta\beta}$	Centrifugal distortion corrections to $\langle BL_y\rangle$.
D_A	Quadratic centrifugal distortion correction to A.
E_Σ	Zero point energy difference between Π and Σ electronic states.
a, b, c, d	Electron spin-nuclear spin hyperfine coupling constants.
d_J	Centrifugal distortion correction to the hyperfine coupling constant d.
C_{SR}	Nuclear spin-rotation coupling constant.
F	Total angular momentum quantum number including spin, $F = I + J$.
I	Nuclear spin.
J	Total angular momentum quantum number excluding spin, $J = L + S$.
Ω	Component of the J angular momentum quantum number about the internuclear axis.
eq Q_1, eq Q_2	Nuclear electric quadrupole coupling constants for D cf. ref. 7 for discussion of these terms.
μ	Electric dipole moment.

b. Conversion Factors

$$B(\text{MHz}) = \frac{5.05376 \times 10^5}{I(\text{amu}\cdot\text{Å}^2)}$$

$$\nu(\text{MHz}) = 29979.25\ \lambda^{-1}\ (\text{cm}^{-1})$$

1.4. Acknowledgements

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[1] Figures in brackets indicate literature references in section 1.5.

2. Hydroxyl Spectral Tables

TABLE I. Molecular Parameters of ^{16}OH, ^{16}OD, and ^{18}OH.[a]

Part A: Microwave Parameters of ^{16}OH, ^{16}OD, and ^{18}OH.

	^{16}OH		^{16}OD		^{18}OH	
E_Σ	979,826,000[b]		979,747,400[b]		979,826,000[b]	
B_Σ	507,471.7[b]		270,817.0[b]		504,122.4[b]	
B_Π	556,140.9[b]		296,312.0[b]		552,470.4[b]	
A	-4,157,663.076	± 450	-4,165,275.463	± 2300	-4,157,071.476	± 26
$\langle BL_y \rangle$	376,653.4542	± 24	200,437.6893	± 79	374,164.503	± 1.1
$\langle (A+2B)L_y \rangle$	-1,534,291.918	± 97	-1,892,097.323	± 751	-1,539,412.716	± 4.6
$D_{\Pi B}$	58.3519[b]		16.1417[b]		57.584	
$D_{\Sigma B}$	61.4491[b]		17.2636[b]		60.641	
D_α	202.6695	± 0.091	27.0824	± 0.20	200.53	
D_β	80.87536	± 0.021	22.71912	± 0.018	79.4438	
$D_{\alpha\alpha}$	0.01638	± 0.0011	.0053539	± 0.0031	0.0141	
$D_{\beta\beta}$	0.0067654	± 0.0019	.0010828	± 0.000086	0.00630	
D	-291.7691	± 21	112.4132	± 37	-288.51	
a	86.1118	± 0.0033	13.3051	± 0.00050	86.1248	± 0.0020
b	-116.2806	± 0.016	-17.8648	± 0.011	-116.281	
c	130.2212	± 0.019	20.1375	± 0.011	130.22	
d	56.6550	± 0.0036	8.7698	± 0.00046	56.6664	± 0.0075
d_J	0.022815	± 0.00020	0.0020301	± 0.00017	0.02255	
C_{SR}	-0.099647	± 0.00079	-0.0080742	± 0.00022	-0.09929	
eq Q_1			0.28496	± 0.0011		
eq Q_2			-0.11889	± 0.0042		

a. All units are MHz unless otherwise noted. As many digits have been kept as are necessary to reproduce the observed frequencies within the range of the experimental measurements. The unfitted molecular parameters of ^{18}OH were obtained by isotopic scaling of the parameters of ^{16}OH.

b. Obtained from M. Geller who has made a new fit of the optical data.

TABLE I. Molecular Parameters of ^{16}OH, ^{16}OD, and ^{18}OH (continued).

Part B: Other Parameters

	Electronic State	Vibrational State, v	Parameter			Ref.
OH	$^2\Pi_{1/2}$	0	μ = 1.721	± 0.029	D	71H
			μ = 1.732	± 0.02	D	65A
			μ = 1.66758	± 0.00010	D	73G
		1	μ = 1.657	± 0.05	D	71H
			μ = 1.667	± 0.04	D	65A
		2	μ = 1.637	± 0.045	D	71H
	$^2\Pi_{3/2}$	0	μ = 1.66	± 0.01	D	65B
	$^2\Sigma^+$	0	μ = 1.977	± 0.084	D	71H
		1	μ = 2.22	± 0.44	D	71H
OD	$^2\Pi_{1/2}$	0	μ = 1.695	± 0.032	D	71H
			μ = 1.65312	± 0.00014	D	73G
		1	μ = 1.646	± 0.023	D	71H
		2	μ = 1.567	± 0.061	D	71H
	$^2\Sigma^+$	0	μ = 1.72	± 0.10	D	73J
			μ = 2.159	± 0.076	D	71H
		0	eq Q = 0.18	± 0.10	MHz	76H

TABLE II. MICROWAVE SPECTRUM OF ^{16}OH IN THE GROUND VIBRATIONAL STATE. FREQUENCIES ARE IN MHz; ENERGY LEVELS IN cm^{-1}.

$^2\Pi_{1/2}$

J	F U	F L	OBSERVED FREQUENCY	EST. UNCERT.	CALCULATED FREQUENCY	EST. UNCERT.	LINE STRENGTH	ENERGY LEVELS UPPER	ENERGY LEVELS LOWER	REF
.5	0	1	4660.2420(	.0030)	4660.2425(	.0030)	.1667	87.8650	87.7096	68C
.5	1	1	4750.6560(	.0030)	4750.6586(	.0020)	.3333	87.8680	87.7096	68C
.5	1	0	4765.5620(	.0030)	4765.5646(	.0030)	.1667	87.8680	87.7091	68C
1.5	1	2	7749.9090(	.0050)	7749.9126(	.0022)	.0188	149.1817	148.9232	70A
1.5	1	1	7761.7470(	.0050)	7761.7455(	.0022)	.0938	149.1817	148.9228	70A
1.5	2	2	7820.1250(	.0050)	7820.1233(	.0026)	.1689	149.1841	148.9232	70A
1.5	2	1	7831.9620(	.0050)	7831.9562(	.0021)	.0188	149.1841	148.9228	70A
2.5	2	3	8118.0510(	.0050)	8118.0566(	.0021)	.0062	250.5030	250.2322	75E
2.5	2	2	8135.8700(	.0050)	8135.8668(	.0019)	.0869	250.5030	250.2316	75F
2.5	3	3	8189.5870(	.0050)	8189.5846(	.0025)	.1242	250.5054	250.2322	75F
2.5	3	2	8207.4020(	.0050)	8207.3949(	.0021)	.0062	250.5054	250.2316	75F
3.5	3	4	5449.4360(	.0050)	5449.4437(	.0017)	.0030	390.9765	390.7947	75F
3.5	3	3	5473.0450(	.0050)	5473.0391(	.0016)	.0806	390.9765	390.7939	75F
3.5	4	4	5523.4380(	.0050)	5523.4428(	.0018)	.1045	390.9790	390.7947	75F
3.5	4	3	5547.0420(	.0050)	5547.0382(	.0017)	.0030	390.9790	390.7939	75F
4.5	5	4	192.9957(	.0005)	192.9960(	.0011)	.0017	569.8040	569.7976	73G
4.5	4	4	164.7960(	.0005)	164.7960(	.0011)	.0757	569.8031	569.7976	73G
4.5	5	5	117.1495(	.0005)	117.1498(	.0011)	.0930	569.8040	569.8001	73G
4.5	4	5	88.9504(	.0005)	88.9498(	.0011)	.0017	569.8031	569.8001	73G

TABLE II. MICROWAVE SPECTRUM OF ^{16}OH IN THE GROUND VIBRATIONAL STATE (CONTINUED).

$^2\Pi_{1/2}$

J	F U	F L	OBSERVED FREQUENCY	EST. UNCERT.	CALCULATED FREQUENCY	EST. UNCERT.	LINE STRENGTH	ENERGY LEVELS UPPER	ENERGY LEVELS LOWER	REF.
5.5	6	5			8611.8226(	.0041)	.0011	786.5529	786.2656	
5.5	5	5	8580.1370(	.0300)	8580.1381(	.0043)	.0717	786.5518	786.2656	74E
5.5	6	6	8534.8340(	.0300)	8534.8417(	.0041)	.0849	786.5529	786.2682	74E
5.5	5	6			8503.1572(	.0042)	.0011	786.5518	786.2682	
6.5	7	6			19596.1878(	.0118)	.0008	1040.4230	1039.7693	
6.5	6	6	19561.8970(	.0200)	19561.8927(	.0122)	.0680	1040.4219	1039.7693	75B
6.5	7	7	19518.6120(	.0100)	19518.6138(	.0116)	.0786	1040.4230	1039.7719	75B
6.5	6	7			19484.3187(	.0118)	.0008	1040.4219	1039.7719	
7.5	8	7			32957.5144(	.0400)	.0005	1330.8533	1329.7539	
7.5	7	7			32921.2508(	.0404)	.0646	1330.8521	1329.7539	
7.5	8	8			32879.7200(	.0395)	.0732	1330.8533	1329.7565	
7.5	7	8			32843.4564(	.0398)	.0005	1330.8521	1329.7565	
8.5	9	8			48531.5445(	.1282)	.0004	1657.3090	1655.6902	
8.5	8	8			48493.7757(	.1285)	.0614	1657.3078	1655.6902	
8.5	9	9			48453.7778(	.1277)	.0686	1657.3090	1655.6928	
8.5	8	9			48416.0090(	.1280)	.0004	1657.3078	1655.6928	
9.5	10	9			66171.5981(	.3365)	.0003	2019.2591	2017.0518	
9.5	9	9			66132.6578(	.3368)	.0584	2019.2578	2017.0518	
9.5	10	10			66094.0228(	.3360)	.0646	2019.2591	2017.0544	
9.5	9	10			66055.0824(	.3362)	.0003	2019.2578	2017.0544	
10.5	11	10			85741.5315(	.7544)	.0002	2416.1600	2413.3000	

TABLE II. MICROWAVE SPECTRUM OF ^{16}OH IN THE GROUND VIBRATIONAL STATE (CONTINUED).

$^2\Pi_{1/2}$

J	F U	F L	OBSERVED FREQUENCY	EST. UNCERT.	CALCULATED FREQUENCY	EST. UNCERT.	LINE STRENGTH	ENERGY LEVELS UPPER	LOWER	REF.
10.5	10	10			85701.6614(	.7546)	.0556	2416.1587	2413.3000	
10.5	11	11			85664.2553(	.7538)	.0609	2416.1600	2413.3025	
10.5	10	11			85624.3851(	.7540)	.0002	2416.1587	2413.3025	
11.5	12	11			107110.4289(	1.5088)	.0002	2847.4454	2843.8726	
11.5	11	11			107069.8054(	1.5090)	.0530	2847.4440	2843.8726	
11.5	12	12			107033.5233(	1.5082)	.0576	2847.4454	2843.8751	
11.5	11	12			106992.8998(	1.5084)	.0002	2847.4440	2843.8751	
12.5	13	12			130149.0583(	2.7716)	.0002	3312.5186	3308.1773	
12.5	12	12			130107.8114(	2.7717)	.0506	3312.5172	3308.1773	
12.5	13	13			130072.5709(	2.7709)	.0547	3312.5186	3308.1798	
12.5	12	13			130031.3239(	2.7711)	.0002	3312.5172	3308.1798	
13.5	14	13			154727.6763(	4.7670)	.0001	3810.7479	3805.5868	
13.5	13	13			154685.9021(	4.7672)	.0484	3810.7465	3805.5868	
13.5	14	14			154651.6393(	4.7664)	.0520	3810.7479	3805.5893	
13.5	13	14			154609.8651(	4.7665)	.0001	3810.7465	3805.5893	

TABLE II. MICROWAVE SPECTRUM OF ^{16}OH IN THE GROUND VIBRATIONAL STATE (CONTINUED).

$^2\Pi_{3/2}$

J	F U	F L	OBSERVED FREQUENCY	EST. UNCERT.	CALCULATED FREQUENCY	EST. UNCERT.	LINE STRENGTH	ENERGY LEVELS UPPER	ENERGY LEVELS LOWER	REF.
1.5	1	2	1612.2310(	.0002)	1612.2309(	.0002)	.1440	-37.9806	-38.0344	72F
1.5	1	1	1665.4018(	.0002)	1665.4019(	.0002)	.7198	-37.9806	-38.0362	72F
1.5	2	2	1667.3590(	.0002)	1667.3590(	.0002)	1.2956	-37.9788	-38.0344	72F
1.5	2	1	1720.5300(	.0002)	1720.5299(	.0002)	.1440	-37.9788	-38.0362	72F
2.5	2	3	6016.7460(	.0050)	6016.7471(	.0030)	.0389	45.8655	45.6648	68C
2.5	2	2	6030.7470(	.0050)	6030.7454(	.0009)	.5446	45.8655	45.6643	75F
2.5	3	3	6035.0920(	.0050)	6035.0902(	.0010)	.7780	45.8661	45.6648	75F
2.5	3	2	6049.0840(	.0080)	6049.0886(	.0031)	.0389	45.8661	45.6643	68C
3.5	3	4	13442.0300(	.0250)	13442.1048(	.0053)	.0153	164.2682	163.8198	75C
3.5	3	3	13434.5960(	.0100)	13434.6299(	.0020)	.4121	164.2682	163.8201	75C
3.5	4	4	13441.3650(	.0100)	13441.4095(	.0022)	.5342	164.2682	163.8198	75C
3.5	4	3	13433.9300(	.0250)	13433.9347(	.0054)	.0153	164.2682	163.8201	75C
4.5	4	5	23838.9330(	.0100)	23838.9348(	.0068)	.0073	317.7067	316.9115	75B
4.5	4	4	23817.6150(	.0020)	23817.6136(	.0022)	.3227	317.7067	316.9122	75F
4.5	5	5	23826.6210(	.0030)	23826.6181(	.0026)	.3960	317.7063	316.9115	75F
4.5	5	4	23805.2970(	.0100)	23805.2969(	.0069)	.0073	317.7063	316.9122	75B
5.5	5	6	37014.4200(	.0300)	37014.4143(	.0099)	.0040	506.4629	505.2282	75B
5.5	5	5	36983.4700(	.0300)	36983.4967(	.0060)	.2609	506.4629	505.2293	68B
5.5	6	6	36994.4300(	.0500)	36994.4235(	.0062)	.3091	506.4622	505.2282	68B
5.5	6	5	36963.4800(	.0300)	36963.5059(	.0097)	.0040	506.4622	505.2293	75B
6.5	6	7	52759.8900(	.0300)	52759.9254(	.0149)	.0024	730.6361	728.8762	75B

TABLE II. MICROWAVE SPECTRUM OF ^{16}OH IN THE GROUND VIBRATIONAL STATE (CONTINUED).

$^2\Pi_{3/2}$ J	F U	F L	OBSERVED FREQUENCY	EST. UNCERT.	CALCULATED FREQUENCY	EST. UNCERT.	LINE STRENGTH	ENERGY LEVELS UPPER	LOWER	REF
6.5	6	6	52722.0400(	.0200)	52722.0551(	.0119)	.2167	730.6361	728.8775	75B
6.5	7	7	52734.5600(	.0200)	52734.5968(	.0119)	.2504	730.6352	728.8762	75B
6.5	7	6	52696.7200(	.0300)	52696.7265(	.0146)	.0024	730.6352	728.8775	75A
7.5	7	8			70888.1237(	.0188)	.0015	990.1761	987.8115	
7.5	7	7	70845.0810(	.0200)	70845.0478(	.0161)	.1841	990.1761	987.8129	75B
7.5	8	8	70858.9300(	.0200)	70858.9265(	.0160)	.2088	990.1751	987.8115	75B
7.5	8	7			70815.8507(	.0187)	.0015	990.1751	987.8129	
8.5	8	9			91235.3968(	.0689)	.0010	1284.9139	1281.8706	
8.5	8	8	91188.2600(	.1000)	91188.3190(	.0683)	.1592	1284.9139	1281.8722	76B
8.5	9	9	91203.2200(	.1000)	91203.2955(	.0682)	.1781	1284.9128	1281.8706	76B
8.5	9	8			91156.2177(	.0693)	.0010	1284.9128	1281.8722	
9.5	9	10			113655.2643(	.2285)	.0007	1614.5845	1610.7934	
9.5	9	9			113605.0416(	.2284)	.1398	1614.5845	1610.7951	
9.5	10	10			113620.9136(	.2284)	.1546	1614.5834	1610.7934	
9.5	10	9			113570.6909(	.2290)	.0007	1614.5834	1610.7951	
10.5	10	11			138011.3849(	.5756)	.0005	1978.8423	1974.2387	
10.5	10	10			137958.6451(	.5757)	.1244	1978.8423	1974.2405	
10.5	11	11			137975.2416(	.5757)	.1363	1978.8411	1974.2387	
10.5	11	10			137922.5018(	.5761)	.0005	1978.8411	1974.2405	
11.5	11	12			164172.2623(	1.2294)	.0004	2377.2717	2371.7955	
11.5	11	11			164117.4767(	1.2296)	.1118	2377.2717	2371.7973	

TABLE II. MICROWAVE SPECTRUM OF ^{16}OH IN THE GROUND VIBRATIONAL STATE (CONTINUED).

$^2\Pi_{3/2}$

J	F U	F L	OBSERVED FREQUENCY	EST. UNCERT.	CALCULATED FREQUENCY	EST. UNCERT.	LINE STRENGTH	ENERGY LEVELS UPPER	LOWER	REF.
11.5	12	12			164134.6529(	1.2297)	.1216	2377.2705	2371.7955	
11.5	12	11			164079.8673(	1.2300)	.0004	2377.2705	2371.7973	
12.5	12	13			192007.7002(	2.3541)	.0003	2809.3942	2802.9895	
12.5	12	12			191951.2304(	2.3544)	.1014	2809.3942	2802.9914	
12.5	13	13			191968.8627(	2.3544)	.1095	2809.3929	2802.9895	
12.5	13	12			191912.3930(	2.3548)	.0003	2809.3929	2802.9914	
13.5	13	14			221386.6022(	4.1660)	.0002	3274.6731	3267.2884	
13.5	13	13			221328.7314(	4.1663)	.0927	3274.6731	3267.2904	
13.5	14	14			221346.7130(	4.1663)	.0996	3274.6718	3267.2884	
13.5	14	13			221288.8422(	4.1667)	.0002	3274.6718	3267.2904	
14.5	14	15			252175.7150(	6.9421)	.0002	3772.5167	3764.1050	
14.5	14	14			252116.6688(	6.9424)	.0853	3772.5167	3764.1069	
14.5	15	15			252134.9067(	6.9425)	.0912	3772.5153	3764.1050	
14.5	15	14			252075.8605(	6.9428)	.0002	3772.5153	3764.1069	

TABLE III. MICROWAVE SPECTRUM OF ^{16}OD IN THE GROUND VIBRATIONAL STATE. FREQUENCIES ARE IN MHz; ENERGY LEVELS IN cm^{-1}.

$^2\Pi_{1/2}$

J	F U	F L	OBSERVED FREQUENCY	EST. UNCERT.	CALCULATED FREQUENCY	EST. UNCERT.	LINE STRENGTH	ENERGY LEVELS UPPER	ENERGY LEVELS LOWER	REF.
.5	1.5	.5	3114.5294(	.0010)	3114.5298(	.0005)	.1975	79.2786	79.1747	73F
.5	.5	.5	3093.6057(	.0010)	3093.6054(	.0005)	.0247	79.2779	79.1747	73F
.5	1.5	1.5	3111.1414(	.0010)	3111.1411(	.0005)	.2469	79.2786	79.1748	73F
.5	.5	1.5	3090.2163(	.0010)	3090.2167(	.0005)	.1975	79.2779	79.1748	73F
1.5	1.5	.5	5895.1350(	.0050)	5895.1358(	.0009)	.0207	110.7936	110.5970	75F
1.5	2.5	1.5	5906.7120(	.0050)	5906.7116(	.0010)	.0223	110.7940	110.5970	75F
1.5	.5	.5	5887.7410(	.0050)	5887.7401(	.0008)	.0258	110.7934	110.5970	75F
1.5	1.5	1.5	5894.6800(	.0050)	5894.6784(	.0005)	.0500	110.7936	110.5970	75F
1.5	2.5	2.5	5906.2150(	.0050)	5906.2132(	.0007)	.1171	110.7940	110.5970	75F
1.5	1.5	2.5	5894.1790(	.0050)	5894.1800(	.0010)	.0223	110.7936	110.5970	75F
1.5	.5	1.5	5887.2820(	.0050)	5887.2827(	.0009)	.0207	110.7934	110.5970	75F
2.5	2.5	1.5	8118.7330(	.0050)	8118.7333(	.0016)	.0068	163.1654	162.8946	75F
2.5	3.5	2.5	8128.9610(	.0050)	8128.9626(	.0018)	.0070	163.1658	162.8947	75F
2.5	1.5	1.5	8110.7170(	.0050)	8110.7171(	.0016)	.0358	163.1652	162.8946	75F
2.5	2.5	2.5	8118.0130(	.0050)	8118.0098(	.0010)	.0501	163.1654	162.8947	75F
2.5	3.5	3.5	8128.1810(	.0050)	8128.1818(	.0018)	.0782	163.1658	162.8947	75F
2.5	2.5	3.5	8117.2280(	.0050)	8117.2290(	.0018)	.0070	163.1654	162.8947	75F
2.5	1.5	2.5	8109.9940(	.0050)	8109.9937(	.0016)	.0068	163.1652	162.8947	75F
3.5	3.5	2.5			9587.5829(	.0031)	.0031	236.2398	235.9200	
3.5	4.5	3.5			9597.1728(	.0035)	.0032	236.2401	235.9200	

TABLE III. MICROWAVE SPECTRUM OF ^{16}OD IN THE GROUND VIBRATIONAL STATE (CONTINUED).

$^2\Pi_{1/2}$

J	F_U	F_L	OBSERVED FREQUENCY	EST. UNCERT.	CALCULATED FREQUENCY	EST. UNCERT.	LINE STRENGTH	ENERGY LEVELS UPPER	ENERGY LEVELS LOWER	REF.
3.5	2.5	2.5	9578.9000(	.0800)	9578.9323(	.0034)	.0353	236.2395	235.9200	69F
3.5	3.5	3.5	9586.3200(	.0800)	9586.3128(	.0026)	.0449	236.2398	235.9200	69F
3.5	4.5	4.5	9595.7400(	.0800)	9595.7562(	.0039)	.0608	236.2401	235.9201	69F
3.5	3.5	4.5			9584.8962(	.0035)	.0032	236.2398	235.9201	
3.5	2.5	3.5			9577.6622(	.0031)	.0031	236.2395	235.9200	
4.5	4.5	3.5			10201.4374(	.0086)	.0017	329.8343	329.4940	
4.5	5.5	4.5			10210.5669(	.0088)	.0018	329.8347	329.4941	
4.5	3.5	3.5	10192.2100(	.0800)	10192.2233(	.0089)	.0337	329.8340	329.4940	69F
4.5	4.5	4.5	10199.5600(	.0800)	10199.5647(	.0082)	.0408	329.8343	329.4941	69F
4.5	5.5	5.5	10208.5000(	.0800)	10208.4847(	.0093)	.0514	329.8347	329.4942	69F
4.5	4.5	5.5			10197.4824(	.0088)	.0018	329.8343	329.4942	
4.5	3.5	4.5			10190.3506(	.0086)	.0017	329.8340	329.4941	
5.5	5.5	4.5			9924.3907(	.0237)	.0011	443.7542	443.4232	
5.5	6.5	5.5			9933.1301(	.0236)	.0011	443.7546	443.4232	
5.5	4.5	4.5	9914.7000(	.0800)	9914.7051(	.0241)	.0322	443.7539	443.4232	69F
5.5	5.5	5.5	9921.9500(	.0800)	9921.9419(	.0234)	.0378	443.7542	443.4232	69F
5.5	6.5	6.5	9930.4400(	.0800)	9930.4358(	.0240)	.0455	443.7546	443.4233	69F
5.5	5.5	6.5			9919.2477(	.0236)	.0011	443.7542	443.4233	
5.5	4.5	5.5			9912.2563(	.0237)	.0011	443.7539	443.4232	
6.5	6.5	5.5			8763.0098(	.0566)	.0008	577.8024	577.5101	
6.5	7.5	6.5			8771.3994(	.0563)	.0008	577.8027	577.5101	

TABLE III. MICROWAVE SPECTRUM OF ^{16}OD IN THE GROUND VIBRATIONAL STATE (CONTINUED).

$^2\Pi_{1/2}$

J	F U	F L	OBSERVED FREQUENCY	EST. UNCERT.	CALCULATED FREQUENCY	EST. UNCERT.	LINE STRENGTH	ENERGY LEVELS UPPER	ENERGY LEVELS LOWER	REF.
6.5	5.5	5.5			8752.9425(	.0571)	.0309	577.8020	577.5101	
6.5	6.5	6.5			8760.0415(	.0563)	.0355	577.8024	577.5101	
6.5	7.5	7.5			8768.1692(	.0564)	.0415	577.8027	577.5103	
6.5	6.5	7.5			8756.8113(	.0563)	.0008	577.8024	577.5103	
6.5	5.5	6.5			8749.9742(	.0566)	.0008	577.8020	577.5101	
7.5	7.5	6.5			6747.3688(	.1186)	.0005	731.7845	731.5594	
7.5	8.5	7.5			6755.4394(	.1179)	.0005	731.7848	731.5595	
7.5	6.5	6.5			6736.9988(	.1191)	.0298	731.7841	731.5594	
7.5	7.5	7.5			6743.9451(	.1181)	.0336	731.7845	731.5595	
7.5	8.5	8.5			6751.7502(	.1178)	.0385	731.7848	731.5596	
7.5	7.5	8.5			6740.2559(	.1179)	.0005	731.7845	731.5596	
7.5	6.5	7.5			6733.5751(	.1185)	.0005	731.7841	731.5595	
8.5	8.5	7.5			3918.0274(	.2245)	.0004	905.5101	905.3794	
8.5	9.5	8.5			3925.8057(	.2235)	.0004	905.5105	905.3795	
8.5	7.5	7.5			3907.4208(	.2251)	.0289	905.5098	905.3794	
8.5	8.5	8.5			3914.2099(	.2239)	.0321	905.5101	905.3795	
8.5	9.5	9.5			3921.7271(	.2232)	.0362	905.5105	905.3797	
8.5	8.5	9.5			3910.1313(	.2235)	.0004	905.5101	905.3797	
8.5	7.5	8.5			3903.6033(	.2244)	.0004	905.5098	905.3795	
9.5	9.5	8.5			318.4415(	.3937)	.0003	1098.7917	1098.7811	
9.5	10.5	9.5			325.9514(	.3924)	.0003	1098.7921	1098.7812	

TABLE III. MICROWAVE SPECTRUM OF ^{16}OD IN THE GROUND VIBRATIONAL STATE (CONTINUED).

$^2\Pi_{1/2}$

J	F_U	F_L	OBSERVED FREQUENCY	EST. UNCERT.	CALCULATED FREQUENCY	EST. UNCERT.	LINE STRENGTH	ENERGY LEVELS UPPER	ENERGY LEVELS LOWER	REF.
9.5	8.5	8.5			307.6522(	.3944)	.0279	1098.7913	1098.7811	
9.5	9.5	9.5			314.2854(	.3930)	.0308	1098.7917	1098.7812	
9.5	10.5	10.5			321.5435(	.3919)	.0342	1098.7921	1098.7814	
9.5	9.5	10.5			309.8775(	.3924)	.0003	1098.7917	1098.7814	
9.5	8.5	9.5			303.4961(	.3937)	.0003	1098.7913	1098.7812	
10.5	9.5	10.5			4008.8221(	.6513)	.0002	1311.5761	1311.4424	
10.5	10.5	11.5			4001.5590(	.6497)	.0002	1311.5763	1311.4428	
10.5	9.5	9.5			4019.7507(	.6522)	.0271	1311.5761	1311.4420	
10.5	10.5	10.5			4013.2692(	.6504)	.0296	1311.5763	1311.4424	
10.5	11.5	11.5			4006.2460(	.6490)	.0325	1311.5764	1311.4428	
10.5	11.5	10.5			4017.9561(	.6497)	.0002	1311.5764	1311.4424	
10.5	10.5	9.5			4024.1978(	.6512)	.0002	1311.5763	1311.4420	
11.5	10.5	11.5			9023.5970(	1.0297)	.0002	1543.5751	1543.2741	
11.5	11.5	12.5			9016.5616(	1.0277)	.0002	1543.5752	1543.2745	
11.5	10.5	10.5			9034.6303(	1.0307)	.0262	1543.5751	1543.2737	
11.5	11.5	11.5			9028.2948(	1.0287)	.0284	1543.5752	1543.2741	
11.5	12.5	12.5			9021.4857(	1.0268)	.0311	1543.5754	1543.2745	
11.5	12.5	11.5			9033.2189(	1.0277)	.0002	1543.5754	1543.2741	
11.5	11.5	10.5			9039.3281(	1.0296)	.0002	1543.5752	1543.2737	
12.5	11.5	12.5			14688.4255(	1.5709)	.0002	1794.5849	1794.0950	
12.5	12.5	13.5			14681.6007(	1.5686)	.0002	1794.5851	1794.0954	

TABLE III. MICROWAVE SPECTRUM OF ^{16}OD IN THE GROUND VIBRATIONAL STATE (CONTINUED).

$^2\Pi_{1/2}$

J	F_U	F_L	OBSERVED FREQUENCY	EST. UNCERT.	CALCULATED FREQUENCY	EST. UNCERT.	LINE STRENGTH	ENERGY LEVELS UPPER	ENERGY LEVELS LOWER	REF.
12.5	11.5	11.5			14699.5358(	1.5722)	.0254	1794.5849	1794.0946	
12.5	12.5	12.5			14693.3401(	1.5697)	.0274	1794.5851	1794.0950	
12.5	13.5	13.5			14686.7277(	1.5675)	.0297	1794.5853	1794.0954	
12.5	13.5	12.5			14698.4671(	1.5686)	.0002	1794.5853	1794.0950	
12.5	12.5	11.5			14704.4505(	1.5709)	.0002	1794.5851	1794.0946	
13.5	12.5	13.5			20968.3108(	2.3294)	.0001	2064.4076	2063.7081	
13.5	13.5	14.5			20961.6817(	2.3266)	.0001	2064.4077	2063.7085	
13.5	12.5	12.5			20979.4761(	2.3308)	.0247	2064.4076	2063.7078	
13.5	13.5	13.5			20973.4142(	2.3280)	.0265	2064.4077	2063.7081	
13.5	14.5	14.5			20966.9834(	2.3253)	.0285	2064.4079	2063.7085	
13.5	14.5	13.5			20978.7159(	2.3266)	.0001	2064.4079	2063.7081	
13.5	13.5	12.5			20984.5795(	2.3294)	.0001	2064.4077	2063.7078	
14.5	13.5	14.5			27830.2666(	3.3741)	.0001	2352.8380	2351.9097	
14.5	14.5	15.5			27823.8201(	3.3710)	.0001	2352.8381	2351.9100	
14.5	13.5	13.5			27841.4692(	3.3757)	.0240	2352.8380	2351.9093	
14.5	14.5	14.5			27835.5353(	3.3726)	.0256	2352.8381	2351.9097	
14.5	15.5	15.5			27829.2735(	3.3694)	.0274	2352.8383	2351.9100	
14.5	15.5	14.5			27840.9887(	3.3710)	.0001	2352.8383	2351.9097	
14.5	14.5	13.5			27846.7380(	3.3741)	.0001	2352.8381	2351.9093	
15.5	14.5	15.5			35242.8373(	4.7922)	.0001	2659.6632	2658.4877	
15.5	15.5	16.5			35236.5622(	4.7886)	.0001	2659.6634	2658.4881	

TABLE III. MICROWAVE SPECTRUM OF ^{16}OD IN THE GROUND VIBRATIONAL STATE (CONTINUED).

$^2\Pi_{1/2}$

J	F U	F L	OBSERVED FREQUENCY	EST. UNCERT.	CALCULATED FREQUENCY	EST. UNCERT.	LINE STRENGTH	ENERGY LEVELS UPPER	LOWER	REF.
15.5	14.5	14.5			35254.0630(	4.7940)	.0232	2659.6632	2658.4873	
15.5	15.5	15.5			35248.2520(	4.7904)	.0247	2659.6634	2658.4877	
15.5	16.5	16.5			35242.1482(	4.7869)	.0264	2659.6636	2658.4881	
15.5	16.5	15.5			35253.8379(	4.7886)	.0001	2659.6636	2658.4877	
15.5	15.5	14.5			35259.4776(	4.7922)	.0001	2659.6634	2658.4873	
16.5	15.5	16.5			43175.6665(	6.6910)	.0001	2984.6615	2983.2213	
16.5	16.5	17.5			43169.5530(	6.6870)	.0001	2984.6617	2983.2217	
16.5	15.5	15.5			43186.9035(	6.6930)	.0226	2984.6615	2983.2209	
16.5	16.5	16.5			43181.2108(	6.6891)	.0239	2984.6617	2983.2213	
16.5	17.5	17.5			43175.2560(	6.6851)	.0254	2984.6618	2983.2217	
16.5	17.5	16.5			43186.9138(	6.6871)	.0001	2984.6618	2983.2213	
16.5	16.5	15.5			43192.4478(	6.6910)	.0001	2984.6617	2983.2209	
17.5	16.5	17.5			51599.1391(	9.2014)	.0001	3327.6010	3325.8798	
17.5	17.5	18.5			51593.1787(	9.1970)	.0001	3327.6012	3325.8802	
17.5	16.5	16.5			51610.3779(	9.2036)	.0219	3327.6010	3325.8795	
17.5	17.5	17.5			51604.7995(	9.1993)	.0231	3327.6012	3325.8798	
17.5	18.5	18.5			51598.9858(	9.1948)	.0245	3327.6014	3325.8802	
17.5	18.5	17.5			51610.6066(	9.1971)	.0001	3327.6014	3325.8798	
17.5	17.5	16.5			51616.0383(	9.2015)	.0001	3327.6012	3325.8795	
18.5	17.5	18.5			60484.1012(	12.4803)	.0001	3688.2398	3686.2223	
18.5	18.5	19.5			60478.2867(	12.4755)	.0001	3688.2400	3686.2227	

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TABLE III. MICROWAVE SPECTRUM OF ^{16}OD IN THE GROUND VIBRATIONAL STATE (CONTINUED).

$^2\Pi_{1/2}$

J	F U	F L	OBSERVED FREQUENCY	EST. UNCERT.	CALCULATED FREQUENCY	EST. UNCERT.	LINE STRENGTH	ENERGY LEVELS UPPER	ENERGY LEVELS LOWER	REF.
18.5	17.5	17.5			60495.3341(	12.4827)	.0213	3688.2398	3686.2219	
18.5	18.5	18.5			60489.8664(	12.4779)	.0224	3688.2400	3686.2223	
18.5	19.5	19.5			60484.1873(	12.4731)	.0237	3688.2402	3686.2227	
18.5	19.5	18.5			60495.7670(	12.4755)	.0001	3688.2402	3686.2223	
18.5	18.5	17.5			60501.0993(	12.4803)	.0001	3688.2400	3686.2219	

TABLE III. MICROWAVE SPECTRUM OF ^{16}OD IN THE GROUND VIBRATIONAL STATE (CONTINUED).

$^2\Pi_{3/2}$

J	F_U	F_L	OBSERVED FREQUENCY	EST. UNCERT.	CALCULATED FREQUENCY	EST. UNCERT.	LINE STRENGTH	ENERGY LEVELS UPPER	LOWER	REF.
1.5	1.5	.5	317.3290(	.0040)	317.3274(	.0007)	.1751	-51.5596	-51.5702	73F
1.5	2.5	1.5	322.4800(	.0020)	322.4803(	.0005)	.1891	-51.5592	-51.5699	73F
1.5	.5	.5	310.1445(	.0010)	310.1440(	.0003)	.2189	-51.5598	-51.5702	73F
1.5	1.5	1.5	310.2147(	.0010)	310.2151(	.0002)	.4238	-51.5596	-51.5699	73F
1.5	2.5	2.5	310.3627(	.0010)	310.3626(	.0002)	.9929	-51.5592	-51.5695	73F
1.5	1.5	2.5	298.0970(	.0010)	298.0974(	.0005)	.1891	-51.5596	-51.5695	73F
1.5	.5	1.5	303.0320(	.0020)	303.0318(	.0007)	.1751	-51.5598	-51.5699	73F
2.5	2.5	1.5	1194.3390(	.0010)	1194.3396(	.0003)	.0528	-5.1583	-5.1981	73F
2.5	3.5	2.5	1196.0060(	.0030)	1196.0073(	.0005)	.0539	-5.1581	-5.1980	73F
2.5	1.5	1.5	1190.5659(	.0020)	1190.5652(	.0004)	.2771	-5.1584	-5.1981	73F
2.5	2.5	2.5	1190.7741(	.0020)	1190.7739(	.0004)	.3882	-5.1583	-5.1980	73F
2.5	3.5	3.5	1191.1047(	.0020)	1191.1039(	.0004)	.6060	-5.1581	-5.1979	73F
2.5	2.5	3.5	1185.8712(	.0010)	1185.8705(	.0004)	.0539	-5.1583	-5.1979	73F
2.5	1.5	2.5	1186.9986(	.0030)	1186.9995(	.0004)	.0528	-5.1584	-5.1980	73F
3.5	3.5	2.5	2823.5328(	.0020)	2823.5317(	.0006)	.0218	59.9384	59.8442	73F
3.5	4.5	3.5	2824.2276(	.0020)	2824.2268(	.0006)	.0220	59.9385	59.8443	73F
3.5	2.5	2.5	2822.0007(	.0020)	2821.9997(	.0006)	.2452	59.9384	59.8442	73F
3.5	3.5	3.5	2822.3883(	.0020)	2822.3857(	.0005)	.3123	59.9384	59.8443	73F
3.5	4.5	4.5	2822.9250(	.0020)**	2822.9279(	.0007)	.4231	59.9385	59.8443	73F
3.5	3.5	4.5	2821.0857(	.0020)	2821.0868(	.0006)	.0220	59.9384	59.8443	73F
3.5	2.5	3.5	2820.8514(	.0020)	2820.8537(	.0006)	.0218	59.9384	59.8443	73F

TABLE III. MICROWAVE SPECTRUM OF ^{16}OD IN THE GROUND VIBRATIONAL STATE (CONTINUED).

$^2\Pi_{3/2}$

J	F U	F L	OBSERVED FREQUENCY	EST. UNCERT.	CALCULATED FREQUENCY	EST. UNCERT.	LINE STRENGTH	ENERGY LEVELS UPPER	ENERGY LEVELS LOWER	REF.
4.5	4.5	3.5	5303.9340(	.0050)**	5303.9421(	.0011)	.0108	143.8228	143.6459	75F
4.5	5.5	4.5	5304.3590(	.0050)	5304.3544(	.0011)	.0109	143.8228	143.6458	75F
4.5	3.5	3.5	5304.0150(	.0050)	5304.0168(	.0011)	.2085	143.8228	143.6459	75F
4.5	4.5	4.5	5304.6000(	.0050)	5304.6019(	.0010)	.2524	143.8228	143.6458	75F
4.5	5.5	5.5	5305.3720(	.0050)	5305.3697(	.0012)	.3181	143.8228	143.6458	75F
4.5	4.5	5.5	5305.6190(	.0050)	5305.6172(	.0011)	.0109	143.8228	143.6458	75F
4.5	3.5	4.5	5304.6810(	.0050)	5304.6766(	.0011)	.0108	143.8228	143.6458	75F
5.5	5.5	4.5			8670.2946(	.0025)	.0061	246.5735	246.2843	
5.5	6.5	5.5			8670.6848(	.0024)	.0061	246.5735	246.2843	
5.5	4.5	4.5	8671.6000(	.0800)	8671.5760(	.0025)	.1773	246.5736	246.2843	69F
5.5	5.5	5.5	8672.3700(	.0800)	8672.3670(	.0023)	.2079	246.5735	246.2843	69F
5.5	6.5	6.5	8673.3500(	.0800)	8673.3604(	.0025)	.2506	246.5735	246.2842	69F
5.5	5.5	6.5			8675.0427(	.0024)	.0061	246.5735	246.2842	
5.5	4.5	5.5			8673.6484(	.0024)	.0061	246.5736	246.2843	
6.5	6.5	5.5			12914.8891(	.0055)	.0037	368.2459	367.8151	
6.5	7.5	6.5			12915.3686(	.0054)	.0037	368.2458	367.8150	
6.5	5.5	5.5	12917.0800(	.0800)	12917.1019(	.0055)	.1522	368.2460	367.8151	69F
6.5	6.5	6.5	12918.1300(	.0800)	12918.0952(	.0054)	.1745	368.2459	367.8150	69F
6.5	7.5	7.5	12919.3300(	.0800)	12919.3048(	.0055)	.2042	368.2458	367.8149	69F
6.5	6.5	7.5			12922.0314(	.0054)	.0037	368.2459	367.8149	
6.5	5.5	6.5			12920.3081(	.0055)	.0037	368.2460	367.8150	

TABLE III. MICROWAVE SPECTRUM OF ^{16}OD IN THE GROUND VIBRATIONAL STATE (CONTINUED).

$^2\Pi_{3/2}$

J	F U	F L	OBSERVED FREQUENCY	EST. UNCERT.	CALCULATED FREQUENCY	EST. UNCERT.	LINE STRENGTH	ENERGY LEVELS UPPER	LOWER	REF.
7.5	7.5	6.5			18006.5372(	.0104)	.0024	508.8666	508.2659	
7.5	8.5	7.5			18007.1539(	.0104)	.0024	508.8664	508.2658	
7.5	6.5	6.5	18009.4600(	.0800)	18009.4827(	.0105)	.1322	508.8667	508.2659	69F
7.5	7.5	7.5	18010.6300(	.0800)	18010.6680(	.0103)	.1490	508.8666	508.2658	69F
7.5	8.5	8.5	18012.1300(	.0800)	18012.0787(	.0105)	.1706	508.8664	508.2656	69F
7.5	7.5	8.5			18015.5928(	.0104)	.0024	508.8666	508.2656	
7.5	6.5	7.5			18013.6135(	.0104)	.0024	508.8667	508.2658	
8.5	8.5	7.5			23903.5682(	.0153)	.0016	668.4324	667.6351	
8.5	9.5	8.5			23904.3393(	.0153)	.0016	668.4323	667.6349	
8.5	7.5	7.5	23907.0800(	.0800)	23907.0987(	.0155)	.1160	668.4325	667.6351	69F
8.5	8.5	8.5	23908.4400(	.0800)	23908.4620(	.0153)	.1290	668.4324	667.6349	69F
8.5	9.5	9.5	23910.0400(	.0800)	23910.0563(	.0155)	.1454	668.4323	667.6347	69F
8.5	8.5	9.5			23914.1790(	.0153)	.0016	668.4324	667.6347	
8.5	7.5	8.5			23911.9924(	.0154)	.0016	668.4325	667.6349	
9.5	9.5	8.5			30561.4085(	.0162)	.0012	846.9118	845.8924	
9.5	10.5	9.5			30562.3354(	.0162)	.0012	846.9116	845.8922	
9.5	8.5	8.5	30565.4200(	.0800)	30565.4122(	.0164)	.1028	846.9119	845.8924	69F
9.5	9.5	9.5	30566.9500(	.0800)	30566.9378(	.0160)	.1132	846.9118	845.8922	69F
9.5	10.5	10.5	30568.7200(	.0800)	30568.6973(	.0164)	.1259	846.9116	845.8920	69F
9.5	9.5	10.5			30573.2997(	.0162)	.0012	846.9118	845.8920	
9.5	8.5	9.5			30570.9414(	.0162)	.0012	846.9119	845.8922	

TABLE III. MICROWAVE SPECTRUM OF ^{16}OD IN THE GROUND VIBRATIONAL STATE (CONTINUED).

$^2\Pi_{3/2}$

J	F U	F L	OBSERVED FREQUENCY	EST. UNCERT.	CALCULATED FREQUENCY	EST. UNCERT.	LINE STRENGTH	ENERGY LEVELS UPPER	ENERGY LEVELS LOWER	REF.
10.5	10.5	9.5			37936.3616(	.0242)	.0008	1044.2464	1042.9810	
10.5	11.5	10.5			37937.4380(	.0242)	.0008	1044.2463	1042.9808	
10.5	9.5	9.5	37940.7300(	.0800)	37940.7528(	.0245)	.0920	1044.2466	1042.9810	69F
10.5	10.5	10.5	37942.4200(	.0800)	37942.4248(	.0241)	.1004	1044.2464	1042.9808	69F
10.5	11.5	11.5	37944.3500(	.0800)	37944.3315(	.0245)	.1105	1044.2463	1042.9806	69F
10.5	10.5	11.5			37949.3183(	.0242)	.0008	1044.2464	1042.9806	
10.5	9.5	10.5			37946.8160(	.0242)	.0008	1044.2466	1042.9808	
11.5	11.5	10.5			45987.1158(	.0823)	.0006	1260.3537	1258.8198	
11.5	12.5	11.5			45988.3315(	.0822)	.0006	1260.3535	1258.8195	
11.5	10.5	10.5			45991.8283(	.0824)	.0829	1260.3539	1258.8198	
11.5	11.5	11.5			45993.6310(	.0822)	.0899	1260.3537	1258.8195	
11.5	12.5	12.5			45995.6679(	.0824)	.0981	1260.3535	1258.8193	
11.5	11.5	12.5			46000.9673(	.0822)	.0006	1260.3537	1258.8193	
11.5	10.5	11.5			45998.3435(	.0822)	.0006	1260.3539	1258.8195	
12.5	12.5	11.5			54675.0497(	.2143)	.0005	1495.1286	1493.3049	
12.5	13.5	12.5			54676.3930(	.2143)	.0005	1495.1285	1493.3046	
12.5	11.5	11.5			54680.0317(	.2144)	.0754	1495.1288	1493.3049	
12.5	12.5	12.5			54681.9504(	.2143)	.0812	1495.1286	1493.3046	
12.5	13.5	13.5			54684.1016(	.2144)	.0880	1495.1285	1493.3044	
12.5	12.5	13.5			54689.6590(	.2143)	.0005	1495.1286	1493.3044	
12.5	11.5	12.5			54686.9324(	.2143)	.0005	1495.1288	1493.3046	

TABLE III. MICROWAVE SPECTRUM OF ^{16}OD IN THE GROUND VIBRATIONAL STATE (CONTINUED).

$^2\Pi_{3/2}$

J	F_U	F_L	OBSERVED FREQUENCY	EST. UNCERT.	CALCULATED FREQUENCY	EST. UNCERT.	LINE STRENGTH	ENERGY LEVELS UPPER	ENERGY LEVELS LOWER	REF.
13.5	13.5	12.5			63963.9833(	.4597)	.0004	1748.4458	1746.3122	
13.5	14.5	13.5			63965.4419(	.4596)	.0004	1748.4456	1746.3119	
13.5	12.5	12.5			63969.1939(	.4597)	.0689	1748.4459	1746.3122	
13.5	13.5	13.5			63971.2150(	.4596)	.0739	1748.4458	1746.3119	
13.5	14.5	14.5			63973.4659(	.4597)	.0796	1748.4456	1746.3116	
13.5	13.5	14.5			63979.2390(	.4597)	.0004	1748.4458	1746.3116	
13.5	12.5	13.5			63976.4255(	.4596)	.0004	1748.4459	1746.3119	
14.5	14.5	13.5			73819.7254(	.8743)	.0003	2020.1607	2017.6983	
14.5	15.5	14.5			73821.2870(	.8743)	.0003	2020.1605	2017.6980	
14.5	13.5	13.5			73825.1320(	.8743)	.0634	2020.1608	2017.6983	
14.5	14.5	14.5			73827.2428(	.8742)	.0677	2020.1607	2017.6980	
14.5	15.5	15.5			73829.5804(	.8743)	.0725	2020.1605	2017.6978	
14.5	14.5	15.5			73835.5361(	.8743)	.0003	2020.1607	2017.6978	
14.5	13.5	14.5			73832.6495(	.8742)	.0003	2020.1608	2017.6980	
15.5	15.5	14.5			84209.5930(	1.5311)	.0002	2310.1111	2307.3022	
15.5	16.5	15.5			84211.2462(	1.5312)	.0002	2310.1109	2307.3019	
15.5	14.5	14.5			84215.1698(	1.5311)	.0586	2310.1113	2307.3022	
15.5	15.5	15.5			84217.3586(	1.5311)	.0623	2310.1111	2307.3019	
15.5	16.5	16.5			84219.7708(	1.5312)	.0665	2310.1109	2307.3017	
15.5	15.5	16.5			84225.8833(	1.5312)	.0002	2310.1111	2307.3017	
15.5	14.5	15.5			84222.9354(	1.5311)	.0002	2310.1113	2307.3019	

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TABLE III. MICROWAVE SPECTRUM OF ^{16}OD IN THE GROUND VIBRATIONAL STATE (CONTINUED).

$^2\Pi_{3/2}$

J	F U	F L	OBSERVED FREQUENCY	EST. UNCERT.	CALCULATED FREQUENCY	EST. UNCERT.	LINE STRENGTH	ENERGY LEVELS UPPER	ENERGY LEVELS LOWER	REF.
16.5	16.5	15.5			95101.9794(	2.5226)	.0002	2618.1182	2614.9459	
16.5	17.5	16.5			95103.7131(	2.5226)	.0002	2618.1180	2614.9457	
16.5	15.5	15.5			95107.7053(	2.5225)	.0545	2618.1184	2614.9459	
16.5	16.5	16.5			95109.9616(	2.5226)	.0577	2618.1182	2614.9457	
16.5	17.5	17.5			95112.4375(	2.5227)	.0613	2618.1180	2614.9454	
16.5	16.5	17.5			95118.6860(	2.5226)	.0002	2618.1182	2614.9454	
16.5	15.5	16.5			95115.6874(	2.5225)	.0002	2618.1184	2614.9457	
17.5	17.5	16.5			106465.9955(	3.9626)	.0002	2943.9868	2940.4355	
17.5	18.5	17.5			106467.7995(	3.9627)	.0002	2943.9866	2940.4352	
17.5	16.5	16.5			106471.8534(	3.9625)	.0509	2943.9870	2940.4355	
17.5	17.5	17.5			106474.1674(	3.9626)	.0537	2943.9868	2940.4352	
17.5	18.5	18.5			106476.6972(	3.9628)	.0569	2943.9866	2940.4349	
17.5	17.5	18.5			106483.0651(	3.9627)	.0002	2943.9868	2940.4349	
17.5	16.5	17.5			106480.0254(	3.9625)	.0002	2943.9870	2940.4352	
18.5	18.5	17.5			118271.1897(	5.9898)	.0001	3287.5065	3283.5614	
18.5	19.5	18.5			118273.0545(	5.9899)	.0001	3287.5063	3283.5611	
18.5	17.5	17.5			118277.1658(	5.9896)	.0476	3287.5067	3283.5614	
18.5	18.5	18.5			118279.5286(	5.9898)	.0502	3287.5065	3283.5611	
18.5	19.5	19.5			118282.1032(	5.9900)	.0529	3287.5063	3283.5608	
18.5	18.5	19.5			118288.5773(	5.9899)	.0001	3287.5065	3283.5608	
18.5	17.5	18.5			118285.5047(	5.9896)	.0001	3287.5067	3283.5611	

TABLE III. MICROWAVE SPECTRUM OF ^{16}OD IN THE GROUND VIBRATIONAL STATE (CONTINUED).

$^2\Pi_{3/2}$

J	F U	F L	OBSERVED FREQUENCY	EST. UNCERT.	CALCULATED FREQUENCY	EST. UNCERT.	LINE STRENGTH	ENERGY LEVELS UPPER	LOWER	REF.
19.5	19.5	18.5			130487.3375(	8.7697)	.0001	3648.4520	3644.0994	
19.5	20.5	19.5			130489.2542(	8.7698)	.0001	3648.4517	3644.0991	
19.5	18.5	18.5			130493.4203(	8.7695)	.0448	3648.4522	3644.0994	
19.5	19.5	19.5			130495.8237(	8.7697)	.0470	3648.4520	3644.0991	
19.5	20.5	20.5			130498.4349(	8.7700)	.0495	3648.4517	3644.0988	
19.5	19.5	20.5			130505.0044(	8.7698)	.0001	3648.4520	3644.0988	
19.5	18.5	19.5			130501.9065(	8.7695)	.0001	3648.4522	3644.0991	

** These transitions were calculated by using SUM RULES.

TABLE IV. MICROWAVE SPECTRUM OF ^{18}OH IN THE GROUND VIBRATIONAL STATE.
FREQUENCIES ARE IN MHz; ENERGY LEVELS IN cm^{-1}.

$^2\Pi_{1/2}$

J	F U	F L	OBSERVED FREQUENCY	EST. UNCERT.	CALCULATED FREQUENCY	EST. UNCERT.	LINE STRENGTH	ENERGY LEVELS UPPER	ENERGY LEVELS LOWER	REF.
.5	0	1	4644.6500(	.0060)	4644.6400(	.0030)	.1667	87.7322	87.5773	74E
.5	1	1	4735.0730(	.0060)	4735.0724(	.0020)	.3333	87.7352	87.5773	74E
.5	1	0	4749.3710(	.0050)	4749.3792(	.0030)	.1667	87.7352	87.5768	74E
1.5	1	2			7746.6238(	.0022)	.0187	148.6183	148.3599	
1.5	1	1			7758.3472(	.0022)	.0937	148.6183	148.3595	
1.5	2	2			7816.7560(	.0026)	.1687	148.6207	148.3599	
1.5	2	1			7828.4795(	.0021)	.0187	148.6207	148.3595	
2.5	2	3			8167.3315(	.0021)	.0062	249.2375	248.9651	
2.5	2	2			8184.3925(	.0019)	.0868	249.2375	248.9645	
2.5	3	3			8238.7585(	.0025)	.1239	249.2399	248.9651	
2.5	3	2			8256.4195(	.0021)	.0062	249.2399	248.9645	
3.5	3	4			5590.8303(	.0017)	.0030	388.7511	388.5646	
3.5	3	3			5614.2675(	.0016)	.0804	388.7511	388.5638	
3.5	4	4			5664.7321(	.0018)	.1042	388.7535	388.5646	
3.5	4	3			5688.1693(	.0017)	.0030	388.7535	388.5638	
4.5	4	5			75.0279(	.0011)	.0017	566.3647	566.3622	
4.5	4	4			103.0761(	.0011)	.0755	566.3647	566.3613	
4.5	5	5			150.7909(	.0011)	.0927	566.3672	566.3622	
4.5	5	4			178.8392(	.0011)	.0017	566.3672	566.3613	

TABLE IV. MICROWAVE SPECTRUM OF ^{18}OH IN THE GROUND VIBRATIONAL STATE (CONTINUED).

$^2\Pi_{1/2}$

J	F U	F L	OBSERVED FREQUENCY	EST. UNCERT.	CALCULATED FREQUENCY	EST. UNCERT.	LINE STRENGTH	ENERGY LEVELS UPPER	ENERGY LEVELS LOWER	REF.
5.5	6	5			8187.1841(	.1001)	.0011	781.6585	781.3854	
5.5	5	5			8155.6388(	.1001)	.0715	781.6575	781.3854	
5.5	6	6			3110.2698(	.1001)	.0847	781.6585	781.3880	
5.5	5	6			3078.7245(	.1001)	.0011	781.6575	781.3880	
6.5	7	6			18988.2343(	.2003)	.0008	1033.8414	1033.2080	
6.5	6	6			18954.0647(	.2004)	.0678	1033.8403	1033.2080	
6.5	7	7			18910.7114(	.2003)	.0783	1033.8414	1033.2106	
6.5	6	7			18876.5418(	.2003)	.0008	1033.8403	1033.2106	
7.5	8	7			32141.3926(	.2040)	.0005	1322.3551	1321.2830	
7.5	7	7			32105.8417(	.2040)	.0644	1322.3539	1321.2830	
7.5	8	8			32064.2358(	.2039)	.0730	1322.3551	1321.2856	
7.5	7	8			32028.0848(	.2039)	.0005	1322.3539	1321.2856	
8.5	9	8			47486.2833(	.3262)	.0004	1646.6702	1645.0863	
8.5	8	8			47448.6160(	.3264)	.0612	1646.6690	1645.0863	
8.5	9	9			47408.5427(	.3260)	.0685	1646.6702	1645.0889	
8.5	8	9			47370.8754(	.3262)	.0004	1646.6690	1645.0889	
9.5	10	9			64376.4143(	.5227)	.0003	2006.2614	2004.0973	
9.5	9	9			64837.5660(	.5229)	.0582	2006.2601	2004.0973	
9.5	10	10			64798.3553(	.5224)	.0644	2006.2614	2004.0999	

TABLE IV. MICROWAVE SPECTRUM OF ^{18}OH IN THE GROUND VIBRATIONAL STATE (CONTINUED).

$^2\Pi_{1/2}$

J	F U	F L	OBSERVED FREQUENCY	EST. UNCERT.	CALCULATED FREQUENCY	EST. UNCERT.	LINE STRENGTH	ENERGY LEVELS UPPER	LOWER	REF.
9.5	9	10			84760.0070(	.5225)	.0003	2006.2601	2004.0993	
10.5	11	10			84178.2581(	.9639)	.0002	2400.5911	2397.7833	
10.5	10	10			84138.4722(	.9641)	.0555	2400.5898	2397.7833	
10.5	11	11			84100.9899(	.9634)	.0608	2400.5911	2397.7858	
10.5	10	11			84061.2040(	.9636)	.0002	2400.5898	2397.7858	
11.5	12	11			105262.9850(	1.6633)	.0002	2829.0997	2825.5885	
11.5	11	11			105222.4394(	1.6635)	.0529	2829.0984	2825.5885	
11.5	12	12			105186.0801(	1.6627)	.0575	2829.0997	2825.5911	
11.5	11	12			105145.5345(	1.6629)	.0002	2829.0984	2825.5911	
12.5	13	12			128003.5183(	2.8847)	.0002	3291.1977	3286.9280	
12.5	12	12			127962.3441(	2.8848)	.0505	3291.1964	3286.9280	
12.5	13	13			127927.0253(	2.8841)	.0546	3291.1977	3286.9305	
12.5	12	13			127885.8512(	2.8843)	.0002	3291.1964	3286.9305	
13.5	14	13			152272.3205(	4.8708)	.0001	3786.2613	3781.1820	
13.5	13	13			152230.5151(	4.8710)	.0483	3786.2599	3781.1820	
13.5	14	14			152196.2722(	4.8702)	.0519	3786.2613	3781.1845	
13.5	13	14			152154.5668(	4.8703)	.0001	3786.2599	3781.1845	

TABLE IV. MICROWAVE SPECTRUM OF ^{18}OH IN THE GROUND VIBRATIONAL STATE (CONTINUED).

$^2\Pi_{3/2}$

J	F U	F L	OBSERVED FREQUENCY	EST. UNCERT.	CALCULATED FREQUENCY	EST. UNCERT.	LINE STRENGTH	ENERGY LEVELS UPPER	ENERGY LEVELS LOWER	REF.
1.5	1	2	1584.2740(	.0020)	1584.2747(	.0002)	.1440	-38.1505	-38.2034	74E
1.5	1	1	1637.5640(	.0020)	1637.5643(	.0002)	.7200	-38.1505	-38.2052	74E
1.5	2	2	1639.5030(	.0020)	1639.5037(	.0002)	1.2961	-38.1487	-38.2034	74E
1.5	2	1	1692.7950(	.0020)	1692.7933(	.0002)	.1440	-38.1487	-38.2052	74E
2.5	2	3	5920.5050(	.0050)	5920.5015(	.0030)	.0389	45.1785	44.9811	74E
2.5	2	2	5934.6440(	.0060)	5934.6534(	.0009)	.5450	45.1785	44.9806	74E
2.5	3	3	5938.9670(	.0050)	5938.9641(	.0010)	.7736	45.1792	44.9811	74E
2.5	3	2	5953.1160(	.0040)	5953.1160(	.0031)	.0389	45.1792	44.9806	74E
3.5	3	4			13237.3834(	.0053)	.0153	162.8389	162.3973	
3.5	3	3			13230.5685(	.0020)	.4126	162.8389	162.3976	
3.5	4	4			13237.3031(	.0022)	.5348	162.8389	162.3973	
3.5	4	3			13229.9862(	.0054)	.0153	162.8389	162.3976	
4.5	4	5			23492.0382(	.0068)	.0073	315.3035	314.5199	
4.5	4	4			23470.8688(	.0022)	.3231	315.3035	314.5206	
4.5	5	5			23479.3228(	.0026)	.3965	315.3031	314.5199	
4.5	5	4			23458.6532(	.0068)	.0073	315.3031	314.5206	
5.5	5	6			36494.6610(	.1005)	.0040	502.8522	501.6349	
5.5	5	5			36463.8808(	.1002)	.2613	502.8522	501.6359	
5.5	6	6			36474.7563(	.1002)	.3095	502.8515	501.6349	

TABLE IV. MICROWAVE SPECTRUM OF ^{18}OH IN THE GROUND VIBRATIONAL STATE (CONTINUED).

$^2\Pi_{3/2}$

J	F U	F L	OBSERVED FREQUENCY	EST. UNCERT.	CALCULATED FREQUENCY	EST. UNCERT.	LINE STRENGTH	ENERGY LEVELS UPPER	ENERGY LEVELS LOWER	REF.
5.5	6	5			36443.3761(	.1005)	.0040	502.8515	501.6359	
6.5	6	7			52040.3885(	.2006)	.0024	725.5849	723.8491	
6.5	6	6			52002.6403(	.2004)	.2170	725.5849	723.8503	
6.5	7	7			52015.1322(	.2004)	.2508	725.5841	723.8491	
6.5	7	6			51977.3840(	.2005)	.0024	725.5841	723.8503	
7.5	7	8			69944.3100(	.2009)	.0015	983.4542	981.1211	
7.5	7	7			69901.3415(	.2006)	.1843	983.4542	981.1225	
7.5	8	8			69915.1738(	.2006)	.2091	983.4532	981.1211	
7.5	8	7			69872.2054(	.2009)	.0015	983.4532	981.1225	
8.5	8	9			90044.8924(	.3078)	.0010	1276.2948	1273.2913	
8.5	8	8			89997.9089(	.3077)	.1595	1276.2948	1273.2928	
8.5	9	9			90012.8432(	.3077)	.1783	1276.2938	1273.2913	
8.5	9	8			89965.8597(	.3079)	.0010	1276.2938	1273.2928	
9.5	9	10			112197.6519(	.4607)	.0007	1603.8466	1600.1041	
9.5	9	9			112147.5120(	.4606)	.1400	1603.8466	1600.1058	
9.5	10	10			112163.3464(	.4606)	.1549	1603.8455	1600.1041	
9.5	10	9			112113.2065(	.4609)	.0007	1603.8455	1600.1058	
10.5	10	11			136268.2844(	.8315)	.0005	1965.7695	1961.2241	
10.5	10	10			136215.6173(	.8315)	.1245	1965.7695	1961.2259	

TABLE IV. MICROWAVE SPECTRUM OF ^{18}OH IN THE GROUND VIBRATIONAL STATE (CONTINUED).

$^2\Pi_{3/2}$

J	F U	F L	OBSERVED FREQUENCY	EST. UNCERT.	CALCULATED FREQUENCY	EST. UNCERT.	LINE STRENGTH	ENERGY LEVELS UPPER	ENERGY LEVELS LOWER	REF.
10.5	11	11			136232.1813(	.8315)	.1365	1965.7683	1961.2241	
10.5	11	10			136179.5142(	.8318)	.0005	1965.7683	1961.2259	
11.5	11	12			162127.4137(	1.4147)	.0004	2361.6543	2356.2463	
11.5	11	11			162072.6919(	1.4149)	.1119	2361.6543	2356.2481	
11.5	12	12			162089.8409(	1.4150)	.1217	2361.6531	2356.2463	
11.5	12	11			162035.1190(	1.4152)	.0004	2361.6531	2356.2481	
12.5	12	13			189647.0466(	2.5203)	.0003	2791.0293	2784.7034	
12.5	12	12			189590.6327(	2.5206)	.1015	2791.0293	2784.7053	
12.5	13	13			189608.2432(	2.5206)	.1097	2791.0280	2784.7034	
12.5	13	12			189551.8294(	2.5209)	.0003	2791.0280	2784.7053	
13.5	13	14			213699.3537(	4.2843)	.0002	3253.3655	3246.0705	
13.5	13	13			218640.5318(	4.2846)	.0928	3253.3655	3246.0724	
13.5	14	14			218658.4971(	4.2846)	.0997	3253.3641	3246.0705	
13.5	14	13			218600.6752(	4.2850)	.0002	3253.3641	3246.0724	
14.5	14	15			249150.3838(	7.0451)	.0002	3748.0791	3739.7684	
14.5	14	14			249091.3801(	7.0453)	.0854	3748.0791	3739.7704	
14.5	15	15			249109.6073(	7.0454)	.0913	3748.0778	3739.7684	
14.5	15	14			249050.6036(	7.0457)	.0002	3748.0778	3739.7704	

TABLE V. MICROWAVE SPECTRUM OF ^{17}OH IN THE GROUND VIBRATIONAL STATE.[a]

$J = 3/2 \quad {}^2\Pi_{3/2}$

TRANSITION $F_U^1 \; F_U \rightarrow F_L^1 \; F_L$	FREQUENCY, MHz	THEORETICAL RELATIVE INTENSITY	REF.
3 5/2 → 2 3/2	1302.119	0.047	74E
3 7/2 → 2 5/2	1322.464	0.067	74E
2 3/2 → 1 1/2	1418.202	0.029	74E
2 5/2 → 1 3/2	1455.729	0.052	74E
4 7/2 → 4 7/2	1624.516	0.121	74E
4 9/2 → 4 9/2	1626.161	0.153	74E
3 7/2 → 3 7/2	1656.542	0.043	74E
3 5/2 → 3 5/2	1655.499	0.032	74E
1 3/2 → 1 3/2	1683.540	0.020	74E
1 1/2 → 1 1/2	1684.542	0.008	74E
1 3/2 → 2 5/2	1902.093	0.052	74E
1 3/2 → 2 3/2	1912.439	0.005	74E
1 1/2 → 2 3/2	1940.287	0.029	74E
2 5/2 → 3 7/2	2008.354	0.067	74E
2 3/2 → 3 5/2	2027.323	0.047	74E
3 7/2 → 4 9/2	2102.731	0.052	74E
3 5/2 → 4 7/2	2117.800	0.040	74E

$J = 1/2 \quad {}^2\Pi_{1/2}$

TRANSITION $F_U^1 \; F_U \rightarrow F_L^1 \; F_L$	FREQUENCY, MHz	THEORETICAL RELATIVE INTENSITY	REF.
3 5/2 → 3 5/2	3980.229	0.106	74E
3 7/2 → 3 7/2	4025.914	0.143	74E
2 5/2 → 3 7/2	5473.032	0.185	74E
2 3/2 → 3 5/2	5523.435	0.130	74E
2 5/2 → 2 5/2	5716.505	0.52	74E
2 3/2 → 2 3/2	5746.333	0.033	74E

[a] The following coupling scheme was employed: $F_1 = J + I_{17_O}$, $F = F_1 + I_{1_H}$

TABLE V. MICROWAVE SPECTRUM OF ^{17}OH IN THE GROUND VIBRATIONAL STATE (CONT.).

$J = 5/2 \quad {}^2\Pi_{3/2}$

TRANSITION F_U^1	F_U		F_L^1	F_L	FREQUENCY, MHz	THEORETICAL RELATIVE INTENSITY	REF.
4	7/2	→	3	5/2	5752.916	0.027	74E
4	9/2	→	3	7/2	5760.223	0.035	74E
3	5/2	→	2	3/2	5851.057	0.025	74E
3	7/2	→	2	5/2	5857.578	0.036	74E
5	9/2	→	5	9/2	5914.960	0.116	74E
5	11/2	→	5	11/2	5918.956	0.140	74E
2	3/2	→	1	1/2	5931.908	0.016	74E
2	5/2	→	1	3/2	5938.801	0.030	74E
4	7/2	→	4	7/2	5971.048	0.061	74E
4	9/2	→	4	9/2	5974.374	0.077	74E
1	3/2	→	0	1/2	6005.626	0.018	74E
3	7/2	→	3	7/2	6013.646	0.036	74E
0	1/2	→	1	3/2	6114.648	0.018	74E
1	3/2	→	2	5/2	6157.620	0.030	74E
2	5/2	→	3	7/2	6200.038	0.036	74E
2	3/2	→	3	5/2	6202.176	0.025	74E

TABLE VI. MICROWAVE SPECTRUM OF ^{16}OH IN ORDER OF FREQUENCY.

ORDERED TRANSITION FREQUENCIES
(OBSERVED TRANSITIONS INDICATED BY ASTERISK)

CALC OR OBS FREQUENCY	EST. UNCERT.	J	F_U	F_L	Ω
88.9504(	.0010)*	9/2	4	5	1/2
117.1495(	.0010)*	9/2	5	5	1/2
164.7960(	.0010)*	9/2	4	4	1/2
192.9957(	.0010)*	9/2	5	4	1/2
1612.2310(	.0002)*	3/2	1	2	3/2
1665.4018(	.0002)*	3/2	1	1	3/2
1667.3590(	.0002)*	3/2	2	2	3/2
1720.5300(	.0002)*	3/2	2	1	3/2
4660.2420(	.0030)*	1/2	0	1	1/2
4750.6560(	.0030)*	1/2	1	1	1/2
4765.5620(	.0030)*	1/2	1	0	1/2
5449.4360(	.0050)*	7/2	3	4	1/2
5473.0450(	.0050)*	7/2	3	3	1/2
5523.4380(	.0050)*	7/2	4	4	1/2
5547.0420(	.0050)*	7/2	4	3	1/2
6016.7460(	.0050)*	5/2	2	3	3/2
6030.7470(	.0050)*	5/2	2	2	3/2
6035.0920(	.0050)*	5/2	3	3	3/2
6049.0840(	.0080)*	5/2	3	2	3/2
7749.9090(	.0050)*	3/2	1	2	1/2
7761.7470(	.0050)*	3/2	1	1	1/2
7820.1250(	.0050)*	3/2	2	2	1/2
7831.9620(	.0050)*	3/2	2	1	1/2
8118.0510(	.0050)*	5/2	2	3	1/2
8135.8700(	.0050)*	5/2	2	2	1/2
8189.5870(	.0050)*	5/2	3	3	1/2
8207.4020(	.0050)*	5/2	3	2	1/2
8503.1572(	.0042)	11/2	5	6	1/2
8534.8340(	.0300)*	11/2	6	6	1/2
8580.1370(	.0300)*	11/2	5	5	1/2
8611.8226(	.0041)	11/2	6	5	1/2
13433.9500(	.0250)*	7/2	4	3	3/2
13434.5960(	.0100)*	7/2	3	3	3/2
13441.3650(	.0100)*	7/2	4	4	3/2
13442.0300(	.0250)*	7/2	3	4	3/2
19484.3187(	.0118)	13/2	6	7	1/2
19518.6120(	.0100)*	13/2	7	7	1/2
19561.8970(	.0200)*	13/2	6	6	1/2
19596.1878(	.0118)	13/2	7	6	1/2
23805.2970(	.0100)*	9/2	5	4	3/2
23817.6150(	.0020)*	9/2	4	4	3/2
23826.6210(	.0030)*	9/2	5	5	3/2
23838.9330(	.0100)*	9/2	4	5	3/2
32843.4564(	.0398)	15/2	7	8	1/2
32879.7200(	.0395)	15/2	8	8	1/2
32921.2508(	.0404)	15/2	7	7	1/2
32957.5144(	.0400)	15/2	8	7	1/2
36963.4800(	.0300)*	11/2	6	5	3/2
36983.4700(	.0300)*	11/2	5	5	3/2
36994.4300(	.0500)*	11/2	6	6	3/2
37014.4200(	.0300)*	11/2	5	6	3/2

BLE VI. MICROWAVE SPECTRUM OF ^{16}OH IN ORDER OF FREQUENCY (CONTINUED).

48416.0090(	.1280)	17/2	8	9	1/2
48453.7778(	.1277)	17/2	9	9	1/2
48493.7757(	.1285)	17/2	8	8	1/2
48531.5445(	.1282)	17/2	9	8	1/2
52696.7200(	.0300)*	13/2	7	6	3/2
52722.0400(	.0200)*	13/2	6	6	3/2
52734.5600(	.0200)*	13/2	7	7	3/2
52759.8900(	.0300)*	13/2	6	7	3/2
66055.0824(	.3362)	19/2	9	10	1/2
66094.0228(	.3360)	19/2	10	10	1/2
66132.6578(	.3368)	19/2	9	9	1/2
66171.5981(	.3365)	19/2	10	9	1/2
70815.8507(	.0187)	15/2	8	7	3/2
70845.0810(	.0200)*	15/2	7	7	3/2
70858.9300(	.0200)*	15/2	8	8	3/2
70868.1237(	.0188)	15/2	7	8	3/2
85624.3851(	.7540)	21/2	10	11	1/2
85664.2553(	.7538)	21/2	11	11	1/2
85701.6614(	.7546)	21/2	10	10	1/2
85741.5315(	.7544)	21/2	11	10	1/2
91156.2177(	.0693)	17/2	9	8	3/2
91188.2600(	.1000)*	17/2	8	8	3/2
91203.2200(	.1000)*	17/2	9	9	3/2
91235.3968(	.0689)	17/2	8	9	3/2
106992.8998(	1.5084)	23/2	11	12	1/2
107033.5233(	1.5082)	23/2	12	12	1/2
107069.8054(	1.5090)	23/2	11	11	1/2
107110.4289(	1.5088)	23/2	12	11	1/2
113570.6909(	.2290)	19/2	10	9	3/2
113605.0416(	.2284)	19/2	9	9	3/2
113620.9136(	.2284)	19/2	10	10	3/2
113655.2643(	.2285)	19/2	9	10	3/2
130031.3239(	2.7711)	25/2	12	13	1/2
130072.5709(	2.7709)	25/2	13	13	1/2
130107.8114(	2.7717)	25/2	12	12	1/2
130149.0583(	2.7716)	25/2	13	12	1/2
137922.5018(	.5761)	21/2	11	10	3/2
137958.6451(	.5757)	21/2	10	10	3/2
137975.2416(	.5757)	21/2	11	11	3/2
138011.3849(	.5756)	21/2	10	11	3/2
154609.8651(	4.7665)	27/2	13	14	1/2
154651.6393(	4.7664)	27/2	14	14	1/2
154685.9021(	4.7672)	27/2	13	13	1/2
154727.6763(	4.7670)	27/2	14	13	1/2
164079.8673(	1.2300)	23/2	12	11	3/2
164117.4767(	1.2296)	23/2	11	11	3/2
164134.6529(	1.2297)	23/2	12	12	3/2
164172.2023(	1.2294)	23/2	11	12	3/2
191912.3930(	2.3548)	25/2	13	12	3/2
191951.2304(	2.3544)	25/2	12	12	3/2
191968.8627(	2.3544)	25/2	13	13	3/2
192007.7002(	2.3541)	25/2	12	13	3/2
221288.8422(	4.1667)	27/2	14	13	3/2
221328.7314(	4.1663)	27/2	13	13	3/2
221346.7130(	4.1663)	27/2	14	14	3/2
221386.6022(	4.1660)	27/2	13	14	3/2
252075.8605(	6.9428)	29/2	15	14	3/2
252116.6686(	6.9424)	29/2	14	14	3/2
252134.9067(	6.9425)	29/2	15	15	3/2
252175.7150(	6.9421)	29/2	14	15	3/2

TABLE VII. MICROWAVE SPECTRUM OF ^{16}OD, ^{18}OH AND ^{17}OH TRANSITIONS IN ORDER OF FREQUENCY.[a]

CALC OR OBS FREQUENCY	EST. UNCERT.	Ω	J	F_U	F_L	F'_U	F'_L	ISOTOPE
75.0279(	.0011)	1/2	9/2	4	5			18OH
103.0761(	.0011)	1/2	9/2	4	4			18OH
150.7909(	.0011)	1/2	9/2	5	5			18OH
178.8392(	.0011)	1/2	9/2	5	4			18OH
298.0970(	.0010)	3/2	3/2	3/2	5/2			16OD
303.0320(	.0020)	3/2	3/2	1/2	3/2			16OD
303.4961(	.3937)	1/2	19/2	17/2	19/2			16OD
307.6522(	.3944)	1/2	19/2	17/2	17/2			16OD
309.8775(	.3924)	1/2	19/2	19/2	21/2			16OD
310.1445(	.0010)	3/2	3/2	1/2	1/2			16OD
310.2147(	.0010)	3/2	3/2	3/2	3/2			16OD
310.3027(	.0010)	3/2	3/2	5/2	5/2			16OD
314.2854(	.3930)	1/2	19/2	19/2	19/2			16OD
317.3230(	.0040)	3/2	3/2	3/2	1/2			16OD
318.4415(	.3937)	1/2	19/2	19/2	17/2			16OD
321.5435(	.3919)	1/2	19/2	21/2	21/2			16OD
322.4800(	.0020)	3/2	3/2	5/2	3/2			16OD
325.9514(	.3924)	1/2	19/2	21/2	19/2			16OD
1185.8712(	.0010)	3/2	5/2	5/2	7/2			16OD
1186.9086(	.0030)	3/2	5/2	3/2	5/2			16OD
1190.5659(	.0020)	3/2	5/2	3/2	3/2			16OD
1190.7741(	.0020)	3/2	5/2	5/2	5/2			16OD
1191.1047(	.0020)	3/2	5/2	7/2	7/2			16OD
1194.3390(	.0010)	3/2	5/2	5/2	3/2			16OD
1196.0060(	.0030)	3/2	5/2	7/2	5/2			16OD
1302.1190(	.0050)	3/2	3/2	5/2	3/2	3	2	17OH
1322.4640(	.0050)	3/2	3/2	7/2	5/2	3	2	17OH
1413.2020(	.0050)	3/2	3/2	3/2	1/2	2	1	17OH
1455.7290(	.0050)	3/2	3/2	5/2	3/2	2	1	17OH
1584.2740(	.0020)	3/2	3/2	1	2			18OH
1624.5180(	.0050)	3/2	3/2	7/2	7/2	4	4	17OH
1626.1910(	.0030)	3/2	3/2	9/2	9/2	4	4	17OH
1637.5640(	.0020)	3/2	3/2	1	1			18OH
1638.5030(	.0020)	3/2	3/2	2	2			18OH
1655.4090(	.0050)	3/2	3/2	5/2	5/2	3	3	17OH
1656.5420(	.0050)	3/2	3/2	7/2	7/2	3	3	17OH
1683.5400(	.0050)	3/2	3/2	3/2	3/2	1	1	17OH
1684.5420(	.0050)	3/2	3/2	1/2	1/2	1	1	17OH
1692.7950(	.0020)	3/2	3/2	2	1			18OH
1902.0330(	.0050)	3/2	3/2	3/2	5/2	1	2	17OH
1912.4290(	.0050)	3/2	3/2	3/2	3/2	1	2	17OH
1940.2370(	.0050)	3/2	3/2	1/2	3/2	1	2	17OH
2008.3540(	.0050)	3/2	3/2	5/2	7/2	2	3	17OH
2027.3230(	.0050)	3/2	3/2	3/2	5/2	2	3	17OH
2102.7910(	.0050)	3/2	3/2	7/2	9/2	3	4	17OH
2117.8000(	.0050)	3/2	3/2	5/2	7/2	3	4	17OH
2820.8514(	.0020)	3/2	7/2	5/2	7/2			16OD
2821.0357(	.0020)	3/2	7/2	7/2	9/2			16OD
2822.0007(	.0020)	3/2	7/2	5/2	5/2			16OD
2822.3033(	.0020)	3/2	7/2	7/2	7/2			16OD
2822.9250(	.0020)	3/2	7/2	9/2	9/2			16OD

TABLE VII. MICROWAVE SPECTRUM OF ^{16}OD, ^{18}OH AND ^{17}OH TRANSITIONS IN ORDER OF FREQUENCY. (CONTINUED)

CALC OR OBS FREQUENCY	EST. UNCERT.	Ω	J	F_U	F_L	F'_U	F'_L	ISOTOPE
2823.5328(	.0020)	3/2	7/2	7/2	5/2			160D
2824.2276(	.0020)	3/2	7/2	9/2	7/2			160D
3090.2163(	.0010)	1/2	1/2	1/2	3/2			160D
3093.5057(	.0010)	1/2	1/2	1/2	1/2			160D
3111.1414(	.0010)	1/2	1/2	3/2	3/2			160D
3114.5234(	.0010)	1/2	1/2	3/2	1/2			160D
3903.6033(	.2244)	1/2	17/2	15/2	17/2			160D
3907.4208(	.2251)	1/2	17/2	15/2	15/2			160D
3910.1313(	.2235)	1/2	17/2	17/2	19/2			160D
3914.2099(	.2239)	1/2	17/2	17/2	17/2			160D
3918.0274(	.2245)	1/2	17/2	17/2	15/2			160D
3921.7271(	.2232)	1/2	17/2	19/2	19/2			160D
3925.8057(	.2235)	1/2	17/2	19/2	17/2			160D
3980.2290(	.0050)	1/2	1/2	5/2	5/2	3	3	170H
4001.5590(	.6497)	1/2	21/2	21/2	23/2			160D
4006.2460(	.6480)	1/2	21/2	23/2	23/2			160D
4008.8221(	.6513)	1/2	21/2	19/2	21/2			160D
4013.2092(	.6504)	1/2	21/2	21/2	21/2			160D
4017.9561(	.6497)	1/2	21/2	23/2	21/2			160D
4019.7507(	.6522)	1/2	21/2	19/2	19/2			160D
4024.1978(	.6512)	1/2	21/2	21/2	19/2			160D
4025.9140(	.0050)	1/2	1/2	7/2	7/2	3	3	170H
4644.6500(	.0060)	1/2	1/2	0	1			180H
4735.0730(	.0060)	1/2	1/2	1	1			180H
4749.9710(	.0050)	1/2	1/2	1	0			180H
5303.9340(	.0050)	3/2	9/2	9/2	7/2			160D
5304.0150(	.0050)	3/2	9/2	7/2	7/2			160D
5304.3590(	.0050)	3/2	9/2	11/2	9/2			160D
5304.6000(	.0050)	3/2	9/2	9/2	9/2			160D
5304.6310(	.0050)	3/2	9/2	7/2	9/2			160D
5305.3720(	.0050)	3/2	9/2	11/2	11/2			160D
5305.6190(	.0050)	3/2	9/2	9/2	11/2			160D
5473.0320(	.0050)	1/2	1/2	5/2	7/2	2	3	170H
5523.4350(	.0050)	1/2	1/2	3/2	5/2	2	3	170H
5590.8303(	.0017)	1/2	7/2	3	4			180H
5614.2075(	.0016)	1/2	7/2	3	3			180H
5664.7321(	.0018)	1/2	7/2	4	4			180H
5688.1693(	.0017)	1/2	7/2	4	3			180H
5716.5050(	.0050)	1/2	1/2	5/2	5/2	2	2	170H
5748.3330(	.0050)	1/2	1/2	3/2	3/2	2	2	170H
5752.9160(	.0050)	3/2	5/2	7/2	5/2	4	3	170H
5760.2230(	.0050)	3/2	5/2	9/2	7/2	4	3	170H
5851.0570(	.0050)	3/2	5/2	5/2	3/2	3	2	170H
5857.5780(	.0050)	3/2	5/2	7/2	5/2	3	2	170H
5887.2820(	.0050)	1/2	3/2	1/2	3/2			160D
5887.7410(	.0050)	1/2	3/2	1/2	1/2			160D
5894.1790(	.0050)	1/2	3/2	3/2	5/2			160D
5894.6800(	.0050)	1/2	3/2	3/2	3/2			160D
5895.1350(	.0050)	1/2	3/2	3/2	1/2			160D
5906.2150(	.0050)	1/2	3/2	5/2	5/2			160D
5906.7120(	.0050)	1/2	3/2	5/2	3/2			160D

TABLE VII. MICROWAVE SPECTRUM OF ^{16}OD, ^{18}OH AND ^{17}OH TRANSITIONS IN ORDER OF FREQUENCY. (CONTINUED)

CALC OR OBS FREQUENCY	EST. UNCERT.	Ω	J	F_U	F_L	F'_U	F'_L	ISOTOPE
5914.9600(	.0050)	3/2	5/2	9/2	9/2	5	5	170H
5918.9560(	.0050)	3/2	5/2	11/2	11/2	5	5	170H
5920.5050(	.0050)	3/2	5/2	2	3			180H
5931.9080(	.0050)	3/2	5/2	3/2	1/2	2	1	170H
5934.6440(	.0060)	3/2	5/2	2	2			180H
5938.8010(	.0050)	3/2	5/2	5/2	3/2	2	1	170H
5938.9670(	.0050)	3/2	5/2	3	3			180H
5953.1160(	.0040)	3/2	5/2	3	2			180H
5971.0480(	.0050)	3/2	5/2	7/2	7/2	4	4	170H
5974.3740(	.0050)	3/2	5/2	9/2	9/2	4	4	170H
6005.6260(	.0050)	3/2	5/2	3/2	1/2	1	0	170H
6013.9460(	.0050)	3/2	5/2	7/2	7/2	3	3	170H
6114.6480(	.0050)	3/2	5/2	1/2	3/2	0	1	170H
6157.6200(	.0050)	3/2	5/2	3/2	5/2	1	2	170H
6200.0380(	.0050)	3/2	5/2	5/2	7/2	2	3	170H
6202.1760(	.0050)	3/2	5/2	3/2	5/2	2	3	170H
6733.5751(	.1185)	1/2	15/2	13/2	15/2			160D
6736.3938(	.1191)	1/2	15/2	13/2	13/2			160D
6740.2559(	.1179)	1/2	15/2	15/2	17/2			160D
6743.3451(	.1181)	1/2	15/2	15/2	15/2			160D
6747.3688(	.1186)	1/2	15/2	15/2	13/2			160D
6751.7502(	.1178)	1/2	15/2	17/2	17/2			160D
6755.4394(	.1179)	1/2	15/2	17/2	15/2			160D
7746.6238(	.0022)	1/2	3/2	1	2			180H
7758.3472(	.0022)	1/2	3/2	1	1			180H
7816.7560(	.0026)	1/2	3/2	2	2			180H
7828.4795(	.0021)	1/2	3/2	2	1			180H
8073.7245(	.1001)	1/2	11/2	5	6			180H
8109.9940(	.0050)	1/2	5/2	3/2	5/2			160D
8110.2693(	.1001)	1/2	11/2	6	6			180H
8110.7170(	.0050)	1/2	5/2	3/2	3/2			160D
8117.2280(	.0050)	1/2	5/2	5/2	7/2			160D
8118.0130(	.0050)	1/2	5/2	5/2	5/2			160D
8118.7330(	.0050)	1/2	5/2	5/2	3/2			160D
8128.1810(	.0050)	1/2	5/2	7/2	7/2			160D
8128.9610(	.0050)	1/2	5/2	7/2	5/2			160D
8155.6388(	.1001)	1/2	11/2	5	5			180H
8167.3315(	.0021)	1/2	5/2	2	3			180H
8184.9925(	.0019)	1/2	5/2	2	2			180H
8187.1341(	.1001)	1/2	11/2	6	5			180H
8238.7585(	.0025)	1/2	5/2	3	3			180H
8256.4195(	.0021)	1/2	5/2	3	2			180H
8670.2946(	.0025)	3/2	11/2	11/2	9/2			160D
8670.6848(	.0024)	3/2	11/2	13/2	11/2			160D
8671.6000(	.0800)	3/2	11/2	9/2	9/2			160D
8672.3700(	.0800)	3/2	11/2	11/2	11/2			160D
8673.3500(	.0800)	3/2	11/2	13/2	13/2			160D
8673.6484(	.0024)	3/2	11/2	9/2	11/2			160D
8675.0427(	.0024)	3/2	11/2	11/2	13/2			160D
8749.9742(	.0566)	1/2	13/2	11/2	13/2			160D
8752.9425(	.0571)	1/2	13/2	11/2	11/2			160D

TABLE VII. MICROWAVE SPECTRUM OF ^{16}OD, ^{18}OH AND ^{17}OH TRANSITIONS IN ORDER OF FREQUENCY. (CONTINUED)

CALC OR OBS FREQUENCY	EST. UNCERT.	Ω	J	F_U	F_L	F'_U	F'_L	ISOTOPE
8756.8113(	.0563)	1/2	13/2	13/2	15/2			160D
8760.0415(	.0563)	1/2	13/2	13/2	13/2			160D
8763.0098(	.0566)	1/2	13/2	13/2	11/2			160D
8768.1692(	.0564)	1/2	13/2	15/2	15/2			160D
8771.3994(	.0563)	1/2	13/2	15/2	13/2			160D
9016.5616(	1.0277)	1/2	23/2	23/2	25/2			160D
9021.4957(	1.0268)	1/2	23/2	25/2	25/2			160D
9023.5970(	1.0297)	1/2	23/2	21/2	23/2			160D
9028.2948(	1.0287)	1/2	23/2	23/2	23/2			160D
9033.2189(	1.0277)	1/2	23/2	25/2	23/2			160D
9034.6303(	1.0307)	1/2	23/2	21/2	21/2			160D
9039.3281(	1.0296)	1/2	23/2	23/2	21/2			160D
9577.6622(	.0031)	1/2	7/2	5/2	7/2			160D
9578.9000(	.0800)	1/2	7/2	5/2	5/2			160D
9584.8962(	.0035)	1/2	7/2	7/2	9/2			160D
9586.3200(	.0800)	1/2	7/2	7/2	7/2			160D
9587.5829(	.0031)	1/2	7/2	7/2	5/2			160D
9595.7400(	.0800)	1/2	7/2	9/2	9/2			160D
9597.1728(	.0035)	1/2	7/2	9/2	7/2			160D
9912.2563(	.0237)	1/2	11/2	9/2	11/2			160D
9914.7000(	.0800)	1/2	11/2	9/2	9/2			160D
9919.2477(	.0236)	1/2	11/2	11/2	13/2			160D
9921.9500(	.0800)	1/2	11/2	11/2	11/2			160D
9924.3007(	.0237)	1/2	11/2	11/2	9/2			160D
9930.4400(	.0800)	1/2	11/2	13/2	13/2			160D
9933.1301(	.0236)	1/2	11/2	13/2	11/2			160D
10190.3506(	.0086)	1/2	9/2	7/2	9/2			160D
10192.2100(	.0800)	1/2	9/2	7/2	7/2			160D
10197.4824(	.0088)	1/2	9/2	9/2	11/2			160D
10199.5900(	.0800)	1/2	9/2	9/2	9/2			160D
10201.4374(	.0090)	1/2	9/2	9/2	7/2			160D
10208.5000(	.0800)	1/2	9/2	11/2	11/2			160D
10210.5669(	.0088)	1/2	9/2	11/2	9/2			160D
12914.9091(	.0055)	3/2	13/2	13/2	11/2			160D
12915.3686(	.0054)	3/2	13/2	15/2	13/2			160D
12917.0800(	.0800)	3/2	13/2	11/2	11/2			160D
12918.1300(	.0800)	3/2	13/2	13/2	13/2			160D
12919.3300(	.0800)	3/2	13/2	15/2	15/2			160D
12920.3081(	.0055)	3/2	13/2	11/2	13/2			160D
12922.0314(	.0054)	3/2	13/2	13/2	15/2			160D
13229.9882(	.0054)	3/2	7/2	4	3			180H
13230.5585(	.0020)	3/2	7/2	3	3			180H
13237.3031(	.0022)	3/2	7/2	4	4			180H
13237.8334(	.0053)	3/2	7/2	3	4			180H
14681.6007(	1.5686)	1/2	25/2	25/2	27/2			160D
14686.7277(	1.5675)	1/2	25/2	27/2	27/2			160D
14688.4235(	1.5709)	1/2	25/2	23/2	25/2			160D
14693.3401(	1.5697)	1/2	25/2	25/2	25/2			160D
14698.4671(	1.5686)	1/2	25/2	27/2	25/2			160D
14693.5353(	1.5722)	1/2	25/2	23/2	23/2			160D
14704.4505(	1.5709)	1/2	25/2	25/2	23/2			160D

TABLE VII. MICROWAVE SPECTRUM OF ^{16}OD, ^{18}OH AND ^{17}OH TRANSITIONS IN ORDER OF FREQUENCY. (CONTINUED)

CALC OR OBS FREQUENCY	EST. UNCERT.	Ω	J	F_U	F_L	F'_U	F'_L	ISOTOPE
18006.5372(	.0104)	3/2	15/2	15/2	13/2			16OD
18007.1539(	.0104)	3/2	15/2	17/2	15/2			16OD
18009.4600(	.0800)	3/2	15/2	13/2	13/2			16OD
18010.6300(	.0800)	3/2	15/2	15/2	15/2			16OD
18012.1300(	.0800)	3/2	15/2	17/2	17/2			16OD
18013.5135(	.0104)	3/2	15/2	13/2	15/2			16OD
18015.5928(	.0104)	3/2	15/2	15/2	17/2			16OD
18876.5418(	.2003)	1/2	13/2	6	7			18OH
18910.7114(	.2003)	1/2	13/2	7	7			18OH
18954.0047(	.2004)	1/2	13/2	6	6			18OH
18988.2343(	.2003)	1/2	13/2	7	6			18OH
20961.6317(	2.3266)	1/2	27/2	27/2	29/2			16OD
20966.9834(	2.3253)	1/2	27/2	29/2	29/2			16OD
20968.3108(	2.3294)	1/2	27/2	25/2	27/2			16OD
20973.4142(	2.3280)	1/2	27/2	27/2	27/2			16OD
20978.7159(	2.3266)	1/2	27/2	29/2	27/2			16OD
20979.4761(	2.3308)	1/2	27/2	25/2	25/2			16OD
20984.5795(	2.3294)	1/2	27/2	27/2	25/2			16OD
23458.6532(	.0069)	3/2	9/2	5	4			18OH
23470.8886(	.0022)	3/2	9/2	4	4			18OH
23479.8228(	.0026)	3/2	9/2	5	5			18OH
23492.0382(	.0069)	3/2	9/2	4	5			18OH
23903.5682(	.0153)	3/2	17/2	17/2	15/2			16OD
23904.3393(	.0153)	3/2	17/2	19/2	17/2			16OD
23907.0800(	.0800)	3/2	17/2	15/2	15/2			16OD
23908.4400(	.0800)	3/2	17/2	17/2	17/2			16OD
23910.0400(	.0800)	3/2	17/2	19/2	19/2			16OD
23911.9024(	.0154)	3/2	17/2	15/2	17/2			16OD
23914.1790(	.0153)	3/2	17/2	17/2	19/2			16OD
27823.9201(	3.3710)	1/2	29/2	29/2	31/2			16OD
27829.2735(	3.3694)	1/2	29/2	31/2	31/2			16OD
27830.2665(	3.3741)	1/2	29/2	27/2	29/2			16OD
27835.5353(	3.3726)	1/2	29/2	29/2	29/2			16OD
27840.9887(	3.3710)	1/2	29/2	31/2	29/2			16OD
27841.4692(	3.3757)	1/2	29/2	27/2	27/2			16OD
27846.7380(	3.3741)	1/2	29/2	29/2	27/2			16OD
30561.4085(	.0162)	3/2	19/2	19/2	17/2			16OD
30562.3354(	.0162)	3/2	19/2	21/2	19/2			16OD
30565.4200(	.0800)	3/2	19/2	17/2	17/2			16OD
30566.9500(	.0800)	3/2	19/2	19/2	19/2			16OD
30568.7200(	.0800)	3/2	19/2	21/2	21/2			16OD
30570.9414(	.0162)	3/2	19/2	17/2	19/2			16OD
30573.2397(	.0162)	3/2	19/2	19/2	21/2			16OD
32028.0343(	.2039)	1/2	15/2	7	8			18OH
32064.2358(	.2039)	1/2	15/2	8	8			18OH
32105.8417(	.2040)	1/2	15/2	7	7			18OH
32141.9920(	.2040)	1/2	15/2	8	7			18OH
35236.5622(	4.7836)	1/2	31/2	31/2	33/2			16OD
35242.1482(	4.7869)	1/2	31/2	33/2	33/2			16OD
35242.3373(	4.7922)	1/2	31/2	29/2	31/2			16OD
35248.2520(	4.7904)	1/2	31/2	31/2	31/2			16OD

TABLE VII. MICROWAVE SPECTRUM OF ^{16}OD, ^{18}OH AND ^{17}OH TRANSITIONS IN ORDER OF FREQUENCY. (CONTINUED)

CALC OR OBS FREQUENCY	EST. UNCERT.	Ω	J	F_U	F_L	F'_U	F'_L	ISOTOPE
35253.8379(	4.7886)	1/2	31/2	33/2	31/2			160D
35254.0630(	4.7940)	1/2	31/2	29/2	29/2			160D
35259.4778(	4.7922)	1/2	31/2	31/2	29/2			160D
36443.9761(	.1005)	3/2	11/2	6	5			180H
36463.8808(	.1002)	3/2	11/2	5	5			180H
36474.7563(	.1002)	3/2	11/2	6	6			180H
36494.6610(	.1005)	3/2	11/2	5	6			180H
37936.3616(	.0242)	3/2	21/2	21/2	19/2			160D
37937.4380(	.0242)	3/2	21/2	23/2	21/2			160D
37940.7300(	.0800)	3/2	21/2	19/2	19/2			160D
37942.4200(	.0800)	3/2	21/2	21/2	21/2			160D
37944.3500(	.0800)	3/2	21/2	23/2	23/2			160D
37946.8160(	.0242)	3/2	21/2	19/2	21/2			160D
37948.3183(	.0242)	3/2	21/2	21/2	23/2			160D
43169.5530(	6.6870)	1/2	33/2	33/2	35/2			160D
43175.2560(	6.6851)	1/2	33/2	35/2	35/2			160D
43175.0865(	6.6910)	1/2	33/2	31/2	33/2			160D
43181.2108(	6.6891)	1/2	33/2	33/2	33/2			160D
43186.9035(	6.6930)	1/2	33/2	31/2	31/2			160D
43186.9138(	6.6871)	1/2	33/2	35/2	33/2			160D
43192.4478(	6.6910)	1/2	33/2	33/2	31/2			160D
45987.1153(	.0823)	3/2	23/2	23/2	21/2			160D
45988.3315(	.0822)	3/2	23/2	25/2	23/2			160D
45991.8283(	.0824)	3/2	23/2	21/2	21/2			160D
45993.6310(	.0822)	3/2	23/2	23/2	23/2			160D
45995.6673(	.0824)	3/2	23/2	25/2	25/2			160D
45998.3435(	.0822)	3/2	23/2	21/2	23/2			160D
46000.9673(	.0822)	3/2	23/2	23/2	25/2			160D
47370.8754(	.3262)	1/2	17/2	8	9			180H
47408.5427(	.3260)	1/2	17/2	9	9			180H
47448.6100(	.3264)	1/2	17/2	8	8			180H
47486.2833(	.3262)	1/2	17/2	9	8			180H
51977.3840(	.2005)	3/2	13/2	7	6			180H
52002.6403(	.2004)	3/2	13/2	6	6			180H
52015.1322(	.2004)	3/2	13/2	7	7			180H
52040.3885(	.2009)	3/2	13/2	6	7			180H
54675.0497(	.2143)	3/2	25/2	25/2	23/2			160D
54676.3930(	.2143)	3/2	25/2	27/2	25/2			160D
54680.0317(	.2144)	3/2	25/2	23/2	23/2			160D
54681.9504(	.2143)	3/2	25/2	25/2	25/2			160D
54684.1016(	.2144)	3/2	25/2	27/2	27/2			160D
54686.9324(	.2143)	3/2	25/2	23/2	25/2			160D
54689.6590(	.2143)	3/2	25/2	25/2	27/2			160D
63963.9333(	.4597)	3/2	27/2	27/2	25/2			160D
63965.4419(	.4598)	3/2	27/2	29/2	27/2			160D
63969.1339(	.4597)	3/2	27/2	25/2	25/2			160D
63971.2150(	.4598)	3/2	27/2	27/2	27/2			160D
63973.4659(	.4597)	3/2	27/2	29/2	29/2			160D
63976.4255(	.4598)	3/2	27/2	25/2	27/2			160D
63979.2390(	.4597)	3/2	27/2	27/2	29/2			160D
64760.0070(	.5225)	1/2	19/2	9	10			180H

TABLE VII. MICROWAVE SPECTRUM OF ^{16}OD, ^{18}OH AND ^{17}OH TRANSITIONS IN ORDER OF FREQUENCY. (CONTINUED)

CALC OR OBS FREQUENCY	EST. UNCERT.	Ω	J	F_U	F_L	F'_U	F'_L	ISOTOPE
64798.8553(	.5224)	1/2	19/2	10	10			180H
64837.5660(	.5229)	1/2	19/2	9	9			180H
64876.4143(	.5227)	1/2	19/2	10	9			180H
69872.2054(	.2009)	3/2	15/2	8	7			180H
69901.3415(	.2008)	3/2	15/2	7	7			180H
69915.1738(	.2008)	3/2	15/2	8	8			180H
69944.3100(	.2009)	3/2	15/2	7	8			180H
73813.7254(	.8743)	3/2	29/2	29/2	27/2			160D
73821.2870(	.8743)	3/2	29/2	31/2	29/2			160D
73825.1320(	.8743)	3/2	29/2	27/2	27/2			160D
73827.2428(	.8742)	3/2	29/2	29/2	29/2			160D
73829.5804(	.8743)	3/2	29/2	31/2	31/2			160D
73832.6495(	.8742)	3/2	29/2	27/2	29/2			160D
73835.5381(	.8743)	3/2	29/2	29/2	31/2			160D
84061.2040(	.9636)	1/2	21/2	10	11			180H
84100.9833(	.9634)	1/2	21/2	11	11			180H
84138.4722(	.9641)	1/2	21/2	10	10			180H
84178.2531(	.9639)	1/2	21/2	11	10			180H
84209.5930(	1.5311)	3/2	31/2	31/2	29/2			160D
84211.2462(	1.5312)	3/2	31/2	33/2	31/2			160D
84215.1698(	1.5311)	3/2	31/2	29/2	29/2			160D
84217.3536(	1.5311)	3/2	31/2	31/2	31/2			160D
84219.7708(	1.5312)	3/2	31/2	33/2	33/2			160D
84222.9354(	1.5311)	3/2	31/2	29/2	31/2			160D
84225.8933(	1.5312)	3/2	31/2	31/2	33/2			160D
89965.8597(	.3079)	3/2	17/2	9	8			180H
89997.9069(	.3077)	3/2	17/2	8	8			180H
90012.8432(	.3077)	3/2	17/2	9	9			180H
90044.8924(	.3078)	3/2	17/2	8	9			180H
95101.9734(	2.5226)	3/2	33/2	33/2	31/2			160D
95103.7131(	2.5226)	3/2	33/2	35/2	33/2			160D
95107.7053(	2.5225)	3/2	33/2	31/2	31/2			160D
95109.9618(	2.5226)	3/2	33/2	33/2	33/2			160D
95112.4373(	2.5227)	3/2	33/2	35/2	35/2			160D
95115.6874(	2.5225)	3/2	33/2	31/2	33/2			160D
95118.6860(	2.5226)	3/2	33/2	33/2	35/2			160D
105145.5345(	1.6629)	1/2	23/2	11	12			180H
105186.0801(	1.6627)	1/2	23/2	12	12			180H
105222.4394(	1.6635)	1/2	23/2	11	11			180H
105262.9350(	1.6633)	1/2	23/2	12	11			180H
106465.9955(	3.9620)	3/2	35/2	35/2	33/2			160D
106467.7935(	3.9627)	3/2	35/2	37/2	35/2			160D
106471.8534(	3.9625)	3/2	35/2	33/2	33/2			160D
106474.1074(	3.9628)	3/2	35/2	35/2	35/2			160D
106476.8972(	3.9628)	3/2	35/2	37/2	37/2			160D
106480.0254(	3.9625)	3/2	35/2	33/2	35/2			160D
106483.0051(	3.9627)	3/2	35/2	35/2	37/2			160D
112113.2065(	.4609)	3/2	19/2	10	9			180H
112147.5120(	.4608)	3/2	19/2	9	9			180H
112183.3484(	.4608)	3/2	19/2	10	10			180H
112197.6519(	.4607)	3/2	19/2	9	10			180H

TABLE VII. MICROWAVE SPECTRUM OF ^{16}OD, ^{18}OH AND ^{17}OH TRANSITIONS IN ORDER OF FREQUENCY. (CONTINUED)

CALC OR OBS FREQUENCY	EST. UNCERT.	Ω	J	F_U	F_L	F'_U	F'_L	ISOTOPE
136179.5142(	.8318)	3/2	21/2	11	10			18OH
136215.6173(	.8315)	3/2	21/2	10	10			18OH
136232.1813(	.8315)	3/2	21/2	11	11			18OH
136268.2344(	.8315)	3/2	21/2	10	11			18OH
162035.1190(	1.4152)	3/2	23/2	12	11			18OH
162072.6919(	1.4149)	3/2	23/2	11	11			18OH
162089.8409(	1.4150)	3/2	23/2	12	12			18OH
162127.4137(	1.4147)	3/2	23/2	11	12			18OH
189551.8294(	2.5209)	3/2	25/2	13	12			18OH
189590.6327(	2.5206)	3/2	25/2	12	12			18OH
189608.2432(	2.5206)	3/2	25/2	13	13			18OH
189547.0466(	2.5203)	3/2	25/2	12	13			18OH

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