Experimental Stark widths and shifts for spectral lines of neutral and ionized atoms

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Experimental Stark Widths and Shifts for Spectral Lines of Neutral and Ionized Atoms
(A Critical Review of Selected Data for the Period 1983 through 1988)

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A critical review of the available experimental data on Stark widths and shifts for spectral lines of non-hydrogenic neutral atoms and positive ions has been carried out. The review covers the period from 1983 through the end of 1988 and represents a continuation of earlier critical reviews up to 1982. Data tables containing the selected experimental Stark broadening parameters are presented with estimated accuracies. Guidelines for the accuracy estimates have been developed during the previous reviews and are summarized. The data are arranged according to elements and spectra, and these are presented in alphabetical and numerical order, respectively. Comparisons with comprehensive calculations based either on the semiclassical theory, or—for multiply ionized atoms—on the modified semiempirical approximation, are made whenever possible, since the comparison with theory has often been a principal motivation for the experiments.

Key words: critically evaluated data; full-width-at-half-maximum intensity; neutral atoms; positive ions; Stark broadening parameters; Stark shifts; Stark widths.

Contents

1. Introduction

With this tabulation we continue the series of critical reviews and tables on experimental Stark broadening data for spectral lines of non-hydrogenic atoms and ions which we started in 1976[1,2] and updated in 1984[3,4]. In this new installment, we cover the period from 1983 to the end of 1988, and we have now merged the data on atoms and ions into a single set of tables. But in all other respects we have adhered to the format of our previous reviews, and we have subjected the data again to the same evaluation criteria as established earlier.

Our main source of literature references has been the master file of the Data Center on Atomic Line Shapes and Shifts at the National Institute of Standards and Technology (formerly the National Bureau of Standards).[5] Also, one of us (N.K.) has maintained an independent literature search during the entire period.

A principal reason for many Stark broadening experiments is to provide comparisons for theoretical Stark width and shift data. We have therefore also presented comparisons with the most comprehensive calculations, as in our previous reviews.

2. General Discussion of Our Evaluation Procedure

We have evaluated and tabulated two principal Stark broadening parameters obtained from the experiments: the full width of a spectral line at half maximum intensity (FWHM) and the shift of a line, usually determined at peak intensity. This shift is listed as positive, when it occurs toward longer wavelengths (red shift) and as negative when it occurs toward shorter wavelengths (blue shift).

We have provided detailed discussions of our evaluation procedure and of the adopted criteria in our earlier reviews[1–4] and have given extensive literature references there. Therefore, we only summarize here our principal criteria for the selection of the experimental results and for the estimates of the uncertainties:

(a) The plasma source must be well characterized, i.e., it must be homogeneous in the observation region, be steady-state during observation time and must be reproducible.

(b) The electron density in the observed plasma region must have been determined accurately by an independent method (i.e., a method other than utilizing the Stark broadening of the investigated lines), with an uncertainty of 15–30% or less.

(c) A temperature determination with an accuracy similar to that for the electron density must have been carried out.

(d) In the determination of Stark widths and shifts all possible competing line broadening and shift mechanisms must have been considered, such as Doppler, Van der Waals, and instrumental broadening. Also, pertinent experimental problems such as possible non-negligible optical depth at the line center, inhomogeneous plasma boundary layers, etc. must have been considered.

We have generally found that in the large majority of the experiments the above listed critical factors (a) to (d) have been fully addressed. Occasionally, one of the factors—like the measurement of the plasma temperature—has not been described, and we have noted this in the tables which list "key data on experiments."

In arriving at our estimates of the uncertainties in the data, we have taken into account occasional disagreements between authors outside their mutual error estimates. Furthermore, whenever possible, we have tested the adherence of the data to regularities and similarities predicted on the basis of atomic structure considerations[6]. For example, Stark half-widths are normally nearly the same for all lines within multiplets. But when we found irregular behavior, we have usually been able to trace this to experimental problems or to special circumstances in the atomic structure.

In our earlier reviews, we selected the resonance lines of singly ionized alkaline-earth atoms for detailed case discussions, because many experimental and theoretical data were available for these—including very sophisticated quantum mechanical calculations—but considerable inconsistencies persisted. We continue this discussion here with Figs. 1 and 2, since some new experimental and theoretical data have become available for the Be^+ and Ca^+ resonance lines.

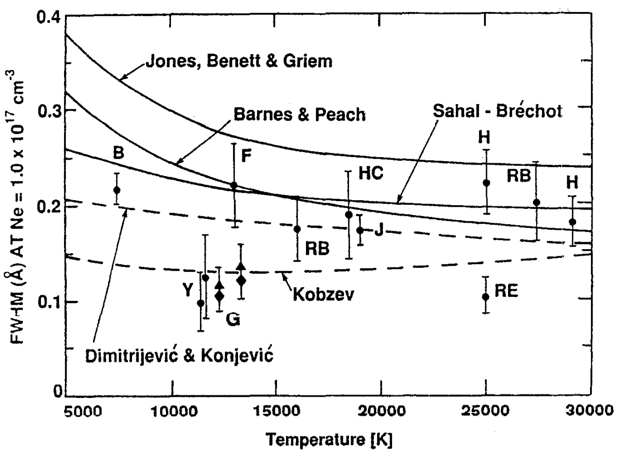

FIG. 1. Comparison of Stark width data for the Ca II resonance lines. Experimental results: B = Baur and Cooper[10]; F = Fleurier *et al.*[9]; G = Goldbach *et al.*[7] (triangles for the $J = 1/2 \rightarrow 3/2$ line, diamonds for the $J = 1/2 \rightarrow 1/2$ line); H = Hadžiomerspahić *et al.*[13]; HC = Hildum and Cooper[12]; J = Jones *et al.*[15]; RB = Roberts and Barnard[11]; RE = Roberts and Eckerle[14]; Y = Yamamoto[8]. The error flags represent the authors' uncertainty estimates. The theoretical results, given as solid or broken lines, are from the quantum mechanical calculations of Barnes and Peach[17], the semi-classical calculations of Jones, Benett and Griem[16] and Sahal-Bréchot[9], and the semiempirical calculations of Kobzev[19] and Dimitrijević and Konjević[18].

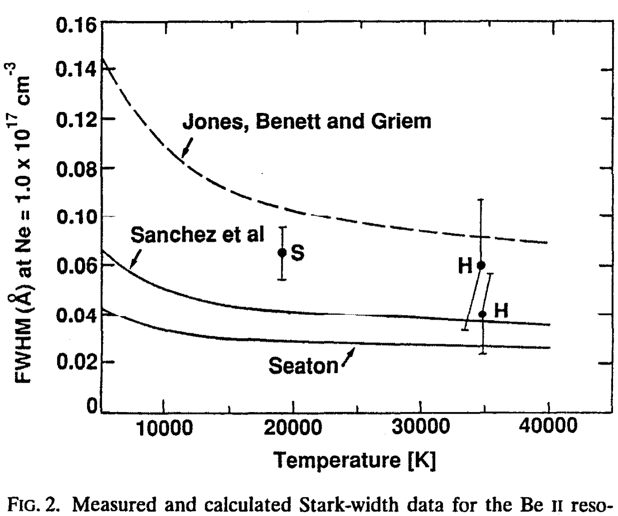

FIG. 2. Measured and calculated Stark-width data for the Be II resonance lines. Experimental results: H = Hadžiomerspahić *et al.*[13]; S = Sanchez *et al.*[21]. The theoretical results are from two quantum mechanical calculations by Sanchez *et al.*[21] and Seaton[20], and from the semi-classical calculations of Jones, Benett and Griem[16].

The new experimental Stark width data for Ca^+ shown in Fig. 1 are those of Goldbach *et al.*[7] which are the result of the most advanced experiment on Ca^+ Stark broadening undertaken to date. The principal feature of their work is the application of a Fabry-Perot interferometer which yields high spectral resolution for the narrow resonance lines. Furthermore, their plasma source is the well proven wall-stabilized arc, a very reproducible steady-state source, with which an electron density of about 10^{17} cm^{-3} has been obtained. It is seen that the results of Goldbach *et al.*[7] agree with those of Yamamoto[8], but disagree with those of Fleurier *et al.*[9] and Baur and Cooper.[10] Comparisons with other experiments[11–15] are difficult to interpret, since these were carried out at significantly higher temperatures, and the temperature dependence of the widths is not clearly established. Interestingly, the Stark widths of Goldbach *et al.*[7] for the two lines are larger for their higher temperature point, while all theories[9,16–19] predict decreasing widths with increasing temperature in this range.

An interesting addition to the theoretical data has occurred for the resonance lines of Be II (Fig. 2), where Seaton[20] has performed a new quantum mechanical calculation. It is puzzling that his results disagree with an earlier quantum mechanical calculation by Sanchez *et al.*[21], also based on the close-coupling approach, by almost a factor of two. The few available experimental points [13,21] point to larger values than obtained from either calculation.

3. Comparisons with Theory

Whenever possible, we have provided in the tables comparisons with two extensive sets of theoretical data in order to show the agreement, or disagreement, between the experiments and theory and thus provide a measure of the quality and accuracy of the calculated data. For neutral and singly ionized atoms of the light elements, up to atomic number $Z = 20$, as well as for neutral Cs, we have used the tables by Griem[22] based on his semiclassical theory. For multiply ionized atoms, we have either employed the tables of Dimitrijević and Konjević[23] based on their modified semi-empirical approach (MSE), or one of us (N.K.) has performed additional calculations utilizing the MSE approach. We already showed in the earlier reviews, especially in a summary table in the general introduction of Ref. 4, that these theoretical approaches compare very well with experiment. Generally, this is also observed here again.

We should note that the theoretical width data *for ions* are for the electron width only, and the usually very small additional width caused by ion broadening is neglected. Also, shifts contributed by ions are neglected in the theoretical shift data for ions.

4. Arrangement of the Tables

The data are presented in separate tables for each spectrum (or stage of ionization) and the spectra are arranged according to chemical elements which are given in alphabetical order.

Each data table is preceded by short comments providing additional information on the selected literature and by a short tabular overview providing some key points on each selected experiment, such as the type of plasma source employed. For spectra containing more than 20 transitions, we also provide a finding list where the selected lines are given in order of increasing wavelength.

The data tables are subdivided into four principal parts. In the first part, which comprises three columns, each spectral line is identified by transition array, multiplet designation, and wavelength (given in Angstrom units). The wavelengths are usually taken from the tables of Reader *et al.*,[24] and wavelengths not listed there are taken from the compilation by Striganov and Sventitskii.[25] The multiplet numbers refer to the running numbers in the multiplet tables by Moore[26], and the transitions are listed in order of increasing lower and upper quantum numbers.

In the second part of the table, the principal plasma data are listed. Normally, these are the ranges of temperatures and electron densities at which the width and shift data have been measured. However, in a number of papers the authors have not listed the actual electron densities at which the measurements were made, but have presented their data scaled to a nominal electron density of 10^{16} cm^{-3} for neutrals and 10^{17} cm^{-3} for ions, in order to facilitate comparisons with theory. If the range of electron densities has been reported in these cases, we list this in our introductory comments.

In the third part of the table, we present the measured Stark broadening data, specifically the full width at half maximum intensity (FWHM), i.e., in short, the Stark width, w_m, and the Stark shift, d_m. We also present the ratios of measured to theoretical widths and shifts, w_m/w_{th} and d_m/d_{th}.

In the fourth part of the table, we provide estimates of the accuracy of the data and we also identify the literature sources. When Stark widths as well as shifts are measured, we provide two accuracy estimates, where the first one refers to the width, while the second pertains to the shift. For the accuracy estimates we use code letters which indicate the following:

A = uncertainties within 15%
B = uncertainties within 30%
C = uncertainties within 50%, and
D = uncertainties larger than 50%.

We have made further differentiations within this classification scheme by singling out slightly better data among similar ones by assigning plus signs to indicate our first choices. The overall uncertainties, which are due mainly to uncertainties in the determination of the electron density as well as measurement errors in the line width and shift determinations, should be considered to be estimates of the extent of deviation from the true values. These estimates include random errors as well as our estimates of the maximum effects of possible systematic errors.

5. Summary and Conclusions

We have critically evaluated and compiled the recent experimental Stark broadening data for isolated spectral lines of neutral and ionized atoms since our last compilations[3,4] in 1984.

We have found that the new experimental data are generally very consistent with the earlier material, as well as with the results of the semiclassical theory. Also, many of the new data are estimated to be significantly more accurate—a result of improved experimental techniques.

Especially for lines of neutral atoms we observe that for the Stark widths the agreement between different experiments as well as experiment and theory is usually within ±20%, and often within 10%, so that Stark broadening of isolated heavy-element lines begins to compete with other techniques as a high accuracy plasma diagnostic approach for the determination of electron densities. Stark width data of especially good quality and mutual consistency are found for the spectra of Ar I and F I. For lines of singly and multiply ionized atoms, the accuracy of the experimental data is, however, not as well established yet, and more measurements are highly desirable. For example, the various Stark width results for Si II exhibit large scatter.

6. Acknowledgements

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8. Tables of Stark Widths and Shifts

Aluminum

Al I

Ground State: $1s^2 2s^2 2p^6 3s^2 3p\ ^2P^o_{1/2}$

Ionization Energy: 5.986 eV = 48 278.37 cm^{-1}

Our last review of Al I Stark broadening data[1] contained results for four transitions. Two of them have been investigated again with a special technique.[2,3] Resonant self-reversed aluminum lines from a pulsed arc plasma were reduced to the optically thin case by solving an inverse spectroscopic problem. By comparing the emission and absorption profiles, the authors determined the source function and the arc temperature profile. In addition, they measured the ion broadening parameters.

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Key data on experiments

Ref.	Plasma source	Method of measurement: Electron density	Method of measurement: Temperature	Remarks
2,3	Pulsed arc	H_α Stark width	Modified Bartels method[4]	Photographic technique; Optically thick profiles; H_α diagnostics done with older, lower accuracy theoretical data

Numerical results for Al I

No.	Transition array	Multiplet (No.)	Wavelength (Å)	Temperature (K)	Electron density (10^{17} cm^{-3})	w_m (Å)	w_m/w_{th}	d_m (Å)	d_m/d_{th}	Acc.	Ref.
1.	$3p-4s$	$^2P^o-^2S$	3961.52	11700	2.5	0.84	0.99	0.42	0.83	C,C	2,3
		(1)	3944.01	11700	2.5	0.84	0.99	0.42	0.83	C,C	2,3

Aluminum

Al II

Ground State: $1s^22s^22p^63s^2\ ^1S_0$

Ionization Energy: 18.829 eV = 151 862.7 cm^{-1}

Purić *et al.*[1] measured Stark widths and shifts for the lines of the $4s\ ^3S-4p\ ^3P^o$ multiplet with an electromagnetically driven shock tube (T-tube). Their measurements were done at temperatures of 16 000 K and 20 000 K over a range of electron densities N_e from $0.3\times10^{17}\ cm^{-3}$ to $1.4\times10^{17}\ cm^{-3}$, but they tabulated results only for $N_e=10^{17}\ cm^{-3}$ at these two temperatures.

We have also tabulated again the earlier results of this group (Lakićević *et al.*[2]), since they were erroneously cited in our 1984 review.[3] Lakićević *et al.*[2] performed their measurements over an electron density range from 0.44 to $2.2\times10^{17}\ cm^{-3}$, as we had stated. However, their tabulated results pertain only to a nominal electron density of $10^{17}\ cm^{-3}$, within the range of indicated temperatures. While they do not state this in their paper, it becomes evident from the theoretical comparison data.

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[3]N. Konjević, M. S. Dimitrijević and W. L. Wiese, J. Phys. Chem. Ref. Data, 13, 649 (1984).

Key data on experiments

Ref.	Plasma source	Method of measurement: Electron density	Method of measurement: Temperature	Remarks
1	T-tube	He-Ne laser interferometer at 6328 Å and H_β Stark width	Boltzmann plot of relative intensities of Ar II lines and intensity ratios of Si III to Si II lines	

Numerical results for Al II

No.	Transition array	Multiplet (No.)	Wavelength (Å)	Temperature (K)	Electron density ($10^{17}\ cm^{-3}$)	w_m (Å)	w_m/w_{th}	d_m (Å)	d_m/d_{th}	Acc.	Ref.
1.	$3s4s-$	$^3S-^3P^o$	7042.06	16000&	1.0	1.96&	1.23&	(−0.70)&	1.04&	C⁺,C⁺	1
	$3s(^2S)4p$	(3)		20000		1.90	1.21	(−0.68)	1.05		
				15000–	1.0	2.00–	1.19–	(−0.73)–	1.07–	C, C	2
				26000		1.86	1.19	(−0.66)	1.06		
			7056.56	16000&	1.0	1.90&	1.19&	(−0.72)&	1.07&	C⁺,C⁺	1
				20000		1.84	1.18	(−0.70)	1.08		
				15000–	1.0	1.94–	1.15–	(−0.75)–	1.10–	C, C	2
				26000		1.80	1.15	(−0.68)	1.10		
			7063.62	16000&	1.0	1.92&	1.20&	(−0.69)&	1.02&	C⁺,C⁺	1
				20000		1.86	1.20	(−0.67)	1.04		
				15000–	1.0	1.96–	1.17–	(−0.72)–	1.06–	C, C	2
				26000		1.82	1.17	(−0.65)	1.05		

Antimony

Sb II

Ground State: $1s^2 2s^2 2p^6 3s^2 3p^6 3d^{10} 4s^2 4p^6 4d^{10} 5s^2 5p^2\ ^3P_0$

Ionization Energy: 16.5305 eV = 133 327.5 cm^{-1}

Purić *et al.*[1] used an electromagnetic shock tube (T-tube) to measure the Stark width and shift of the 6005.21Å line. This is the first Stark broadening measurement for this spectrum. The measurements were done at temperatures of 16 000 and 20 000 K and over a range of electron densities N_e from 0.3×10^{17} cm^{-3} to 1.4×10^{17} cm^{-3}, but they have tabulated their result only for $N_e = 10^{17}$ cm^{-3}.

Reference

[1]J. Purić, M. Ćuk and I. S. Lakićević, Phys. Rev. A 32, 1106 (1985).

Key data on experiments

Ref.	Plasma source	Method of measurement: Electron density	Method of measurement: Temperature	Remarks
1	T-tube	He-Ne laser interferometer at 6328Å and H_β Stark width	Boltzmann plot of relative intensities of Ar II lines and intensity ratios of Si III to Si II lines	

Numerical results for Sb II

No.	Transition array	Multiplet (No.)	Wavelength (Å)	Temperature (K)	Electron density (10^{17} cm^{-3})	w_m (Å)	w_m/w_{th}	d_m (Å)	d_m/d_{th}	Acc.	Ref.
1.	$5p6s-$ $5p(^2P^o)6p$	$^3P^o-^3D$	6005.21	16000& 20000	1.0	1.82& 1.48		(−0.45)& (−0.31)		C^+,C	1

Argon

Ar I

Ground State: $1s^22s^22p^63s^23p^6\ ^1S_0$

Ionization Energy: 15.760 eV = 127 109.80 cm^{-1}

List of tabulated lines

Wavelength (Å)	No.	Wavelength (Å)	No.	Wavelength (Å)	No.	Wavelength (Å)	No.
4158.59	11	4596.10	17	6965.43	3	7724.21	9
4259.36	19	4628.44	16	7147.04	2	7948.18	8
4272.17	13	4702.32	15	7206.98	23	8424.65	4
4300.10	12	6416.31	22	7272.94	6	8761.69	21
4510.73	18	6677.28	7	7503.87	10	13406.6	1
4522.32	14	6752.83	20	7514.65	5		

Our previous reviews[11,12], especially the 1976 review[12], contained experimental width and shift data for more than 100 transitions. Recently, many lines of the prominent $4s-4p$ and $4s-5p$ transition arrays have been remeasured with significantly improved accuracy due to advances in the plasma sources as well as the plasma diagnostics and particularly the data acquisition techniques. For the example of the 4300.10 Å line, we list below all the width data contained in our earlier and present reviews that have been estimated to be of "B" accuracy (±30%) or better:

Stark Width[a] (FWHM in Å)	Estimated Accuracy	Authors	Ref. No. and Review (in parentheses)
1.89	A	Jones *et al.*	5 (present)
2.03	A	Czernichowski and Chapelle	2 (present)
1.94	B	Abbas *et al.*	8 (present)
1.80	B	Bues *et al.*	9 (1976)
1.92	B	Helbig	19 (1976)
1.27	B	Queffelec and Girault	14 (1976)

[a]at an electron density of 10^{17} cm^{-3}

It is seen that—with the exception of Reference 14 of our 1976 review—the agreement between the experimental results is excellent, i.e. they differ at most by only 13%.

We should note, that in Ref. [4] measurements were done over an electron density range from $7.1 \times 10^{16} cm^{-3}$ to $1.10 \times 10^{17} cm^{-3}$ and at temperatures from 12100 K to 13100 K, but results were only tabulated for a nominal electron density of 10^{17} cm^{-3}. Also, it should be stated that ion broadening parameters have been derived in Refs. 5 and 6 from quantitative studies of the degree of asymmetry in the Stark broadened lines. The differences with the ion broadening parameters obtained from semi-classical theory[10] are in the range from 8% to 55%. The line width and shift measurements by Vitel and Skowronek[7] were performed in very dense plasmas, and departures from the linear dependence of the electron width on electron density were found. Abbas et al.[9] report numerous data on Ar I Stark widths and shifts, but have measured the electron density only from the Ar I Stark widths and not by an independent method. We have therefore not tabulated these results.

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Key data on experiments

Ref.	Plasma source	Method of measurement: Electron density	Method of measurement: Temperature	Remarks
1	Wall-stabilized arc	H_β Stark width	Total intensity of H_β line	Photographic technique
2	Wall-stablizied arc	H_β Stark width	Absolute intensity of Ar I lines and intensity ratios of Ar II to Ar I lines	
3	Pulsed low pressure linear discharge	H_β Stark width	Plasma composition data	
4	Wall-stabilized arc	H_β Stark width	Plasma composition data	
5	Wall-stabilized arc	H_β Stark width	Plasma composition data	
6	Wall-stabilized arc	H_β Stark width	Plasma composition data	
7	Linear flash-tube	Intensity of continuum between 3600 and 3850 Å, H_α Stark width, and laser interferometer at 3.39 μm	Intensity of optically thick Ar I infrared lines	
8	Wall-stabilized arc	H_β Stark width	Plasma composition data	

Numerical results for Ar I

No.	Transition array	Multiplet (No.)	Wavelength (Å)	Temperature (K)	Electron density (10^{17} cm^{-3})	w_m (Å)	w_m/w_{th}	d_m (Å)	d_m/d_{th}	Acc.	Ref.
1.	$3d-4f$	[3 1/2]°–[4 1/2]	13406.6	12400–29600	0.073–0.20	2.0–5.8	0.91–0.76			C	3
2.	$4s-4p'$	[1 1/2]°–[1 1/2]	7147.04	13000	1.0	0.78				B$^+$	4
3.	$4s-4p'$	[1 1/2]°–[1/2]	6965.43	13000	1.0	0.81		0.50		B$^+$,B	4
				16500–18700	6.0–10.0	4.4–6.5		1.9–2.6		B, C	7
4.	$4s-4p'$	[1 1/2]°–[2 1/2]	8424.65	13000	1.0	0.98	1.03	0.58	4.14	B$^+$,B	4
5.	$4s-4p$	[1 1/2]°–[1/2]	7514.65	13000	1.0	1.01				B$^+$	4
6.	$4s-4p'$	[1 1/2]°–[1/2]	7272.94	13000	1.0	0.89				B$^+$	4
7.	$4s-4p'$	[1 1/2]°–[1/2]	6677.28	13000	1.0	0.98		0.66		B$^+$,B	4
8.	$4s'-4p'$	[1/2]°–[1 1/2]	7948.18	13000	1.0	0.98	0.89	0.46	1.21	B$^+$,B	4
9.	$4s'-4p'$	[1/2]°–[1/2]	7724.21	13000	1.0	1.02		0.61		B$^+$,B	4
10.	$4s'-4p'$	[1/2]°–[1/2]	7503.87	13000	1.0	1.16		0.95		B$^+$,B	4
11.	$4s-5p$	[1 1/2]°–[1 1/2]	4158.59	11900	0.62	1.21				A	5
				11900	0.62	1.23				A	6

Numerical results for Ar I — Continued

No.	Transition array	Multiplet (No.)	Wavelength (Å)	Temperature (K)	Electron density (10^{17} cm^{-3})	w_m (Å)	w_m/w_{th}	d_m (Å)	d_m/d_{th}	Acc.	Ref.
12.	$4s$–$5p$	[1 1/2]°–[2 1/2]	4300.10	9000–15500	0.11–1.1	0.2–2.23				A	2
				11900	0.62	1.17				A	5
				10200–14200	0.22–1.44	0.48–2.80				B	8
13.	$4s$–$5p$	[1 1/2]°–[1 1/2]	4272.17	11900	0.62	1.18	0.85			A	5
14.	$4s'$–$5p$	[1/2]°–[1/2]	4522.32	11900&12100	0.62& 0.70	1.20& 1.34				A	5
15.	$4s'$–$5p$	[1/2]°–[1/2]	4702.32	11900&12100	0.62& 0.70	1.32& 1.50				A	5
16.	$4s'$–$5p$	[1/2]°–[2 1/2]	4628.44	11900&12100	0.62& 0.70	1.32& 1.51				A	5
17.	$4s'$–$5p$	[1/2]°–[1 1/2]	4596.10	11900&12100	0.62& 0.70	1.39& 1.50				A	5
18.	$4s'$–$5p$	[1/2]°–[1/2]	4510.73	11900&12100	0.62& 0.70	1.57& 1.79	0.63& 0.64			A	5
19.	$4s'$–$5p'$	[1/2]°–[1/2]	4259.36	11900	0.62	1.44	0.77			A	5
20.	$4p$–$4d$	[1/2]°–[1 1/2]°	6752.83	11900	0.62	4.25	0.83			A	6
21.	$4p'$–$4d$	[1/2]–[1 1/2]°	8761.69	11300&12500	0.42& 0.85	5.46& 11.38	0.92& 0.92			B	1
22.	$4p$–$6s$	[1/2]–[1 1/2]°	6416.31	11900	0.62	6.14				A	6
23.	$4p'$–$6s'$	[1 1/2]–[1/2]°	7206.98	11300&12500	0.42& 0.85	5.54& 11.52	0.89& 0.87			B	1

Argon

Ar II

Ground State: $1s^2 2s^2 2p^6 3s^2 3p^5\ {}^2P^o_{3/2}$

Ionization Energy: 27.630 eV = 222 848.2 cm^{-1}

List of tabulated lines

Wavelength (Å)	No.	Wavelength (Å)	No.	Wavelength (Å)	No.	Wavelength (Å)	No.
2955.39	10	3928.62	5	4426.00	4		
3000.44	10	4013.86	2	4430.19	4	4806.02	3
3093.40	15	4331.20	4	4431.00	1	4847.81	3
3273.32	12	4348.06	4	4545.05	8	4879.86	7
3307.23	14	4375.95	9	4579.35	9	4933.21	3
3388.53	16	4379.67	4	4657.90	8	4965.08	7
3464.13	11	4400.10	1	4726.87	7	5145.31	6
3655.28	13	4400.99	1	4764.86	8		

Our extensive 1976 tabulation[7] of Ar II Stark broadening data included 120 spectral lines, often with multiple entries. Our 1984 review[8] added data for about 20 ultraviolet lines, and this table represents again a significant addition. As in the Ar I situation, we estimate that the accuracy of the recent data is significantly better than the earlier material. The measurements by Nick and Helbig[2] were performed over a range of electron densities from $0.70x10^{17}$ cm^{-3} to $1.46x10^{17}$ cm^{-3} and temperatures from 12100 K to 13800 K, and the work of Pittman and Konjević[3] was done at electron densities from 0.9 to $1.4x10^{17}$ cm^{-3} and temperatures from 23000 K to 28500 K; but in both papers, the Stark width data are listed only for a nominal electron density of 10^{17} cm^{-3}.

References

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[6]N. Konjević and W. L. Wiese, J. Phys. Chem. Ref. Data 5, 259 (1976).
[7]N. Konjević, M. S. Dimitrijević and W. L. Wiese, J. Phys. Chem. Ref. Data 13, 649 (1984).

Key data on experiments

Ref.	Plasma source	Method of measurement: Electron density	Method of measurement: Temperature	Remarks
1	Wall-stabilized arc	Michelson interferometer at two wavelengths		Temperature measurement method not reported. Inhomogeneous boundary layers apparently not considered in line width measurements.
2	Wall-stabilized arc	Michelson interferometer at two wavelengths	Absolute line intensity	
3	Low-pressure pulsed arc	He-Ne laser quadrature interferometer at 6328Å	Relative intensity of 4369.3Å and 4366.9Å O II impurity lines	
4	Linear flash-tube	Intensity of argon continuum between 3600Å and 3850Å, H_α Stark width, and laser interferometer at 3.39μm	Intensity of optically thick infrared Ar I lines	
5	Wall-stabilized arc	Stark widths of H_β and 4300.1Å Ar I line	Plasma composition data	

Numerical results for Ar II

No.	Transition array	Multiplet (No.)	Wavelength (Å)	Temperature (K)	Electron density (10^{17} cm^{-3})	w_m (Å)	w_m/w_{th}	d_m (Å)	d_m/d_{th}	Acc.	Ref.
1.	$3p^43d-$ $3p^4(^3P)4p$	$^4D-^4P^o$ (1)	4400.99	12800	1.0	0.220	0.75			B+	2
			4431.00	12800	1.0	0.234	0.80			B+	2
			4400.10	12800	1.0	0.225	0.77			B+	2
2.		$^4D-^4D^o$ (2)	4013.86	12800	1.0	0.205	0.87			B+	2
3.	$3p^44s-$ $3p^4(^3P)4p$	$^4P-^4P^o$ (6)	4806.02	11000–14000	0.73–0.98	0.120–0.195	0.39–0.51			B	1
				12800	1.0	0.238	0.61			B+	2
				16500–18000	6.0–14.9	1.6–3.4	0.71–0.62	(−0.3)–(−0.6)	1.33–1.39	C, D	4
				12000	0.69	0.544	1.92	−0.460	8.13	D, D	5
			4933.21	12800	1.0	0.236	0.57			B+	2
			4847.81	12800	1.0	0.240	0.60			B+	2
				16500–18000	6.0–14.9	1.6–3.3	0.71–0.60	(−0.3)–(−0.6)	1.33–0.93	C, D	4

Numerical results for Ar II

No.	Transition array	Multiplet (No.)	Wavelength (Å)	Temperature (K)	Electron density (10^{17} cm^{-3})	w_m (Å)	w_m/w_{th}	d_m (Å)	d_m/d_{th}	Acc.	Ref.
4.		^{4}P–^{4}D°	4348.06	12800	1.0	0.197	0.60			B	2
		(7)		16500–18000	6.0–14.9	1.7–3.2	0.90–0.72	(−0.2)–(−0.4)	0.97–1.03	C, D	4
			4426.00	11000–14000	0.38–1.21	0.085–0.225	0.62–0.56			B	1
				12800	1.0	0.227	0.67			B^+	2
			4331.20	12800	1.0	0.167	0.51			D^+	2
			4430.19	12800	1.0	0.196	0.59			B^+	2
			4379.67	12800	1.0	0.189	0.57			B	2
5.		^{4}P–^{4}S° (10)	3928.62	12800	1.0	0.164				B^+	2
6.		^{2}P–^{4}D° (13)	5145.31	12000	0.69	3.760		1.350		D, D	5
7.		^{2}P–^{2}D°	4879.86	12800	1.0	0.304				B^+	2
		(14)		12000	0.69	1.210		−0.375		D, D	5
			4726.87	12800	1.0	0.298				B^+	2
				12000	0.69	0.820		−0.300		D, D	5
			4965.08	12800	1.0	0.334				B	2
				12000	0.69	0.950		0.350		D, D	5
8.		^{2}P–^{2}P°	4545.05	12800	1.0	0.265				B^+	2
		(15)	4657.90	12800	1.0	0.249				B^+	2
				12000	0.69	0.340		−0.125		D, D	5
			4764.86	12800	1.0	0.304				B^+	2
9.		^{4}P–^{2}S°	4375.95	12800	1.0	0.133				B^+	2
		(17)	4579.35	12000	0.69	0.210		0.060		D, D	5
10.	$3p^44p$–	^{2}D°–^{2}D	3000.44	28500	1.0	0.88				C^+	3
	$3p^4(^3P)4d$	(69)	2955.39	28500	1.0	0.90				C^+	3
11.		^{2}D°–^{2}F (70)	3464.13	28500	1.0	0.62	0.97			C^+	3
12.		^{2}D°–^{2}P (71)	3273.32	28500	1.0	0.78				C^+	3
13.		^{2}P°–^{2}F (82)	3655.28	28500	1.0	0.63				C^+	3
14.		^{2}P°–^{2}P (83)	3307.23	28500	1.0	0.84	0.69			C^+	3
15.		^{2}P°–^{2}D	3093.40	28500	1.0	0.98				C^+	3
16.		^{2}S°–^{2}P (96)	3388.53	28500	1.0	0.58				C^+	3

Argon

Ar III

Ground State: $1s^2 2s^2 2p^6 3s^2 3p^4\ ^3P_2$

Ionization Energy: 40.74 eV = 328 600 cm^{-1}

Almost all data are from the low-pressure pulsed arc experiment of Konjević and Pittman,[1] and one additional transition has been measured by Purić *et al.*[2] with the same type of source. The experimental results are in excellent agreement with the modified semiempirical (MSE) theory by Dimitrijević and Konjević[3] (see also general introduction), with which comparisons are made in the table. Even closer agreement exists between the new experimental data and the experimental results by Platiša *et al.*,[4] which were tabulated in our 1984 review.[5]

References

[1]N. Konjević and T. L. Pittman, J. Quant. Spectrosc. Radiat. Transfer **37**, 311 (1987).

[2]J. Purić, S. Djeniže, A. Srećković, M. Ćuk, J. Labat and M. Platiša, Z. Phys. D **8**, 343 (1988).

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[4]M. Platiša, M. Popović, M. Dimitrijević, and N. Konjević, Z. Naturforsch. **A30**, 212 (1975).

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Key data on experiments

Ref.	Plasma source	Method of measurement: Electron density	Method of measurement: Temperature	Remarks
1	Low-pressure pulsed arc	He-Ne laser quadrature interferometer at 6328Å	Relative intensity of O II impurity lines	
2	Low-pressure pulsed arc	He-Ne laser interferometer at 6328Å	Intensity ratios of Ar IV to Ar III lines	

Numerical results for Ar III

No.	Transition array	Multiplet (No.)	Wavelength (Å)	Temperature (K)	Electron density (10^{17} cm^{-3})	w_m (Å)	w_m/w_{th}	d_m (Å)	d_m/d_{th}	Acc.	Ref.
1.	$3p^34s-$	$^5S^o-^5P$	3285.85	26000	0.85	0.122	1.08			B	1
	$3p^3(^4S^o)4p$	(1)	3311.25	26000	0.85	0.122	1.08			B	1
2.		$^3S^o-^3P$	3514.18	27500	0.84	0.124	0.96			B	1
			3509.33	27500	0.84	0.134	1.04			B	1
3.	$3p^34s'-$	$^3D^o-^3D$	3503.58	27500	0.84	0.124	1.01			B	1
	$3p^3(^2D^o)4p'$	(2)	3499.67	27500	0.84	0.119	0.97			B	1
4.		$^3D^o-^3F$	3336.13	26000	0.85	0.122	1.04			B	1
		(3)	3344.72	26000	0.85	0.121	1.04			B	1
5.	$3p^34s''-$	$^3P^o-^3D$	3024.05	42000	2.80	0.212	1.11			C+	2
	$3p^3(^2P^o)4p''$	(4)	3054.82	27500	0.84	0.114	1.26			B	1

Argon

Ar IV

Ground State: $1s^22s^22p^63s^22p^3\ ^4S^o_{3/2}$

Ionization Energy: 59.81 eV = 482 400 cm^{-1}

Purić *et al.*[1] measured the Stark widths for nine transitions with a low-pressure pulsed arc. The widths are in good agreement with the results of the modified semiempirical (MSE) theory by Dimitrijević and Konjević (see general introduction). For two lines, comparisons may also be made with the data of Platiša *et al.*[2] listed in our 1984 review.[3] When scaled linearly with electron density, the data by Platiša *et al.*[2] are about 20-30% *smaller* than those of Purić *et al.*[1] But according to theory,[4] the Stark widths decrease significantly with increasing temperature. When this is taken into account, the widths at the lower temperature (22000 K) of the Platiša *et al.*[2] experiment are calculated to be about 35% *larger* than for the conditions (42000 K) of the new work by Purić *et al.*[1]

References

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Key data on experiments

Ref.	Plasma source	Method of measurement: Electron density	Method of measurement: Temperature	Remarks
1	Low-pressure pulsed arc	He-Ne laser interferometer at 6328Å	Boltzmann plot of Ne III line intensities and intensity ratios of Ne IV to Ne III lines	

Numerical results for Ar IV

No.	Transition array	Multiplet (No.)	Wavelength (Å)	Temperature (K)	Electron density (10^{17} cm^{-3})	w_m (Å)	w_m/w_{th}	d_m (Å)	d_m/d_{th}	Acc.	Ref.
1.	$3p^24s-$	$^4P-^4D^o$	2809.44	42000	2.80	0.202	1.23			C+	1
	$3p^2(^3P)4p$	(4uv)	2788.96	42000	2.80	0.204	1.25			C+	1
			2776.26	42000	2.80	0.204	1.25			C+	1
2.		$^4P-^4P^o$	2640.34	42000	2.80	0.204	1.45			C+	1
		(5uv)	2615.68	42000	2.80	0.154	1.10			C+	1
3.		$^2P-^2D^o$	2913.00	42000	2.80	0.176	0.96			C+	1
		(2)	2926.33	42000	2.80	0.200	1.10			C+	1
4.	$3p^24s'-$	$^2D-^2F^o$	2757.92	42000	2.80	0.176	1.14			C+	1
	$3p^2(^1D)4p$	(6uv)	2784.47	42000	2.80	0.176	1.14			C+	1

Bismuth

Bi II

Ground State: $1s^2 2s^2 2p^6 3s^2 3p^6 3d^{10} 4s^2 4p^6 4d^{10} 4f^{14} 5s^2 5p^6 5d^{10} 6s^2 6p^2\ {}^3P_0$

Ionization Energy: 16.70 eV = 134 720 cm^{-1}

Purić *et al.*[1] applied an electromagnetic shock-tube (T-tube) to measure a few Stark widths and shifts in the Bi II spectrum. Their measurements were done at temperatures of 16 000 K and 20 000 K and over a range of electron densities N_e from 0.3×10^{17} cm^{-3} to 1.4×10^{17} cm^{-3}, but they have tabulated their results only for $N_e = 10^{17}$ cm^{-3}. Their data differ greatly for the two temperatures. It is therefore difficult to compare them with the other available width data, measured by Miller and Bengtson[2] at a much lower temperature of 11 000 K, which are tabulated in our 1984 review.[3]

References

[1]J. Purić, M. Ćuk and I. S. Lakićević, Phys. Rev. A **32**, 1106 (1985).
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[3]N. Konjević, M. S. Dimitrijević, and W. L. Wiese, J. Phys. Chem. Ref. Data **13**, 649 (1984).

Key data on experiments

Ref.	Plasma source	Method of measurement: Electron density	Method of measurement: Temperature	Remarks
1	T-tube	He-Ne laser interferometer at 6328Å and H_β Stark width	Boltzmann plot of relative intensities of Ar II lines and intensity ratios of Si III to Si II lines	

Numerical results for Bi II

No.	Transition array	Multiplet (No.)	Wavelength (Å)	Temperature (K)	Electron density (10^{17} cm^{-3})	w_m (Å)	w_m/w_{th}	d_m (Å)	d_m/d_{th}	Acc.	Ref.
1.	$6p7s-6p7p$	$^3P^o-^3P$	5719.8	16000& 20000	1.0	2.14& 1.02				C+	1
			5719.2	16000& 20000	1.0	2.14& 1.02				C+	1
2.		$^3P^o-^3D$	5209.2	16000& 20000	1.0	1.12& 1.64		(−0.73)& (−0.46)		C+,C	1
3.		$^3P^o-^1P$	5144.3	16000& 20000	1.0	1.68& 1.28		(−0.73)& (−0.49)		C+,C	1

Bromine

Br I

Ground State: $1s^22s^22p^63s^23p^63d^{10}4s^24p^5\ ^2P^o_{3/2}$

Ionization Energy: 11.814 eV = 95 284.8 cm^{-1}

The work by Djurović *et al.*[1] is the first extensive experimental Stark-broadening study for neutral bromine. The authors note that there are close similarities for the widths and shifts of lines within multiplets as expected from atomic structure considerations.[2] Comparisons with semiclassical calculations and two simplified theoretical approaches have been carried out[1] and yield agreements within the estimated errors of experiment and theory. Semiclassical calculations[3] are only available for the multiplet 5s ^{4}P-6p ^{4}D, but we did not tabulate the w_m/w_{th} ratios, since the set of perturbing levels is very incomplete for this case.

References

[1]S. Djurović, R. Konjević, M. Platiša and N. Konjević, J. Phys. B 21, 739 (1988).

[2]W. L. Wiese and N. Konjević, J. Quant. Spectrosc. Radiat. Transfer 28, 185 (1982).

[3]M. S. Dimitrijević and N. Konjević, J. Quant. Spectrosc. Radiat. Transfer 30, 45 (1983).

Key data on experiments

Ref.	Plasma source	Method of measurement: Electron density	Temperature	Remarks
1	Wall-stabilized arc	H_β Stark width	Plasma composition data	

Numerical results for Br I

No.	Transition array	Multiplet (No.)	Wavelength (Å)	Temperature (K)	Electron density (10^{17} cm^{-3})	w_m (Å)	w_m/w_{th}	d_m (Å)	d_m/d_{th}	Acc.	Ref.
1.	$4p^45s-4p^4(^3P_2)5p$	^{4}P–^{4}D°	8272.44	9700	0.300	0.70				B+	1
2.	$4p^45s-4p^4(^3P_2)6p$	^{4}P–^{4}D°	4441.74	9800	0.325	1.02				B+	1
				9600	0.280			0.39		B	1
			4477.72	9800	0.325	1.04				B+	1
				9600	0.280			0.43		B	1
			4752.28	9800	0.315	1.09				B+	1
			4780.31	9800	0.315	1.10				B+	1
3.	$(^3P_2)4p^45s-(^3P_1)4p^45p$	^{4}P–^{2}D°	6631.62	9700	0.300	0.48				B+	1
			7348.51	9700	0.300	0.56				B+	1
				9600	0.280			0.15		B	1
4.		^{4}P–^{4}S°	6350.73	9700	0.300	0.43				B+	1
			7005.19	9700	0.300	0.50				B+	1
				9600	0.280			0.17		B	1
5.	$4p^45s-(^3P_1)4p^46p$	^{2}P–^{2}D°	4614.58	9800	0.325	1.27				B+	1
6.	$(^3P_2)4p^45s-(^1D_2)4p^45p$	^{4}P–^{2}P°	4472.61	9800	0.325	1.06				B+	1
				9600	0.280			0.42		B	1
7.	$(^3P_1)4p^45s-(^1D_2)4p^45p$	^{2}P–^{2}P°	4979.76	9800	0.315	1.09				B+	1
8.	$(^3P_0)4p^45s-(^1D_2)4p^45p$	^{2}P–^{2}P°	5395.52	9800	0.315	0.85				B+	1

Bromine

Br II

Ground State: $1s^2 2s^2 2p^6 3s^2 3p^6 3d^{10} 4s^2 4p^4\ ^3P_2$

Ionization Energy: 21.80 eV = 175 850 cm^{-1}

This first Stark broadening experiment[1] for the Br II spectrum was carried out with a pulsed low-pressure arc, which was operated in a mixture of nitrogen gas and bromine vapor. Multiplets 2 to 5 belong to the $5s$-$5p$ transition array and have also the same parent term. They exhibit similar Stark widths, which vary by no more than 24%, as is expected from general regularity considerations.[2]

References

[1]S. Djeniže, O. Labat, A. Srećković and J. Purić, 9th Int. Conf. Spectral Line Shapes, Contributed papers, Torun, Poland (1988) p.A16.

[2]W. L. Wiese and N. Konjević, J. Quant. Spectrosc. Radiat. Transfer **28**, 185 (1982).

Key data on experiments

Ref.	Plasma source	Method of measurement: Electron density	Method of measurement: Temperature	Remarks
1	Low-pressure pulsed arc	He-Ne laser interferometer at 6328Å	Intensity ratios of N III to N II lines	

Numerical results for Br II

No.	Transition array	Multiplet (No.)	Wavelength (Å)	Temperature (K)	Electron density (10^{17} cm^{-3})	w_m (Å)	w_m/w_{th}	d_m (Å)	d_m/d_{th}	Acc.	Ref.
1.	$4p^35s$–$4p^3(^4S^o)5p$	$^5S^o$–^5P	4816.70	36000	1.10	0.290				B	1
			4700.8	36000	1.10	0.330				B	1
2.	$4p^35s$–$4p^3(^2D^o)5p$	$^3D^o$–^3D	4928.79	36000	1.10	0.250				B	1
			4930.66	36000	1.10	0.250				B	1
3.		$^3D^o$–^3P	4179.63	36000	1.10	0.233				B	1
4.		$^1D^o$–^1D	4223.89	36000	1.10	0.253				B	1
5.		$^1D^o$–^1F	5332.05	36000	1.10	0.288				B	1

Calcium

Ca II

Ground State: $1s^22s^22p^63s^23p^64s\ ^2S_{1/2}$

Ionization Energy: 11.87181 eV = 95 751.87 cm^{-1}

The Stark widths of the resonance lines have been measured again, this time with a wall-stabilized arc and a high-resolution interferometric setup by Goldbach *et al.*[1] This is a high quality addition to the body of data on the resonance lines tabulated in our earlier reviews.[2,3] (The earlier reviews also contain data for many other transitions of Ca II). The results by Goldbach *et al.* are at the lower end of all experimental data for the resonance lines. Also, the results of semiclassical as well as quantum mechanical calculations are factors of two or more higher. Furthermore, the measurements show an increase of the Stark widths with temperature, while all calculations show either a decrease or no change in this temperature range. We have presented a graphical comparison of all these data in the general introduction (see Fig. 1). Thus, the situation on the resonance lines remains unresolved.

Reference

[1]C. Goldbach, G. Nollez, P. Plomdeur and J. P. Zimmermann, Phys. Rev. A **28**, 234 (1983).
[2]N. Konjević and W. L. Wiese, J. Phys. Chem. Ref. Data **5**, 259 (1976).
[3]N. Konjević, M. S. Dimitrijević, and W. L. Wiese, J. Phys. Chem. Ref. Data **13**, 649 (1984).

Key data on experiments

Ref.	Plasma source	Method of measurement: Electron density	Method of measurement: Temperature	Remarks
1	Wall-stabilized arc	H_β Stark width and argon continuum at 4000Å	Absolute intensity of Ar I 4300Å and Ar II 4806Å lines	

Numerical results for Ca II

No.	Transition array	Multiplet (No.)	Wavelength (Å)	Temperature (K)	Electron density (10^{17} cm^{-3})	w_m (Å)	w_m/w_{th}	d_m (Å)	d_m/d_{th}	Acc.	Ref.
1.	$4s$–$4p$	^2S–$^2P^o$ (1)	3933.66	12240& 13350	0.80& 1.32	0.0914& 0.180	0.41& 0.50			B^+	1
			3968.47	12240& 13350	0.80& 1.32	0.0846& 0.161	0.38& 0.44			B^+	1

Carbon

C I

Ground State: $1s^2 2s^2 2p^2\ ^3P_0$

Ionization Energy: 11.260 eV = 90 820.42 cm^{-1}

All three experiments[1-3] were carried out with wall-stabilized arc sources. The results are closely consistent as seen from the comparisons with theory. In the work of Goly and Weniger,[3] the three strongest lines of the $2s2p^3\ ^3D^o - 2s^2 2p4p\ ^3P$ multiplet near 5798Å are individually resolved as shown in their Fig. 1 and their widths are the same within the experimental accuracy. Our 1976 review[4] covers most of these lines, too, and the new and old data are found to be consistent within the estimated accuracy ratings, when the connection through the theory is made.

References

[1] A. Goly, D. Rakotoarijimy and S. Weniger, J. Quant. Spectrosc. Radiat. Transfer **30**, 417 (1983).
[2] D. W. Jones and W. L. Wiese, Phys. Rev. A **30**, 2602 (1984).
[3] A. Goly and S. Weniger, J. Quant. Spectrosc. Radiat. Transfer **38**, 225 (1987).
[4] N. Konjević and J. R. Roberts, J. Phys. Chem. Ref. Data **5**, 209 (1976).

Key data on experiments

Ref.	Plasma source	Method of measurement: Electron density	Method of measurement: Temperature	Remarks
1	Wall-stabilized arc	H_β Stark width and Ar II 4348Å Stark width	Plasma-composition data and intensity ratios of Ar II to Ar I lines	
2	Wall-stabilized arc	H_β Stark width	Plasma composition data	
3	Wall-stabilized arc	H_β Stark width and O I 4368Å Stark width	Boltzmann plot of relative intensities and plasma compostion data	

Numerical results for C I

No.	Transition array	Multiplet (No.)	Wavelength (Å)	Temperature (K)	Electron density (10^{17} cm^{-3})	w_m (Å)	w_m/w_{th}	d_m (Å)	d_m/d_{th}	Acc.	Ref.
1.	$2p3s-$ $2p(^2P^o)4p$	$^3P^o-^3S$ (5)	4826.80	11600	0.793	1.88	0.90			B+	2
			4817.37	11600	0.793	1.92	0.92			B+	2
			4812.92	11600	0.793	1.68	0.81			B+	2
2.		$^3P^o-^3P$ (6)	4771.75	9000–11600	0.091–0.596	0.25–1.52	1.06–0.92	0.12–0.57	1.18–0.83	B, C+	1
				11600	0.793	2.08	0.91			B+	2
			4766.68	9000	0.091	0.22	0.95			B	1
				11600	0.793	2.04	0.89			B+	2
			4775.91	11600	0.793	2.09	0.92			B+	2
				9000	0.091	0.22	0.92			B	1
				10000	0.165	0.35	0.81	0.15	0.77	B, B	1
			4770.03	11600	0.793	1.75	0.77			C+	2
3.		$^1P^o-^1P$ (11)	5380.34	9000–11600	0.091–0.596	0.25–1.50	1.10–0.91			B+	1
				11600	0.739	2.29	1.06			A	2

Numerical results for C I – Continued

No.	Transition array	Multiplet (No.)	Wavelength (Å)	Temperature (K)	Electron density (10^{17} cm^{-3})	w_m (Å)	w_m/w_{th}	d_m (Å)	d_m/d_{th}	Acc.	Ref.
4.		$^1P^o$–^1D (12)	5052.17	9000–11600	0.091–0.596	0.36–1.94	1.13–0.84	0.095–1.01	0.59–0.93	A, B	1
				11600	0.793	3.08	1.00			A	2
5.		$^1P^o$–^1S (13)	4932.05	9000–11600	0.091–0.596	0.42–2.34	0.81–0.63	0.21–1.56	0.76–0.85	A, B	1
				11600	0.793	3.90	0.80			A	2
6.	$2s2p^3$–$2s^22p(^2P^o)4p$	$^3D^o$–^3P (18)	5798	10200	0.341	0.58	1.01			B	3
				11400	0.610	1.03	0.93	0.67		B, B$^+$	3

Carbon

C II

Ground State: $1s^22s^22p\ ^2P^o_{1/2}$

Ionization Energy: 24.384 eV = 196 664.7 cm^{-1}

Six lines in the near ultraviolet have been measured by Goly and Weniger[1] with a wall-stabilized arc, and are in close agreement with their earlier work, which is tabulated in our previous review.[4] The other two experiments[2,3] cover lines in the visible spectrum, most of which have been measured for the first time. Three of these lines have been studied earlier by other authors and have been tabulated by us in 1976.[5] The lines at 3919 Å and 3921 Å have been measured at very similar temperatures. When linear scaling with the electron density is applied, the new and old results are found to be closely consistent.

References

[1]A. Goly and S. Weniger, J. Quant. Spectrosc. Radiat. Transfer 28, 389 (1982).

[2]S. Djeniže, A. Srećković, M. Milosavljević, O. Labat, M. Platiša and J. Purić, Z. Phys. D 9, 129 (1988).

[3]M. C. Perez, M. I. de la Rosa, A. M. de Frutos and S. Mar, 9th Int. Conf. Spectral Line Shapes, Contributed papers. Torun, Poland (1988) p.A9.

[4]N. Konjević, M. S. Dimitrijević and W. L. Wiese, J. Phys. Chem. Ref. Data 13, 649 (1984).

[5]N. Konjević, and W. L. Wiese, J. Phys. Chem. Ref. Data 5, 259 (1976).

Key data on experiments

Ref.	Plasma source	Method of measurement: Electron density	Method of measurement: Temperature	Remarks
1	Wall-stabilized arc	He I 3889Å Stark width	Intensity ratios of C II to C I lines and plasma composition data	
2	Low-pressure pulsed arc	He-Ne laser interferometer at 6328Å	Boltzmann plot of relative intensities of C II lines and ratios of C III to C II lines	
3	Low-pressure pulsed arc	He I 6678Å Stark width	Intensity ratios of C III to C II lines	

Numerical results for C II – Continued

No.	Transition array	Multiplet (No.)	Wavelength (Å)	Temperature (K)	Electron density (10^{17} cm^{-3})	w_m (Å)	w_m/w_{th}	d_m (Å)	d_m/d_{th}	Acc.	Ref.
1.	$2s2p^2$–	^2P–$^2D^o$	2512.06	12800	0.19	0.024				C	1
	$2p^3$	(14uv)	2509.12	12800	0.19	0.026				C	1
2.	$2s2p^2$–	^2S–$^2P^o$	2836.71	12800	0.19	0.052	1.58			C	1
	$2s^2(^1S)3p$	(13uv)	2837.60	12800	0.19	0.052	1.58			C	1
3.	$3s$–	^2S–$^2P^o$	6578.05	35000	1.43	1.106	0.79	−0.14	0.31	B,C	2
	$(^1S)3p$	(2)		35300	1.30	1.08	0.86			C	3
			6582.88	35000	1.43	1.106	0.79	−0.13	0.28	B,C	2
				35300	1.30	1.01	0.80			C	3
4.	$2s2p3s$–	$^4P^o$–^4S	5662.47	35000	1.43	0.88		0.08		B,C	2
	$2s2p(^3P^o)3p$	(15)									
5.		$^4P^o$–^4P	5151.09	35300	1.30	0.59				C	3
		(16)	5145.16	35000	1.43	0.790		0.06		B,C	2
				35300	1.30	0.54				C	3
			5143.49	35000	1.43	0.732				B	2
				35300	1.30	0.53				C	3
6.	$3p$–	$^2P^o$–^2D	7236.42	35000	1.43	1.712	1.06	0.000	*	B	2
	$(^1S)3d$	(3)									
7.	$3p$–	$^2P^o$–^2S	3920.69	12800	0.19	0.15	0.77			C+	1
	$(^1S)4s$	(4)	3918.98	12800	0.19	0.15	0.77			C+	1
8.	$3d$–	^2D–^2F	4267.26	35300	1.30	1.44	0.73			C	3
	$(^1S)4f$	(6)									

*Theoretical shift also very small.

Carbon

C III

Ground State: $1s^22s^2\ ^1S_0$

Ionization Energy: 47.888 eV = 386 241.0 cm^{-1}

El-Farra and Hughes[1] performed Stark width measurements using a pulsed vacuum arc, and achieved very high electron densities. For the two vacuum ultraviolet multiplets at 1577 Å and 1620 Å they could not resolve individual lines, which are within an Angström unit. Thus, their measured Stark widths seem to be the apparent multiplet widths. For the 5695.92 Å line, where comparison data by Djeniže *et al.*[2] are available, the two results for the Stark widths are very consistent. The consistency with an earlier result, tabulated in our 1984 review,[5] is also very satisfactory. Some of the experimental data could be compared with the modified semiempirical (MSE) calculations by Dimitrijević and Konjević (see general introduction) and fair agreement is obtained, except for the multiplet at 1577Å, for which the set of perturbing levels is rather incomplete.

References

[1]M. A. El-Farra and T. P. Hughes, J. Quant. Spectrosc. Radiat. Transfer **30**, 335 (1983).
[2]S. Djeniže, A. Srećković, M. Milosavljević, O. Labat, M. Platiša and J. Purić, Z. Phys. D **9**, 129 (1988).
[3]T. P. Hughes and M. A. El-Farra, J. Phys. D **16**, 811 (1983).
[4]H. R. Griem, *Spectral Line Broadening of Plasmas*, Academic, New York (1974).
[5]N. Konjević, M. S. Dimitrijević and W. L. Wiese, J. Phys. Chem. Ref. Data **13**, 649 (1984).

Key data on experiments

Ref.	Plasma source	Method of measurement: Electron density	Method of measurement: Temperature	Remarks
1	Pulsed vacuum arc between carbon electrodes	Stark widths of two C II doublets in conjunction with semiclassical calculations by Griem[4]	Intensity ratios of C IV to C III lines	Diagnostic methods are described in ref. 3 VUV multiplets are not resolved
2	Low-pressure pulsed arc	He-Ne laser interferometer at 6328Å	Boltzmann plot of relative intensities of C II lines and intensity ratios of C III to C II lines	

Numerical results for C III

No.	Transition array	Multiplet (No.)	Wavelength (Å)	Temperature (K)	Electron density (10^{17} cm^{-3})	w_m (Å)	w_m/w_{th}	d_m (Å)	d_m/d_{th}	Acc.	Ref.
1.	$2s2p-2p^2$	$^1P^o-^1D$ (8uv)	2296.87	38000	1.64	0.572		0.10		B,D$^+$	2
2.	$2p3s'-2p(^2P^o)3p'$	$^3P^o-^3P$ (5)	4665.86	38000	1.64	0.814	1.77	0.00		B	2
3.	$2s3p-2s(^2S)3d$	$^1P^o-^1D$ (2)	5695.92	53000	15.	7.9	1.49			C	1
				38000	1.64	0.974	1.52	0.13		B,D$^+$	2
4.	$2s3p-2s(^2S)4d$	$^3P^o-^3D$ (11.72uv)	1620	53000	15.	2.3	0.90			C	1
5.	$2s(^2S)3d-2p(^2P^o)3d'$	$^3D-^3F^o$ (12.03uv)	1577	53000	15.	1.5	4.22			C	1

Carbon

C IV

Ground State: $1s^22s\ ^2S_{1/2}$

Ionization Energy: 64.494 eV = 520 178.4 cm^{-1}

Recent work[1-5] has provided many new data for this spectrum which significantly expand the material from our earlier reviews[8,9]. When several results are available for the same transition (e.g., for the 5801.33 Å line), the measurements carried out at rather different temperatures appear to be consistent within the mutual uncertainty estimates; this is best seen from the comparisons with the modifed semiempirical (MSE) calculations by Dimitrijević and Konjević (see general introduction).

References

[1]M. A. El-Farra and T. P. Hughes, J. Quant. Spectrosc. Radiat. Transfer 30, 335 (1983).
[2]U. Ackermann, K. H. Finken, J. Musielok, Phys. Rev. A 31, 2597 (1985).
[3]F. Böttcher, J. Musielok and H. -J. Kunze, Phys. Rev. A 36, 2265 (1987).
[4]S. Djeniže, A. Srećković, M. Milosavljević, O. Labat, M. Platiša and J. Purić, Z. Phys. D 9, 129 (1988).
[5]F. Böttcher, P. Breger, J. D. Hey and H. -J. Kunze, Phys. Rev. A 38, 2690 (1988).
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[9]N. Konjević, M. S. Dimitrijević, and W. L. Wiese, J. Phys. Chem. Ref. Data 13, 649 (1984).

Key data on experiments

Ref.	Plasma source	Method of measurement: Electron density	Method of measurement: Temperature	Remarks
1	Vacuum arc between carbon electrodes	Stark widths of two C II doublets in conjunction with semiclassical calculations by Griem[7]	Intensity ratios of C IV to C III lines	Diagnostic methods are described in ref. 6
2	Gas-liner pinch	He II 4686Å Stark width	Intensity ratios of C IV to C III lines	
3	Gas-liner pinch	He II 4686Å Stark width	Intensity ratios of C IV to C III lines	
4	Low-pressure pulsed arc	He-Ne laser interferometer	Boltzmann plot of relative intensities of C II lines and intensity ratios of C III to C II lines	
5	Gas-liner pinch	90° Thomson scattering	90° Thomson scattering	

Numerical results for C IV

No.	Transition array	Multiplet (No.)	Wavelength (Å)	Temperature (K)	Electron density (10^{17} cm^{-3})	w_m (Å)	w_m/w_{th}	d_m (Å)	d_m/d_{th}	Acc.	Ref.
1.	$3s$–$3p$	^2S–$^2P^o$ (1)	5801.33	58000	15	6.2	1.06			C	1
				116000	5	2.8	1.62			C	2
				38000	1.64	0.908	1.29	0.10		B,C	4
				145000	18	10.0	1.66			C	5
			5811.98	116000	5	2.8	1.62			C	2
				38000	1.64	0.708	1.00	0.12		B,C	4
2.	$3s$–$4p$	^2S–$^2P^o$ (11.12uv)	948.1	116000	5	0.4	2.13			C	2
3.	$3p$–$4s$	$^2P^o$–^2S (11.14uv)	1230	116000	5	0.58	2.50			C	2
4.	$3p$–$4d$	$^2P^o$–^2D (11.15uv)	1108	116000	5	0.53	1.77			C	2
				114000&124000	4.7& 7.7	1.0& 1.8	3.54& 4.00			C	3
5.	$3p$–$4f$*	$^2P^o$–^2F	1106.5	116000	5	0.35	2.23			C	2
6.	$3d$–$4f$	^2D–$^2F^o$ (11.19uv)	1169	58000	15	0.62	1.02			C	1
				116000	5	0.4	2.57			C	2
				114000&124000	4.7& 7.7	0.6& 1.2	4.10& 5.14			C+	3
7.	$4p$–$5s$	$^2P^o$–^2S (12uv)	2698	116000	5	5.4	2.55			C	2
8.	$4p$–$5d$	$^2P^o$–^2D (12.01uv)	2405	116000	5	10.0	1.94			C	2
9.	$4d$–$5f$	^2D–$^2F^o$ (14uv)	2524.4	116000	5	8.4	1.54			C	2
				124000	7.7	10	1.22			C	3
10.	$4f$–$5g$	$^2F^o$–^2G (15uv)	2530	116000	5	4.2	1.84			C	2
				124000	7.7	10	2.91			C	3

Numerical results for C IV — Continued

No.	Transition array	Multiplet (No.)	Wavelength (Å)	Temperature (K)	Electron density (10^{17} cm^{-3})	w_m (Å)	w_m/w_{th}	d_m (Å)	d_m/d_{th}	Acc.	Ref.
11.	$5f$–$6g$	$^2F^o$–^2G	4658	116000	5	21				C	2
12.	$5g$–$6h$	^2G–$^2H^o$	4658	116000	5	21	1.14			C	2
13.	$5g$–$7h$	^2G–$^2H^o$	2906	116000	5	33	1.25			C	2
14.	$5d$–$7f$	^2D–$^2F^o$	2902	116000	5	33	0.82			C	2
15.	$5f$–$7g$	$^2F^o$–^2G	2906	116000	5	33	0.86			C	2

*Classification of this forbidden line is still uncertain[2]

Cesium

Cs I

Ground State: $1s^22s^22p^63s^23p^63d^{10}4s^24p^64d^{10}5s^25p^66s\ ^2S_{1/2}$

Ionization Energy: 3.893908 eV = 31 406.468 cm^{-1}

Three new measurements[1-3] have been reported, all for the 6s-6p resonance line. In our early reviews,[5,6] numerous other lines of Cs I were covered, but not this one. Lakićević *et al.*[1] and Purić *et al.*[2] used electromagnetic shock tubes (T-tubes) in their experiments, at electron densities from 0.44 to 2.2x10^{17} cm^{-3} and 0.3 to 1.4x10^{17} cm^{-3}, respectively (they presented their results only for a nominal density of 1x10^{17} cm^{-3}). But Skowronek *et al.* covered a much larger density range, up to very high electron densities, i.e., from 5.3 to 3000x10^{17} cm^{-3}, by employing a special optical cell. Thus, only the results of Refs. 1 and 2 may be intercompared, and they are completely consistent.

In addition to the tabulated data, some additional results have been obtained in graphical form for the 5d-5f transition by Landen *et al.*[4]

References

[1]I. S. Lakićević, J. Purić and M. Ćuk, Phys. Lett. A 91, 19 (1982).
[2]J. Purić, M. Ćuk and I. S. Lakićević, Phys. Rev. A 32, 1106 (1985).
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[5]N. Konjević and J. R. Roberts, J. Phys. Chem. Ref. Data 5, 209 (1976).
[6]N. Konjević, M. S. Dimitrijević and W. L. Wiese, J. Phys. Chem. Ref.

Key data on experiments

Ref.	Plasma source	Method of measurement: Electron density	Method of measurement: Temperature	Remarks
1	T-tube	Laser interferometer at single wavelength	Ratio of Si II and Si I line intensities	Interferometer wavelength not specified, probably 6328Å
2	T-tube	He-Ne laser interferometer at 6328Å and H_β Stark width	Boltzmann plot of relative intensities of Ar II lines and intensity ratios of Si III to Si II lines	
3	Optical cell	Deduced from electrical conductivity measurements	Thermocouple	Optically thick line; line shape determined in absorption

Numerical results for Cs I — Continued

No.	Transition array	Multiplet (No.)	Wavelength (Å)	Temperature (K)	Electron density (10^{17} cm^{-3})	w_m (Å)	w_m/w_{th}	d_m (Å)	d_m/d_{th}	Acc.	Ref.
1.	6s–6p	^{2}S–^{2}P°	8521.12	15000–20800	1.0	2.42–2.58	0.94–0.93	0.88–0.79	1.03–0.94	C+,C+	1
				26000	1.0	1.66		0.75		C+,C+	1
				16000–20000	1.0	2.52–2.58	0.97–0.93	0.85–0.79	0.94–0.94	C+,C+	2
				1173–1773	5.7–3000	52–240		0–11		D,D	3

Chlorine

Cl I

Ground State: $1s^22s^22p^63s^23p^5\ ^2P^o_{3/2}$

Ionization Energy: 12.968 eV = 104 591.0 cm^{-1}

Almost all new data are from the wall-stabilized arc experiment of Djurović and Konjević.[2] The width data overlap partially with the earlier results of Miller and Bengtson[3] and Konjević *et al.*[4] with pulsed sources, which have been tabulated in our 1976 review.[5] While the results of Ref. 3 are all larger than those of Ref. 2 — up to factors of two —, the agreement between Refs. 2 and 4 on the 7744.97Å line is within 7%. Also, the agreement of the new data with semiclassical theory is excellent, except for multiplet No. 7.

References

[1]M. H. Miller, D. Abadie and A. Lesage, Astrophys. J. **291**, 219 (1985).
[2]S. Djurović and N. Konjević, Z. Phys. D **10**, 425 (1988).
[3]M. H. Miller and R. D. Bengtson, Phys. Rev. **A1**, 983 (1970).
[4]N. Konjević, M. Platiša, and J. Labat, Phys. Lett. **32A**, 420 (1970).
[5]N. Konjević and J. R. Roberts, J. Phys. Chem. Ref. Data **5**, 209 (1976).

Key data on experiments

Ref.	Plasma source	Method of measurement: Electron density	Method of measurement: Temperature	Remarks
1	Gas-driven shock tube	H_β Stark width	Absolute intensity of Ne I 5852Å line and line reversal intensities of H_α line	
2	Wall-stabilized arc	H_β Stark width	Plasma-composition data	

Numerical results for Cl I

No.	Transition array	Multiplet (No.)	Wavelength (Å)	Temperature (K)	Electron density (10^{17} cm^{-3})	w_m (Å)	w_m/w_{th}	d_m (Å)	d_m/d_{th}	Acc.	Ref.
1.	$3p^44s-$	$^4P-^4D^o$	8375.94	10000	0.370	0.57	1.06			B+	2
	$3p^4(^3P)4p$	(2)		9500	0.265			0.16	0.93	B	2
			8333.31	10000	0.370	0.56	1.06			B+	2
2.		$^4P-^2P^o$	7717.58	10000	0.370	0.50				B+	2
		(4)	7414.11	10000	0.370	0.49				B+	2
3.		$^4P-^4S^o$	7744.97	10000	0.370	0.58	0.94			B+	2
		(5)		9500	0.265			0.17	0.80	B	2
			7547.07	10000	0.370	0.55	0.95			B+	2
				9500	0.265			0.17	0.80	B	2
			7256.62	10000	0.370	0.51	0.95			B+	2
				9500	0.265			0.17	0.81	B	2
4.	$3p^44s-$	$^4P-^4D^o$	4389.75	10000	0.370	0.99	0.99			B+	2
	$3p^4(^3P)5p$	(7)		9500	0.265			0.30	0.79	B	2
5.		$^4P-^2D^o$	4209.67	10000	0.370	0.96				B+	2
		(8)									
6.		$^4P-^4S^o$	4323.35	10000	0.370	0.96	0.98			B+	2
		(9)	4226.42	10000	0.370	0.92	0.98			B+	2
7.		$^2P-^2P^o$	4600.98	10000	0.370	1.33	0.76			B+	2
				11600	1.0	4.2	0.94			C	1
			4526.19	10000	0.370	1.12	0.66			B+	2
				9500	0.265			0.35	0.51	B	2

Chlorine

Cl II

Ground State: $1s^22s^22p^63s^23p^4\ ^3P_2$

Ionization Energy: 23.814 eV = 192 070 cm^{-1}

Purić *et al.*[1] measured the Stark widths and shifts of six transitions with a pulsed arc at a fairly high plasma temperature (27 000 K). All these lines, plus many other transitions in this spectrum, have been measured before and are tabulated in our 1976 review.[2] Since the earlier measurements were done at a lower temperature (18 600 K), direct comparisons are difficult to make. However, it appears that the temperature dependence of these Stark widths is small in this range, since the data agree in all six cases within 15%.

References

[1]J. Purić, A. Srećković, S. Djeniže and M. Platiša, Phys. Rev. A 37, 4380 (1988).
[2]N. Konjević and W. L. Wiese, J. Phys. Chem. Ref. Data 5, 259 (1976).

Key data on experiments

Ref.	Plasma source	Method of measurement: Electron density	Method of measurement: Temperature	Remarks
1	Low-pressure pulsed arc	Laser interferometry at 6328Å	Boltzmann plot of Cl II line intensities and intensity ratios of several Cl III to Cl II lines	

Numerical results for Cl II

No.	Transition array	Multiplet (No.)	Wavelength (Å)	Temperature (K)	Electron density (10^{17} cm^{-3})	w_m (Å)	w_m/w_{th}	d_m (Å)	d_m/d_{th}	Acc.	Ref.
1.	$3p^34s-$ $3p^3(^4S^o)4p$	$^5S^o-^5P$ (1)	4810.06	27000	1.97	0.654	0.81	−0.04	0.12	B,D+	1
2.		$^3S^o-^3P$ (3)	5221.36	27000	1.97	0.766	0.77	−0.04	−0.08	B,D+	1
3.	$3p^34s'-$ $3p^3(^2D^o)4p'$	$^3D^o-^3D$ (16)	5078.26	27000	1.97	0.994		0.00		B	1
4.		$^3D^o-^3P$ (19)	4343.62	27000	1.97	0.656		0.08		B,D+	1
5.	$3p^34s''-$ $3p^3(^2P^o)4p''$	$^3P^o-^3D$ (40)	4768.65	27000	1.97	0.616		0.00		B	1
6.	$3p^34p'-$ $3p^3(^2D^o)4d'$	$^3F-^3F^o$ (68)	3913.87	27000	1.97	0.960		0.24		B,D+	1

Chlorine

Cl III

Ground State: $1s^22s^22p^63s^23p^3\ ^4S^o_{3/2}$

Ionization Energy: 39.61 eV = 319 500 cm^{-1}

Purić *et al.*[1] measured the Stark widths and shifts of eight Cl III transitions with a low-pressure pulsed arc. For three lines, their work overlaps with data by Platiša *et al.*[2] tabulated in our 1984 review.[3] Since both experiments were carried out at similar temperatures, i.e., 27 000 K versus 24 200 K, the results may be compared after linear scaling with the electron density. The differences are always within the estimated uncertainties and range from 18% to 33%. The large differences between the expermental data and the MSE calculations (see general introduction) are probably mainly due to the circumstance that the energy level data for perturbing levels are quite incomplete.

References

[1]J. Purić, A. Srećković, S. Djeniže and M. Platiša, Phys. Rev. A 37, 4380 (1988).
[2]M. Platiša, M. Dimitrijević, M. Popovič and N. Konjević, Astron. Astrophys. 54, 837 (1977).
[3]N. Konjević, M. S. Dimitrijević, and W. L. Wiese, J. Phys. Chem. Ref. Data 13, 649 (1984).

Key data on experiments

Ref.	Plasma source	Method of measurement: Electron density	Method of measurement: Temperature	Remarks
1	Low-pressure pulsed arc	Laser interferometry at 6328Å	Boltzmann plot of Cl II line intensities and intensity ratios of several Cl III to Cl II lines	

Numerical results for Cl III

No.	Transition array	Multiplet (No.)	Wavelength (Å)	Temperature (K)	Electron density (10^{17} cm^{-3})	w_m (Å)	w_m/w_{th}	d_m (Å)	d_m/d_{th}	Acc.	Ref.
1.	$3p^2 3d'$–$3p^2(^1D)4p'$	^2F–$^2D^o$ (13)	4608.21	27000	1.97	0.730	1.88	0.04		B,D+	1
2.	$3p^2 4s$–$3p^2(^3P)4p$	^4P–$^4P^o$ (2)	3283.41	27000	1.97	0.436	1.51	0.00		B	1
			3289.80	27000	1.97	0.426	1.48	0.02		B,D+	1
3.		^4P–$^4S^o$ (3)	3191.45	27000	1.97	0.384	1.44	0.00		B	1
			3139.34	27000	1.97	0.362	1.36	0.00		B	1
4.		^2P–$^2P^o$ (6)	3320.57	27000	1.97	0.462	1.64	0.00		B	1
			3259.32	27000	1.97	0.462	1.64	0.00		B	1
5.	$3p^2 4s'$–$3p^2(^1D)4p$	^2D–$^2P^o$ (11 uv)	2965.56	27000	1.97	0.320	1.27	−0.04		B,D+	1

Chlorine

Cl IV

Ground State: $1s^2 2s^2 2p^6 3s^2 3p^2\ ^3P_0$

Ionization Energy: 53.466 eV = 431 226 cm^{-1}

The Stark widths measured by Purić *et al.*[1] with a low-pressure pulsed arc are the first experimental Stark broadening data for this spectrum. Their results are compared with calculated data obtained by Dimitrijević and Konjević on the basis of the modified semiempirical (MSE) approach (see general introduction).

Reference

[1]J. Purić, A. Srećković, S. Djeniže and M. Platiša, Phys. Rev. A 37, 4380 (1988).

Key data on experiments

Ref.	Plasma source	Method of measurement: Electron density	Method of measurement: Temperature	Remarks
1	Low-pressure pulsed arc	Laser interferometry at 6328Å	Boltzmann plot of Cl II line intensities and intensity ratios of several Cl III to Cl II lines	

Numerical data for Cl IV

No.	Transition array	Multiplet (No.)	Wavelength (Å)	Temperature (K)	Electron density (10^{17} cm^{-3})	w_m (Å)	w_m/w_{th}	d_m (Å)	d_m/d_{th}	Acc.	Ref.
1.	$3p4s-$ $3p(^2P^o)4p$	$^3P^o-^3D$	3076.68	27000	1.97	0.200	1.08			B	1
			3063.13	27000	1.97	0.208	1.12			B	1
2.		$^3P^o-^3P$	2782.47	27000	1.97	0.196	1.28			B	1

Chromium

Cr II

Ground State: $1s^22s^22p^63s^23p^63d^5$ $^6S_{5/2}$

Ionization Energy: 16.4975 eV = 133 060 cm^{-1}

The Stark broadening measurements of three ultraviolet lines with an electromagnetic shock tube (T-tube) by Rathore *et al.*[1] have yielded the first data for this spectrum. The experiments were carried out at electron densities ranging from 0.33×10^{17} cm^{-3} to 2.55×10^{17} cm^{-3}, but the results are only tabulated for a nominal density of 10^{17} cm^{-3}. As expected from atomic structure considerations,[2] the widths and shifts of these three lines within the same multiplet are very similar, but the measured dependence on temperature is unusually strong.

Reference

[1]B. A. Rathore, I. S. Lakićević, M. Ćuk and J. Purić, Phys. Lett. A **100**, 31 (1984).

[2]W. L. Wiese and N. Konjević, J. Quant. Spectrosc. Radiat. Transfer **28**, 185 (1982).

Key data on experiments

Ref.	Plasma source	Method of measurement: Electron density	Method of measurement: Temperature	Remarks
1	T-tube	Laser interferometer at 6328Å and H_β Stark width	Relative intensity of Ne I lines, Boltzmann plot	

Numerical results for Cr II

No.	Transition array	Multiplet (No.)	Wavelength (Å)	Temperature (K)	Electron density (10^{17} cm^{-3})	w_m (Å)	w_m/w_{th}	d_m (Å)	d_m/d_{th}	Acc.	Ref.
1.		a ^{4}D–z ^{4}F° (5)	3132.06	13700–18100	1.0	0.226–0.134		(−0.11)–(−0.047)		C,C	1
			3124.94	13700–18100	1.0	0.26–0.130		(−0.12)–(0.048)		C,C	1
			3120.37	13700–18100	1.0	0.34–0.132		(−0.10)–(−0.049)		C,C	1

Cobalt

Co I

Ground State: $1s^22s^22p^63s^23p^63d^74s^2\ ^4F_{9/2}$

Ionization Energy: 7.864 eV = 63 430 cm^{-1}

Purić *et al.*[1] measured the Stark widths and shifts of five Co I lines in the near ultraviolet and visible spectrum using an electromagnetic shock tube (T-tube). They varied the electron density over a range from 0.33x10^{17} cm^{-3} to 2.55x10^{17} cm^{-3}, but reported their results only after scaling the data to an electron density of 1x10^{17} cm^{-3}. The measured variations of the widths with temperature are unusually large. These are the first Stark broadening measurements for this atom.

Reference

[1]J. Purić, M. Ćuk, B. A. Rathore and I. S. Lakićević, Phys. Lett. A **106**, 374 (1984).

Key data on experiments

Ref.	Plasma source	Method of measurement: Electron density	Method of measurement: Temperature	Remarks
1	T-tube	He-Ne laser interferometer at 6328Å and H_β Stark width	Boltzmann plot of relative intensities of Ne I lines	

Numerical results for Co I

No.	Transition array	Multiplet (No.)	Wavelength (Å)	Temperature (K)	Electron density (10^{17} cm^{-3})	w_m (Å)	w_m/w_{th}	d_m (Å)	d_m/d_{th}	Acc.	Ref.
1.		a ^{4}F–z ^{4}D° (6)	3412.63	14800–18100	1.0	0.16–0.10		(−0.056)–(−0.048)		C,C	1
2.		b ^{4}F–y ^{4}D° (21)	3502.28	14800–18100	1.0	0.50–0.20		(−0.056)–(−0.048)		C,C	1
3.		b ^{4}F–y ^{4}G° (22)	3453.50	14800–18100	1.0	0.32–0.18		(−0.057)–(−0.048)		C,C	1
4.		b ^{4}F–y ^{4}F° (23)	3405.12	14800–18100	1.0	0.13–0.10		(−0.056)–(−0.048)		C,C	1
5.		a ^{2}F–z ^{2}G° (28)	4121.32	14800–18100	1.0	0.30–0.13		(−0.11)–(−0.06)		C,C	1

Copper

Cu I

Ground State: $1s^22s^22p^63s^23p^63d^{10}4s\ ^2S_{1/2}$

Ionization Energy: 7.7264 eV = 62 317.44 cm^{-1}

The tabulated results are the first experimental Stark broadening data reported for this spectrum. In the two selected experiments,[1,2] the results are given for a nominal electron density of 10^{17} cm^{-3}, but the measurements were done over a range of electron densities; Fleurier[1] varied the electron density from 2×10^{16} to 2×10^{17} cm^{-3} and the temperature from 5 000 to 20 000 K, and Neger and Jäger[2] varied the density from 5×10^{17} to 8×10^{17} cm^{-3} and the temperature from 18 000 K to 24 000 K. Furthermore, Fleurier and Maulat[3] reported preliminary results in 1985 and these were considerably revised by Fleurier[1] in 1987. We have only tabulated the latter data.

Some of the measured variations of Stark widths for different lines within multiplets are unusually large, as in multiplets 1, 6 and 7.

References

[1]C. Fleurier, in *Spectral Line Shapes*, Vol III, Ed. R. J. Exton, A. Deepak Publ., Hampton, Va (1987) p. 67.

[2]T. Neger and H. Jäger, Z. Naturforsch. A **42**, 429 (1987).

[3]C. Fleurier and C. Maulat, Proceed. 17th Int. Conf. Phenom. Ionized Gases **2**, 981 (Budapest, 1985).

Key data on experiments

Ref.	Plasma source	Method of measurement: Electron density	Method of measurement: Temperature	Remarks
1	Low-pressure pulsed arc	H_α and H_β Stark widths and laser interferometry	Intensities of Ar II and Cu I lines	
2	Plasma jet emerging from a capillary discharge	H_β Stark width	Relative intensities of Ba II lines	Photographic technique

Numerical results for Cu I

No.	Transition array	Multiplet (No.)	Wavelength (Å)	Temperature (K)	Electron density (10^{17} cm^{-3})	w_m (Å)	w_m/w_{th}	d_m (Å)	d_m/d_{th}	Acc.	Ref.
1.	$3d^94s^2-$	$^2D-^2P^o$	5105.54	10000	1.0	0.43		0.067		C,C	1
	$3d^{10}(^1S)4p$		5782.13	10000	1.0	0.72		0.076		C,C	1
2.	$3d^{10}4p-$	$^2P^o-^2S$	7933.13	10000	1.0	3.20		0.71		C,C	1
	$3d^{10}(^1S)5s$		8092.63	10000	1.0	2.93		0.57		C,C	1
3.	$3d^{10}4p-$	$^2P^o-^2S$	4480.35	10000	1.0	2.40				C	1
	$3d^{10}(^1S)6s$		4530.78	10000	1.0	2.21		0.57		C,C	1
4.	$3d^{10}4p-$	$^2P^o-^2D$	5153.24	10000	1.0	1.90		−0.27		C,C	1
	$3d^{10}(^1S)4d$		5218.20	10000	1.0	2.20		−0.30		C,C	1
			5220.07	10000	1.0	2.20		−0.30		C,C	1
5.	$3d^{10}4p-$	$^2P^o-^2D$	4022.63	10000	1.0	4.31		1.95		C,C	1
	$3d^{10}(^1S)5d$		4062.64	10000	1.0	4.19		1.74		C,C	1

Numerical results for Cu I – Continued

No.	Transition array	Multiplet (No.)	Wavelength (Å)	Temperature (K)	Electron density (10^{17} cm^{-3})	w_m (Å)	w_m/w_{th}	d_m (Å)	d_m/d_{th}	Acc.	Ref.
6.	$3d^94s4p-$ $3d^94s(^3D)5s$	$^4P°-^4D$	4275.11	10000	1.0	0.80		0.30		C,C	1
				20000	1.0	0.44				C	2
			4378.20	20000	1.0	0.67				C	2
7.		$^4F°-^4D$	4509.37	20000	1.0	0.91				C	2
			4539.70	10000	1.0	1.80		0.19		C,C	1
				20000	1.0	0.88				C	2
			4586.97	10000	1.0	1.40				C	1
				20000	1.0	0.76				C	2
			4651.12	10000	1.0	0.87		0.13		C,C	1
				20000	1.0	0.58				C	2

Copper

Cu II

Ground State: $1s^22s^22p^63s^23p^63d^{10}\ ^1S_0$

Ionization Energy: 20.2921 eV = 163 665.6 cm^{-1}

The work of Fleurier[1] and Neger and Jäger[2] has yielded the first experimental Stark broadening data for this spectrum. In both experiments, the results are given for a nominal electron density of 10^{17} cm^{-3}; but Fleurier measured the line widths over an electron density range from 2×10^{16} to 2×10^{17} cm^{-3} and at temperatures from 5 000 K to 20 000 K, and Neger and Jäger[2] varied the electron density from 5×10^{17} to 8×10^{17} cm^{-3} and the temperature from 18 000 K to 24 000 K.

It is difficult to compare the results of the two experiments, since the data were taken at such different temperatures.

References

[1]C. Fleurier, in *Spectral Line Shapes*, Vol. III, Ed. R. J. Exton, A. Deepak Publ., Hampton, Va (1987) p. 67.
[2]T. Neger and H. Jäger, Z. Naturforsch. A **42**, 429 (1987).

Key data on experiments

Ref.	Plasma source	Method of measurement: Electron density	Method of measurement: Temperature	Remarks
1	Low-pressure pulsed arc	H_α and H_β Stark widths and laser interferometer	Intensities of Ar II and Cu I lines	
2	Plasma jet emerging from a capillary discharge	H_β Stark width	Relative intensities of Ba II lines	Photographic technique

Numerical results for Cu II

No.	Transition array	Multiplet (No.)	Wavelength (Å)	Temperature (K)	Electron density (10^{17} cm^{-3})	w_m (Å)	w_m/w_{th}	d_m (Å)	d_m/d_{th}	Acc.	Ref.
1.	$3d^9(^2D_{5/2})4p$–$3d^84s^2$	$^3P^o$–^3P (1)	4555.92	10000	1.0	0.40				C	1
				20000	1.0	0.13				C	2
			4889.69	10000	1.0	0.39				C	1
2.		$^3F^o$–^1G (2)	3686.56	10000	1.0	0.54				C	1
3.		$^3D^o$–^1G (3)	4043.75	10000	1.0	0.17				C	1
				20000	1.0	0.15				C	2
4.		$^1F^o$–^1G	4227.94	20000	1.0	0.11				C	2
5.	$3d^94d$–$3d^9(^2D_{5/2})4f$	^3G–$^3H^o$ (5)	4931.70	10000	1.0	0.58				C	1
6.		^1P–$^1D^o$ (8)	4812.95	10000	1.0	0.67				C	1
7.	$3d^9(^2D_{5/2})4d$–$3d^84s(^4F)4p$	^3F–$^3G^o$	5124.46	10000	1.0	0.50				C	1

Fluorine

F I

Ground State: $1s^22s^22p^5\ ^2P^o_{3/2}$

Ionization Energy: 17.423 eV = 140 524.5 cm^{-1}

Three high-quality experiments[1-3] were recently performed with wall-stabilized arcs, with similar plasma diagnostic techniques. The results are in excellent agreement. They are also quite close to — but always slightly below — the data from the semiclassical calculations of Benett and Griem.[4] Since the set of perturbing energy levels available to Benett and Griem was incomplete, but has become much better known since then, Vujnović *et al.*[1] performed new semiclassical calculations for these transitions which increase the w_m/w_{th}- ratios by about 10 to 15%.

All measured Stark widths within the studied $3s$-$3p$ transition array — and especially for lines within multiplets — are quite similar, as expected from general atomic structure considerations.[5] But for the Stark shifts a very strong increase with energy level position is noticed. It appears that for the $3s\ ^4P-3p\ ^4P^o$ transitions, which have the smallest values for the upper energy levels, the perturbations by the interacting lower and upper levels nearly cancel, while for the other lines the higher lying perturber levels become increasingly effective.

This new table of F I Stark broadening data is both quantitatively and qualitatively superior to our earlier tabulations and should thus be considered first.

References

[1]V. Vujnović, C. Vadla, V. Lokner and M. S. Dimitrijević, Astron. Astrophys. **123**, 249 (1983).

[2]S. Mar, A. Czernichowski and J. Chapelle, J. Phys. D **19**, 43 (1986).

[3]S. Djurović and N. Konjević, Z. Phys. D **10**, 425 (1988).

[4]S. M. Benett and H. R. Griem, Univ. of Maryland Techn. Rept. No. 71-097 (1971).

[5]W. L. Wiese and N. Konjević, J. Quant. Spectrosc. Radiat. Transfer **28**, 185 (1982).

Key data on experiments

Ref.	Plasma source	Method of measurement: Electron density	Method of measurement: Temperature	Remarks
1	Wall-stabilized arc	H_β Stark width	Relative intensities of Ar II and Ar I lines	
2	Wall-stabilized arc	H_β and Ar I 4300.1Å Stark width	Intensity ratios of S II to S I lines	
3	Wall-stabilized arc	H_β Stark width	Plasma composition data	

Numerical results for F I

No.	Transition array	Multiplet (No.)	Wavelength (Å)	Temperature (K)	Electron density (10^{17} cm^{-3})	w_m (Å)	w_m/w_{th}	d_m (Å)	d_m/d_{th}	Acc.	Ref.
1.	$2p^4 3s-$	$^4P-^4P^o$	7490*	14000	1.0	0.43	0.74			B	1
	$2p^4(^3P)3p$	(1)	7331.96	10000	0.37	0.19	0.97			B+	3
				9700	0.31			0.009	0.93	C	3
			7398.69	9700	0.31			0.009	0.91	C	3
2.		$^4P-^4D^o$	6859*	14000	1.0	0.41	0.73			B	1
		(2)	6909.82	10000	0.37	0.19	0.98			B+	3
				9800	0.315			0.052	0.98	B	3
			6902.48	10000	0.370	0.19	0.97			B+	3
				9800	0.315			0.052	0.98	B	3
			6856.03	10000	0.370	0.19	0.97			B+	3
				9800	0.315			0.052	0.98	B	3
			6834.26	10000	0.370	0.19	0.98			B+	3
3.		$^4P-^4S^o$	6304*	14000	1.0	0.47	0.77			B+	1
		(3)	6413.65	12700	1.0	0.48	0.83			A	2
				10000	0.370	0.22	0.97			B+	3
			6348.51	12700	1.0	0.49	0.84			A	2
				10000	0.370	0.21	0.97			B+	3
				9800	0.315			0.082	0.98	B	3
			6239.65	10000	0.370	0.21	0.98			B+	3
				9800	0.315			0.080	0.99	B	3
4.		$^2P-^2D^o$	7759*	14000	1.0	0.60	0.94			B	1
		(4)	7754.70	10000	0.37	0.26	0.97			B+	3
5.		$^2P-^2S^o$ (5)	7489.16	14000	1.0	0.73	0.94			B	1
6.		$^2P-^2P^o$	7067*	14000	1.0	0.62	0.77			B	1
		(6)	7037.47	10000	0.370	0.27	0.97			B+	3
				9800	0.315			0.085	0.97	B	3
7.		$^4P-^2D^o$	6622*	14000	1.0	0.47	0.92			B	1

*The authors of ref. 1 have measured all, or nearly all, lines of this multiplet individually, but present only one mean value for the Stark width. We have therefore listed the mean wavelength for the multiplet.

FLUORINE

F III

Ground State: $1s^22s^22p^3\ ^4S^o_{3/2}$

Ionization Energy: 62.709 eV = 505 777 cm^{-1}

Purić *et al.*[1] measured the Stark widths of two F III transitions with a low-pressure pulsed arc. Their results are compared with data calculated by Dimitrijević and Konjević on the basis of a modified semiempirical (MSE) approach (see general introduction). These are the first experimental Stark broadening data for this spectrum.

Reference

[1]J. Purić, A. Srećković, S. Djeniže and M. Platiša, Phys. Rev. A 37, 4380 (1988).

Key data on experiments

Ref.	Plasma source	Method of measurement: Electron density	Method of measurement: Temperature	Remarks
1	Low-pressure pulsed arc	He-Ne laser interferometer at 6328Å	Boltzmann plot of Cl II line intensities and intensity ratios of several Cl III to Cl II lines	

Numerical results for F III

No.	Transition array	Multiplet (No.)	Wavelength (Å)	Temperature (K)	Electron density (10^{17} cm^{-3})	w_m (Å)	w_m/w_{th}	d_m (Å)	d_m/d_{th}	Acc.	Ref.
1.	$2p^23s-2p^2(^3P)3p$	$^4P-^4D^o$ (1)	3113.62	27000	1.97	0.184	1.17			B	1
2.	$2p^23p'-2p^2(^1D)3d'$	$^2P^o-^2D$ (4)	3154.39	27000	1.97	0.230	1.13			B	1

Gallium

Ga I

Ground State: $1s^2 2s^2 2p^6 3s^2 3p^6 3d^{10} 4s^2 4p\ ^2P^o_{1/2}$

Ionization Energy: 5.999 eV = 48 387.63 cm^{-1}

The Stark width measurements of four Ga I lines by N'Dollo and Fabry[1] with a liquid cathode arc have yielded the first experimental Stark broadening data for this spectrum. The authors apparently carried out side-on observations, judging from the design of their source[2], but they did not comment whether they took into account source inhomogeneities along the line of sight (by applying, for example, an Abel inversion procedure). They undertook all measurements at fairly low electron densities, from 10^{14} cm^{-3} to 2×10^{15} cm^{-3}, and at a temperature of about 3300 K, but they scaled the results to the electron density and temperature values given in the table.

For the two 4*p*-5*s* lines N'Dollo and Fabry obtained very small half-widths, so that the instrumental width as well as Doppler broadening produce much larger contributions to the observed overall widths. While the authors have taken this into account, it seems to be difficult to do this correction accurately under such conditions. We estimate that – at the largest electron density used by the authors – the stated instrumental width of 0.04Å is about a factor of 11 larger and the Doppler-width of about 0.02Å is about a factor of 5 larger than the listed Stark width of 0.0037Å. Therefore we have lowered the accuracy estimates of the authors for these lines.

The ratios w_m/w_{th} were obtained by N'Dollo and Fabry from calculations based on the semiclassical theory.

References

[1]M. N'Dollo and M. Fabry, J. Physique 48, 703 (1987).
[2]G. Thiell, A. Rosseler and M. Fabry, J. Appl. Phys. 47, 1724 (1976).

Key data on experiments

Ref.	Plasma source	Method of measurement: Electron density	Method of measurement: Temperature	Remarks
1	Liquid cathode arc	H_β Stark width	Relative intensities of 3*p*–*nd* lines of sodium and 4*p*–*nd* lines of potassium	Source inhomogeneities not discussed

Numerical results for Ga I

No.	Transition array	Multiplet (No.)	Wavelength (Å)	Temperature (K)	Electron density (10^{17} cm^{-3})	w_m (Å)	w_m/w_{th}	d_m (Å)	d_m/d_{th}	Acc.	Ref.
1.	$4s^24p$–	$^2P^o$–^2S	4034.1	5000	0.1	0.0196	1.00			D	1
	$4s^2(^1S)5s$		4173.2	5000	0.1	0.0192	0.98			D	1
2.	$4s^25s$–	^2S–$^2P^o$	6415.2	5000	0.1	1.74	0.97			C	1
	$4s^2(^1S)6p$		6398.3	5000	0.1	1.60	0.89			C	1

Gallium

Ga II

Ground State: $1s^2 2s^2 2p^6 3s^2 3p^6 3d^{10} 4s^2\ ^1S_0$

Ionization Energy: 20.51 eV = 165 458 cm^{-1}

The Stark-width measurements of two Ga II lines by N'Dollo and Fabry[1] with a liquid cathode arc represent the first Stark broadening data for this spectrum. The authors apparently carried out side-on observations of their discharge, judging from the design of their source,[2] but they did not comment whether they took the source inhomogeneities along the line of sight into account (applying, for example, an Abel inversion procedure). They undertook all measurements at fairly low electron densities from 10^{14} cm^{-3} to 2×10^{15} cm^{-3} and at a temperature of about 3300 K, but scaled the results to the electron density and temperature values given in the table.

References

[1]M. N'Dollo and M. Fabry, J. Physique **48**, 703 (1987).
[2]G. Thiell, A. Rosseler and M. Fabry, J. Appl. Phys. **47**, 1724 (1976).

Key data on experiments

Ref.	Plasma source	Method of measurement: Electron density	Method of measurement: Temperature	Remarks
1	Liquid cathode arc	H_β Stark width	Relative intensities of $3p$–nd lines of sodium and $4p$–nd lines of potassium	Source inhomogeneities not discussed

Numerical results for Ga II

No.	Transition array	Multiplet (No.)	Wavelength (Å)	Temperature (K)	Electron density (10^{17} cm^{-3})	w_m (Å)	w_m/w_{th}	d_m (Å)	d_m/d_{th}	Acc.	Ref.
1.	$4s5p$–$4s(^2S)5d$	^3P–^3D	5339.9	5000	1.0	12.2				C	1
			5361.9	5000	1.0	13.0				C	1

Germanium

Ge I

Ground State: $1s^22s^22p^63s^23p^63d^{10}4s^24p^2\ ^3P_0$

Ionization Energy: 7.899 eV = 63 713.24 cm^{-1}

The first extended Stark broadening study for this spectrum has been carried out by Musiol *et al.*[1] with a wall-stabilized arc. The widths of different lines in the two studied transition arrays are quite similar, as one would expect on the basis of atomic structure considerations.[2] Only two lines have been studied earlier and the results have been tabulated in our 1984 review.[3] A comparison is possible for the 4226.56Å line, and the differences with the shock-tube data of Jones and Miller[4] as well as with the semiclassical theory[5] are large, i.e., factors of 22 and 3.4, respectively, with the results by Musiol *et al.*[1] producing the smallest width.

Jones and Miller[4] also measured the Stark width for another, much weaker line in the $4p$–$5s$ transition array. The width of this line should be similar to the 4226.56Å line, on the basis of the above mentioned atomic structure considerations.[2] However, for this line the Stark width by Jones and Miller is a factor of ten smaller, and thus much more consistent with the data of Musiol *et al.*[1] Thus it appears that self-absorption may have been an important factor for the 4226.56Å line in the Jones and Miller experiment.

References

[1] K. Musiol, S. Labuz and B. Pokrzywka, J. Quant. Spectrosc. Radiat. Transfer **40**, 143 (1988).

[2] W. L. Wiese and N. Konjević, J. Quant. Spectrosc. Radiat. Transfer **28**, 185 (1982).

[3] N. Konjević, M. S. Dimitrijević and W. L. Wiese, J. Phys. Chem. Ref. Data **13**, 619 (1984).

[4] W. W. Jones and M. H. Miller, Phys. Rev. **A10**, 1803 (1974).

[5] M. S. Dimitrijević and N. Konjević, J. Quant. Spectrosc, Radiat. Transfer **30**, 45 (1983).

Key data on experiments

Ref.	Plasma source	Method of measurement: Electron density	Method of measurement: Temperature	Remarks
1	Wall-stabilized arc	H_β Stark width	Plasma-composition data	

Numerical results for Ge I

No.	Transition array	Multiplet (No.)	Wavelength (Å)	Temperature (K)	Electron density (10^{17} cm^{-3})	w_m (Å)	w_m/w_{th}	d_m (Å)	d_m/d_{th}	Acc.	Ref.
1.	$4s^24p^2$–$4s^24p(^2P^o)5s$	^3P–$^3P^o$	2754.59	12450	0.57	0.0509				C	1
			2709.62	12450	0.57	0.0434				C	1
			2651.57	12450	0.57	0.0358				C	1
			2651.17	12450	0.57	0.0421				C	1
			2592.53	12450	0.57	0.0452				C	1
2.		^1D–$^3P^o$ (1)	3124.82	12450	0.57	0.0628				C	1
3.		^1D–$^1P^o$ (2)	3039.07	12450	0.57	0.0622				C	1
4.		^1S–$^1P^o$ (4)	4226.56	12450	0.57	0.0815				D+	1
5.	$4s^24p^2$–$4s^24p(^2P^o)4d$	^1D–$^1D^o$	2417.37	12450	0.57	0.0440				C	1
6.		^1S–$^1P^o$	2740.43	12450	0.57	0.0578				C	1

Helium

He I

Ground State: $1s^2\ ^1S_0$

Ionization Energy: 24.588 eV = 198 310.76 cm^{-1}

Mazing *et al.*[1-3] performed some Stark width measurements with a low pressure pulsed arc, and reported the electron impact widths after taking account of the asymmetric part of the profile, due to ion broadening. (This work was done in 1974, but only came to our attention recently). The measurements were carried out over an electron density range from 2 to 7×10^{16} cm^{-3}, but were only reported for a density of 10^{16} cm^{-3}.

With a pulsed low-pressure arc, Perez *et al.*[4] performed measurements of the Stark widths of the lines at 5015 Å, 6678 Å and 4713 Å in the electron density range from 1×10^{16} cm^{-3} to 7×10^{16} cm^{-3} and for temperatures between 20 000 K and 40 000 K. They plotted the line widths versus electron density and achieved very good linear fits, which are also supported by existing literature data. Numerical relations are presented for the conditions of best fit, but no explicit measured data are given except for some points in a graph for the 5015 Å line.

In Ref. 5, results for the 6678 Å line are tabulated and good agreement with semiclassical calculations is obtained.

Our earlier reviews[6,7] contain much more extensive coverage of Stark broadening data for neutral helium lines.

References

[1]M. A. Mazing and V. A. Slemzin, Sov. Phys. Lebedev Inst. Rep. 4, 42 (1973) (in Russian).
[2]M. A. Mazing, V. A. Slemzin, A. P. Shevel'ko and M. A. Larina, Sov. Phys. Lebedev Inst. Rep. 5, 29 (1974) (in Russian).
[3]M. A. Mazing and V. A. Slemzin, Sov. Phys. Lebedev Inst. Rep. 3, 37 (1973) (in Russian).
[4]M. S. Perez, M. I. de la Rosa, A. M. de Frutos and S. Mar, 9th Int. Conf. Spectral Line Shapes, Contributed papers, Nicholas Copernicus University Press, Torun, Poland (1988) A10.
[5]B. T. Vujicić and R. Kobilarov, 9th Int. Conf. Spectral Line Shapes, Contributed papers, Nicholas Copernicus University Press, Torun, Poland (1988) A18.
[6]N. Konjević and J. R. Roberts, J. Phys. Chem. Ref. Data 5, 209 (1976).
[7]N. Konjević, M. S. Dimitrijević and W. L. Wiese, J. Phys. Chem. Ref. Data 13, 619 (1984).

Key data on experiments

Ref.	Plasma source	Method of measurement: Electron density	Method of measurement: Temperature	Remarks
1,2	Low pressure pulsed arc	He – Ne laser interferometer and Stark widths of the He II 4686 Å and He I 5016 Å lines	Intensity ratios of He II 4686 Å and He I 4713 Å lines and line to continuum ratio[3]	
4	Low-pressure pulsed arc	Twyman-Green interferometer at two wavelengths	Intensity ratios of He II to He I lines	
5	Plasma produced with a CO_2 laser	He I 3889Å and 5016Å Stark widths	Line to continuum ratio at two wavelengths	

Numerical results for He I

No.	Transition array	Multiplet (No.)	Wavelength (Å)	Temperature (K)	Electron density (10^{17} cm^{-3})	w_m (Å)	w_m/w_{th}	d_m (Å)	d_m/d_{th}	Acc.	Ref.
1.	$1s2s-$ $1s2p$	$^1S-^1P^o$	20581.30	34800	0.1	0.94	0.82			B	2
2.	$1s2p-$ $1s3s$	$^1P^o-^1S$ (45)	7281.35	34800	0.1	0.85	1.02			B	1
3.	$1s2p-$ $1s3d$	$^1P^o-^1D$ (46)	6678.15	26000–35000	0.71–1.62	6.2–11.5	0.95–0.75			C	5
4.	$1s2p-$ $1s3s$	$^3P^o-^3S$ (10)	7065.19	34800	0.1	0.51	1.01			B	1

Indium

In I

Ground State: $1s^22s^22p^63s^23p^63d^{10}4s^24p^64d^{10}5s^25p\ ^2P^o_{1/2}$

Ionization Energy: 5.78636 eV = 46 670.107 cm^{-1}

The Stark widths measurements of two In I lines by N'Dollo and Fabry[1] with a liquid cathode arc represent the first Stark broadening data for this spectrum. The authors apparently carried out side-on observations of their discharge, judging from the design of their source,[2] but they did not comment whether they took the source inhomogeneities along the line of sight into account (applying, for example, an Abel inversion procedure). They undertook all measurements at fairly low electron densities from 10^{14} cm^{-3} to 2×10^{15} cm^{-3} and at a temperature of about 3300 K, but scaled the results to the electron density and temperature values given in the table.

The ratios w_m/w_{th} were obtained by N'Dollo and Fabry from calculations based on the semiclassical theory.

References

[1]M. N'Dollo and M. Fabry, J. Physique **48**, 703 (1987).
[2]G. Thiell, A. Rosseler and M. Fabry, J. Appl. Phys. **47**, 1724 (1976).

Key data on experiments

Ref.	Plasma source	Method of measurement: Electron density	Method of measurement: Temperature	Remarks
1	Liquid cathode arc	H_β Stark width	Relative intensities of $3p-nd$ lines of sodium and $4p-nd$ lines of potassium	Source inhomogeneities not discussed

Numerical results for In I

No.	Transition array	Multiplet (No.)	Wavelength (Å)	Temperature (K)	Electron density (10^{17} cm^{-3})	w_m (Å)	w_m/w_{th}	d_m (Å)	d_m/d_{th}	Acc.	Ref.
1.	$5s^26s-$ $5s^2(^1S)8p$	$^2S-^2P^o$	5711.5	5000	0.1	6.6	1.30			C	1
			5729.3	5000	0.1	5.6	1.09			C	1

Indium

In II

Ground State: $1s^22s^22p^63s^23p^63d^{10}4s^24p^64d^{10}5s^2\ ^1S_0$

Ionization Energy: 18.870 eV = 152 195 cm^{-1}

The Stark width measurements of two In II lines by N'Dollo and Fabry[1] with a liquid cathode arc represent the first Stark broadening data for this spectrum. The authors apparently carried out side-on observations of their discharge, judging from the design of their source,[2] but they did not comment whether they took the source inhomogeneities along the line of sight into account (applying, for example, an Abel inversion procedure). They undertook all measurements at fairly low electron densities from 10^{14} cm^{-3} to 2×10^{15} cm^{-3} and at a temperature of about 3300 K, but scaled the results to the electron density and temperature values given in the table.

References

[1]M. N'Dollo and M. Fabry, J. Physique **48**, 703 (1987).
[2]G. Thiell, A. Rosseler and M. Fabry, J. Appl. Phys. **47**, 1724 (1976).

Key data on experiments

Ref.	Plasma source	Method of measurement: Electron density	Method of measurement: Temperature	Remarks
1	Liquid cathode arc	H_β Stark width	Relative intensities of $3p$–nd lines of sodium and $4p$–nd lines of potassium	Source inhomogeneities not discussed

Numerical results for In II

No.	Transition array	Multiplet (No.)	Wavelength (Å)	Temperature (K)	Electron density (10^{17} cm^{-3})	w_m (Å)	w_m/w_{th}	d_m (Å)	d_m/d_{th}	Acc.	Ref.
1.	$5s5d$–$5s(^2S)7p$	^3D–$^3P^o$	4015.0	5000	1.0	6.6				C+	1
2.	$5s7p$–$5s(^2S)11s$	$^1P^o$–^1S	5557.1	5000	1.0	62.8				C	1

Iodine

I I

Ground State: $1s^22s^22p^63s^23p^63d^{10}4s^24p^64d^{10}5s^25p^5\ ^2P^o_{3/2}$

Ionization Energy: 10.451 eV = 84 295 cm^{-1}

Djurović and Konjević[1] employed a wall-stabilized arc for the first Stark broadening experiment on neutral iodine.

Reference

[1]S. Djurović and N. Konjević, 9th Int. Conf. Spectral Line Shapes, Contributed papers, Nicholas Copernicus University Press, Torun, Poland (1988) A17.

Key data on experiments

Ref.	Plasma source	Method of measurement Electron density	Temperature	Remarks
1	Wall-stabilized arc	H_β Stark width	Plasma composition data	

Numerical results for I I

No.	Transition array	Multiplet (No.)	Wavelength (Å)	Temperature (K)	Electron density (10^{17} cm^{-3})	w_m (Å)	w_m/w_{th}	d_m (Å)	d_m/d_{th}	Acc.	Ref.
1.	$(^3P_2)6s-$ $(^3P_1)6p$	$[2]-[2]^o$	5586.36	9400	0.23	0.40				B	1
			6082.43	9400	0.23	0.44				B	1
2.		$[2]-[1]^o$	5427.06	9400	0.23	0.38				B	1
			5894.53	9400	0.23	0.43				B	1
3.	$(^3P_2)6s-$ $(^3P_0)6p$	$[2]-[1]^o$	5764.33	9400	0.23	0.37				B	1
			6293.98	9400	0.23	0.41				B	1

Krypton

Kr I

Ground State: $1s^22s^22p^63s^23p^63d^{10}4s^24p^6\ ^1S_0$

Ionization Energy: 14.000 eV = 112 914.6 cm^{-1}

Vitel and Skowronek[1] have generated dense plasmas with a flashtube and achieved electron densities from 7.6 × 10^{17} cm^{-3} to 16 × 10^{17} cm^{-3}. Their half-width data are consistent with those of Brandt *et al.*[2], but inconsistent with those of Klein and Meiners, both obtained at appreciably lower electron densities. These data are both tabulated in our 1984 review,[4] which also contains a number of other Kr I lines. We stated there[4] that the Klein and Meiners[3] data are estimated to be quite uncertain, since they were taken in the presence of strong self-absorption.

References

[1]Y. Vitel and M. Skowronek, J. Phys. B **20**, 6493 (1987).
[2]T. Brandt, V. Helbig and K. P. Nick, in *Spectral Line Shapes*, Ed. B. Wende, W. de Gruyter, Berlin (1981), p. 265.
[3]P. Klein and D. Meiners, J. Quant. Spectrosc. Radiat. Transfer **17**, 197 (1977).
[4]N. Konjević, M. S. Dimitrijević and W. L. Wiese, J. Phys. Chem. Ref. Data **13**, 619 (1984).

Key data on experiments

Ref.	Plasma source	Method of measurement Electron density	Temperature	Remarks
1	Linear flash tube	Continuum emission, H_α Stark width, and laser interferometer at 3.39μm	Intensity of optically thick infrared lines	

Numerical results for Kr I

No.	Transition array	Multiplet (No.)	Wavelength (Å)	Temperature (K)	Electron density (10^{17} cm^{-3})	w_m (Å)	w_m/w_{th}	d_m (Å)	d_m/d_{th}	Acc.	Ref.
1.	$5s$–$5p'$	[1 1/2]°–[1 1/2]	5870.91	14300–17400	7.6–16.2	4.8–9.0		1.9–3.2		B,C	1

Krypton

Kr II

Ground State: $1s^22s^22p^63s^23p^63d^{10}4s^24p^5\ ^2P^o_{3/2}$

Ionization Energy: 24.359 eV = 196 474.8 cm^{-1}

Richou *et al.*[1] have presented the results of their work for a nominal electron density of 10^{17}cm^{-3}, but actually carried out their measurements on a gas-driven shock tube over a density range from 0.2 to 1.5 × 10^{17} cm^{-3}.

Our 1984 review[4] included some Stark-width data for Kr II, too, and there is overlap for the lines at 4766 and 4619 Å. The new Stark widths by Richou *et al.* are about twice as large as the earlier data by Brandt *et al.*,[5] which were obtained with a wall-stabilized arc. The results of Vitel and Skowrowek[3], obtained at distictly higher temperatures and densities, are more consistent with the data by Brandt *et al.*[5], but also indicate that the widths do not scale linearly with the electron density at these high densities.

References

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[4]N. Konjević, M. S. Dimitrijević and W. L. Wiese, J. Phys. Chem. Ref. Data 13, 649 (1984).
[5]T. Brandt, V. Helbig, and K. P. Nick, in *Spectral Line Shapes*, Ed. B. Wende, W. de Gruyter, Berlin (1981), p. 265.

Key data on experiments

Ref.	Plasma source	Method of measurement: Electron density	Method of measurement: Temperature	Remarks
1	Gas-driven shock tube	He-Ne laser interferometer at 3.39 μm	Intensity ratios of Fe I impurity lines; plasma-composition data	
2	Low-pressure pulsed arc	He-Ne laser quadrature interferometer at 6328Å	Relative intensities of O II impurity lines	
3	Linear flash-tube	Continuum emission, H_α Stark width, and laser interferometer at 3.39μm	Intensity of optically thick infrared lines	Insufficient information provided on electron density and temperature measurements

Numerical results for Kr II

No.	Transition array	Multiplet (No.)	Wavelength (Å)	Temperature (K)	Electron density (10^{17} cm^{-3})	w_m (Å)	w_m/w_{th}	d_m (Å)	d_m/d_{th}	Acc.	Ref.
1.	$4p^45s$– $4p^4(^3P)5p$	^4P–$^4P^o$	4658.88	10000	1.0	0.62				C+	1
				14900–17400	7.6–15.8	2.2–3.6		(−0.8)–(−1.1)		C,D	3
		^4P–$^4D^o$	4739.00	10000	1.0	0.62				C+	1
				14900–17400	7.6–16.2	2.3–4.1		(−0.6)–(−0.8)		C,D	3
			4292.92	10000	1.0	0.44				C	1
			4355.48	10000	1.0	0.55				C	1
				14900–17400	7.6–15.8	2.0–3.2		0–(0.2)		C,D	3
2.			4765.74	10000	1.0	0.72				C+	1
3.		^2P–$^2D^o$	4619.17	10000	1.0	0.67				C+	1
4.	$4p^45p$– $4p^4(^3P)5d$	$^2D^o$–^2D	3607.88	26500	0.9	0.58				C+	2
5.		$^2D^o$–^2F	3648.61	26500	0.9	0.78				C+	2
6.		$^2P^o$–^2F	3651.02	26500	0.9	0.78				C+	2
7.		$^2P^o$–^2D	3470.05	26500	0.9	0.59				C+	2
8.		$^2P^o$–^2P	3589.65	26500	0.9	0.68				C+	2

Krypton

Kr III

Ground State: $1s^22s^22p^63s^23p^63d^{10}4s^24p^4\ ^3P_2$

Ionization Energy: 36.95 eV = 298 020 cm^{-1}

The work with a low-pressure pulsed arc by Konjević and Pittman[1] has produced the first experimental data for this spectrum. Some of their results are compared with the modified semiempirical (MSE) approximation by Dimitrijević and Konjević (see general introduction), with which they are in close agreement.

References

[1]N. Konjević and T. L. Pittman, J. Quant. Spectrosc. Radiat. Transfer 37, 311 (1987).

Key data on experiments

Ref.	Plasma source	Method of measurement: Electron density	Method of measurement: Temperature	Remarks
1	Low-pressure pulsed arc	He-Ne laser quadrature interferometer at 6328Å	Relative intensities of O II impurity lines	

Numerical results for Kr III

No.	Transition array	Multiplet (No.)	Wavelength (Å)	Temperature (K)	Electron density (10^{17} cm^{-3})	w_m (Å)	w_m/w_{th}	d_m (Å)	d_m/d_{th}	Acc.	Ref.
1.	$4p^35s-$ $4p^3(^4S^o)5p$	$^5S^o-^5P$	3351.93	25000	0.86	0.140	1.17			B	1
			3325.75	25000	0.86	0.140	1.17			B	1
2.		$^3S^o-^3P$	3564.23	25000	0.86	0.144	0.92			B	1
3.	$4p^35s'-$ $4p^3(^2D^o)5p'$	$^3D^o-^3D$	3474.65	25000	0.86	0.135				B	1
			3439.46	25000	0.86	0.135				B	1
4.		$^3D^o-^3F$	3191.21	25000	0.86	0.142				B	1
5.	$4p^35s''-$ $4p^3(^2P^o)5p''$	$^3P^o-^3D$	3374.96	25000	0.86	0.153				B	1

Lead

Pb II

Ground State: $1s^22s^22p^63s^23p^63d^{10}4s^24p^64d^{10}4f^{14}5s^25p^65d^{10}6s^26p\ ^2P^o_{1/2}$

Ionization Energy: 15.0325 eV = 121 245.1 cm^{-1}

Purić *et al.*[1] used an electromagnetic shock tube (T-tube) to measure the Stark widths and shifts of three Pb II lines. Their measurements were done at temperatures of 16 000 K and 20 000 K, and over a range of electron densities N_e from 0.3×10^{17} cm^{-3} to 1.4×10^{17} cm^{-3}, but they have tabulated their results only for $N_e=10^{17}$ cm^{-3}. Their data differ appreciably for the two temperatures. It is therefore difficult to compare them with the other available width data, measured by Miller *et al.*[2] at a much lower temperature of 11 600 K (these are tabulated in our 1984 review[3]).

References

[1] J. Purić, M. Ćuk and I. S. Lakićević, Phys. Rev. A **32**, 1106 (1985); I. S. Lakićević, Ph. D. thesis, University of Belgrade (1982).

[2] M. H. Miller, R. D. Bengtson and J. M. Lindsay, Phys. Rev. **A20**, 1997 (1979).

[3] N. Konjević, M. S. Dimitrijević and W. L. Wiese, J. Phys. Chem. Ref. Data **13**, 649 (1984).

Key data on experiments

Ref.	Plasma source	Method of measurement: Electron density	Method of measurement: Temperature	Remarks
1	T-tube	He-Ne laser interferometer at 6328Å and H_β Stark width	Boltzmann plot of relative intensities of Ar II lines and intensity ratios of Si III to Si II lines	

Numerical results for Pb II

No.	Transition array	Multiplet (No.)	Wavelength (Å)	Temperature (K)	Electron density (10^{17} cm^{-3})	w_m (Å)	w_m/w_{th}	d_m (Å)	d_m/d_{th}	Acc.	Ref.
1.	$6s^26d-$ $6s^25f$	$^2D-^2F^o$	4244.92	16000& 20000	1.0	1.52& 1.28		(−0.60)& (−0.38)		C⁺,C	1
2.	$6s^27p-$ $6s^27d$	$^2P^o-^2P$	5544.25	16000& 20000	1.0	3.18& 2.10		1.37& 0.76		C⁺,C	1
3.		$^2S-^2P^o$	5608.85	16000& 20000	1.0	2.12& 1.72		(−0.91)& (−0.61)		C⁺,C	1

Mercury

Hg I

Ground State: $1s^22s^22p^63s^23p^63d^{10}4s^24p^64d^{10}4f^{14}5s^25p^65d^{10}6s^2\ ^1S_0$

Ionization Energy: 10.4375 eV = 84 184.10 cm^{-1}

The experiment by Damelincourt *et al.*[1] with high-pressure mercury arc discharges operating on 50 Hz alternating current at power levels of about 1100 W is the only source of data. In our earlier reviews[2,3] their previous result on the Hg I 5460.75Å line was our only data source. Thus this new experiment may be regarded as the continuation of their work, and the new result should supersede the earlier one. As in the earlier experiment, all lines are strongly self-reversed. Therefore the line shapes for the optically thin condition are reconstructed from the equations of radiative transfer. The authors also calculated the Stark widths of these lines by applying Sahal-Bréchot's semiclassical theory formalism[4-6] and these are utilized in our table for comparisons with theoretical data.

References

[1]J. J. Damelincourt, M. Aubes and P. Fragnac, J. Appl. Phys. 54, 3087 (1983).
[2]N. Konjević and J. R. Roberts, J. Phys. Chem. Ref. Data 5, 209 (1976).
[3]N. Konjević, M. S. Dimitrijević and W. L. Wiese, J. Phys. Chem. Ref. Data 13, 619 (1984).
[4]S. Sahal-Bréchot, Astron. Astrophys. 1, 91 (1969).
[5]S. Sahal-Bréchot, Astron. Astrophys. 2, 322 (1969).
[6]S. Sahal-Bréchot, Astron. Astrophys. 35, 319 (1974).

Key data on experiments

Ref.	Plasma source	Method of measurement: Electron density	Method of measurement: Temperature	Remarks
1	High-pressure mercury discharge	Plasma-composition data	Absolute intensity of Hg I line	Shapes of optically thick lines measured

Numerical results for Hg I

No.	Transition array	Multiplet (No.)	Wavelength (Å)	Temperature (K)	Electron density (10^{17} cm^{-3})	w_m (Å)	w_m/w_{th}	d_m (Å)	d_m/d_{th}	Acc.	Ref.
1.	$5d^{10}6s6p-$ $5d^{10}6s(^2S)7s$	$^3P^o-^3S$ (1)	4046.57	6000	0.10	0.028	0.88			C	1
			4358.34	6000	0.10	0.028	0.65			C	1
			5460.75	6000	0.10	0.067	1.03			C	1

Neon

Ne I

Ground State: $1s^22s^22p^6\ ^1S_0$

Ionization Energy: 21.565 eV = 173 929.70 cm^{-1}

List of tabulated lines

Wavelength (Å)	No.	Wavelength (Å)	No.	Wavelength (Å)	No.	Wavelength (Å)	No.
5400.56	14	6096.16	12	6334.43	3	7173.94	17
5852.49	19	6143.06	5	6382.99	10	7245.17	8
5881.90	7	6163.59	16	6402.25	2	7488.87	20
5944.83	6	6217.28	4	6506.53	9	8377.61	21
6030.00	13	6266.50	15	7024.05	18		
6074.34	11	6328.16	22	7032.41	1		

Two experiments carried out by Purić and co-workers[2,3] with a T-tube and low-pressure pulsed arc have provided all the Stark width and shift data, except for the gas-laser line at 6328 Å, which was studied by Schade *et al.*,[1] employing a wall-stabilized arc.

The T-tube measurements by Purić *et al.*[2] were performed over a large electron density and temperature range, from 0.15 × 10^{17} to 1.4 × 10^{17} cm^{-3} and 10 000 to 25 000 K, respectively, but the results are reported only for an electron density of 1 × 10^{17} cm^{-3} and several temperature values. The measurements are in good agreement with the semiclassical theory for the high temperatures, but differ increasingly with theory for the lower temperatures, with the measured widths becoming systematically too large. Such systematic disagreement with theory is very unusual and was not found in earlier work with wall-stabilized arcs tabulated in our 1976 review.[4] The problem thus appears to lie with the results of Purić *et al.*[2] and we have therefore given very conservative accuracy ratings.

References

[1]W. Schade, K. -P. Nick and V. Helbig, in *Spectral Line Shapes*, Vol. 3, Ed. F. Rostas, Walter de Gruyter, Berlin (1985), p. 59.

[2]J. Purić, M. Ćuk, B. H. Rathore, Phys. Rev. A **35**, 1132 (1987).

[3]J. Purić, A. Srećković, S. Djeniže, J. Labat and Lj. Ćirković, Phys. Lett. A. **126**, 280 (1988).

[4]N. Konjević and J. R. Roberts, J. Phys. Chem. Ref. Data **5**, 209 (1976).

Key data on experiments

Ref.	Plasma source	Method of measurement: Electron density	Method of measurement: Temperature	Remarks
1	Wall-stabilized arc	Michelson laser interferometer		No temperature measurements are reported
2	T-tube	He-Ne laser interferometer at 6328Å	Boltzmann plot of Ar II line intensities	
3	Low-pressure pulsed arc	He-Ne laser interferometer at 6328Å	Boltzmann plot of Ne II line intensities	

Numerical results for Ne I

No.	Transition array	Multiplet (No.)	Wavelength (Å)	Temperature (K)	Electron density (10^{17} cm^{-3})	w_m (Å)	w_m/w_{th}	d_m (Å)	d_m/d_{th}	Acc.	Ref.
1.	$2p^53s-2p^5(^2P^o_{1\,1/2})3p$	[1 1/2]°–[1/2]	7032.41	10000–25000	1.0	0.96–0.60	2.55–1.01	0.09–0.07	1.26–1.18	D,C$^+$	2
2.		[1 1/2]°–[2 1/2] (1)	6402.25	10000–25000	1.0	0.90–0.66	2.25–1.14	0.170–0.132	0.98–0.77	D,C$^+$	2
				28000–35200	0.56–1.42	0.410–0.690	1.15–0.76	0.074–0.111	0.77–0.50	C,C$^+$	3
				40200	0.75	0.384	0.76			C$^+$	3
3.		[1 1/2]°–[1 1/2]	6334.43	10000–25000	1.0	0.84–0.52		0.10–0.133		D,C$^+$	2
4.		[1 1/2]°–[1 1/2]	6217.28	10000–25000	1.0	0.88–0.60		0.12–0.125		D,C$^+$	2
5.		[1 1/2]°–[1/2]	6143.06	10000–25000	1.0	0.90–0.54		0.24–0.227		D,C$^+$	2
				27700–31400	0.39–0.92	0.304–0.256				C$^+$	3
				27700&28000	0.39&0.56			0.061&0.078		C	3
6.	$2p^5(^2P^o_{1\,1/2})3s-2p^5(^2P^o_{1/2})3p'$	[1 1/2]°–[1 1/2]	5944.83	10000–25000	1.0	0.52–0.46	1.39–0.89	0.170–0.170	0.91–0.91	D,C$^+$	2
7.		[1 1/2]°–[1/2] (1)	5881.90	10000–25000	1.0	0.80–0.48		0.15–0.15		D,C$^+$	2
8.	$2p^53s-2p^5(^2P^o_{1\,1/2})3p$	[1 1/2]°–[1/2]	7245.17	10000–25000	1.0	0.90–0.64	2.25–0.99	0.09–0.08	2.07–2.14	D,C$^+$	2
9.		[1 1/2]°–[2 1/2] (3)	6506.53	28000	0.56	0.452	1.31			C$^+$	3
10.		[1 1/2]°–[1 1/2]	6382.99	10000–25000	1.0	0.70–0.50		0.24–0.18		D,C$^+$	2
				27700–35000	0.39–1.42	0.276–0.650				C$^+$	3
				27700&28000	0.39&0.56			0.039&0.058		C	3
11.		[1 1/2]°–[1/2]	6074.34	10000–25000	1.0	0.80–0.46		0.12–0.14		D,C$^+$	2
				22500–28000	0.28–0.56	0.220–0.396		0.045–0.080		C$^+$,C	3

Numerical results for Ne I – Continued

No.	Transition array	Multiplet (No.)	Wavelength (Å)	Temperature (K)	Electron density (10^{17} cm^{-3})	w_m (Å)	w_m/w_{th}	d_m (Å)	d_m/d_{th}	Acc.	Ref.
12.	$2p^5(^2P^\circ_{1\,1/2})3s-$ $2p^5(^2P^\circ_{1/2})3p'$	$[1\ 1/2]^\circ-$ $[1\ 1/2]$	6096.16	10000–25000	1.0	0.70– 0.44	1.80– 0.82	0.13– 0.166	0.71– 0.93	D,C$^+$	2
13.		$[1\ 1/2]^\circ-$ $[1/2]$ (3)	6030.00	10000–25000	1.0	0.80– 0.50		0.14– 0.16		D,C$^+$	2
14.		$[1\ 1/2]^\circ-$ $[1/2]$	5400.56	10000–25000	1.0	0.70– 0.54		0.27– 0.22		D,C$^+$	2
15.	$2p^53s'-$ $2p^5(^2P^\circ)3p'$	$[1/2]^\circ-$ $[1\ 1/2]$	6266.50	10000–25000	1.0	0.78– 0.50	1.86– 0.82	0.16– 0.174	0.86– 0.90	D,C$^+$	2
16.		$[1/2]^\circ-$ $[1/2]$	6163.59	10000–25000	1.0	0.80– 0.52		0.32– 0.20		D,C$^+$	2
17.	$2p^5(^2P^\circ_{1/2})3s'-$ $2p^5(^2P^\circ_{1\,1/2})3p$	$[1/2]^\circ-$ $[2\ 1/2]$	7173.94	10000–25000	1.0	0.90– 0.52		0.21– 0.163		D,C$^+$	2
18.		$[1/2]^\circ-$ $[1\ 1/2]$	7024.05	10000–25000	1.0	0.74– 0.45		0.12– 0.135		D,C$^+$	2
19.	$2p^53s'-$ $2p^5(^2P^\circ_{1/2})3p'$	$[1/2]^\circ-$ $[1/2]$ (6)	5852.49	10000–25000	1.0	0.94– 0.60		0.23– 0.25		D,C$^+$	2
				27700&28000	0.39& 0.56	0.286& 0.378		0.071& 0.080		D,C$^+$	2
				38000–40200	0.25– 0.75	0.212– 0.528				C$^+$	3
				39000	0.39			0.046		C	3
20.	$2p^53p-$ $2p^5(^2P^\circ_{1\,1/2})3d$	$[1/2]-$ $[1\ 1/2]^\circ$	7488.87	10000–25000	1.0	4.40– 3.72	0.96– 0.73	1.70– 1.98	0.72– 0.85	C,C$^+$	2
21.		$[2\ 1/2]^\circ-$ $[3\ 1/2]$ (12)	8377.61	10000–25000	1.0	5.10– 5.34	1.06– 0.94	1.50– 1.60	0.60– 0.66	C,C$^+$	2
22.	$2p^53p'-$ $2p^5(^2P^\circ_{1/2})5s'$	$[1\ 1/2]-$ $[1/2]^\circ$	6328.16	*	0.021– 0.080	0.14– 0.60		0.095– 0.283		B,B	1

*No temperature data given; from similar work with wall-stabilized arcs, temperatures in the range from 12 000 K to 15 000 K are estimated.

Neon

Ne II

Ground State: $1s^2 2s^2 2p^5\ ^2P^o_{3/2}$

Ionization Energy: 40.964 eV = 330 391 cm^{-1}

List of tabulated lines

Wavelength (Å)	No.	Wavelength (Å)	No.	Wavelength (Å)	No.	Wavelength (Å)	No.
3001.67	3	3323.74	6	3542.85	17	3709.62	1
3017.31	8	3334.84	2	3557.80	5	3713.08	4
3027.07	8	3344.40	2	3565.84	17	3753.83	18
3028.86	3	3355.02	2	3568.50	7	3766.26	1
3176.16	11	3360.60	2	3594.18	17	3818.43	19
3190.86	10	3388.42	12	3612.35	15	4290.40	21
3194.58	11	3416.91	14	3628.06	20	4391.99	21
3198.59	10	3417.69	13	3643.93	4	4409.30	21
3218.19	10	3453.10	14	3664.07	1	4413.22	21
3311.30	2	3477.69	14	3679.80	20		
3320.29	9	3503.61	16	3694.21	1		

The experiments by Pittman and Konjević[1,2] and Purić *et al.*[3] provide an extensive body of Stark width and shift data for this spectrum, and there is complete mutual consistency within the estimated uncertainties. The new work includes many of the lines tabulated in our 1984 review,[4] and good agreement is also found with the earlier Stark width data, assuming linear scaling of the widths with the electron density.

References

[1]T. L. Pittman and N. Konjević, J. Quant. Spectrosc. Radiat. Transfer **35**, 247 (1986).
[2]N. Konjević and T. L. Pittman, J. Quant. Spectrosc. Radiat. Transfer **35**, 473 (1986).
[3]J. Purić, S. Djeniže, A. Srećković, J. Labat and Lj. Ćirković, Phys. Rev. A **35**, 2111 (1987).
[4]N. Konjević, M. S. Dimitrijević and W. L. Wiese, J. Phys. Chem. Ref. Data **13**, 649 (1984).

Key data on experiments

Ref.	Plasma source	Method of measurement: Electron density	Method of measurement: Temperature	Remarks
1, 2	Low-pressure pulsed arc	He-Ne laser quadrature interferometer at 6328Å	Relative intensity of O II impurity lines	
3	Low-pressure pulsed arc	He-Ne laser interferometer at 6328Å	Boltzmann plot of Ne II line intensities and intensity ratios of Ne II to Ne I lines	LTE required for temperature measurement from Ne II to Ne I intensity ratios; according to criteria doubtful at this electron density

Numerical results for Ne II

No.	Transition array	Multiplet (No.)	Wavelength (Å)	Temperature (K)	Electron density (10^{17} cm^{-3})	w_m (Å)	w_m/w_{th}	d_m (Å)	d_m/d_{th}	Acc.	Ref.
1.	$2p^4 3s-$	$^4P-^4P^o$	3664.07	27000	1.45	0.161	0.84			B	2
	$2p^4(^3P)3p$	(1)	3694.21	27000	1.45	0.168	0.87			B	2
				30000–40000	0.92–	0.126–	1.10–			B	3
					1.14	0.146	1.01				
				35000	1.42			0.025	0.39	D$^+$	3
			3709.62	27000	1.45	0.161	0.84			B	2
				30000–40000	0.92–	0.110–	0.97–			B$^+$	3
					1.14	0.148	1.04				
				35000	1.42			0.027	0.42	D$^+$	3
			3766.26	27000	1.45	0.168	0.87			B	2
2.		$^4P-^4D^o$	3334.84	30000–40000	0.92–	0.108–	1.04–			B$^+$	3
		(2)			1.14	0.116	0.90				
				35000	1.42			0.015	0.31	D$^+$	3
			3355.02	27000	1.45	0.213	1.21			B	2
				30000–40000	0.92–	0.108–	1.04–			B$^+$	3
					1.14	0.116	0.90			B	3
				35000	1.42			0.027	0.54	D$^+$	3
			3360.60	27000	1.45	0.213	1.21			B	2
			3344.40	27000	1.45	0.213	1.21			B	2
			3311.30	28000	1.39	0.210	1.26			B	2
3.		$^4P-^4S^o$	3001.67	27000	1.45	0.142	1.06			B	2
		(4)	3028.86	27000	1.45	0.142	1.06			B	2
4.		$^2P-^2D^o$	3713.08	36000–40000	0.51–	0.082–	1.10–			B	3
		(5)			1.14	0.160	0.97				
				35000	1.42			−0.054	*	D	3
			3643.93	27000	1.45	0.182	0.83			B	2
5.		$^2P-^2S^o$	3557.80	28000	1.39	0.149	1.20			B	2
		(6)									
6.		$^2P-^2P^o$	3323.74	28000	1.39	0.189				B	2
		(7)		30000–40000	0.92–	0.120–				B	3
					1.14	0.168					
				35000	1.42			0.013		D$^+$	3
7.	$2p^4 3s'-$	$^2D-^2F^o$	3568.50	30000–40000	0.92–	0.118–				B	3
	$2p^4(^1D)3p'$	(9)			1.14	0.150					
				35000	1.42			0.024		D$^+$	3
8.	$2p^4 3p-$	$^4P^o-^4D$	3027.07	27000	1.45	0.208	1.25			B	2
	$2p^4(^3P)3d$	(8)	3017.31	28000	1.39	0.208	1.31			B	2
9.		$^4D^o-^4D$	3320.29	40000	1.14	0.146				B$^+$	3
		(12)									
				35000	1.42			0.031		D$^+$	3
10.		$^4D^o-^4F$	3218.19	30000–35000	0.92–	0.136–	1.10–			B	3
		(13)			1.42	0.196	1.01				
				35000	1.42			0.027	0.36	D$^+$	3
			3198.59	27000	1.45	0.275	1.14			B	2
			3190.86	28000	1.39	0.264	1.14			B	2
11.		$^4D^o-^4P$	3194.58	28000	1.39	0.264				B	2
		(16)	3176.16	28000	1.39	0.253				B	2
12.		$^2D^o-^4F$	3388.42	30000–35000	0.92–	0.148–				B	3
		(19)			1.42	0.232					
				35000	1.42			0.024		D$^+$	3
13.		$^2D^o-^2F$	3417.69	36000–40000	0.51–	0.090–	1.11–			B$^+$	3
		(20)			1.14	0.178	1.01				
				35000	1.42			0.054	0.55	D$^+$	3

Numerical results for Ne II – Continued

No.	Transition array	Multiplet (No.)	Wavelength (Å)	Temperature (K)	Electron density (10^{17} cm^{-3})	w_m (Å)	w_m/w_{th}	d_m (Å)	d_m/d_{th}	Acc.	Ref.
14.		$^2D^o$–^2D (21)	3416.91	36000–40000	0.51–1.14	0.070–0.178				B	3
				35000	1.42			0.040		D*	3
			3453.10	27000	1.4	0.25				B	1
			3477.69	27000	1.4	0.26				B	1
15.		$^2S^o$–^2D (26)	3612.35	27000	1.4	0.27				B	1
16.		$^2S^o$–^2P (28)	3503.61	27000	1.4	0.29	1.14			B	1
				30000–40000	0.92–1.14	0.158–0.202	0.96–1.02			B+	3
				35000	1.42			0.007	0.08	D	3
17.		$^4S^o$–^4P (34)	3542.85	30000–40000	0.92–1.14	0.160–0.224	0.94–1.06			B	3
				35000	1.42			0.054	0.49	D*	3
			3565.84	28000	1.39	0.257	1.17			B	2
				30000–40000	0.92–1.14	0.182–0.212	1.06–1.00			B	3
				35000	1.42			0.054	0.49	D*	3
			3594.18	28000	1.39	0.257	1.17			B	2
18.		$^2P^o$–^2F (38)	3753.83	27000	1.4	0.30				B	1
19.		$^2P^o$–^2D (39)	3818.43	27000	1.4	0.26				B	1
20.		$^2P^o$–^2P (41)	3628.06	27000	1.4	0.28				B	1
			3679.80	27000	1.4	0.28				B	1
21.	$2p^43d$–$2p^4(^3P)4f$	^4F–$^4G^o$ (57)	4290.40	30000–35000	0.92–1.42	0.934–1.314				B	3
				35000	1.42			−0.123		D*	3
			4391.99	36000–40000	0.51–1.14	0.512–1.058				B	3
				35000	1.42			−0.135		D*	3
			4409.30	36000–40000	0.51–1.14	0.512–1.080				B	3
				35000	1.42			−0.123		D*	3
			4413.22	36000–40000	0.51–1.14	0.512–1.040				B	3

*Theory predicts positive shift

Neon

Ne III

Ground State: $1s^22s^22p^4\ ^3P_2$

Ionization Energy: 63.46 eV = 511 800 cm^{-1}

The work with low-pressure pulsed arcs by Konjević and Pittman[1] and Purić *et al.*[2] has produced the first experimental data for this spectrum. Most of their results are compared with the modified semiempirical (MSE) approximation by Dimitrijević and Konjević (see general introduction), with which they are in good-to-fair agreement.

References

[1] N. Konjević and T. L. Pittman, J. Quant. Spectrosc. Radiat. Transfer **37**, 311 (1987).

[2] J. Purić, S. Djeniže, A. Srećković, M. Ćuk, J. Labat and M. Platiša, Z. Phys. D **8**, 343 (1988).

[3] M. S. Dimitrijević and N. Konjević, J. Quant. Spectrosc. Radiat. Transfer **24**, 451 (1980).

Key data on experiments

Ref.	Plasma source	Method of measurement: Electron density	Method of measurement: Temperature	Remarks
1	Low-pressure pulsed arc	He-Ne laser quadrature interferometer at 6328Å	Intensity ratio of O II impurity lines	
2	Low-pressure pulsed arc	He-Ne laser interferometer at 6328Å	Boltzmann plot of Ne III line intensities and intensity ratios of Ne IV to Ne III lines	

Numerical results for Ne III

No.	Transition array	Multiplet (No.)	Wavelength (Å)	Temperature (K)	Electron density (10^{17} cm^{-3})	w_m (Å)	w_m/w_{th}	d_m (Å)	d_m/d_{th}	Acc.	Ref.
1	$2p^33s-$	$^5S°-^5P$	2593.60	34000	2.12	0.105	1.09			B	1
	$2p^3(^4S°)3p$	(11uv)	2595.68	34000	2.12	0.106	1.10			B	1
2		$^3S°-^3P$	2677.90	34000	2.12	0.138	1.25			B	1
		(12uv)	2678.64	34000	2.12	0.138	1.25			B	1
3	$2p^33s'-$ $2p^3(^2D°)3p'$	$^3D°-^3D$	2777.65	34000	2.12	0.115	1.07			B	1
4		$^3D°-^3F$	2610.03	59000	2.18	0.110	1.46			C+	2
			2613.41	34000	2.12	0.099	1.04			B	1
				59000	2.18	0.081	1.09			C+	2
			2615.87	34000	2.12	0.100	1.04			B	1
				59000	2.18	0.110	1.47			C+	2
5	$2p^33p-$ $2p^3(^4S°)3d$	$^5P-^5D°$	2163.77	59000	2.18	0.080	1.29			C+	2
6	$2p^33p'-$ $2p^3(^2D°)3d'$	$^3D-^3D°$	2095.54	59000	2.18	0.068	1.24			C+	2

Neon

Ne IV

Ground State: $1s^2 2s^2 2p^3\ {}^4S^o_{3/2}$

Ionization Energy: 97.08 eV = 783 300 cm^{-1}

The work by Purić *et al.*[1] with a low-pressure pulsed arc has produced the first experimental Stark width data for this spectrum. Their results are compared with the modified semiemipirical (MSE) approximation by Dimitrijević and Konjević (see general introduction), and good agreement is obtained for the first two multiplets.

Reference

[1] J. Purić, S. Djeniže, A. Srećković, M. Ćuk, J. Labat and M. Platiša, Z. Phys. D 8, 343 (1988).

Key data on experiments

Ref.	Plasma source	Method of measurement: Electron density	Method of measurement: Temperature	Remarks
1	Low-pressure pulsed arc	He-Ne laser interferometer at 6328Å	Boltzmann plot of Ne III line intensities and intensity ratios of Ne IV to Ne III lines	

Numerical results for Ne IV

No.	Transition array	Multiplet (No.)	Wavelength (Å)	Temperature (K)	Electron density (10^{17} cm^{-3})	w_m (Å)	w_m/w_{th}	d_m (Å)	d_m/d_{th}	Acc.	Ref.
1.	$2p^23s-$ $2p^2(^3P)3p$	$^4P-^4D^o$	2357.96	59000	2.18	0.062	1.12			C+	
			2352.52	59000	2.18	0.076	1.38			C+	
2.	$2p^23s'-$ $2p^2(^1D)3p'$	$^2D-^2F^o$	2285.79	59000	2.18	0.064	1.20			C+	
3.	$2p^23s'''-$ $2p^2(^1S)3p'''$	$^6S-^6P^o$	2258.02	59000	2.18	0.064	1.60			C+	
			2262.08	59000	2.18	0.080	2.00			C+	

Nitrogen

N II

Ground State: $1s^2 2s^2 2p^2\ ^3P_0$

Ionization Energy: 29.602 eV = 238 750.5 cm^{-1}

List of tabulated lines

Wavelength (Å)	No.	Wavelength (Å)	No.	Wavelength (Å)	No.	Wavelength (Å)	No.
3437.15	5	4035.08	11	4607.16	3	5320.95	9
3829.79	10	4041.31	11	4613.87	3	5351.22	9
3838.37	10	4043.53	11	4621.39	3	5495.67	8
3919.00	6	4503.41	14	4630.54	3	5710.77	1
3995.00	4	4552.53	13	4643.08	3	5941.65	7
4026.08	12	4601.48	3	5045.10	2	5952.39	7

The experiments by Purcell and Barnard,[1] Pittman and Konjević,[2] and Purić *et al.*[3] have all been carried out with low-pressure pulsed arcs. Their work includes many of the lines covered in our earlier reviews, [4,5] but also adds a good amount of new data. When the data overlap, the consistency between the new and the earlier results – often obtained at very different temperatures – varies from good to fair, i.e., from within 10% to differences of factors of two. In these cases we recommend the use of the new data, since they have been obtained with significantly improved sources and data acquisition techniques.

References

[1]S. T. Purcell and A. J. Barnard, J. Quant. Spectrosc. Radiat. Transfer **32**, 205 (1984).

[2]T. L. Pittman and N. Konjević, J. Quant. Spectrosc. Radiat. Transfer **36**, 289 (1986).

[3]J. Purić, A. Srećković, S. Djeniže and M. Platiša, Phys. Rev. A **36**,

[4]N. Konjević and W. L. Wiese, J. Phys. Chem. Ref. Data **5**, 259 (1976).

[5]N. Konjević, M. S. Dimitrijević and W. L. Wiese, J. Phys. Chem. Ref. Data **13**, 649 (1984).

Key data on experiments

Ref.	Plasma source	Method of measurement: Electron density	Method of measurement: Temperature	Remarks
1	Low-pressure pulsed arc	He I 5876 and 6678Å Stark widths	Intensity ratios of N III to N II lines	
2	Low-pressure pulsed arc	He II 4686Å Stark width	Intensity ratio of two O II impurity lines	
3	Low-pressure pulsed arc	He-Ne laser interferometer at 6328Å	Boltzmann plots of relative intensities of N IV and N III lines; also, intensity ratios of N III to N II and N IV to N III lines	

Numerical results for N II

No.	Transition array	Multiplet (No.)	Wavelength (Å)	Temperature (K)	Electron density (10^{17} cm^{-3})	w_m (Å)	w_m/w_{th}	d_m (Å)	d_m/d_{th}	Acc.	Ref.
1.	$2p3s$– $2p(^2P^o)3p$	$^3P^o$–^3D (3)	5710.77	36000	0.9– 2.9	0.44– 1.12	0.81– 0.64			C	1
2.		$^3P^o$–^3S (4)	5045.10	36000	0.9– 2.9	0.31– 0.68				C	1
3.		$^3P^o$–^3P (5)	4630.54	36000	0.9– 2.9	0.29– 8.12				C	1
				53000	0.90	0.140				B	3
			4613.87	36000	0.9– 2.9	0.32– 0.83				C	1
			4643.08	36000	0.9– 2.9	0.26– 0.79				C	1
			4621.39	36000	0.9– 2.9	0.32– 0.83				C	1
			4601.48	36000	0.9– 2.9	0.35– 0.84				C	1
			4607.16	36000	0.9– 2.9	0.30– 0.77				C	1
4.		$^1P^o$–^1D (12)	3995.00	36000	0.9– 2.9	0.30– 0.74				C	1
5.		$^1P^o$–^1S (13)	3437.15	53000	0.90	0.084				B	3
6.	$2p3p$– $2p(^2P^o)3d$	^1P–$^1P^o$ (17)	3919.00	36000	0.9& 2.2	0.26& 0.57				C	1
7.		^3P–$^3D^o$ (28)	5941.65	36000	0.9	0.75	1.38			C	1
			5952.39	36000	0.9– 2.9	0.69– 1.34	1.27– 0.77			C	1
8.		^3P–$^3P^o$ (29)	5495.67	36000	0.9– 2.9	0.53– 1.14				C	1
9.	$2s2p^23p$– $2s2p^2(^4P)3d$	$^5P^o$–^5P (69)	5351.22	36000	0.9– 2.9	0.54– 1.35				C	1
			5320.95	36000	0.9	0.64				C	1
10.	$2p^23p$– $2p(^2P^o)4s$	^3P–$^3P^o$ (30)	3838.37	53000	0.90	0.322				B	3
			3829.79	36000	0.9– 2.9	0.87– 2.13	1.31– 0.99			C	1
11.	$2p3d$– $2p(^2P^o)4f$	$^3F^o$–^3G (39)	4041.31	28300	0.75	0.60	0.66			B	2
				31600	0.59	0.38	0.54			B	2
				32300	0.63	0.42	0.56			B	2
				53000	0.90	0.47				B	3
			4043.53	28300	0.75	0.74				B	2
				31600	0.59	0.43				B	2
				32300	0.63	0.53				B	2
			4035.08	28300	0.75	0.59				B	2
				31600	0.59	0.43				B	2
				32300	0.63	0.48				B	2
12.		$^3F^o$–^1G (40)	4026.08	28300	0.75	0.90				B	2
				31600	0.59	0.56				B	2
				32300	0.63	0.65				B	2
13.		$^1F^o$–^3G (58)	4552.53	36000	0.9– 2.9	1.76– 4.12				C	1
				28300	0.75	0.90				B	2
				31600	0.59	0.61				B	2
				32300	0.63	0.53				B	2
14.		$^1F^o$–^1G (59)	4530.41	28300	0.75	1.02				B	2
				31600	0.59	0.73				B	2
				32300	0.63	0.79				B	2

Nitrogen

N III

Ground State: $1s^2 2s^2 2p\ ^2P^o_{1/2}$

Ionization Energy: 47.450 eV = 382 704 cm^{-1}

List of tabulated lines

Wavelength (Å)	No.	Wavelength (Å)	No.	Wavelength (Å)	No.	Wavelength (Å)	No.
2983.58	9	3771.05	4	4103.43	1	4634.14	2
3342.77	7	3934.41	8	4200.10	6	4640.64	2
3365.79	5	3938.52	8	4510.91	3	4861.33	10
3367.34	5	4003.58	12	4514.86	3	4867.15	10
3754.67	4	4097.33	1	4546.36	11	4873.58	10

The experiments by Purcell and Barnard[1] and by Purić *et al.*[2,3] roughly double the availability of the experimental Stark width data for this spectrum. Also, many of the lines listed in our 1984 tabulation[4] have been studied again with improved plasma sources and better data acquisiton techniques. Nevertheless, the mutual consistency between the results of the new work as well as with the earlier experiments covered in the 1984 review is not satisfactory.

References

[1]S. T. Purcell and A. J. Barnard, J. Quant. Spectrosc. Radiat. Transfer **32**, 205 (1984).

[2]J. Purić, A. Srećković, S. Djeniže and M. Platiša, Phys. Rev. A 36, 3957 (1987).

[3]J. Purić, S. Djeniže, A. Srećković, M. Milosavljević, M. Platiša and J. Labat, 14th Summer School and Symp. Phys. Ionized Gases, Contrib. Papers (Eds. N. Konjević, L. Tanović, and N. Tanović) Sarajevo, Yugoslavia (1988), p. 345.

[4]N. Konjević, M. S. Dimitrijević and W. L. Wiese, J. Phys. Chem. Ref. Data **13**, 649 (1984).

Key data on experiments

Ref.	Plasma source	Method of measurement: Electron density	Method of measurement: Temperature	Remarks
1	Low-pressure pulsed arc	He I 5876Å and 6678Å Stark widths	Intensity ratios of N III to N II lines	
2,3	Low-pressure pulsed arc	He-Ne laser interferometer at 6328Å	Boltzmann plots of relative intensities of N IV and N III lines; also, intensity ratios of N III to N II and N IV to N III lines	

Numerical results for N III

No.	Transition array	Multiplet (No.)	Wavelength (Å)	Temperature (K)	Electron density (10^{17} cm^{-3})	w_m (Å)	w_m/w_{th}	d_m (Å)	d_m/d_{th}	Acc.	Ref.
1.	$3s-$	$^2S-^2P^o$	4097.33	36000	0.9–	0.22–	1.35–			D$^+$	1
	$(^1S)3p$	(1)			2.9	0.29	0.55				
				50000	1.78	0.214	0.78	−0.041		B,C	2,3
			4103.43	36000	0.9–	0.20–	1.22–			C	1
					2.9	0.46	0.87				
				50000	1.78	0.184	0.67	−0.041		B,C	2,3
2.	$3p-$	$^2P^o-^2D$	4634.14	36000	0.9–	0.26–	1.30–			C	1
	$(^1S)3d$	(2)			2.9	0.71	1.10				
			4640.64	36000	0.9–	0.31–	1.55–			D$^+$	1
					2.9	0.61	0.94				
3.	$2s2p3s-$	$^4P^o-^4D$	4514.86	36000	0.9–	0.25–	1.31–			C	1
	$2s2p(^3P^o)3p$	(3)			2.9	0.75	1.22				
				50000	1.78	0.276	0.86	−0.020		B,C	2,3
			4510.91	36000	0.9–	0.22–	1.15–			C	1
					2.9	0.67	1.09				
4.		$^4P^o-^4S$	3771.05	36000	0.9–	0.26–	1.89–			C	1
		(4)			2.9	0.65	1.46				
				50000	1.78	0.224	0.97	−0.000		B	2,3
			3754.67	36000	0.9–	0.20–	1.46–			C	1
					2.9	0.50	1.14				
5.		$^4P^o-^4P$	3367.34	50000	1.78	0.198	1.06	0.000		B	2,3
		(5)	3365.79	50000	1.78	0.222	1.19	0.000		B	2,3
6.		$^4P^o-^4P$	4200.10	50000	1.78	0.3941.	1.16	0.000		B	2
		(6)									
7.		$^2P^o-^2S$	3342.77	50000	1.78	0.244	1.07	0.000		B	2,3
		(7)									
8.	$2s2p3p-$	$^2P-^2D^o$	3938.52	50000	1.78	0.336	1.34	−0.041		B,C	2,3
	$2s2p(^3P^o)3d$	(8)	3934.41	50000	1.78	0.336	1.35	−0.041		B,C	2,3
9.		$^2P-^2P^o$	2983.58	50000	1.78	0.202	1.35			B	2
		(25uv)									
10.		$^4D-^4F^o$	4867.15	36000	0.9–	0.32–	1.57–			C	1
		(9)			2.9	0.76	1.15				
			4861.33	50000	1.78	0.376	1.06	0.000		B	2,3
			4873.58	36000	0.9&	0.32&	1.57&			C	1
					2.2	0.85	1.29				
11.		$^4S-^4P^o$	4546.36	50000	1.78	0.466	1.41	−0.060		B,C	2,3
		(13)									
12.	$4d-$	$^2D-^2F^o$	4003.58	50000	1.78	1.024	0.18			B	2
	$(^1S)5f$	(17)									

Nitrogen

N IV

Ground State: $1s^2 2s^2\ ^1S_0$

Ionization Energy: 77.474 eV = 624 866 cm^{-1}

The data are taken from the low-pressure pulsed arc work of Purić *et al.*[1] The 4058 Å line has been studied once before by Källne *et al.*[2] in a theta-pinch experiment and was discussed in our 1984 review.[3] When scaled linearly with electron density to a common density value, the two Stark width results[1,2] for this line disagree by a factor of 3.6, with the result by Källne *et al.*[2] yielding the larger value. As discussed before,[3] plasma source problems in the Källne *et al.*[2] work may be largely responsible for this discrepancy.

References

[1] J. Purić, A. Srećković, S. Djeniže and M. Platiša, Phys. Rev. A **36**, 3957 (1987).

[2] E. Källne, L. A. Jones, and A. J. Barnard, J. Quant. Spectrosc. Radiat. Transfer **22**, 589 (1979).

[3] N. Konjević, M. S. Dimitrijević, and W. L. Wiese, J. Phys. Chem. Ref. Data **13**, 649 (1984).

Key data on experiments

Ref.	Plasma source	Method of measurement: Electron density	Temperature	Remarks
1	Low-pressure pulsed arc	He-Ne laser interferometer at 6328Å	Boltzmann plots of relative intensities of N IV and N III lines; also, intensity ratios of N III to N II and N IV to N III lines	

Numerical results for N IV

No.	Transition array	Multiplet (No.)	Wavelength (Å)	Temperature (K)	Electron density (10^{17} cm^{-3})	w_m (Å)	w_m/w_{th}	d_m (Å)	d_m/d_{th}	Acc.	Ref.
1.	$2s3s-$ $2s(^2S)3p$	$^3S-^3P^o$ (1)	3478.71	50000	1.78	0.192	1.08			B	1
			3484.96	50000	1.78	0.192	1.08			B	1
2.	$2p3s-$ $2p(^2P^o)3p$	$^3P^o-^3P$ (7)	3463.37	50000	1.78	0.194	1.03			B	1
3.		$^1P^o-^1D$ (8)	3747.54	50000	1.78	0.262	0.99			B	1
4.	$3s3p-$ $2s(^2S)3d$	$^1P^o-^1D$ (3)	4057.76	50000	1.78	0.262	1.29			B	1

Nitrogen

N v

Ground State: $1s^2 2s\ ^2S_{1/2}$

Ionization Energy: 97.891 eV = 789 537.2

The work by Böttcher *et al.*[1,3] with a gas-liner pinch and by Purić *et al.*[2] with a low-pressure arc has produced the first Stark width data for this spectrum. For the 4604Å line, Böttcher *et al.*[3] compared their experimental result with the modified semiempirical (MSE) approximation by Dimitrijević and Konjević (see general introduction) and find their measured Stark width to be about twice as large.

References

[1]F. Böttcher, J. Musielok and H.-J. Kunze, Phys. Rev. A 36, 2265 (1987).
[2]J. Purić, A. Srećković, S. Djeniže and M. Platiša, Phys. Rev. A 36, 3957 (1987).
[3]F. Böttcher, P. Breger, J. D. Hey and H.-J. Kunze, Phys. Rev. A 38, 2690 (1988).

Key data on experiments

Ref.	Plasma source	Method of measurement: Electron density	Method of measurement: Temperature	Remarks
1	Gas-liner pinch	He II 4686Å Stark width	Ratio of C IV to C III line intensities	
2	Low-pressure pulsed arc	He-Ne laser interferometer at 6328Å	Boltzmann plots of relative intensities of N IV and N III lines and intensity ratios of N III to N II and N IV to N III lines	
3	Gas-liner pinch	90° Thomson scattering	90° Thomson scattering	

Numerical results for N v

No.	Transition array	Multiplet (No.)	Wavelength (Å)	Temperature (K)	Electron density (10^{17} cm^{-3})	w_m (Å)	w_m/w_{th}	d_m (Å)	d_m/d_{th}	Acc.	Ref.
1.	$3s$–$3p$	^2S–$^2P^o$ (1)	4603.73	50000	1.78	0.338	1.09			B	2
				145000	18	4.92	1.93			B	3
			4619.98	50000	1.78	0.338	1.08			B	2
2.	$3p$–$4d$	$^2P^o$–^2D (31uv)	713.860 713.518	145000	7.7	0.42	3.71			B	1
3.	$3d$–$4f$	^2D–$^2F^o$ (39uv)	748.291 748.195	124000	7.7	0.30	4.92			B	1
4.	$4d$–$5f$	^2D–$^2F^o$ (50uv)	1616.33	124000	7.7	10	5.02			C+	1
5.	$4f$–$5g$	$^2F^o$–^2G (53uv)	1619.69	124000	7.7	5.5	6.13			C+	1

Oxygen

O I

Ground State: $1s^2 2s^2 2p^4\ ^3P_2$

Ionization Energy: 13.618 eV = 109 837.0 cm^{-1}

Two experiments by Goly and co-workers[1,2] with wall-stabilized arcs have provided the Stark width and shift data for four multiplets. In each case the lines within the multiplets are totally blended so that only an averaged line value is presented. All these transitions are also included in our more extensive 1976 tabulation,[3] and the agreement between new and old data is very good, especially for the widths. However, the red shift (i.e., positive shift) measured for the 3947 Å multiplet is very small and rather uncertain.[2] An earlier experiment, listed in the 1976 table,[3] shows a small *blue* shift which is also the result of the semiclassical theory.

References

[1] A. Goly, D. Rakotoarijimy and S. Weniger, J. Quant. Spectrosc. Radiat. Transfer **30**, 417 (1983).

[2] A. Goly and S. Weniger, J. Quant. Spectrosc. Radiat. Transfer **38**, 225 (1987).

[3] N. Konjević and J. R. Roberts, J. Phys. Chem. Ref. Data **5**, 209 (1976).

Key data on experiments

Ref.	Plasma source	Method of measurement: Electron density	Method of measurement: Temperature	Remarks
1	Wall-stabilized arc	H_β Stark width and Ar II 4348Å Stark width	Plasma composition data and intensity ratios of Ar II to Ar I lines	
2	Wall-stabilized arc	H_β Stark width and O I 4368Å Stark width	Boltzmann plot of relative intensities of O I lines and plasma composition data	

Numerical results for O I

No.	Transition array	Multiplet (No.)	Wavelength (Å)	Temperature (K)	Electron density (10^{17} cm^{-3})	w_m (Å)	w_m/w_{th}	d_m (Å)	d_m/d_{th}	Acc.	Ref.
1.	$2p^3 3s-$ $2p^3(^4S^o)4p$	$^5S^o-^5P$ (3)	3947	11580&12500	0.397& 0.784	0.62& 1.20	1.17& 1.12	0.05& 0.09	*	B^+,D	2
				13570	0.441	0.64	1.02			B	2
2.		$^3S^o-^3P$ (5)	4368	10100–12700	0.191– 0.713	0.39– 1.57	1.22– 1.20			B	1
				11580&12500	0.397& 0.784	0.78& 1.44	1.16& 1.04	0.12& 0.27	0.84& 0.95	B^+,C^+	2
3.	$2p^3 3p-$ $2p^3(^4S^o)5d$	$^5P-^5D^o$ (12)	5330	11120&12480	0.317& 0.704	15.82& 33.8	0.61& 0.67	2.8& 8.6	0.48& 0.69	B^+,C^+	2
4.	$2p^3 3p-$ $2p^3(^4S^o)6s$	$^5P-^5S^o$ (11)	5436	11120&12480	0.317& 0.704	5.64& 10.62	0.87& 0.71	3.13& 6.5	1.06& 1.00	B^+,B^+	2

*See introductory remarks.

Oxygen

O II

Ground State: $1s^2 2s^2 2p^3\ ^4S^o_{3/2}$

Ionization Energy: 35.118 eV = 283 240 cm^{-1}

The experiment by Purić *et al.*[1] with a low-pressure pulsed arc is the only available new data source. The 3712.75Å line was also included in our more extensive 1976 tabulation[2] and the results agree within 14%.

References

[1] J. Purić, S. Djeniže, A. Srećković, M. Platiša and J. Labat, Phys. Rev. A **37**, 498 (1988).
[2] N. Konjević and W. L. Wiese, J. Phys. Chem. Ref. Data **5**, 259 (1976).

Key data on experiments

Ref.	Plasma source	Method of measurement: Electron density	Method of measurement: Temperature	Remarks
1	Low-pressure pulsed arc	Laser interferometer at 6328Å	Boltzmann plot of relative intensities of O II lines and intensity ratios of O III to O II lines	

Numerical results for O II

No.	Transition array	Multiplet (No.)	Wavelength (Å)	Temperature (K)	Electron density (10^{17} cm^{-3})	w_m (Å)	w_m/w_{th}	d_m (Å)	d_m/d_{th}	Acc.	Ref.
1.	$2p^2 3s$– $2p^2(^3P)3p$	^4P–$^4S^o$ (3)	3712.75	43400	1.59	0.296				B	1
2.	$2p^2 3p$– $2p^2(^3P)4s$	$^2S^o$–^2P (20uv)	2733.34	40000	1.30	0.324	0.78			B	1

Oxygen

O III

Ground State: $1s^2 2s^2 2p^2\ ^3P_0$

Ionization Energy: 54.936 eV = 443 086 cm^{-1}

List of tabulated lines

Wavelength (Å)	No.	Wavelength (Å)	No.	Wavelength (Å)	No.	Wavelength (Å)	No.
2454.99	5	3059.30	2	3340.74	1	3698.70	6
2695.49	15	3088.04	16	3350.99	7	3715.08	11
2983.78	4	3215.97	18	3355.92	17	3961.59	13
3004.35	10	3260.98	9	3405.74	12	4081.10	8
3017.63	10	3265.46	9	3408.13	12	5268.06	14
3047.13	2	3312.30	1	3415.29	12	5592.37	3

The work by Purić *et al.*[1,2] with a low-pressure pulsed arc has for the first time provided a fairly extensive table of Stark width data for this spectrum. There is partial overlap with the lines covered in our previous review[3] (four out of the six tabulated lines), and the agreement with the earlier data is impressive, not exceeding 17% in the worst case.

References

[1]J. Purić, S. Djeniže, A. Srećković, M. Platiša and J. Labat, Phys. Rev. A **37**, 498 (1988).

[2]J. Purić, S. Djeniže. A. Srećković, M. Milosavljević, M. Platiša and J. Labat, 14th Summer School and Symp. Phys. Ionized Gases, Contrib. Papers (Eds. N. Konjević, L. Tanović, and N. Tanović) Sarajevo, Yugoslavia (1988), p. 345.

[3]N. Konjević , M. S. Dimitrijević and W.L. Wiese, J. Phys. Chem. Ref. Data **13**, 649 (1984).

Key data on experiments

Ref.	Plasma source	Method of measurement: Electron density	Method of measurement: Temperature	Remarks
1,2	Low-pressure pulsed arc	Laser interferometer at 6328Å	Boltzmann plot of relative intensities of O II lines and intensity ratios of O III to O II lines	

Numerical results for O III

No.	Transition array	Multiplet (No.)	Wavelength (Å)	Temperature (K)	Electron density (10^{17} cm^{-3})	w_m (Å)	w_m/w_{th}	d_m (Å)	d_m/d_{th}	Acc.	Ref.
1.	$2p3s-2p(^2P^o)3p$	$^3P^o-^3S$ (3)	3340.74	42500	2.18	0.260	1.30			B	1
			3312.30	42500	2.18	0.236	1.18			B	1
2.		$^3P^o-^3P$ (4)	3047.13	42500	2.18	0.240	1.40			B	1
			3059.30	42500	2.18	0.260	1.51	−0.037		B,C	1,2
3.		$^1P^o-^1P$ (5)	5592.37	42500	2.18	0.762	1.37	−0.074		B,C	1,2
4.		$^1P^o-^1D$ (18uv)	2983.78	42500	2.18	0.274	1.53	0.000		B	1,2
5.		$^1P^o-^1S$ (19uv)	2454.99	42500	2.18	0.192	1.49			B	1
6.	$2s2p^23s-2s2p^2(^4P)3p$	$^5P-^5D^o$ (21)	3698.70	42500	2.18	0.378	1.58			B	1
7.		$^5P-^5P^o$ (22)	3350.99	42500	2.18	0.348	1.72			B	1
8.		$^3P-^3D^o$ (23)	4081.10	42500	2.18	0.590	1.72	0.000		B	1,2
9.	$2p3p-2p(^2P^o)3d$	$^3D-^3F^o$ (8)	3265.46	42500	2.18	0.252	1.30	−0.063		B,C	1,2
			3260.98	42500	2.18	0.252	1.30	−0.050		B,C	1,2
10.		$^3D-^3D^o$ (10)	3017.63	42500	2.18	0.250	1.51			B	1
			3004.35	42500	2.18	0.250	1.53			B	1
11.		$^3P-^3D^o$ (14)	3715.08	42500	2.18	0.266	1.02			B	1
12.		$^3P-^3P^o$ (15)	3415.29	42500	2.18	0.286	1.27	0.026		B,C	1,2
			3408.13	42500	2.18	0.261	1.17			B	1
			3405.74	42500	2.18	0.261	1.17			B	1
13.		$^1D-^1F^o$ (17)	3961.59	42500	2.18	0.606	1.83			B	1

Numerical results for O III — Continued

No.	Transition array	Multiplet (No.)	Wavelength (Å)	Temperature (K)	Electron density (10^{17} cm^{-3})	w_m (Å)	w_m/w_{th}	d_m (Å)	d_m/d_{th}	Acc.	Ref.
14.		$^1S-^1P^o$ (19)	5268.06	42500	2.18	0.650	1.05	0.076		B,C	1,2
15.	$2s2p^23p-$ $2s2p^2(^4P)3d$	$^3S^o-^3P$ (23uv)	2695.49	42500	2.18	0.234	1.72			B	1
16.		$^5D^o-^5D$ (26)	3088.04	42500	2.18	0.316	1.83	−0.026		B,C	1,2
17.		$^5P^o-^5P$ (28)	3355.92	42500	2.18	0.334	1.72	0.000		B	1,2
18.		$^3D^o-^3D$ (31)	3215.97	42500	2.18	0.484	2.24			B	1

Oxygen

O IV

Ground State: $1s^22s^22p\ ^2P^o_{1/2}$

Ionization Energy: 77.414 eV = 624 383.8 cm^{-1}

The work by Purić *et al.*[1] with a low-pressure pulsed arc has produced the first experimental Stark width data for this spectrum. Their results are compared with the modified semiempirical (MSE) approximation by Dimitrijević and Konjević (see general introduction), and fair agreement is obtained.

Reference

[1]J. Purić, S. Djeniže, A. Srećković, M. Platiša and J. Labat, Phys. Rev. A 37, 498 (1988).

Key data on experiments

Ref.	Plasma source	Method of measurement: Electron density	Method of measurement: Temperature	Remarks
1	Low-pressure pulsed arc	Laser interferometer at 6328Å	Boltzmann plot of relative intensities of O II lines and intensity ratios of O III to O II lines	

Numerical results for O IV

No.	Transition array	Multiplet (No.)	Wavelength (Å)	Temperature (K)	Electron density (10^{17} cm^{-3})	w_m (Å)	w_m/w_{th}	d_m (Å)	d_m/d_{th}	Acc.	Ref.
1.	$3s-$ $(^1S)3p$	$^2S-^2P^o$ (1)	3063.42 3071.61	42500 42500	2.18 2.18	0.200 0.200	1.32 1.31			B B	1 1
2.	$3p-$ $(^1S)3d$	$^2P^o-^2D$ (2)	3411.69 3403.52	42500 42500	2.18 2.18	0.216 0.204	1.32 1.25			B B	1 1

Oxygen

O V

Ground State: $1s^2 2s^2\ ^1S_0$

Ionization Energy: 113.900 eV = 918 657 cm^{-1}

The work by Purić *et al.*[1] with a low-pressure pulsed arc has produced the first experimental Stark width data for this spectrum. Their results are compared with the modified semiempirical (MSE) approximation by Dimitrijević and Konjević (see general introduction), with which they have appreciable differences.

Reference

[1]J. Purić, S. Djeniže, A. Srećković, M. Platiša and J. Labat, Phys. Rev. A 37, 498 (1988).

Key data on experiments

Ref.	Plasma source	Method of measurement: Electron density	Method of measurement: Temperature	Remarks
1	Low-pressure pulsed arc	Laser interferometer at 6328Å	Boltzmann plot of relative intensities of O II lines and intensity ratios of O III to O II lines	

Numerical results for O V

No.	Transition array	Multiplet (No.)	Wavelength (Å)	Temperature (K)	Electron density (10^{17} cm^{-3})	w_m (Å)	w_m/w_{th}	d_m (Å)	d_m/d_{th}	Acc.	Ref.
1.	$2s3s-$ $2s(^2S)3p$	$^1S-^1P^o$ (1)	5114.07	43400	1.59	0.522	1.83			B	1
2.	$2s3p-$ $2s(^2S)3d$	$^1P^o-^1D$ (2)	3144.66	43400	1.59	0.216	2.66			B	1

Oxygen

O VI

Ground State: $1s^2 2s\ ^2S_{1/2}$

Ionization Energy: 138.121 eV = 1 114 008 cm^{-1}

The work by Böttcher *et al.*[1] with a gas-liner pinch has produced the first experimental Stark width data for this spectrum. Their measured width is much larger than the one calculated with the modified semiempirical (MSE) approximation by Dimitrijević and Konjević (see general introduction).

Reference

[1]F. Böttcher, P. Breger, J. D. Hey and H.-J. Kunze, Phys. Rev. A 38, 2690 (1988).

Key data on experiments

Ref.	Plasma source	Method of measurement: Electron density	Method of measurement: Temperature	Remarks
1	Gas-liner pinch	90° Thomson scattering	90° Thomson scattering	

Numerical results for O VI

No.	Transition array	Multiplet (No.)	Wavelength (Å)	Temperature (K)	Electron density (10^{17} cm^{-3})	w_m (Å)	w_m/w_{th}	d_m (Å)	d_m/d_{th}	Acc.	Ref.
1.	$3s$–$3p$	^{2}S–^{2}P° (1)	3811.35	145000	18	2.78	2.23			B	1

Phosphorus

P I

Ground State: $1s^22s^22p^63s^23p^3\ ^4S^o_{3/2}$

Ionization Energy: 10.49 eV = 84 580 cm^{-1}

The measurements by Miller *et al.*[1] with a gas-driven shock tube were done over a range of electron densities from 5 to 15 × 10^{16} cm^{-3} and for temperatures between 10 000 K and 12 500 K, but results have been presented only for a nominal density of 10^{17} cm^{-3} and for a temperature of 11 600 K (1 eV). A linear dependence of the Stark widths on electron density has been found. The Stark width of the 5079 Å line has been also tabulated in our 1976 review.[2] Within the estimated uncertainties the old and new results are consistent, assuming linear sealing of the width with electron density.

References

[1]M. H. Miller, D. Abadie and A. Lesage, Astrophys. J. **291**, 219 (1985).
[2]N. Konjević and J. R. Roberts, J. Phys. Chem. Ref. Data **5**, 209 (1976).

Key data on experiments

Ref.	Plasma source	Method of measurement: Electron density	Method of measurement: Temperature	Remarks
1	Gas driven shock tube	H_β Stark width	Absolute intensity of Ne I 5852Å line and line reversal intensities of H_α line	

Numerical results for P I

No.	Transition array	Multiplet (No.)	Wavelength (Å)	Temperature (K)	Electron density (10^{17} cm^{-3})	w_m (Å)	w_m/w_{th}	d_m (Å)	d_m/d_{th}	Acc.	Ref.
1.	$3p^24s$–$3p^2(^3P)4p$	^{2}P–^{2}D°	6199.01	11600	1.0	2.7				C	1
2.	$3p^24s$–$3p^2(^3P)5p$	^{4}P–^{4}S°	5079.37	11600	1.0	4.0	0.41			C	1
3.	$3s3p^4$–$3p^2(^3P)4f$	^{4}P–^{4}D°	5447.14	11600	1.0	6.4				C	1

Phosphorus

P II

Ground State: $1s^2 2s^2 2p^6 3s^2 3p^2\ ^3P_0$

Ionization Energy: 19.73 eV = 159 100 cm^{-1}

The measurements by Miller *et al.*[1] with a gas-driven shock tube were done over a range of electron densities from 5 to 15 × $10^{17} cm^{-3}$ and for temperatures between 10 000 K and 12 500 K, but results have been presented only for a nominal density of 10^{17} cm^{-3} and for a temperature of 11 600 K (1 eV). A linear dependence of the Stark widths on electron density was found.

All lines that were measured previously by Miller[3] with a very similar plasma source – these are tabulated in our 1976 review[4] – have been re-measured by Miller *et al.*[1] with improved spectral resolution. The new and old results are consistent within our uncertainty estimates.

Interestingly, the Stark shift measurements by Purić *et al.*[2] for four lines within the same supermultiplet yield red shifts for three lines of one multiplet, but a blue shift for a line in another multiplet.

References

[1]M. H. Miller, D. Abadie and A. Lesage, Astrophys. J. **291**, 219 (1985).
[2]J. Purić, M. Ćuk and I. S. Lakićević, Phys. Rev. A **32**, 1106 (1985).
[3]M. H. Miller, University of Maryland Technical Note BN-550 (1968).
[4]N. Konjević and W. L. Wiese, J. Phys. Chem. Ref. Data **5**, 259 (1976).

Key data on experiments

Ref.	Plasma source	Method of measurement: Electron density	Method of measurement: Temperature	Remarks
1	Gas-driven shock tube	H_β Stark width	Absolute intensity of Ne I 5852Å line and line reversal intensities of H_α line	
2	T-tube	He-Ne laser interferometer at 6328Å and H_β Stark width	Boltzmann plot of relative intensities of Ar II lines and intensity ratios of Si III to Si II lines	

Numerical results for P II

No.	Transition array	Multiplet (No.)	Wavelength (Å)	Temperature (K)	Electron density (10^{17} cm^{-3})	w_m (Å)	w_m/w_{th}	d_m (Å)	d_m/d_{th}	Acc.	Ref.
1.	$3p4s-$ $3p(^2P^\circ)4p$	$^3P^\circ-^3D$	6043.12	11600	1.0	1.40	1.63			C	1
				16000&20000	1.0	1.82&	2.28&	0.45&	1.94&	D^+,C	2
						1.64	2.13	0.35	1.61		
			6024.18	11600	1.0	1.41	1.70			C	1
				16000&20000	1.0	1.82&	2.28&	0.45&	1.94&	D^+,C	2
						1.46	1.90	0.31	1.42		
			6034.04	11600	1.0	1.29	1.50			C	1
				16000&20000	1.0	1.82&	2.28&	0.45&	1.94&	D^+,C	2
						1.64	2.13	0.35	1.61		
			6087.82	11600	1.0	1.08	1.27			C	1
2.		$^3P-^3P^\circ$	5425.91	11600	1.0	1.07	0.76			C^+	1
				16000&20000	1.0	1.52&	1.12&	(−0.55)&	1.15&	D^+,C	2
						1.28	1.01	(−0.46	1.04		
			5386.88	11600	1.0	1.01	0.67			C^+	1
			5499.73	11600	1.0	1.26	0.84			C^+	1
			5409.72	11600	1.0	1.03	0.69			C^+	1
			5316.07	11600	1.0	0.89	0.59			C^+	1

Numerical results for P II — Continued

No.	Transition array	Multiplet (No.)	Wavelength (Å)	Temperature (K)	Electron density (10^{17} cm^{-3})	w_m (Å)	w_m/w_{th}	d_m (Å)	d_m/d_{th}	Acc.	Ref.
3.		$^3P^o$–^3S	5296.13	11600	1.0	1.15				C+	1
			5191.41	11600	1.0	0.79				C+	1
4.		$^1P^o$–^1D	5253.52	11600	1.0	1.38				C+	1
5.		$^1P^o$–^1S	4420.71	11600	1.0	0.82				C+	1
6.	$3p4p$–$3p(^2P^o)4d$	^3D–$^3F^o$	4602.08	11600	1.0	1.69	1.31			C+	1
7.	$3p4p$–$3p(^2P^o)5s$	^3D–$^3P^o$	4943.53	11600	1.0	2.02	1.22			C+	1
8.		^1P–$^3P^o$	6459.99	16000&20000	1.0	2.42& 1.98		0.79& 0.48		C,C	2

Potassium

K I

Ground State: $1s^22s^22p^63s^23p^64s\ ^2S_{1/2}$

Ionization Energy: 4.34069 eV = 30 009.78 cm^{-1}

The wall-stabilized arc experiment by Hohimer[1,2] is the first extensive Stark broadening study of neutral potassium. An earlier experiment by Purić *et al.*[3] addressed only the resonance line and was included in our 1984 review.[4] In the original version of his work, Hohimer[1] treated the instrumental broadening contribution incorrectly, as was pointed out by Konjević.[5] We have tabulated the set of his revised data,[2] and should note that the widths for both the $4p$-ns and $4p$-nd spectral series increase very regularly[5] with principal quantum number n.

References

[1]J. P. Hohimer, Phys. Rev. A **30**, 1449 (1984).
[2]J. P. Hohimer, Phys. Rev. A **32**, 676 (1985).
[3]J. Purić, J. Labat, S. Djeniže, Lj. Ćirković and I. Lakićević, Phys. Lett. **56A**, 83 (1976).
[4]N. Konjević, M. S. Dimitrijević and W. L. Wiese, J. Phys. Chem. Ref. Data **13**, 619 (1984).
[5]N. Konjević, Phys. Rev. A **32**, 673 (1985).

Key data on experiments

Ref.	Plasma source	Method of measurement: Electron density	Method of measurement: Temperature	Remarks
1	Wall-stabilized arc	Michelson interferometer at 118.8 μm	Boltzmann plot of relative intensities of K I lines in $4p$-ns series	

Numerical results for K I

No.	Transition array	Multiplet (No.)	Wavelength (Å)	Temperature (K)	Electron density (10^{17} cm^{-3})	w_m (Å)	w_m/w_{th}	d_m (Å)	d_m/d_{th}	Acc.	Ref.
1.	$4p$–$7s$	$^2P^o$–^2S	5782.38	2950	0.020	0.42				D+	3
2.	$4p$–$8s$	$^2P^o$–^2S	5323.28	2950	0.020	0.77				D+	3
3.	$4p$–$9s$	$^2P^o$–^2S	5084.23	2950	0.020	1.51				D+	3
4.	$4p$–$10s$	$^2P^o$–^2S	4942.02	2950	0.020	2.60				D+	3
5.	$4p$–$5d$	$^2P^o$–^2D	5831.89	2950	0.020	0.55				D+	3
6.	$4p$–$6d$	$^2P^o$–^2D	5359.57	2950	0.020	0.97				D+	3
7.	$4p$–$7d$	$^2P^o$–^2D	5112.25	2950	0.020	1.85				D+	3
8.	$4p$–$8d$	$^2P^o$–^2D	4965.03	2950	0.020	3.61				D+	3

Silicon

Si II

Ground State: $1s^22s^22p^63s^23p\ ^2P^o_{1/2}$

Ionization Energy: 16.346 eV = 131 838.4 cm^{-1}

Kusch and Schröder[1] measured Stark widths with a low-pressure pulsed arc over an electron density range from 0.5 to 2.0 × 10^{17} cm^{-3} and at temperatures from 22 500 to 25 000 K; but their results are given only for a nominal electron density of 10^{17} cm^{-3}. Similarly, Lesage *et al.*[2] measured Stark widths and shifts with an electromagnetic shock tube (T-tube) over an electron density range from 0.3 to 1.4 × 10^{17} cm^{-3} and at temperatures from 16 000 – 22 000 K, but results are given only for an electron density of 10^{17} cm^{-3}.

Many comparisons may be made between the results of Refs. 1 and 2 as well as with earlier material tabulated in our critical reviews[3,4] of 1976 and 1984. The scatter in the width data is still quite large, and the situation thus is not satisfactory, as is shown in the following table, where all the Stark width data assembled in our previous 1976 and 1984 reviews as well as the present review are listed for three randomly selected lines.

Table 1. Comparisons of some Stark widths with data from earlier reviews[3,4]

Stark Width[a] (FWHM in Å)	Estimated Accuracy	Plasma Temperature	Authors	Ref. No. and Review (in parentheses)
(a) 6371.4Å line:				
1.29	C+	8500 – 10000	Konjević *et al.*	2 (1976)
1.00–0.82	C+	8700 – 16400	Purić *et al.*	4,5 (1976)
1.15	B	9000 – 12000	Chapelle and Czernichowski	3 (1976)
1.93	C+	10000	Lesage *et al.*	2 (1984)
1.24–1.28	C+	16000 – 22000	Lesage *et al.*	2 (present)
2.22	B	18000	Chiang a. Griem	3 (1984)
(b) 3856.0Å line:				
0.40–0.38	C+	8500 – 9700	Konjević *et al.*	2 (1976)
0.52–0.60	C+	8700 – 16400	Purić *et al.*	4,5 (1976)
1.07	C+	10000	Lesage *et al.*	2 (1984)
0.64–0.66	C+	16000 – 22000	Lesage *et al.*	2 (present)
1.00	B	18000	Chiang a. Griem	3 (1984)
(c) 5041.0Å line:				
3.0	C	10000	Miller	1 (1976)
3.5	D	10000	Lesage a. Miller	1 (1984)
2.53	C+	10000	Lesage *et al.*	2 (1984)
2.16–2.08	C+	16000 – 22000	Lesage *et al.*	2 (present)
3.90	D	23000	Kusch a. Schröder	1 (present)

[a]at an electron density of 10^{17} cm^{-1}

The data for the three lines are listed in order of increasing temperature, since the semiclassical theory predicts a decrease in the widths of roughly 20% for an increase in the temperature range from 10 000 to 20 000 K. However, this temperature dependence cannot be observed with the large scatter in the data. More accurate measurements are needed to clarify this situation.

References

[1]H. J. Kusch and K. Schröder, Astron. Astrophys. **116**, 255 (1982).
[2]A. Lesage, B. A. Rathore, I. S. Lakićević and J. Purić, Phys. Rev. A **28**, 2264 (1983).

Key data on experiments

Ref.	Plasma source	Method of measurement: Electron density	Method of measurement: Temperature	Remarks
1	Low-pressure pulsed arc	H_β Stark width	Intensity ratios of Si III to Si II lines	Photographic technique
2	T-tube	He-Ne laser interferometer at 6328Å and H_β Stark width	Boltzmann plot of relative intensities of Ne I lines and intensity ratios of Si III to Si II lines	

Numerical results for Si II

No.	Transition array	Multiplet (No.)	Wavelength (Å)	Temperature (K)	Electron density (10^{17} cm^{-3})	w_m (Å)	w_m/w_{th}	d_m (Å)	d_m/d_{th}	Acc.	Ref.
1.	$3s3p^2$– $3s^2(^1S)4p$	^2D–$^2P^o$ (1)	3856.02	16000–22000	1.0	0.64–0.66	0.63–0.67	(−0.17)–(−0.12)	0.41–0.32	C^+,D^+	2
			3862.60	16000–22000	1.0	0.64–0.66	0.63–0.67	(−0.17)–(−0.12)	0.41–0.32	C^+,D^+	2
2.	$3s^23d$– $3s^2(^1S)4f$	^2D–$^2F^o$ (3)	4130.89	16000–22000	1.0	1.0–1.04	0.79–0.86	(−0.39)–(−0.27)	0.88–0.65	C^+,D^+	2
			4128.07	16000–22000	1.0	1.0–1.04	0.79–0.86	(−0.39)–(−0.27)	0.88–0.65	C^+,D^+	2
3.	$3s^24s$– $3s^2(^1S)4p$	^2S–$^2P^o$ (2)	6347.10	16000–22000	1.0	1.24–1.28	0.60–0.66	(−0.39)–(−0.22)	0.45–0.27	C^+,D^+	2
			6371.36	16000–22000	1.0	1.24–1.28	0.60–0.66	(−0.39)–(−0.24)	0.45–0.30	C^+,D^+	2
4.	$3s^24p$– $3s^2(^1S)4d$	$^2P^o$–^2D (5)	5055.98	23000	1.0	4.53	1.69			D	1
				16000–22000	1.0	2.0–2.12	0.73–0.79	0.53–0.57	0.37–0.43	C^+,C	2
			5041.03	23000	1.0	3.90	1.46			D	1
				16000–22000	1.0	2.16–2.08	0.79–0.78	0.53–0.68	0.37–0.52	C^+,C	2
5.	$3s^24p$– $3s^2(^1S)5s$	$^2P^o$–^2S (4)	5978.93	23000	1.0	4.08	1.78			D	1
			5957.56	23000	1.0	3.70	1.62			D	1
				16000–22000	1.0	3.12–2.96	1.32–1.29	0.51–0.79	0.39–0.65	C^+,C	2
6.	$3s^24p$– $3s^2(^1S)6s$	$^2P^o$–^2S (6)	3339.82	23000	1.0	0.27	0.14			D	1
			3333.14	23000	1.0	0.25	0.13			D	1
7.	$3s3p3d$– $3s3p(^3P^o)4p$	$^2D^o$–^2P (7.27)	4190.72	23000	1.0	0.43				D	1
			4198.13	23000	1.0	0.45				D	1
8.		$^4F^o$–^4P (7.33)	5701.37	23000	1.0	0.79				D	1
			5706.37	23000	1.0	0.72				D	1
			5688.81	23000	1.0	0.84				D	1

Silicon

Si III

Ground State: $1s^22s^22p^63s^2\ ^1S_0$

Ionization Energy: 33.493 eV = 270 139.3 cm^{-1}

Kusch and Schröder[1] measured Stark widths with a low-pressure pulsed arc over an electron density range from 0.5 to 2.0 × 10^{17} cm^{-3} and at temperatures from 22 500 to 25 000 K; but results are given only for a nominal electron density of 10^{17} cm^{-3}. Comparisons with earlier tabulated data[2,3] are possible for the lines at 4575 Å and 3791 Å. For the latter, very good agreement is obtained; but for the former, the Kusch and Schröder[1] result appears to be too large by a factor of 10. A misprint or arithmetical error is likely, since Kusch and Schröder point out (a) that the earlier measurements by Purić *et al.*[4] (tabulated in our 1984 review[3]) yielded a much *larger* width than their own and (b) that they are in good agreement with Sahal-Bréchot's[5] semiclassical theory (see also Ref. 3).

References

[1] H. J. Kusch and K. Schröder, Astron. Astrophys. **116**, 255 (1982).
[2] N. Konjević and W. L. Wiese, J. Phys. Chem. Ref. Data **5**, 259 (1976).
[3] N. Konjević, M. S. Dimitrijević and W. L. Wiese, J. Phys. Chem. Ref. Data **13**, 649 (1984).
[4] J. Purić, S. Djeniže, J. Labat, and Lj. Ćirković, Z. Phys. **267**, 71 (1974).
[5] S. Sahal-Bréchot, Astron. Astrophys. **2**, 322 (1969).

Key data on experiments

Ref.	Plasma source	Method of measurement: Electron density	Method of measurement: Temperature	Remarks
1	Low-pressure pulsed arc	H_β Stark width	Intensity ratios of Si III to Si II lines	Photographic technique

Numerical results for Si III

No.	Transition array	Multiplet (No.)	Wavelength (Å)	Temperature (K)	Electron density (10^{17} cm^{-3})	w_m (Å)	w_m/w_{th}	d_m (Å)	d_m/d_{th}	Acc.	Ref.
1.	$3s4s-$ $3s(^2S)4p$	$^3S-^3P^o$ (2)	4574.76	23000	1.0	3.06	6.37			D	1
2.		$^1S-^1P^o$ (4)	5739.73	23000	1.0	0.71	0.85			D+	1
3.	$3s4p-$ $3s(^2S)4d$	$^3P^o-^3D$ (5)	3806.54	23000	1.0	0.47	0.92			D+	1
			3796.11	23000	1.0	0.48	0.94			D+	1
			3791.41	23000	1.0	0.37	0.72			D+	1
4.		$^1P^o-^1D$ (7)	3590.47	23000	1.0	0.54	1.17			D+	1

Sulfur

S I

Ground State: $1s^22s^22p^63s^23p^4\ ^3P_2$

Ionization Energy: 10.360 eV = 83 558 cm^{-1}

The lines of the two multiplets studied by Goly *et al.*[1] with a wall-stabilized arc were not individually resolved, since they are closely spaced. But an average line width could be nevertheless obtained from the best fit of the observed multiplet profile to the component lines, represented by Voigt functions. The new data by Goly *et al.*[1] are fully consistent with data in our 1976 tabulation.[2]

In a recent paper, Miller *et al.*[3] included, without revisions, the earlier data by Miller and Bengston,[4] which were already part of our 1976 review.[2] They are therefore not listed here again.

References

[1]A. Goly, D. Rakotoarijimy and S. Weniger, J. Quant. Spectrosc. Radiat. Transfer **30**, 417 (1983).
[2]N. Konjević and J. R. Roberts, J. Phys. Chem. Ref. Data **5**, 209 (1976).
[3]M. H. Miller, D. Abadie and A. Lesage, Astrophys. J. **291**, 219 (1985).
[4]M. H. Miller and R. D. Bengston, Phys. Rev. A**1**, 983 (1970).

Key data on experiments

Ref.	Plasma source	Method of measurement: Electron density	Method of measurement: Temperature	Remarks
1	Wall-stabilized arc	H_β Stark width and Ar II 4348Å Stark width	Plasma composition data and intensity ratios of Ar II to Ar I lines	

Numerical results for S I

No.	Transition array	Multiplet (No.)	Wavelength (Å)	Temperature (K)	Electron density (10^{17} cm^{-3})	w_m (Å)	w_m/w_{th}	d_m (Å)	d_m/d_{th}	Acc.	Ref.
1.	$3p^34s-$ $3p^3(^4S^o)5p$	$^5S^o-^5P$ (2)	4695.1	9500–11200	0.076–0.301	0.33–1.11	1.00–0.80	0.18–0.54	1.06–0.95	B,B	1
2.		$^3S^o-^3P$ (4)	5278.7	9500–11200	0.076–0.301	0.36–1.21	1.16–0.93	0.16–0.47	1.00–0.92	B,B	1

Sulfur

S II

Ground State: $1s^22s^22p^63s^23p^3\ ^4S^o_{3/2}$

Ionization Energy: 23.33 eV = 188 200 cm^{-1}

The shock-tube measurements by Miller *et al.*[1] were done over the range of electron densities from 5 to 15 × 10^{16} cm^{-3} and at temperatures from 10 000 to 12 500 K, but are reported at a nominal electron density of 10^{17} cm^{-3} and at a temperature of 11 600 K (1 eV).

The new data[1,2] are fully consistent with the material listed in our 1976 tables.[3]

References

[1]M. H. Miller, D. Abadie and A. Lesage, Astrophys. J. **291**, 219 (1985).
[2]S. Mar, A. Czernichowski and J. Chapelle in *Spectral Line Shapes* Vol. 3 (Ed. F. Rostas), Walter de Gruyter, Berlin (1985) p.49.
[3]N. Konjević and W. L. Wiese, J. Phys. Chem. Ref. Data **5**, 259 (1976).

Key data on experiments

Ref.	Plasma source	Method of measurement: Electron density	Method of measurement: Temperature	Remarks
1	Gas-driven shock tube	H_β Stark width	Absolute intensity of Ne I 5852Å line and line reversal intensities of H_α line.	Photographic technique
2	Wall-stabilized arc	H_β Stark width and A I 4300Å Stark width	Relative intensities of S II to S I lines	

Numerical results for S II

No.	Transition array	Multiplet (No.)	Wavelength (Å)	Temperature (K)	Electron density (10^{17} cm^{-3})	w_m (Å)	w_m/w_{th}	d_m (Å)	d_m/d_{th}	Acc.	Ref.
1.	$3p^23d-$ $3p^2(^3P)4p$	$^4F-^4D^o$ (11)	5606.1	11600	1.0	0.77				C+	1
2.	$3p^24s-$ $3p^2(^3P)4p$	$^4P-^4D^o$ (6)	5453.8	11600	1.0	0.66				C+	1
				12000	0.7	0.34				B	2
			5432.8	11600	1.0	0.66				C+	1
			5428.6	11600	1.0	0.69				C+	1
			5509.7	11600	1.0	0.73				C	1
			5473.6	11600	1.0	0.72				C+	1
3.		$^4P-^4P^o$ (9)	5032.41	11600	1.0	0.69				C+	1
			5103.30	11600	1.0	0.74				C	1
			5009.54	11600	1.0	0.84				C	1
4.		$^4P-^4S^o$ (9)	4815.52	11600	1.0	1.21				C	1
5.	$3p^24s'-$ $3p^2(^1D)4p'$	$^2D-^2F^o$ (38)	5320.70	11600	1.0	0.70				C+	1
				12000	0.7	0.37				B	2
			5345.67	11600	1.0	0.67				C	1
6.		$^2D-^2P^o$ (40)	4524.95	12000	0.7	0.54				B	2

Thallium

Tl I

Ground State: $1s^22s^22p^63s^23p^63d^{10}4s^24p^64d^{10}4f^{14}5s^25p^65d^{10}6s^26p\ ^2P^o_{1/2}$

Ionization Energy: 6.108 eV = 49 265.5 cm^{-1}

The measurements by Couris *et al.*[1] of the Stark shift of the $7s-8p$ line at 6549.77 Å with a high pressure mercury-thallium discharge have yielded the first Stark broadening data for this spectrum. The authors do not state the results of their temperature measurements, but one may assume that the temperature in the Hg–Tl discharge is similar to that in a Hg discharge studied earlier under very similar conditions, for which temperature values of about 6000 K were obtained.[2]

References

[1]S. Couris, J. J. Damelincourt, E. Drakakis and D. Karabourniotis, in *The Physics of Ionized Gases SPIG 1988 (Contributions)*, Electrical Engineering Faculty, Sarajevo, Yugoslavia (1988), p. 325.
[2]J. J. Damelincourt, M. Aubes and P. Fragnac, J. Appl. Phys. 54, 3087 (1983).

Key data on experiments

Ref.	Plasma source	Method of measurement: Electron density	Method of measurement: Temperature	Remarks
1	High-pressure mercury-thallium discharge	Plasma-composition data	Relative intensity of Hg I lines	Actual values of temperature not given (see introductory comments)

Numerical results for Tl I

No.	Transition array	Multiplet (No.)	Wavelength (Å)	Temperature (K)	Electron density (10^{17} cm^{-3})	w_m (Å)	w_m/w_{th}	d_m (Å)	d_m/d_{th}	Acc.	Ref.
1.	$6s^27s-6s^2(^1S)8p$	$^2S-^2P^o$	6549.84	6000*	0.004–0.090			0.025–0.562		D+	1

*see introductory text

Tin

Sn II

Ground State: $1s^22s^22p^63s^23p^63d^{10}4s^24p^64d^{10}5s^25p\ ^2P^o_{1/2}$

Ionization Energy: 14.6323 eV = 118 017.0 cm^{-1}

Purić *et al.*[1] used an electromagnetic shocktube (T-tube) to measure the Stark width and shift of the 6844.05Å line. The measurements were done at temperatures of 16 000 and 20 000 K and over a range of electron densities N_e from 0.3×10^{17} cm^{-3} to 1.4×10^{17} cm^{-3}, but they have tabulated their results only for $N_e=10^{17}$ cm^{-3}. Their data differ appreciably for the two temperatures. It is therefore difficult to compare them with the other available width data, tabulated in our 1984 review.[2] The result, obtained by Miller *et al.*[3] at 11 600 K with a gas-driven shock tube, is consistent with the temperature dependence found by Purić *et al.*[1]

References

[1] J. Purić, M. Ćuk and I. S. Lakićević, Phys. Rev. A 32, 1106 (1985).

[2] N. Konjević, M. S. Dimitrijević and W. L. Wiese, J. Phys. Chem. Ref. Data 13, 649 (1984).

[3] M. H. Miller, R. A. Roig and R. D. Bengtson, Phys. Rev. A 20, 499 (1979).

Key data on experiments

Ref.	Plasma source	Method of measurement: Electron density	Method of measurement: Temperature	Remarks
1	T-tube	He-Ne laser interferometer at 6328Å and H_β Stark width	Boltzmann plot of relative intensities of Ar II lines and intensity ratios of Si III to Si II lines	

Numerical results for Sn II

No.	Transition array	Multiplet (No.)	Wavelength (Å)	Temperature (K)	Electron density (10^{17} cm^{-3})	w_m (Å)	w_m/w_{th}	d_m (Å)	d_m/d_{th}	Acc.	Ref.
1.	$5s^26s$–$5s^2(^1S)6p$	^2S–$^2P^o$	6844.05	16000& 20000	1.0	3.30& 2.34		(−0.90)& (−0.75)		C+,C	1

Xenon

Xe I

Ground State: $1s^22s^22p^63s^23p^63d^{10}4s^24p^64d^{10}5s^25p^6\ ^1S_0$

Ionization Energy: 12.1299 eV = 97 833.81 cm^{-1}

Very little new material has been added to our 1976 and 1984 tabulations[1,2] on this spectrum. Vitel and Skowronek[3] performed Stark shift measurements of the 4734.15 Å line at high electron densities, using a linear flash-tube. In a series of papers,[4–6] Hess,[4,5] Kettlitz,[6] and co-workers published the results of studies of Xe I spectra at high densities with a ballistic compressor and a pulsed discharge. Since their results for the line widths and shifts are only given in graphical form, and since it is difficult to extract precise numerical values from the figures, no data have been tabulated from these references.

References

[1]N. Konjević and J. R. Roberts, J. Phys. Chem. Ref. Data 5, 209 (1976).
[2]N. Konjević, M. S. Dimitrijević and W. L. Wiese, J. Phys. Chem. Ref. Data 13, 619 (1984).
[3]Y. Vitel and M. Skowronek, J. Phys. B 20, 6493 (1987).
[4]H. Hess, L. Hitzschke, M. Metzke, H. Warner and M. Wirsig, Proc. 16th Int. Conf. Phenomena in Ionized Gases, Vol. 4, Contributed papers (Eds. W. Bötticher, H. Wenk & E. Schulz-Gulde) West Germany, Düsseldorf (1983) p. 622.
[5]H. Hess, L. Hitzschke, E. Metzke, R. Niepraschk and M. Wirsig, 12th Summer School and Symp. Phys. Ionized Gases, Contributed papers (Ed. M. M. Popović) Yugoslavia, Sibenik (1984) p. 453.
[6]M. Kettlitz, R. Radtke, R. Spanke and L. Hitzschke, J. Quant. Spectrosc. Radiat. Transfer 34, 275 (1985).

Key data on experiments

Ref.	Plasma source	Method of measurement: Electron density	Method of measurement: Temperature	Remarks
3	Linear flash-tube	Continuum emission, H_α Stark width, and laser interferometer at 3.39μm	Intensity of optically thick infrared lines	

Numerical results for Xe I

No.	Transition array	Multiplet (No.)	Wavelength (Å)	Temperature (K)	Electron density (10^{17} cm^{-3})	w_m (Å)	w_m/w_{th}	d_m (Å)	d_m/d_{th}	Acc.	Ref.
1.	$6s$–$6p'$	$[3/2]^o$–$[3/2]$	4734.15	14800	4.7			1.1		C	3
				13000–14300	9.0–13.4			1.8–2.6		C	3

Xenon

Xe II

Ground State: $1s^22s^22p^63s^23p^63d^{10}4s^24p^64d^{10}5s^25p^5\ ^2P^o_{3/2}$

Ionization Energy: 21.21 eV = 171 068.4 cm^{-1}

List of tablulated lines

Wavelength (Å)	No.	Wavelength (Å)	No.	Wavelength (Å)	No.	Wavelength (Å)	No.
4158.04	13	4844.33	5	5261.95	10	5472.61	2
4379.44	11	4876.50	3	5292.22	4	5667.56	1
4406.88	12	4883.53	8	5339.33	4	5976.46	4
4550.79	14	4988.77	6	5372.39	4	6036.20	1
4603.03	5	5191.37	5	5419.15	5	6051.15	1
4651.94	6	5260.44	7	5438.96	9	6097.59	1
4731.19	12						

The results of five recent experiments[1–5], carried out with a variety of plasma sources, provide much more extensive coverage of Stark width and shift data for this spectrum than available earlier.[6] The measurements by Richou *et al.*[1] and Nick and Helbig[2] were carried out over ranges of electron densities from 0.1 to $1.5 \times 10^{17}\ cm^{-3}$ and 0.64 to $1.45 \times 10^{17}\ cm^{-3}$, respectively, and corresponding temperature ranges from 7 800 to 8 400 K, and 9 400 to 10 700 K; but the results are only listed for an electron density of $1.0 \times 10^{17}\ cm^{-3}$, since linear scaling of the widths with electron density was found.

When there is more than one result for a line, the majority of the data are mutually consistent. An exception is found for the 5419.15Å line, where the Stark width measured with a gas-driven shock tube by Richou *et al.*[1] is about 60% larger than the results of Nick and Helbig,[2] and Vitel and Skowronek,[4] but is similar to the low temperature data obtained with a gas-driven shock tube by Manola *et al.*[5] Manola *et al.* showed that the discrepancy may be in large part due to the strong decrease of this Stark width with temperature.

References

[1]J. Richou, S. Manola, J. L. Lebrun and A. Lesage, Phys. Rev. A **29**, 3181 (1984).
[2]K. -P. Nick and V. Helbig, Phys. Scr. **33**, 55 (1986).
[3]T. L. Pittman and N. Konjević, J. Quant. Spectrosc. Radiat. Transfer **35**, 247 (1986).
[4]Y. Vitel and M. Skowronek, J. Phys. B **20**, 6493 (1987).
[5]S. Manola, N. Konjević, J. Richou, J. L. Lebrun and A. Lesage, Phys. Rev. A **38**, 5742 (1988).
[6]N. Konjević, M. S. Dimitrijević and W. L. Wiese, J. Phys. Chem. Ref. Data **13**, 649 (1984).

Key data on experiments

Ref.	Plasma source	Method of measurement: Electron density	Method of measurement: Temperature	Remarks
1	Gas-driven shock tube	He-Ne laser interferometer at 3.39μm	Plasma composition data and intensity ratios of several Fe I lines	
2	Wall-stabilized arc	Michelson interferometer at 6328Å and 1.15μm	Plasma composition data	Inhomogeneous layer in the vicinity of electrodes included, but taken into account by variation of arc length
3	Low-pressure pulsed arc	He-Ne laser quadrature interferometer at 6328Å	Relative intensities of O II impurity lines	
4	Linear flash tube	Continuum emission, H_α Stark width, and laser interferometer at 3.39μm	Intensities of optically thick infrared lines	
5	Gas-driven shock tube	Michelson interferometer at 3.39μm	Plasma compositon data	

Numerical results for Xe II

Xenon

Xe III

Ground State: $1s^2 2s^2 2p^6 3s^2 3p^6 3d^{10} 4s^2 4p^6 4d^{10} 5s^2 5p^4\ ^3P_2$

Ionization Energy: 32.123 eV = 259 089 cm^{-1}

The low-pressure pulsed arc experiment by Konjević and Pittman[1] has produced the first experimental data for this spectrum. Some of their results are compared with the modified semiempirical (MSE) approach by Dimitrijević and Konjević (see general introduction), with which they are in close agreement.

References

[1]N. Konjević and T. L. Pittman, J. Quant. Spectrosc. Radiat. Transfer 37, 311 (1987).

Key data on experiments

Ref.	Plasma source	Method of measurement: Electron density	Method of measurement: Temperature	Remarks
1	Low-pressure pulsed arc	He-Ne laser quadrature interferometer at 6328Å	Relative intensities of O II impurity lines	

Numerical results for Xe III

No.	Transition array	Multiplet (No.)	Wavelength (Å)	Temperature (K)	Electron density (10^{17} cm^{-3})	w_m (Å)	w_m/w_{th}	d_m (Å)	d_m/d_{th}	Acc.	Ref.
1.	$5p^3 6s$– $5p^3(^4S^o)6p$	$^5S^o$–^5P	3950.59	27000	0.83	0.198	1.00			B	1
			3624.08	27000	0.83	0.185	1.06			B	1
2.		$^3S^o$–^3P	3781.02	27000	0.81	0.194	1.02			B	1
3.	$5p^3 6s'$– $5p^3(^2D^o)6p$	$^3D^o$–^3D	3880.5	27000	0.81	0.163	1.10			B	1
			3607.0	27000	0.81	0.133	1.04			B	1
4.		$^3D^o$–^3F	3583.6	27000	0.81	0.149	1.18			B	1
			3579.7	27000	0.81	0.155	1.23			B	1
5.	$5p^3 6s''$– $5p^3(^2P^o)6p''$	$^3P^o$–^3D	3776.3	27000	0.81	0.177	1.18			B	1