Energy Levels of Iron, Fe I through Fe XXVI

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The energy levels of the iron atom in all of its stages of ionization, as derived from the analyses of atomic spectra, have been compiled. In cases where only line classifications are given in the literature, level values have been derived. The percentages for the two leading components of the calculated eigenvectors of the levels are given where available. Ionization energies are also given.

Key words: Atomic energy levels; atomic spectra; iron.

Contents

I. Introduction

Approximately 23 years have elapsed since Moore's [1][1] compilation of the energy levels of iron. Recently much new material on this subject, both experimental and theoretical, has appeared in the literature, and therefore a new compilation of iron energy level data should be of considerable use to spectroscopists and other users of the data.

We give here the energy levels of the iron atom and all of its ions as derived from the analyses of atomic spectra. These include primarily levels arising from outer-shell excitations. For the high stages of ionization, inner-shell excitations are included since the distinction in energy becomes less clear.

For most of the level systems given here the energy level data have been culled from widely scattered sources in the literature. For many of the ions the original papers do not give energy level values, but only classifications of observed lines. In these cases we have derived the level values for inclusion here. We have also derived some of the ionization energies from the observed levels.[2]

[1] Figures in brackets indicate literature references which appear after section 2.
[2] Values for ionization energies are usually derived in their equivalence in cm^{-1}. The conversion factor, 8065.479 cm^{-1}/eV, as given by E. R. Cohen and B. N. Taylor, J. Phys. Chem. Ref. Data **2**, 663 (1973), was used to obtain values in eV.

For a large number of ions, too few levels are known to permit the derivation of an experimental value of the ionization energy. In these cases we have quoted estimated values obtained by extrapolation along isoelectronic sequences. Although it is not possible to give a quantitative uncertainty for these extrapolated values, they are probably accurate to a few units of the last significant figure listed. Edlén [2] has recently published a set of semiempirical formulas that could be used to obtain new estimates for a number of the ionization energies.

Although in most cases we used only published papers as sources of data, unpublished material was included when it constituted a considerable improvement.

For most of the Fe ions, the bulk of the data are the results of laboratory observations of various types of iron plasmas. However, they are often supplemented by data obtained from solar observations. This is particularly true where spin-forbidden lines are required to establish the absolute energy of a system of excited levels and also where parity-forbidden transitions between levels of a ground configuration are used to obtain accurate relative energies for the low levels. Whenever both solar data and equivalent laboratory data were available for a given level system or part of a level system, preference was generally given to the laboratory data in order to avoid the problem of blended lines of various elements in the solar spectra. Our source of data was always the original literature. For a convenient source of wavelengths of iron lines below 2000 Å we refer the reader to the recent compilation by Kelly and Palumbo [3].

Almost every level in the present compilation is accompanied by a quantum mechanical designation (or name). The treatment of the level designations is sometimes a troublesome question. For a given configuration a certain number of terms of various types (^5H, ^7H, etc. in LS coupling, for example) are theoretically expected, and spectroscopists have traditionally tried to give such definite names to terms, even though g values, intensities, and arrangement of the levels may indicate that no such "pure" name is appropriate. It is thus of interest to know just how well the name of a level describes its quantum properties. To this end, we have included the results of theoretical calculations which express the percentage composition of levels in terms of the basis states of a single configuration, or more than one configuration where configuration interaction is important.

The percentage compositions have the following meaning. Suppose that for a given configuration there is a set of n basis states, written symbolically as $\psi_1, \psi_2, \ldots, \psi_n$. Usually these basis states are taken to be the LS states for a configuration, but other coupling schemes are often used. Then the eigenvector ψ_A of an actual energy level A can be expressed as

$$\psi_A = \alpha_1\psi_1 + \alpha_2\psi_2 + \ldots \alpha_n\psi_n,$$

where $\alpha_1^2 + \alpha_2^2 + \ldots \alpha_n^2 = 1$. The squared quantities α_1^2, α_2^2, etc. represent the percentage composition of a given level. Generally, levels are given names corresponding to the basis state having the largest percentage. The percentage compositions are determined in the theoretical calculations by finding the eigenvalues and eigenvectors of the energy matrix.

In the columns of the present tables headed "Leading components" we give first the percentage of the basis state corresponding to the level's name; next the second largest percentage together with the related basis state. We have not listed any second component whose percentage is less than 4 percent. The percentages show that in many cases it is not possible to group the levels into meaningful terms. However, where levels have been arranged into terms in the original papers or in subsequent theoretical calculations, we have generally retained these groupings.

Of course, the percentage compositions cannot be considered to be experimental quantities inasmuch as a new calculation using a different approximation, such as the introduction of configuration interaction where none had been used before, might yield a different set of percentages. In most cases, however, we would not expect the percentages to change drastically in a new calculation, so that the compositions given here should be a useful guide to the true quantum character of the levels.

It should be noted that the theoretical calculations involved in obtaining the percentage compositions are of two types. The semiempirical method treats the radial integrals appearing in the energy matrix as parameters whose values are determined by a least-squares fit to the observed levels. In the *ab initio* method, the radial integrations are carried out with wavefunctions found by solving the wave equation for a given atom, as in a Hartree-Fock calculation or variation thereof. In the present tables, the percentages listed for the lower stages of ionization are mostly taken from published least-squares level-fitting calculations. For the higher stages, only *ab initio* calculations are found in the literature, and we have used these where available. For these higher ions there has apparently been no effort to relate quantitatively the theoretical results to the observations by means of least-squares calculations.

For configurations of equivalent electrons, repeating terms sometimes occur. These are generally distinguished by their seniority number [4]. In the present compilation they are designated in the notation of Nielson and Koster [5]. For example, in the $3d^5$ configuration there are three ^{2}D terms with seniorities of 1, 3, and 5, respectively. These terms are denoted as ^{2}D1, ^{2}D2, and ^{2}D3 by Nielson and Koster.

The labeling of terms by lower case letters, *a*, *b*, *c*, etc. (for example a^5D, z^5G°, etc.) has been dropped, except for Fe I and II, where their use in connection with various wavelength tables makes their retention desirable.

We used the following procedure for carrying out the present compilation. First, a complete list of references for each stage of ionization was drawn up, based primarily on the following bibliographies:

i. papers cited by Moore in ref. 1
ii. C. E. Moore, ref. 6
iii. L. Hagan and W. C. Martin, ref. 7
iv. card file of publications since June 1971 maintained by the NBS Atomic Energy Levels Data Center.

Then, each paper was scanned for new energy level data and the levels compiled or derived from the classified lines. Of course, many more papers were read than actually used in the compilation. For example, for the short level list of Fe XXIV, 18 different papers were reviewed. After a preliminary compilation for all ions was carried out, we returned to Fe I to check the level values, review and incorporate any new papers that had appeared in the meantime, and prepare an Fe I text. This retracing was continued through all of the ions. Approximately 1 year elapsed between the preliminary and final compilations. A final check for new data was made on May 6, 1974, at which time the compilations were considered completed.

2. Acknowledgments

Throughout this work we have made extensive use of the bibliographical files and reprint collection maintained in the Atomic Energy Levels Data Center by Dr. Lucy Hagan. Our thanks are extended to her for her generous cooperation. The compilation has also benefited greatly from the preprints that were generously provided by many of our colleagues.

We would like to thank Dr. W. C. Martin for many helpful discussions. All of the data were prepared for computer assisted printing by Mrs. Ruth Peterson. The manuscript was typed by Mrs. Sylvia Shure. Their able assistance is greatly appreciated.

References to Introduction

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Fe I

26 electrons $Z = 26$

Ground state: $1s^2 2s^2 2p^6 3s^2 3p^6 3d^6 4s^2\ ^5D_4$ Ionization energy = 63 480 cm^{-1} (7.87 eV)

The principal contributors to the analysis of Fe I are Walters, Laporte, Burns, and Catalán [1–5] who together provided 404 energy levels. Following their work and utilizing extensive new Zeeman effect data, Russell, Moore, and Weeks [6] were able to augment the known data by the addition of 60 levels and to confirm the older analysis. A few high levels were later identified by Kiess, Rubin, and Moore [7].

Redetermined values for many of the levels have now been provided by Crosswhite [8]. His revisions result from a new set of observations made with a low pressure hollow cathode discharge. The values given below to three decimal places are due to Crosswhite. A comparison of his results with the earlier data, which were derived from arc sources at atmospheric pressure, shows that the values of levels belonging to the $3d^8$, $3d^7 4s$, $3d^7 4p$, $3d^7 4d$, $3d^6 4s4p$, $3d^6 4s4d$, and $3d^5 4s^2 4p$ configurations should be reduced by 0.04 cm^{-1} to obtain values consistent with observations from low pressure sources. This correction has been applied by us to all levels of these configurations whose values were not already revised by Crosswhite. These are given below to two decimal places. Insufficient information is available to establish equivalent corrections for levels of the $3d^6 4s5s$, $3d^6 4s6s$, $3d^6 4s7s$, $3d^6 4s5d$, $3d^7 5s$, and $3d^6 4s5p$ configurations. The uncorrected values rounded off to two decimal places are given below.

The percentage composition of the levels of odd parity are from Roth [9]. He has calculated the $3d^7 4p$, $3d^6 4s4p$, and $3d^5 4s^2 4p$ groups of levels with configuration interaction. The term $3d^5(^6S)4s^2 4p\ ^5P°$ was not included in the calculation because of its large deviation from the predicted position. Some levels reported in ref. 7 might be assigned designations according to Roth's calculation, but this was not undertaken by us. Roth distinguished repeating terms of the $3d^n$ core by the letters a, b . . . rather than by seniority. His percentage composition for a given level is the sum of the percentages of states that are identical except for the seniority of the core term.

The alphabetic prefixing of final terms with lower case letters, which served to distinguish final terms of the same type, has been repeated here from the literature except for levels that have been redesignated as a result of a new theoretical interpretation. Similarly, the authors' numerical designations for uninterpreted levels have been retained.

A calculation of the even configurations $3d^6 4s^2$, $3d^7 4s$, and $3d^8$ by Schrijver and Noorman [10] provided percentage compositions for these levels.

The ionization energy was derived from the $3d^7 ns$ series ($n = 4, 5$) by Catalán and Velasco [11].

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Fe I

Configuration	Term	J	Level (cm^{-1})	g	Leading components (%)	
					First	Second
$3d^6 4s^2$	$a\ ^5D$	4	0.000	1.496	100	
		3	415.932	1.497	100	
		2	704.004	1.494	100	
		1	888.129	1.498	100	
		0	978.072		100	

Fe I – Continued

Configuration	Term	J	Level (cm^{-1})	g	Leading components (%)	
					First	Second
$3d^7(^4F)4s$	$a\ ^5F$	5	6928.266	1.404	100	
		4	7376.760	1.349	100	
		3	7728.056	1.248	100	
		2	7985.780	0.995	100	
		1	8154.710	−0.014	100	
$3d^7(^4F)4s$	$a\ ^3F$	4	11 976.234	1.254	100	
		3	12 560.930	1.086	100	
		2	12 968.549	0.670	100	
$3d^7(^4P)4s$	$a\ ^5P$	3	17 550.175	1.666	100	
		2	17 726.981	1.820	93	
		1	17 927.376	2.499	98	
$3d^64s^2$	$a\ ^3P2$	2	18 378.181	1.506	52	34 $3d^64s^2\ ^3P1$
		1	19 552.473	1.500	52	35
		0	20 037.813		51	34
$3d^6(^5D)4s4p(^3P^\circ)$	$z\ ^7D^\circ$	5	*19 350.892*	1.597	100	
		4	*19 562.440*	1.642	99	
		3	*19 757.033*	1.746	99	
		2	*19 912.494*	2.008	99	
		1	*20 019.635*	2.999	100	
$3d^64s^2$	$a\ ^3H$	6	19 390.164	1.163	99	
		5	19 621.005	1.038	98	
		4	19 788.245	0.811	96	
$3d^64s^2$	$b\ ^3F2$	4	20 641.109	1.235	72	20 $3d^64s^2\ ^3F1$
		3	20 874.484	1.073	76	20
		2	21 038.985	0.663	79	20
$3d^7(^2G)4s$	$a\ ^3G$	5	21 715.730	1.197	85	13 $3d^64s^2\ ^3G$
		4	21 999.127	1.051	85	11
		3	22 249.428	0.756	86	12
$3d^6(^5D)4s4p(^3P^\circ)$	$z\ ^7F^\circ$	6	*22 650.421*	1.498	100	
		5	*22 845.868*	1.498	99	
		4	*22 996.676*	1.493	99	
		3	*23 110.937*	1.513	99	
		2	*23 192.497*	1.504	100	
		1	*23 244.834*	1.549	100	
		0	*23 270.374*		100	
$3d^7(^4P)4s$	$b\ ^3P$	2	22 838.318	1.498	98	
		1	22 946.808	1.489	95	
		0	23 051.742		94	
$3d^6(^5D)4s4p(^3P^\circ)$	$z\ ^7P^\circ$	4	*23 711.457*	1.747	98	
		3	*24 180.864*	1.908	98	
		2	*24 506.919*	2.333	99	

Fe I – Continued

Configuration	Term	J	Level (cm^{-1})	g	Leading components (%)	
					First	Second
$3d^64s^2$	$b\ ^3$G	5	23 783.614	1.200	85	14 $3d^7(^2G)4s\ ^3$G
		4	24 118.814	1.048	79	9
		3	24 338.762	0.761	85	14
$3d^7(^2P)4s$	$c\ ^3$P	2	24 335.759	1.484	83	7 $3d^64s^2\ ^3$P2
		1	24 772.017	1.466	81	9
		0	25 091.597		82	9
$3d^7(^2G)4s$	$a\ ^1$G	4	24 574.650	1.001	86	6 $3d^64s^2\ ^3$G
$3d^6(^5D)4s4p(^3P^\circ)$	$z\ ^5D^\circ$	4	*25 899.987*	1.502	91	
		3	*26 140.177*	1.500	91	
		2	*26 339.691*	1.503	91	
		1	*26 479.376*	1.495	92	
		0	*26 550.476*		93	
$3d^7(^2H)4s$	$b\ ^3$H	6	26 105.904	1.165	100	
		5	26 351.039	1.032	98	
		4	26 627.604	0.811	95	
$3d^7(^2D2)4s$	$a\ ^3$D	3	26 224.966	1.335	71	20 $3d^7(^2D1)4s\ ^3$D
		1	26 406.470	0.731	40	38 $3d^7(^2P)4s\ ^1$P
		2	26 623.730	1.178	65	17 $3d^7(^2D1)4s\ ^3$D
$3d^6(^5D)4s4p(^3P^\circ)$	$z\ ^5F^\circ$	5	*26 874.549*	1.399	94	
		4	*27 166.819*	1.355	94	
		3	*27 394.688*	1.250	94	
		2	*27 559.581*	1.004	95	
		1	*27 666.346*	−0.012	95	
$3d^7(^2P)4s$	$a\ ^1$P	1	27 543.004	0.817	58	24 $3d^7(^2D2)4s\ ^3$D
$3d^7(^2D2)4s$	$a\ ^1$D	2	28 604.606	1.028	64	18 $3d^7(^2D1)4s\ ^1$D
$3d^7(^2H)4s$	$a\ ^1$H	5	28 819.946	1.000	99	
$3d^6(^5D)4s4p(^3P^\circ)$	$z\ ^5P^\circ$	3	*29 056.321*	1.657	97	
		2	*29 469.020*	1.835	97	
		1	*29 732.733*	2.487	97	
$3d^64s^2$	$a\ ^1$I	6	29 313.003	1.014	100	
$3d^64s^2$	$b\ ^3$D	1	29 320.028		83	12 $3d^7(^2D2)4s\ ^3$D
		2	29 356.740		80	10
		3	29 371.811	1.326	91	6
$3d^64s^2$	$b\ ^1$G2	4	29 798.933	0.979	64	34 $3d^64s^2\ ^1$G1
$3d^6(^5D)4s4p(^3P^\circ)$	$z\ ^3F^\circ$	4	*31 307.243*	1.250	94	
		3	*31 805.067*	1.086	93	
		2	*32 133.986*	0.682	93	

Fe I – Continued

Configuration	Term	J	Level (cm^{-1})	g	Leading components (%) First	Second
$3d^6(^5D)4s4p(^3P^\circ)$	$z\ ^3D^\circ$	3	*31 322.611*	1.321	89	
		2	*31 686.346*	1.168	90	
		1	*31 937.316*	0.513	91	
$3d^8$	$c\ ^3F$	4	32 873.619	1.264	90	6 $3d^7(^2F)4s\ ^3F$
		3	33 412.74	1.066	87	9
		2	33 765.29	0.677	82	12
$3d^7(^4F)4p$	$y\ ^5D^\circ$	4	*33 095.937*	1.496	60	37 $3d^6(^5D)4s4p(^1P^\circ)\ ^5D^\circ$
		3	*33 507.120*	1.492	59	38
		2	*33 801.567*	1.495	57	38
		1	*34 017.098*	1.492	58	39
		0	*34 121.58*		58	40
$3d^7(^4F)4p$	$y\ ^5F^\circ$	5	*33 695.394*	1.417	82	13 $3d^6(^5D)4s4p(^1P^\circ)\ ^5F^\circ$
		4	*34 039.513*	1.344	79	13
		3	*34 328.749*	1.244	80	13
		2	*34 547.206*	0.998	81	13
		1	*34 692.144*	−0.016	83	13
$3d^6(^5D)4s4p(^3P^\circ)$	$z\ ^3P^\circ$	2	*33 946.929*	1.493	96	
		1	*34 362.871*	1.496	96	
		0	*34 555.60*		97	
$3d^64s^2$	$b\ ^1D2$	2	34 636.78		73	20 $3d^64s^2\ ^1D1$
$3d^7(^4F)4p$	$z\ ^5G^\circ$	5	*34 782.416*	1.218	50	43 $^3G^\circ$
		6	*34 843.94*	1.332	94	
		4	*35 257.319*	1.103	71	20 $^3G^\circ$
		3	*35 611.619*	0.887	84	7 $^3G^\circ$
		2	*35 856.400*	0.335	92	
$3d^7(^4F)4p$	$z\ ^3G^\circ$	5	*35 379.206*	1.248	53	41 $^5G^\circ$
		4	*35 767.561*	1.100	72	20
		3	*36 079.366*	0.791	86	7
$3d^7(^4F)4p$	$y\ ^3F^\circ$	4	*36 686.164*	1.246	85	
		3	*37 162.740*	1.086	82	
		2	*37 521.157*	0.688	87	
$3d^6(^5D)4s4p(^1P^\circ)$	$y\ ^5P^\circ$	3	*36 766.962*	1.661	60	32 $3d^5(^6S)4s^24p\ ^5P^\circ$
		2	*37 157.557*	1.836	59	33
		1	*37 409.542*	2.502	58	34
$3d^7(^2F)4s$	$d\ ^3F$	2	36 940.56		87	13 $3d^8\ ^3F$
		3	36 975.60		90	10
		4	37 045.96		93	7
$3d^7(^4F)4p$	$y\ ^3D^\circ$	3	*38 175.350*	1.324	82	8 $3d^6(^5D)4s4p(^3P^\circ)\ ^3D^\circ$
		2	*38 678.032*	1.151	85	7
		1	*38 995.730*	0.493	87	7

Fe I – Continued

Configuration	Term	J	Level (cm^{-1})	g	Leading components (%)	
					First	Second
$3d^6(^5D)4s4p(^1P^\circ)$	$x\ ^5D^\circ$	4	*39 625.800*	1.489	50	24 $3d^7(^4F)4p\ ^5D^\circ$
		3	*39 969.844*	1.504	48	20
		2	*40 231.332*	1.501	47	22
		1	*40 404.506*	1.498	47	21
		0	*40 491.274*		47	22
$3d^5(^6S)4s^24p$	$y\ ^7P^\circ$	2	*40 052.030*	2.340	98	
		3	*40 207.086*	1.908	98	
		4	*40 421.85*	1.75?	99	
$3d^6(^5D)4s4p(^1P^\circ)$	$x\ ^5F^\circ$	5	*40 257.307*	1.390	86	6 $3d^7(^4F)4p\ ^5F^\circ$
		4	*40 594.429*	1.328	85	7
		3	*40 842.151*	1.254	85	7
		2	*41 018.050*	0.998	85	7
		1	*41 130.627*	−0.006	85	7
$3d^64s^2$	$a\ ^1F$	3	40 534.14?		90	9 $3d^7(^2F)4s\ ^1F$
	X	3	40 871.46			
		2	41 178.36			
$3d^6(a\ ^3P)4s4p(^3P^\circ)$	$z\ ^5S^\circ$	2	*40 894.986*	1.985	56	36 $3d^7(^4P)4p\ ^5S^\circ$
$3d^6(a\ ^3P)4s4p(^3P^\circ)$	$x\ ^5P^\circ$	3	*42 532.736*	1.650	88	
		2	*42 859.770*	1.822	78	12 $3d^7(^4P)4p\ ^5S^\circ$
		1	*43 079.026*	2.464	85	6 $3d^7(^4P)4p\ ^5P^\circ$
$3d^6(^3H)4s4p(^3P^\circ)$	$y\ ^5G^\circ$	6	*42 784.35*	1.342	49	30 $3d^6(a\ ^3F)4s4p(^3P^\circ)\ ^5G^\circ$
		5	*42 911.908*	1.203	42	31
		4	*43 022.975*	1.024	36	32
		3	*43 137.479*	0.905	31	32
		2	*43 210.021*	0.331	46	45
$3d^6(^5D)4s(^6D)5s$	$e\ ^7D$	5	42 815.858	1.585		
		4	43 163.327	1.655		
		3	43 434.629	1.755		
		2	43 633.534	2.009		
		1	43 763.980	3.002		
$3d^6(^3H)4s4p(^3P^\circ)$	$z\ ^5H^\circ$	5	*42 991.62*	1.054	69	16 $^5I^\circ$
		4	*43 108.90*	0.871	67	11 $^5G^\circ$
		6	*43 321.08?*		71	20 $^5I^\circ$
		3	*43 325.958*	0.509	63	17 $^5G^\circ$
$3d^6(a\ ^3F)4s4p(^3P^\circ)$	$w\ ^5D^\circ$	4	*43 499.496*	1.492	37	22 $3d^6(a\ ^3P)4s4p(^3P^\circ)\ ^5D^\circ$
		3	*43 922.664*	1.481	50	21 $3d^7(^4P)4p\ ^5D^\circ$
		2	*44 183.620*	1.533	54	23 $3d^7(^4P)4p\ ^5D^\circ$
		1	*44 411.151*	1.315	58	24 $3d^7(^4P)4p\ ^5D^\circ$
		0	*44 458.92*		60	24 $3d^7(^4P)4p\ ^5D^\circ$

Fe I – Continued

Configuration	Term	J	Level (cm^{-1})	g	Leading components (%)	
					First	Second
$3d^6(a\ ^3F)4s4p(^3P^\circ)$	$^5F^\circ$	3	*44 166.203*	1.351	46	20 $3d^6(a\ ^3P)4s4p(^3P^\circ)\ ^5D^\circ$
		5	*44 243.673*	1.382	85	4 $3d^6(^3D)4s4p(^3P^\circ)\ ^5F^\circ$
		2	*44 285.443*	1.117	70	5 $3d^6(^3D)4s4p(^3P^\circ)\ ^5F^\circ$
		1	*44 378.38?*	0.283	82	6 $3d^6(^3D)4s4p(^3P^\circ)\ ^5F^\circ$
		4	*44 415.070*	1.401	71	8 $3d^6(a\ ^3F)4s4p(^3P^\circ)\ ^5D^\circ$
$3d^6(a\ ^3P)4s4p(^3P^\circ)$	$^5D^\circ$	4	*44 022.535*	1.444	46	27 $3d^6(a\ ^3F)4s4p(^3P^\circ)\ ^5F^\circ$
		3	*44 551.330*	1.386	26	28 $3d^6(a\ ^3F)4s4p(^3P^\circ)\ ^5F^\circ$
		2	*44 664.068*	1.378	33	20 $3d^6(a\ ^3P)4s4p(^3P^\circ)\ ^3D^\circ$
		1	*44 760.75*	1.389	52	8 $3d^7(^4P)4p\ ^3D^\circ$
		0	*44 826.88*		78	8 $3d^6(^5D)4s4p(^1P^\circ)\ ^5D^\circ$
$3d^7(^4P)4p$	$y\ ^5S^\circ$	2	*44 511.806*	1.888	45	38 $3d^6(a\ ^3P)4s4p(^3P^\circ)\ ^5S^\circ$
$3d^6(^5D)4s(^6D)5s$	$e\ ^5D$	4	44 677.004	1.502		
		3	45 061.327	1.508		
		2	45 333.874	1.503		
		1	45 509.150	1.518		
		0	45 595.08			
$3d^6(a\ ^3P)4s4p(^3P^\circ)$	$x\ ^3D^\circ$	3	*45 220.676*	1.352	33	32 $3d^7(^4P)4p\ ^3D^\circ$
		2	*45 281.831*	1.200	29	35 $3d^6(a\ ^3P)4s4p(^3P^\circ)\ ^5D^\circ$
		1	*45 551.763*	0.556	30	34 $3d^7(^4P)4p\ ^3D^\circ$
$3d^6(^3H)4s4p(^3P^\circ)$	$y\ ^3G^\circ$	5	*45 294.846*	1.207	52	24 $3d^7(^2G)4p\ ^3G^\circ$
		4	*45 428.397*	1.053	41	22
		3	*45 562.970*	0.765	52	21
$3d^6(a\ ^3F)4s4p(^3P^\circ)$	$x\ ^5G^\circ$	6	*45 608.31?*	1.336	61	34 $3d^6(^3H)4s4p(^3P^\circ)\ ^5G^\circ$
		5	*45 726.117*	1.269	55	36
		4	*45 833.20*	1.158	52	38
		3	*45 913.488*	0.928	51	41
		2	*45 964.959*	0.323	52	45
$3d^6(^3H)4s4p(^3P^\circ)$	$z\ ^3I^\circ$	7	*45 978.00?*	1.149	93	
		6	*46 026.94*	1.040	93	
		5	*46 135.88*	0.833	95	
$3d^7(^4P)4p$	$w\ ^5P^\circ$	3	*46 137.10*	1.658	49	35 $3d^5(^6S)4s^24p\ ^5P^\circ$
		2	*46 313.57*	1.822	46	32
		1	*46 410.40*	2.436	41	28
$3d^6(a\ ^3P)4s4p(^3P^\circ)$	$z\ ^3S^\circ$	1	*46 600.814*	1.888	41	20 $^3P^\circ$
$3d^7(^4P)4p$	$y\ ^3P^\circ$	0	*46 672.527*		36	35 $3d^6(a\ ^3P)4s4p(^3P^\circ)\ ^3P^\circ$
		2	*46 727.068*	1.444	52	25 $3d^6(a\ ^3P)4s4p(^3P^\circ)\ ^3P^\circ$
		1	*46 901.820*	1.600	30	28 $3d^7(^4P)4p\ ^3S^\circ$
$3d^6(a\ ^3F)4s4p(^3P^\circ)$	$^3F^\circ$	4	*46 720.836*	1.341	38	32 $3d^7(^2G)4p\ ^3F^\circ$
		3	*47 092.707*	1.159	45	32 $3d^7(^2G)4p\ ^3F^\circ$
		2	*47 197.014*	0.743	44	26 $3d^6(^3G)4s4p(^3P^\circ)\ ^5F^\circ$

Fe I – Continued

Configuration	Term	J	Level (cm^{-1})	g	Leading components (%)	
					First	Second
$3d^7(^4P)4p$	$^5D^\circ$	4	*46 889.143*	1.344	46	21 $3d^6(a\ ^3F)4s4p(^3P^\circ)\ ^5D^\circ$
		3	*47 017.188*	1.346	50	22
		2	*47 136.072*	1.216	39	20
		0	*47 171.48?*		51	26
		1	*47 177.225*	1.410	50	25
$3d^7(^4P)4p$	$^3D^\circ$	3	*46 744.988*	1.397	50	17 $3d^6(a\ ^3F)4s4p(^3P^\circ)\ ^3D^\circ$
		2	*46 888.510*	1.260	45	18 $3d^6(a\ ^3F)4s4p(^3P^\circ)\ ^3D^\circ$
		1	*47 272.016*	0.767	22	27 $3d^7(^4P)4p\ ^3S^\circ$
$3d^6(^3H)4s4p(^3P^\circ)$	$z\ ^3H^\circ$	6	*46 982.34*	1.200	29	33 $3d^6(^3G)4s4p(^3P^\circ)\ ^5H^\circ$
		5	*47 008.366*	1.060	33	34 $3d^7(^2G)4p\ ^3H^\circ$
		4	*47 106.477*	0.880	23	18 $3d^7(^2G)4p\ ^3H^\circ$
$3d^7(^4F)5s$	$e\ ^5F$	5	47 005.508	1.421		
		4	47 377.962	1.331		
		3	47 755.539	1.236		
		2	48 036.666	0.991		
		1	48 221.314	0.007		
$3d^6(^3G)4s4p(^3P^\circ)$	$w\ ^5G^\circ$	6	*47 363.369*	1.306	59	22 $3d^7(^2G)4p\ ^3H^\circ$
		5	*47 420.229*	1.305	76	8 $3d^7(^2G)4p\ ^3H^\circ$
		4	*47 590.047*	1.145	68	7 $3d^7(^2G)4p\ ^3F^\circ$
		3	*47 693.227*	0.931	71	8 $3d^7(^2G)4p\ ^3F^\circ$
		2	*47 831.150*	0.472	65	16 $3d^7(^2G)4p\ ^3F^\circ$
$3d^6(a\ ^3P)4s4p(^3P^\circ)$	$^1D^\circ$	2	*47 419.674*	1.137	44	10 $3d^6(a\ ^3F)4s4p(^3P^\circ)\ ^1D^\circ$
$3d^7(^2G)4p$	$z\ ^1G^\circ$	4	*47 452.716*	1.025	23	22 $3d^6(^3H)4s4p(^3P^\circ)\ ^1G^\circ$
$3d^7(^4P)4p$	$y\ ^3S^\circ$	1	*47 555.598*	1.884	26	19 $^3D^\circ$
$3d^6(^3G)4s4p(^3P^\circ)$	$v\ ^5F^\circ$	5	*47 606.094*	1.317	41	38 $^5H^\circ$
		4	*47 929.999*	1.264	62	12 $^5H^\circ$
		3	*48 122.928*	1.236	59	10 $^5H^\circ$
		2	*48 238.844*	1.267	72	7 $3d^6(^3D)4s4p(^3P^\circ)\ ^5F^\circ$
		1	*48 350.601*	0.230	64	6 $3d^6(^3D)4s4p(^3P^\circ)\ ^5F^\circ$
$3d^6(^3G)4s4p(^3P^\circ)$	$^5H^\circ$	4	*47 812.118*	1.061	38	32 $3d^6(a\ ^3F)4s4p(^3P^\circ)\ ^3G^\circ$
		3	*47 834.218*	0.668	41	30
		5	*47 834.542*	1.203	32	20
$3d^7(^4F)5s$	$e\ ^3F$	4	47 960.97	1.288		
		3	48 531.90	1.107		
		2	48 928.42	0.622		
$3d^5(^6S)4s^24p$	$v\ ^5P^\circ$	3	*47 966.59*	1.646		
		2	*48 163.438*	1.740		
		1	*48 289.865*	2.213		

Fe I—Continued

Configuration	Term	J	Level (cm^{-1})	g	Leading components (%) First	Second
$3d^6(a\ ^3F)4s4p(^3P°)$	$w\ ^3G°$	5	*48 231.270*	1.27?	34	29 $3d^6(^3G)4s4p(^3P°)\ ^5F°$
		4	*48 361.878*	0.934	36	33 $3d^6(^3G)4s4p(^3P°)\ ^5H°$
		3	*48 475.668*	0.584	30	31 $3d^6(^3G)4s4p(^3P°)\ ^5H°$
$3d^6(a\ ^3P)4s4p(^3P°)$	$x\ ^3P°$	2	*48 304.638*	1.263	40	18 $3d^7(^4P)4p\ ^3P°$
		0	*48 460.098*		30	42
		1	*48 516.135*	1.547	36	25
$3d^7(^2G)4p$	$z\ ^1H°$	5	*48 382.597*	1.018	65	8 $3d^6(^3H)4s4p(^3P°)\ ^1H°$
$3d^6(^3H)4s4p(^3P°)$	$y\ ^1G°$	4	*48 702.526*	1.063	37	11 $3d^7(^2G)4p\ ^1G°$
	2°	2	*49 052.93*			
$3d^7(^2G)4p$	$w\ ^3F°$	4	*49 108.890*	1.181	22	18 $3d^6(a\ ^3F)4s4p(^3P°)\ ^3F°$
		3	*49 242.881*	1.165	29	28
		2	*49 433.121*	0.677	44	27
$3d^6(a\ ^3F)4s4p(^3P°)$	$v\ ^3D°$	3	*49 135.022*	1.211	33	17 $3d^6(a\ ^3P)4s4p(^3P°)\ ^3D°$
		2	*49 242.593*	0.954	39	23
		1	*49 297.620*	0.562	34	20
$3d^6(a\ ^3F)4s4p(^3P°)$	$^1F°$	3	*49 227.12*		39	40 $3d^7(^2G)4p\ ^1F°$
$3d^7(^2G)4p$	$y\ ^3H°$	6	*49 434.156*	1.17?	41	37 $3d^6(^3H)4s4p(^3P°)\ ^3H°$
		5	*49 604.415*	1.075	41	23
		4	*49 726.977*	0.929	46	30
		4	*49 457.36?*			
$3d^7(^2G)4p$	$v\ ^3G°$	5	*49 460.890*	1.163	32	18 $3d^6(a^3F)4s4p(^3P°)^3G°$
		4	*49 627.877*	0.914	35	15
		3	*49 850.581*	0.763	44	22
	$z\ ^1D°$	2	*49 477.10*	0.92?		
$3d^6(^5D)4s\ (^6D)5p$	$x\ ^7P°$	4	*49 558.5*			
		3	*49 804.9*			
		2	*50 045.9*			
$3d^7(^2P)4p$	$w\ ^3P°$	0	*49 951.341*		64	7 $3d^7(^4P)4p\ ^3P°$
		1	*50 043.205*	1.389	48	12 $3d^6(a\ ^3P)4s4p(^3P°)\ ^3P°$
		2	*50 186.830*	1.469	35	13 $3d^7(^4P)4p\ ^5P°$
$3d^6(^5D)4s\ (^6D)4d$	$e\ ^7F$	6	50 342.14	1.490		
		5	50 833.428	1.505		
		3	51 148.859	1.499		
		4	51 192.270	1.617		
		1	51 207.991	2.490		
		2	51 331.044			

Fe I – Continued

Configuration	Term	J	Level (cm^{-1})	g	Leading components (%)	
					First	Second
3d^6(^{5}D)4s (^{6}D)4d	f ^{7}D	5	50 377.913	1.510		
		4	50 807.991	1.574		
		3	50 861.816			
		2	50 998.641	1.844		
		1	51 048.113			
3d^6(^{5}D)4s (^{6}D)4d	f ^{5}D	4	50 423.136	1.514		
		3	50 534.391	1.615		
		2	50 698.624	1.614		
		1	50 880.098	1.662		
		0	50 980.98			
3d^6(^{5}D)4s (^{6}D)4d	e ^{7}P	4	50 475.287	1.585		
		3	50 611.260	1.687		
		2	50 861.321			
3d^6(^{5}D)4s (^{6}D)4d	e ^{5}G	6	50 522.946	1.351		
		5	50 703.866	1.360		
		4	50 979.578	1.238		
		3	51 219.017	1.294		
		2	51 370.130	0.953		
3d^7(^{2}G)4p	z ^{1}F°	3	*50 586.874*	1.018	21	21 3d^7(a ^{2}D)4p ^{1}F°
3d^6(a ^{3}F)4s4p(^{3}P°)	x ^{1}G°	4	*50 613.972*	0.978	59	9 3d^7(^{2}H)4p ^{1}G°
3d^6(^{5}D)4s (^{6}D)4d	e ^{7}G	7	50 651.72?			
		6	50 967.826	1.415		
		5	51 228.555	1.379		
		4	51 334.909	1.338		
		3	51 460.516	1.244		
		2	51 539.712			
		1	51 566.82	−0.374		
3d^6(^{5}D)4s (^{6}D)5p	u ^{5}F°	5	*51 016.72?*			
		4	*51 381.48*			
		3	*51 619.14?*			
		2	*51 827.59?*			
		1	*51 945.86?*			
3d^6(^{3}G)4s4p(^{3}P°)	x ^{3}H°	6	*51 023.152*	1.161	77	17 3d^6(^{3}H)4s4p(^{3}P°) ^{3}H°
		5	*51 068.710*	1.038	56	11 3d^6(^{3}H)4s4p(^{3}P°) ^{1}H°
		4	*51 409.117*	0.953	40	14 3d^7(^{2}H)4p ^{3}G°
3d^6(^{5}D)4s (^{6}D)5p	t ^{5}D°	4	*51 076.68*	1.486		
		3	*51 361.46*			
		2	*51 630.07?*			
		1	*51 836.87?*			
		0	*51 941.76?*			

Fe I – Continued

Configuration	Term	J	Level (cm^{-1})	g	Leading components (%)	
					First	Second
$3d^6(^5D)4s\ (^6D)4d$	$f\ ^5F$	5	51 103.187	1.384		
		4	51 461.672	1.355?		
		3	51 604.102			
		2	51 705.007	0.967		
		1	51 754.490			
$3d^6(^5D)4s\ (^6D)4d$	$e\ ^5S$	2	51 148.883	1.952		
$3d^7(a\ ^2D)4p$	$v\ ^3F^\circ$	2	*51 201.284*	0.803	25	19 $3d^6(^3G)4s4p(^3P^\circ)\ ^3F^\circ$
		4	*51 304.603*	1.122	31	24
		3	*51 365.308*	1.096	30	23
$3d^6(^5D)4s\ (^4D)5s$	$e\ ^3D$	3	51 294.222	1.345		
		2	51 739.920	1.125		
		1	52 039.886	0.801		
$3d^6(^5D)4s\ (^4D)5s$	$g\ ^5D$	4	51 350.491	1.487		
		3	51 770.554	1.492		
		2	52 049.814	1.57?		
		1	52 214.336			
		0	52 257.33			
$3d^6(^3G)4s4p(^3P^\circ)$	$u\ ^3G^\circ$	5	*51 373.909*	1.140	19	19 $3d^6(^3H)4s4p(^3P^\circ)\ ^1H^\circ$
		4	*51 668.189*	1.067	24	23 $3d^7(^2H)4p\ ^3G^\circ$
		3	*51 825.773*	0.801	41	36 $3d^7(^2H)4p\ ^3G^\circ$
	5°	3	*51 435.90?*			
$3d^6(^5D)4s\ (^6D)4d$	$e\ ^7S$	3	51 570.084	1.92?		
$3d^6(^3H)4s4p(^3P^\circ)$	$^1H^\circ$	5	*51 630.172*	1.061	30	24 $3d^7(^2H)4p\ ^3G^\circ$
$3d^6(^5D)4s\ (^6D)5p$	$u\ ^5P^\circ$	3	*51 691.98?*			
		2	*51 945.31?*			
		1	*52 110.30?*	2.633		
$3d^6(a\ ^3F)4s4p(^3P^\circ)$	$y\ ^1D^\circ$	2	*51 708.309*	1.025	36	29 $3d^7(a\ ^2D)4p\ ^1D^\circ$
	7°	2	*51 756.16*			
$3d^7(^2P)4p$	$x\ ^1D^\circ$	2	*51 762.067*	0.883	32	19 $3d^6(a\ ^3P)4s4p(^3P^\circ)\ ^1D^\circ$
$3d^6(^5D)4s\ (^6D)4d$	$e\ ^5P$	3	51 837.24	1.664		
		1	52 019.67	2.432		
		2	52 067.460			
$3d^7(^2P)4p$	$u\ ^3D^\circ$	3	*51 969.079*	1.306	63	15 $3d^6(a\ ^3F)4s4p(^1P^\circ)\ ^3D^\circ$
		2	*52 296.899*	1.156	46	39
		1	*52 512.445*	0.700	47	25
$3d^7(^2P)4p$	$^1P^\circ$	1?	*52 180.804*	0.801	41	15 $3d^7(a\ ^2D)4p\ ^3D^\circ$

Fe I—Continued

Configuration	Term	J	Level (cm^{-1})	g	Leading components (%)	
					First	Second
$3d^7(a\ ^2D)4p$	$^3D°$	3	*52 213.226*	1.317	72	15 $3d^6(a\ ^3F)4s4p(^1P°)\ ^3D°$
		2	*52 682.915*	1.145	59	14 $3d^7(^2P)4p\ ^3D°$
		1	*53 229.942*	1.266	33	10 $3d^7(^2P)4p\ ^3S°$
$3d^7(^2H)4p$	$w\ ^3H°$	6	*52 431.418*	1.177	62	21 $3d^6(^3H)4s4p(^1P°)\ ^3H°$
		5	*52 613.084*	1.033	60	18
		4	*52 768.721*	0.810	59	17
$3d^7(^2H)4p$	$y\ ^3I°$	6	*52 513.549*	1.019	61	27 $^1I°$
		7	*52 655.00?*	1.147	88	8 $3d^6(^1I)4s4p(^3P°)\ ^3I°$
		5	*52 898.971*	0.830	85	9 $3d^6(^1I)4s4p(^3P°)\ ^3I°$
$3d^7(a\ ^2D)4p$	$^3P°$	1	*52 857.790*	1.246	21	13 $3d^6(a\ ^3P)4s4p(^1P°)\ ^3P°$
		2	*52 916.292*	1.495	55	25
	$s\ ^3D°$	3	*52 953.68?*	1.231		
$3d^7(^4F)4d$	$g\ ^5F$	5	53 061.24			
		4	53 393.68			
		3	53 830.973			
		2	54 257.505			
		1	54 386.189			
$3d^7(^2H)4p$	$z\ ^1I°$	6	*53 093.521*	1.010	61	25 $^3I°$
$3d^7(^4F)4d$	$h\ ^5D$	4	53 155.09	1.435		
		3	53 545.847			
		2	53 966.68			
		1	54 132.550			
$3d^7(^4F)4d$	$f\ ^5P$	3	53 160.49			
		2	53 568.68			
		1	53 925.22			
$3d^7(^4F)4d$	$f\ ^5G$	6	53 169.17	1.323		
		5	53 281.70	1.221		
		4	53 768.969			
		3	54 161.132	1.142		
		2	54 375.68			
$3d^7(^4F)4d$	$e\ ^5H$	7	53 275.16?	1.30?		
		6	53 352.98?	1.191		
		5	53 874.26?	1.102		
		4	54 237.16	0.90?		
		3	54 491.04	0.484		

Fe I – Continued

Configuration	Term	J	Level (cm^{-1})	g	Leading components (%) First	Second
$3d^6(^3D)4s4p(^3P^\circ)$	$^5F^\circ$	2	*53 275.23*		84	11 $3d^6(^3G)4s4p(^3P^\circ)$ $^5F^\circ$
		5	*54 013.747*	1.356	87	9
	9°	4	*53 328.87*			
		3	*53 357.53*			
		3	*53 388.68?*			
		4	*53 610.44*			
$3d^7(a\ ^2D)4p$	$y\ ^1F^\circ$	3	*53 661.09*	1.21?	39	17 $3d^7(^2G)4p$ $^1F^\circ$
$3d^6(^3G)4s4p(^3P^\circ)$	$y\ ^1H^\circ$	5	*53 722.40*	1.03?	77	17 $3d^6(^3H)4s4p(^3P^\circ)$ $^1H^\circ$
		3	*53 733.51*			
$3d^7(^4F)4d$	$e\ ^3G$	5	53 739.433	1.248		
		4	54 066.53	1.096		
		3	54 379.40	0.842		
$3d^7(^4F)4d$	$f\ ^3D$	3	53 747.51	1.258		
		2	54 066.758			
		1	54 449.29			
		2	*53 749.39*			
$3d^6(^3G)4s4p(^3P^\circ)$	$x\ ^3F^\circ$	3	*53 763.272*	1.079	30	27 $3d^7(a\ ^2D)4p$ $^3F^\circ$
		3	*53 784.74*			
$3d^6(^5D)4s\ (^6D)6s$	$g\ ^7D$	5	53 800.90	1.586		
		4	54 124.741	1.65?		
		3	54 413.74?			
		2	54 611.703			
		1	54 747.74?			
$3d^7(^2P)4p$	$^3S^\circ$	1	*53 808.353*	1.418	17	18 $3d^7(a\ ^2D)4p$ $^3P^\circ$
$3d^7(^4F)4d$	$e\ ^3H$	6	53 840.64?	1.225		
		5	54 266.72?	1.109		
		4	54 555.41?	0.871		
		4	*53 881.91*			
$3d^6(^3D)4s4p(^3P^\circ)$	$^5D^\circ$	3	*53 891.520*	1.476	74	12 $^5P^\circ$
		4	*54 301.334*		88	7 $3d^6(a\ ^3F)4s4p(^3P^\circ)$ $^5D^\circ$
$3d^7(^2H)4p$	$t\ ^3G^\circ$	5	*53 983.284*	1.234	37	37 $3d^6(^3G)4s4p(^3P^\circ)$ $^3G^\circ$
		4	*54 237.415*	1.183	36	31
		3	*54 600.346*	0.922	33	25

Fe I – Continued

Configuration	Term	J	Level (cm^{-1})	g	Leading components (%)	
					First	Second
$3d^6(^3D)4s4p(^3P^\circ)$	$^5P^\circ$	3	*54 004.78*		69	12 $^5D^\circ$
		2	*54 112.218*	1.70?	78	10 $3d^7(^4P)4p\ ^5P^\circ$
		1	*54 271.057*		69	10 $3d^7(^4P)4p\ ^5P^\circ$
		3	*54 289.09*			
		3	*54 357.40*			
$3d^7(^4F)4d$	$f\ ^3F$	4	54 683.35	1.141		
		3	55 124.93	1.071		
		2	55 378.80	0.676		
$3d^6(^3G)4s4p(^3P^\circ)$	$w\ ^1G^\circ$	4	*54 810.841*	1.001	42	25 $3d^7(^2H)4p\ ^1G^\circ$
$3d^7(^4F)4d$	$e\ ^3P$	2	54 879.68	1.459		
		1	55 376.08	1.459		
		0	55 726.50?			
$3d^6(a\ ^1G)4s4p(^3P^\circ)$	$v\ ^3H^\circ$	5	*55 429.815*	1.057	82	5 $3d^6(^1I)4s4p(^3P^\circ)\ ^3H^\circ$
		4	*55 446.000*	0.804	85	5
		6	*55 489.77*	1.169	82	8
$3d^7(^2H)4p$	$x\ ^1H^\circ$	5	*55 525.54*	1.018	59	13 $3d^6(a\ ^1G)4s4p(^3P^\circ)\ ^3G^\circ$
$3d^7(a\ ^2D)4p$	$w\ ^1D^\circ$	2	*55 754.239*	0.990	56	15 $3d^7(^2P)4p\ ^1D^\circ$
$3d^6(^3G)4s4p(_3P^\circ)$	$w\ ^1F^\circ$	3	*55 790.673*	0.908	61	13 $3d^6(a\ ^3F)4s4p(^3P^\circ)\ ^1F^\circ$
$3d^6(a\ ^1G)4s4p(^3P^\circ)$	$s\ ^3G^\circ$	4	*55 905.538*		76	6 $3d^6(^3G)4s4p(^1P^\circ)\ ^3G^\circ$
		5	*55 907.171*	1.145	66	15 $3d^7(^2H)4p\ ^1H^\circ$
		3	*56 097.829*	0.857	73	6 $3d^6(^3G)4s4p(^1P^\circ)\ ^3G^\circ$
$3d^6(^1I)4s4p(^3P^\circ)$	$u\ ^3H^\circ$	6	*56 333.957*	1.166	63	13 $3d^6(^3H)4s4p(^1P^\circ)\ ^3H^\circ$
		5	*56 382.662*	1.029	62	12 $3d^6(^3H)4s4p(^1P^\circ)\ ^3H^\circ$
		4	*56 423.279*	0.859	35	21 $3d^6(a\ ^1G)4s4p(^3P^\circ)\ ^3F^\circ$
$3d^6(^5D)4s\ (^6D)5d$	1	5	56 428.06			
$3d^6(^5D)4s\ (^6D)5d$	2	4,5	56 452.04			
$3d^6(a\ ^1G)4s4p(^3P^\circ)$	$u\ ^3F^\circ$	4	*56 592.699*	1.148	34	26 $3d^6(^1I)4s4p(^3P^\circ)\ ^3H^\circ$
		3	*56 783.317*	1.077	55	19 $3d^7(a\ ^2D)4p\ ^3F^\circ$
		2	*56 858.659*	0.687	30	23 $3d^6(^3D)4s4p(^3P^\circ)\ ^3P^\circ$
$3d^6(^5D)4s\ (^6D)5d$	3	4	56 842.70			
$3d^7(^2H)4p$	$v\ ^1G^\circ$	4	*56 951.286*	1.053	41	27 $3d^6(^3G)4s4p(^3P^\circ)\ ^1G^\circ$
$3d^6(^1I)4s4p(^3P^\circ)$	$x\ ^3I^\circ$	7	*57 027.52?*	1.145	86	5 $3d^7(^2H)4p\ ^3I^\circ$
		6	*57 070.21*	1.028	86	6
		5	*57 104.22*	0.832	85	7

Fe I – Continued

Configuration	Term	J	Level (cm^{-1})	g	Leading components (%)	
					First	Second
$3d^6(^3D)4s4p(^3P^\circ)$	$t\ ^3F^\circ$	4	*57 550.000*	1.235	65	8 $3d^6(^3G)4s4p(^1P^\circ)\ ^3F^\circ$
		3	*57 641.000*		61	8 $3d^6(^3G)4s4p(^1P^\circ)\ ^3F^\circ$
		2	*57 708.747*	0.698	59	9 $3d^7(^2F)4p\ ^3F^\circ$
		3	*57 565.35?*			
$3d^6(^5D)4s\ (^4D)4d$	$i\ ^5D$	4	57 697.55	1.384		
		3	57 813.940	1.415		
		2	57 974.129			
$3d^6(^5D)4s\ (^6D)7s$	$h\ ^7D$	5	57 897.17			
	$r\ ^3G^\circ$	5	*59 926.62?*	1.190		
		4	*60 172.06*	1.030		
		3	*60 364.76?*	0.780		
$3d^6(^5D)4s\ (^4D)4d$	$g\ ^5G$	6	58 001.84	1.40?		
		5	58 271.46?			
		4	58 520.14?			
		3	58 710.05?			
		2	58 824.77	0.343		
$3d^6(^5D)4s\ (^4D)4d$	4	2	58 213.121			
	$t\ ^3H^\circ$	6	*60 365.70?*	1.163		
		5	*60 549.18*	1.040		
		4	*60 757.68*	0.805		
		3	*60 563.61*			
	$q\ ^3G^\circ$	5	*60 677.23?*			
		4	*60 754.71?*			
		3	*60 806.654*			
		2	*62 081.27?*			
Fe II ($^6D_{9/2}$)	***Limit***	....	**63 480**			

Fe II

25 electrons $Z = 26$

Ground state: $1s^22s^22p^63s^23p^63d^64s\ ^6D_{9/2}$

Ionization energy = 130 524 cm^{-1} (16.1830 eV)

Much of the present list of Fe II energy levels is taken from the original AEL compilation [1]. This compilation was based on the 1935 and 1938 papers of Dobbie [2,3] and extensive unpublished material of Edlén. A number of miscellaneous high levels were taken from the work of Green [4]. The g-values were derived by Weeks especially for AEL and have not been published elsewhere.

In 1953, Sales [5] published a list of 36 new levels of Fe II. However, 28 of these had been found independently by Edlén and were given in the original AEL. The present list contains the eight levels of Sales not previously compiled. Several of the designations given by Sales have been dropped due to conflict with the designations of Edlén. We have used Dobbie's original values for the even levels found by both him and Green at 82 978 cm^{-1}, 83 136 cm^{-1}, and 83 308 cm^{-1}, since Dobbie's level values were derived from longer wavelength transitions than those of Green. The configuration for the term $y^6P°$ at 61 975.11 cm^{-1} has been changed from $3d^6(^7S)4p$ to $3d^54s4p$ according to the suggestion of Roth [6]. We have designated the $3d^54s4p$ levels in a $3d^5(L_1S_1)\ 4s4p(L_2S_2)$, LSJ coupling scheme, because this was found to be the best scheme by Roth for the similar configuration in Fe I, $3d^64s4p$.

Johansson and Litzén [7] have recently investigated this spectrum in the region 4800–11 500 Å. Their observations have yielded the complete set of $3d^6(^5D)4f$ levels as well as a number of new $3d^64d$ levels. They have also revised the energies and designations of several levels of the $3d^64d$ group. The designations of the $3d^64f$ levels are given in $J_1\ell$-coupling.

The $3d^7$, $3d^64s$, and $3d^54s^2$ configurations have been treated theoretically by Shadmi, Oreg, and Stein [8], who confirmed all of the previous designations given in AEL. We have assigned seniorities to the $3d^6$ and $3d^7$ parent terms by use of the theoretical treatment of the $3d^64s4p$ and $3d^74p$ configurations in Fe I by Roth [6]. The $3d^64p$ configuration was treated by Roth [9], who suggested several changes in level designations. Roth's percentage compositions for the $3d^64p$ configuration are given in the present table. Roth distinguished repeating terms of $3d^n$ by the letters a, b . . . rather than by seniority. Each of his percentages for a given level is the sum of the percentages of states that are identical except for the seniority of the core term.

The alphabetic prefixing of terms with lower case letters, which served to distinguished terms of the same type, has been repeated here from the literature except for levels that have been redesignated as a result of a new theoretical interpretation. Similarly, the authors' numerical designations for uninterpreted levels have been retained.

The ionization energy was derived by Russell [10] from the $3d^6(^5D)4s$ and $5s$ levels.

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Fe II

Configuration	Term	J	Level (cm^{-1})	g	Leading components (%)	
					First	Second
$3d^6(^5D)4s$	$a\ ^6D$	9/2	0.00	1.58		
		7/2	384.77	1.58		
		5/2	667.64	1.655		
		3/2	862.63	1.862		
		1/2	977.03	3.31		

Fe II – Continued

Configuration	Term	J	Level (cm^{-1})	g	Leading components (%)	
					First	Second
$3d^7$	$a\ ^4$F	9/2	1872.60	1.33		
		7/2	2430.08	1.223		
		5/2	2837.94	1.02		
		3/2	3117.48	0.385		
$3d^6(^5$D$)4s$	$a\ ^4$D	7/2	7955.24	1.419		
		5/2	8391.92	1.365		
		3/2	8680.47	1.200		
		1/2	8846.76	−0.05		
$3d^7$	$a\ ^4$P	5/2	13 474.43	1.609		
		3/2	13 673.21	1.737		
		1/2	13 904.87	2.67		
$3d^7$	$a\ ^2$G	9/2	15 844.71			
		7/2	16 369.39			
$3d^7$	$a\ ^2$P	3/2	18 360.65	1.28		
		1/2	18 886.75			
$3d^7$	$a\ ^2$H	11/2	20 340.36			
		9/2	20 805.83	0.92		
$3d^7$	$a\ ^2$D2	5/2	20 516.98	1.22		
		3/2	21 308.08			
$3d^6(^3$P2$)4s$	$b\ ^4$P	5/2	20 830.52	1.583		
		3/2	21 812.04	1.720		
		1/2	22 409.82	2.68		
$3d^6(^3$H$)4s$	$a\ ^4$H	13/2	21 251.55	1.20		
		11/2	21 430.39	1.119		
		9/2	21 581.64	0.951		
		7/2	21 711.89	0.661		
$3d^6(^3$F2$)4s$	$b\ ^4$F	9/2	22 637.19	1.307		
		7/2	22 810.33	1.210		
		5/2	22 939.35	1.019		
		3/2	23 031.30	0.398		
$3d^54s^2$	$a\ ^6$S	5/2	23 317.60	1.996		
$3d^6(^3$G$)4s$	$a\ ^4$G	11/2	25 428.80	1.237		
		9/2	25 805.32	1.15		
		7/2	25 981.65	0.98		
		5/2	26 055.40	0.574		
$3d^6(^3$P2$)4s$	$b\ ^2$P	3/2	25 787.60	1.33		
		1/2	26 932.74	0.67		

Fe II – Continued

Configuration	Term	J	Level (cm⁻¹)	g	Leading components (%)	
					First	Second
$3d^6(^3H)4s$	$b\ ^2H$	11/2	26 170.19	1.09		
		9/2	26 352.80	0.927		
$3d^6(^3F2)4s$	$a\ ^2F$	7/2	27 314.93	1.129		
		5/2	27 620.39	0.851		
$3d^6(^3G)4s$	$b\ ^2G$	9/2	30 388.55	1.10		
		7/2	30 764.46	0.898		
$3d^6(^3D)4s$	$b\ ^4D$	3/2	31 364.47			
		1/2	31 368.45			
		5/2	31 387.98	1.327		
		7/2	31 483.20	1.41		
$3d^7$	$b\ ^2F$	5/2	31 811.87	0.86		
		7/2	31 999.12	1.124		
$3d^6(^1I)4s$	$a\ ^2I$	13/2	32 875.63	1.062		
		11/2	32 909.87	0.92		
$3d^6(^1G2)4s$	$c\ ^2G$	9/2	33 466.50	1.099		
		7/2	33 501.32	0.88		
$3d^6(^3D)4s$	$b\ ^2D$	3/2	36 126.41	0.799		
		5/2	36 252.96	1.179		
$3d^6(^1S)4s$	$a\ ^2S$	1/2	37 227.32	2.06		
$3d^6(^1D2)4s$	$c\ ^2D$	5/2	38 164.24	1.176		
		3/2	38 214.50	0.79		
$3d^6(^5D)4p$	$z\ ^6D^\circ$	9/2	*38 458.99*	1.542	99	
		7/2	*38 660.04*	1.584	98	
		5/2	*38 858.96*	1.653	98	
		3/2	*39 013.28*	1.86	99	
		1/2	*39 109.34*	3.35	100	
$3d^6(^5D)4p$	$z\ ^6F^\circ$	11/2	*41 968.11*		100	
		9/2	*42 114.79*	1.43	97	
		7/2	*42 237.05*	1.399	97	
		5/2	*42 334.86*	1.304	98	
		3/2	*42 401.33*	1.04	98	
		1/2	*42 439.88*	−0.647	99	
$3d^6(^5D)4p$	$z\ ^6P^\circ$	7/2	*42 658.23*	1.702	96	
		5/2	*43 238.61*	1.869	98	
		3/2	*43 620.98*	2.398	99	
$3d^6(^5D)4p$	$z\ ^4F^\circ$	9/2	*44 232.51*	1.32	97	
		7/2	*44 753.82*	1.29	91	6 $(^5D)\ ^4D^\circ$
		5/2	*45 079.91*	1.069	93	
		3/2	*45 289.84*	0.445	96	

Fe II – Continued

Configuration	Term	J	Level (cm⁻¹)	g	Leading components (%)	
					First	Second
$3d^6(^5D)4p$	$z\ ^4D°$	7/2	*44 446.89*	1.40	89	6 $(^5D)\ ^4F°$
		5/2	*44 784.78*	1.35	91	
		3/2	*45 044.21*	1.15	94	
		1/2	*45 206.49*	−0.021	96	
$3d^6(^1F)4s$	$c\ ^2F$	7/2	44 915.07			
		5/2	44 929.59			
$3d^6(^5D)4p$	$z\ ^4P°$	5/2	*46 967.47*	1.592	98	
		3/2	*47 389.82*	1.717	99	
		1/2	*47 626.14*	2.70	99	
$3d^7$	$d\ ^2D1$	3/2	47 674.78			
		5/2	48 039.23			
$3d^6(^3P1)4s$	$c\ ^4P$	1/2	49 101.09			
		3/2	49 506.99			
		5/2	50 212.93			
$3d^6(^3F1)4s$	$c\ ^4F$	3/2	50 076.10			
		5/2	50 142.93			
		7/2	50 187.95			
		9/2	50 157.61			
$3d^6(^3P1)4s$	$c\ ^2P$	1/2	54 063.53			
		3/2	54 902.42			
$3d^5(^6S)4s4p(^3P°)$	$z\ ^8P°$	5/2,7/2	*54 490.2*			
$3d^6(^3F1)4s$	$d\ ^2F$	5/2	54 870.62			
		7/2	54 904.50			
$3d^6(^1G1)4s$	$d\ ^2G$	9/2	58 631.65			
		7/2	58 666.36			
$3d^6(a\ ^3P)4p$	$z\ ^4S°$	3/2	*59 663.45*	1.89	63	35 $(a\ ^3P)\ ^4P°$
$3d^54s^2$	$c\ ^4D$	7/2	60 270.37			
		1/2	60 384.46			
		3/2	60 441.05			
		5/2	60 445.28			
$3d^6(a\ ^3P)4p$	$y\ ^4P°$	5/2	*60 402.38*	1.58	76	18 $(a\ ^3P)\ ^4D°$
		1/2	*61 035.37*	2.613	93	
		3/2	*61 332.82*	1.74	38	32 $(a\ ^3P)\ ^4S°$
$3d^6(^3H)4p$	$z\ ^4G°$	11/2	*60 625.47*	1.24	53	33 $(a\ ^3F)\ ^4G°$
		9/2	*60 807.28*	1.155	34	32
		7/2	*60 956.82*	0.969	41	44
		5/2	*61 041.78*	0.799	43	50

Fe II – Continued

Configuration	Term	J	Level (cm^{-1})	g	Leading components (%)	
					First	Second
$3d^6(^3H)4p$	$^4I^\circ$	13/2	*60 837.59*		64	26 $(^3H)\ ^4H^\circ$
		11/2	*60 887.66*		60	24
		9/2	*60 989.48*		56	16
		15/2	*61 347.44*		100	
$3d^6(a\ ^3P)4p$	$z\ ^2D^\circ$	5/2	*61 093.44*	1.01	67	12 $(a\ ^3P)\ ^4P^\circ$
		3/2	*62 125.66*	1.019	44	17 $(a\ ^3P)\ ^4D^\circ$
$3d^6(^3H)4p$	$^4H^\circ$	7/2	*61 156.90*	0.720	68	9 $(^3H)\ ^2G^\circ$
		9/2	*61 512.67*		55	27 $(^3H)\ ^4I^\circ$
		13/2	*61 527.59*		64	29 $(^3H)\ ^4I^\circ$
		11/2	*61 587.24*		61	31 $(^3H)\ ^4I^\circ$
$3d^6(a\ ^3P)4p$	$y\ ^4D^\circ$	7/2	*61 726.09*	1.411	96	
		5/2	*62 689.96*	1.349	70	15 $(a\ ^3P)\ ^2D^\circ$
		1/2	*62 829.16*		92	
		3/2	*62 962.26*	1.14	57	26 $(a\ ^3P)\ ^2D^\circ$
$3d^5(^6S)4s4p(^3P^\circ)$	$y\ ^6P^\circ$	3/2	*61 975.11*			
		5/2	*62 049.17*			
		7/2	*62 171.76*	1.68		
$3d^6(a\ ^3F)4p$	$y\ ^4F^\circ$	7/2	*62 065.57*	1.198	86	6 $(^3H)\ ^4H^\circ$
		5/2	*62 151.61*	1.025	82	5 $(^3D)\ ^4F^\circ$
		9/2	*62 158.19*	1.33	86	4 $(^3D)\ ^4F^\circ$
		3/2	*62 244.57*	0.43	83	6 $(^3D)\ ^4F^\circ$
$3d^6(^3H)4p$	$z\ ^2G^\circ$	9/2	*62 083.17*	1.097	65	16 $(^3G)\ ^2G^\circ$
		7/2	*62 322.50*		49	12
$3d^6(^3H)4p$	$z\ ^2I^\circ$	13/2	*62 293.20*	1.069	93	
		11/2	*62 662.30*	0.910	94	
$3d^6(a\ ^3F)4p$	$x\ ^4D^\circ$	7/2	*62 945.12*	1.385	76	7 $(^3D)\ ^4D^\circ$
		5/2	*63 273.03*	1.351	84	8
		3/2	*63 465.19*	1.21	87	8
		1/2	*63 559.56*	0.013	87	8
$3d^6(a\ ^3F)4p$	$y\ ^4G^\circ$	11/2	*63 876.38*	1.24	62	32 $(^3H)\ ^4G^\circ$
		9/2	*63 948.84*	1.15	48	34
		7/2	*64 040.96*	0.975	43	36
		5/2	*64 087.50*	0.617	37	36
$3d^6(a\ ^3F)4p$	$z\ ^2F^\circ$	7/2	*64 286.44*	1.135	53	11 $(^3G)\ ^2F^\circ$
		5/2	*64 425.46*	0.82	52	15 $(^3H)\ ^4G^\circ$
$3d^6(a\ ^3P)4p$	$z\ ^2P^\circ$	1/2	*64 806.52*		66	24 $(a\ ^3P)\ ^2s^\circ$
		3/2	*64 834.12*	1.329	89	
$3d^6(a\ ^3F)4p$	$y\ ^2G^\circ$	9/2	*64 832.00*	1.101	75	6 $(^3G)\ ^2H^\circ$
		7/2	*65 109.71*	0.896	79	5 $(a\ ^3F)\ ^2F^\circ$

Fe II – Continued

Configuration	Term	J	Level (cm^{-1})	g	Leading components (%) First	Second
$3d^6(^3H)4p$	$z\ ^2H^\circ$	11/2	*65 363.66*	1.066	23	32 $(^3G)\ ^2H^\circ$
		9/2	*65 556.34*	0.913	52	29
$3d^6(^3G)4p$	$x\ ^4G^\circ$	11/2	*65 580.09*		60	22 $(^3H)\ ^2H^\circ$
		9/2	*65 696.11*		61	28 $(^3G)\ ^4F^\circ$
		7/2	*65 931.46*	1.00	78	11 $(^3G)\ ^4F^\circ$
		5/2	*66 078.34*	0.62	83	6 $(a\ ^3F)\ ^2F^\circ$
$3d^6(^3G)4p$	$x\ ^4F^\circ$	9/2	*66 012.83*		54	26 $(^3G)\ ^4G^\circ$
		7/2	*66 377.37*	1.21	68	11 $(^3G)\ ^4G^\circ$
		5/2	*66 522.32*	1.02	67	11 $(a\ ^3F)\ ^2D^\circ$
		3/2	*66 612.74*		69	11 $(a\ ^3F)\ ^2D^\circ$
$3d^6(a\ ^3P)4p$	$z\ ^2S^\circ$	1/2	*66 248.67*		75	21 $(a\ ^3P)\ ^2P^\circ$
$3d^6(^3G)4p$	$y\ ^4H^\circ$	13/2	*66 411.70*		89	9 $(^3H)\ ^4H^\circ$
		11/2	*66 463.59*	1.13	75	11 $(^3H)\ ^2H^\circ$
		9/2	*66 589.17*	0.959	79	8 $(^3H)\ ^4H^\circ$
		7/2	*66 672.39*	0.69	82	11 $(^3H)\ ^4H^\circ$
$3d^6(a\ ^3F)4p$	$y\ ^2D^\circ$	5/2	*67 000.63*	1.16	75	8 $(^3G)\ ^4F^\circ$
		3/2	*67 273.86*	0.719	69	14 $(a\ ^3P)\ ^2D^\circ$
$3d^6(^3G)4p$	$y\ ^2H^\circ$	11/2	*67 516.37*	1.07	52	40 $(^3H)\ ^2H^\circ$
		9/2	*68 000.82*	0.907	56	36
$3d^5(^6S)4s4p(^3P^\circ)$	$x\ ^4P^\circ$	5/2	*69 102.69*			
		3/2	*69 302.35*			
		1/2	*69 427.27*			
$3d^6(^3G)4p$	$y\ ^2F^\circ$	7/2	*69 606.64*	1.13	59	13 $(a\ ^3F)\ ^2F^\circ$
		5/2	*69 650.54*	0.857	61	15 $(^3D)\ ^2F^\circ$
$3d^6(^3G)4p$	$x\ ^2G^\circ$	9/2	*70 314.74*	1.11	77	18 $(^3H)\ ^2G^\circ$
		7/2	*70 523.73*	0.87	69	14
$3d^6(^1I)4p$	$z\ ^2K^\circ$	13/2	*70 986.69*		99	
		15/2	*71 432.75*	1.05	100	
$3d^6(^3D)4p$	$w\ ^4P^\circ$	5/2	*71 964.81*		92	
		3/2	*72 043.21*	1.66	78	9 $(^3D)\ ^4D^\circ$
		1/2	*72 213.10*		73	17
$3d^6(a\ ^1G)4p$	$x\ ^2H^\circ$	9/2	*72 130.44*	0.91	83	10 $(^1I)\ ^2H^\circ$
		11/2	*72 261.83*	1.08	78	18
$3d^6(^3D)4p$	$w\ ^4F^\circ$	3/2	*72 169.15*		77	15 $(^3G)\ ^4F^\circ$
		5/2	*72 238.63*		78	14
		7/2	*72 352.17*		72	12
		9/2	*72 650.63*		85	11

Fe II – Continued

Configuration	Term	J	Level (cm^{-1})	g	Leading components (%)	
					First	Second
$3d^6(^3D)4p$	$w\ ^4D°$	1/2	*72 429.74*		57	23 $(^3D)\ ^4P°$
		3/2	*72 524.62*		69	13 $(^3D)\ ^4P°$
		5/2	*72 619.61*		82	8 $(a\ ^3F)\ ^4D°$
		7/2	*72 651.91*		50	19 $(a\ ^1G)\ ^2F°$
$3d^6(a\ ^1G)4p$	$x\ ^2F°$	7/2	*73 016.33*		31	25 $(^3D)\ ^4D°$
		5/2	*73 054.97*		44	32 $(^3D)\ ^2F°$
$3d^6(a\ ^1G)4p$	$w\ ^2G°$	9/2	*73 091.70*		87	4 $(^3H)\ ^2G°$
		7/2	*73 143.48*	0.91	69	12 $(^3D)\ ^4D°$
$3d^6(^3D)4p$	$y\ ^2P°$	1/2	*73 187.46*		63	15 $(^3D)\ ^4D°$
		3/2	*73 189.16*		68	15 $(a\ ^1S)\ ^2P°$
$3d^6(^1I)4p$	$w\ ^2H°$	11/2	*73 603.53*		63	20 $(b\ ^1G)\ ^2H°$
		9/2	*73 751.34*		79	12
$3d^6(^1I)4p$	$y\ ^2I°$	13/2	*73 966.94*		99	
		11/2	*73 969.71*		89	9 $(^1I)\ ^2H°$
$3d^6(^3D)4p$	$x\ ^2D°$	3/2	*74 498.15*		93	
		5/2	*74 606.97*		93	
$3d^6(^3D)4p$	$w\ ^2F°$	7/2	*75 600.93*	1.125	55	32 $(a\ ^1G)\ ^2F°$
		5/2	*75 915.21*	0.844	49	40
$3d^6(a\ ^1S)4p$	$x\ ^2P°$	3/2	*76 129.58*	1.34	62	23 $(a\ ^1D)\ ^2P°$
		1/2	*76 577.50*		66	17 $(^3D)\ ^2P°$
$3d^6(a\ ^1D)4p$	$v\ ^2F°$	5/2	*77 742.78*		79	6 $(a\ ^1D)\ ^2D°$
		7/2	*78 137.53*	1.13	85	8 $(a\ ^1G)\ ^2F°$
$3d^6(^5D)5s$	$e\ ^6D$	9/2	77 861.47			
		7/2	78 237.54			
		5/2	78 525.27			
		3/2	78 725.61			
		1/2	78 843.72			
$3d^6(a\ ^1D)4p$	$w\ ^2D°$	3/2	*78 487.25*		63	19 $(a\ ^1D)\ ^2P°$
		5/2	*78 690.98*		80	11 $(^1F)\ ^2D°$
$3d^6(a\ ^1D)4p$	$w\ ^2P°$	1/2	*78 841.97*		84	10 $(a\ ^1S)\ ^2P°$
		3/2	*79 243.73*		51	26 $(a\ ^1D)\ ^2D°$
$3d^5(^6S)4s4p(^1P°)$	$x\ ^6P°$	3/2	*79 246.13*			
		5/2	*79 285.10*			
		7/2	*79 331.49*			

Fe II – Continued

Configuration	Term	J	Level (cm^{-1})	g	Leading components (%)	
					First	Second
$3d^6(^5D)5s$	$e\ ^4D$	7/2	79 439.30			
		5/2	79 885.32			
		3/2	80 177.87			
		1/2	80 345.91			
	^2P	1/2	81 221.6			
		3/2	81 438.3			
$3d^6(^5D)4d$	$e\ ^6F$	11/2	82 853.61			
		9/2	82 978.63			
		7/2	83 136.46			
		5/2	83 308.17			
		3/2	83 459.66			
		1/2	83 558.53			
$3d^6(^1F)4p$	$v\ ^2G°$	7/2	*83 305.37*		94	
		9/2	*83 871.31*		96	
$3d^6(^5D)4d$	^6D	7/2	83 713.51			
		9/2	83 726.31			
		5/2	83 812.29			
		3/2	83 990.03			
		1/2	84 131.54			
$3d^6(^1F)4p$	$v\ ^2D°$	5/2	*83 868.65*		80	13 $(a\ ^1D)\ ^2D°$
		3/2	*84 359.90*		85	8
$3d^6(^5D)4d$	$e\ ^6G$	13/2	84 035.06			
		11/2	84 296.77	1.33		
		9/2	84 527.74			
		7/2	84 710.66			
		5/2	84 844.81			
		3/2	84 938.18			
$3d^6(^5D)4d$	^6P	7/2	84 266.52			
		5/2	84 326.88			
		3/2	84 424.35			
$3d^6(^5D)4d$	$f\ ^4D$	7/2	84 685.16			
		5/2	84 870.82			
		3/2	85 048.57			
		1/2	85 172.77			
$3d^6(^5D)4d$	$e\ ^4G$	11/2	84 863.26	1.27		
		9/2	85 184.69			
		7/2	85 462.83			
		5/2	85 679.67			
$3d^6(^5D)4d$	^6S	5/2	85 495.28			
$3d^6(^5D)4d$	^4S	3/2	85 728.79			

Fe II – Continued

Configuration	Term	*J*	Level (cm⁻¹)	*g*	Leading components (%)	
					First	Second
$3d^6(^5D)4d$	$e\ ^4F$	9/2	86 124.26	1.29		
		7/2	86 416.30			
		5/2	86 599.72			
		3/2	86 710.82			
$3d^6(b\ ^3P)4p$	$v\ ^4D^\circ$	1/2	*86 388.98*		56	43 $(b\ ^3F)\ ^4D^\circ$
		3/2	*86 544.14*		53	45
		5/2	*86 767.87*		50	49
		7/2	*86 929.92*		41	46
$3d^6(^1F)4p$	$u\ ^2F^\circ$	7/2	*86 482.75*		92	
		5/2	*86 547.55*		92	
$3d^6(^5D)5p$	$y\ ^6F^\circ$	11/2	*87 340.4*			
		9/2	*87 470.8*			
		7/2	*87 536.9*			
		5/2	*87 571.8*			
		3/2	*87 601.9*			
		1/2	*87 635.2*			
$3d^6(^5D)4d$	^4P	5/2	87 985.60			
		3/2	88 157.09			
		1/2	88 189.03			
	$1^\circ(^6P^\circ)$	7/2	*88 208.6*			
	$2^\circ(^6P^\circ)$	7/2	*89 127.7*			
	3°	5/2	*89 443.7*			
	4°	3/2	*89 625.0*			
	5°	7/2	*90 300.0*			
	6°	7/2,9/2	*90 385.5*			
	$8^\circ(^4P^\circ)$	1/2,3/2	*90 828.4*			
	9°	3/2	*90 898.2*			
	10°	5/2,3/2	*90 981.5*			
	11°	5/2	*91 067.1*			
	$w\ ^6P^\circ$	7/2	*91 167.3*			
		5/2	*91 574.8*			
		3/2	*91 843.1*			
$3d^5(^4G)4s4p(^3P^\circ)$	$x\ ^4H^\circ$	7/2	*92 089.41*			
		9/2	*92 116.98*			
		11/2	*92 166.81*			
		13/2	*92 250.27*			

Fe II – Continued

Configuration	Term	J	Level (cm^{-1})	g	Leading components (%)	
					First	Second
$3d^5(^4G)4s4p(^3P^\circ)$	$v\ ^4F^\circ$	9/2	92 171.95			
		7/2	92 282.76			
		5/2	92 330.1			
		3/2	92 358.8			
$3d^6(b\ ^3F)4p$	$u\ ^2D^\circ$	3/2	92 216.42		51	40 $(b\ ^3P)\ ^2D^\circ$
		5/2	92 695.62		56	30
$3d^6(b\ ^3F)4p$	$u\ ^2G^\circ$	9/2	92 427.22		91	
		7/2	92 602.94		91	
$3d^6(b\ ^3F)4p$	$u\ ^4F^\circ$	3/2	93 328.6		82	8 $(b\ ^3F)\ ^4D^\circ$
		5/2	93 395.6		53	22 $(b\ ^3F)\ ^4D^\circ$
		9/2	93 484.75		94	5 $(b\ ^3F)\ ^2G^\circ$
		7/2	93 487.71		65	19 $(b\ ^3P)\ ^4D^\circ$
$3d^5(^4G)4s4p(^3P^\circ)$	$w\ ^4G^\circ$	5/2	93 988.30			
		7/2	94 073.46			
		9/2	94 148.71			
		11/2	94 190.02			
	14°	5/2	94 210.1			
	15°	7/2	94 762.3			
$3d^5(^4G)4s4p(^3P^\circ)$	$v\ ^2H^\circ$	11/2	96 062.18			
		9/2	96 239.1			
$3d^6(b\ ^3F)4p$	$t\ ^2F^\circ$	5/2	96 279.65		97	
		7/2	96 357.07		94	
$3d^6(^3H)5s$	$e\ ^4H$	13/2	98 129.98			
		11/2	98 294.60			
		9/2	98 445.24			
		7/2	98 568.75			
$3d^6(^3H)5s$	$e\ ^2H$	11/2	99 093.29			
		9/2	99 331.95			
$3d^6(^3F2)5s$	$f\ ^4F$	9/2	99 573.11			
		7/2	99 688.20			
		5/2	99 824.04			
		3/2	99 918.30			
$3d^6(^3F2)5s$	$e\ ^2F$	7/2	100 492.04			
		5/2	100 749.75			
		7/2	101 003.1			
$3d^6(^3G)5s$	$f\ ^4G$	11/2	102 584.81			
$3d^6(^5D_4)4f$	$^2[5]^\circ$	11/2	102 831.26			
		9/2	102 851.30			

Fe II – Continued

Configuration	Term	J	Level (cm⁻¹)	g	Leading components (%)	
					First	Second
$3d^6(^5D_4)4f$	$^2[6]^\circ$	13/2	*102 840.15*			
		11/2	*102 893.34*			
$3d^6(^5D_4)4f$	$^2[4]^\circ$	9/2	*102 882.32*			
		7/2	*102 887.08*			
	^2G	9/2	102 887.0			
		7/2	103 350.2			
$3d^6(^5D_4)4f$	$^2[3]^\circ$	7/2	*102 942.16*			
		5/2	*102 952.10*			
$3d^6(^5D_4)4f$	$^2[7]^\circ$	13/2	*103 019.57*			
		15/2	*103 040.23*			
$3d^6(^5D_4)4f$	$^2[2]^\circ$	5/2	*103 024.26*			
		3/2	*103 034.73*			
$3d^6(^5D_4)4f$	$^2[1]^\circ$	3/2	*103 110.76*			
		1/2	*103 125.64*			
$3d^6(^5D_3)4f$	$^2[5]^\circ$	11/2	*103 325.90*			
		9/2	*103 352.64*			
$3d^6(^5D_3)4f$	$^2[4]^\circ$	9/2	*103 326.38*			
		7/2	*103 340.61*			
$3d^6(^5D_3)4f$	$^2[3]^\circ$	5/2	*103 364.82*			
		7/2	*103 385.69*			
$3d^6(^5D_3)4f$	$^2[2]^\circ$	3/2	*103 391.27*			
		5/2	*103 406.24*			
$3d^6(^5D_3)4f$	$^2[1]^\circ$	3/2	*103 417.87*			
		1/2	*103 437.27*			
$3d^6(^5D_3)4f$	$^2[0]^\circ$	1/2	*103 418.16*			
$3d^6(^5D_3)4f$	$^2[6]^\circ$	11/2	*103 420.12*			
		13/2	*103 421.09*			
$3d^6(^3G)5s$	^2G	9/2	103 608.82			
		7/2	103 983.35			
$3d^6(^5D_2)4f$	$^2[2]^\circ$	5/2	*103 660.95*			
		3/2	*103 645.19*			
$3d^6(^5D_2)4f$	$^2[1]^\circ$	3/2	*103 668.66*			
		1/2	*103 676.20*			
$3d^6(^5D_2)4f$	$^2[3]^\circ$	7/2	*103 676.76*			
		5/2	*103 698.43*			

Fe II – Continued

Configuration	Term	J	Level (cm⁻¹)	g	Leading components (%)	
					First	Second
$3d^6(^5D_2)4f$	$^2[4]^\circ$	9/2	103 680.61			
		7/2	103 711.53			
$3d^6(^5D_2)4f$	$^2[5]^\circ$	11/2	103 691.00			
		9/2	103 701.69			
$3d^6(^5D_1)4f$	$^2[2]^\circ$	5/2	103 857.70			
		3/2	103 869.01			
$3d^6(^5D_1)4f$	$^2[4]^\circ$	9/2	103 873.96			
		7/2	103 882.65			
$3d^6(^5D_1)4f$	$^2[3]^\circ$	7/2	103 969.74			
		5/2	103 987.92			
$3d^6(^5D_0)4f$	$^2[3]^\circ$	7/2	104 022.85			
		5/2	104 046.33			
	16°	7/2	106 863.2			
	17°	5/2,7/2	107 165.6			
	18°	5/2	107 196.2			
	$20^\circ(^6D^\circ)$	7/2	107 886.6			
	21°	7/2,9/2	107 964.7			
	22°	5/2	108 130.6			
	23°	3/2	108 191.6			
	24°	7/2	108 239.2			
	25°	3/2	108 371.7			
	26°	7/2	108 373.8			
$3d^6(^1I)5s$	$e\ ^2I$	11/2	108 630.24			
		13/2	108 648.64			
	27°	3/2	108 780.0			
$3d^6(^1G)5s$	^2G	9/2	109 176.8			
	28°	3/2	109 780.0			
	29°	5/2	111 929.0			
$3d^6(^1F)5s$	^2F	7/2	121 081.6			
Fe III $(^5D_4)$	***Limit***	....	**130 524**			

Fe III

24 electrons $Z = 26$

Ground state: $1s^22s^22p^63s^23d^6\ ^5D_4$

Ionization energy = 247 220 cm^{-1} (30.652 eV)

The present list of energy levels for Fe III is a combination of the results of Edlén and Swings [1] and those of Glad [2]. A correction of 0.8 cm^{-1} has been added to the published level values to place the ground state at zero.

The percentage compositions for levels of the $3d^6$ configuration were taken from the theoretical work of Pasternak and Goldschmidt [3]. For the $3d^54s$ configuration, we have used the percentages given by Shadmi, Caspi, and Oreg [4], who listed compositions only for highly mixed states. Although no statement was made concerning the percentage compositions of the remaining levels, it appears that their purity is at least 90 percent. For the $3d^54p$ configuration we have used the results of Roth [5]. Roth distinguished repeating terms of $3d^n$ by the letters a, b . . . rather than by seniority. Each of his percentages for a given level is the sum of the percentages of states that are identical except for the seniority of the core term.

Transitions between levels of the $3d^6$ configuration observed in nebular spectra have been given by Bowen [6].

The ionization energy was determined by Glad [2] from the $3d^5(^6S)ns\ ^7S$ ($n = 5, 6, 7$) levels.

References

[1] Edlén, B., and Swings, P., Astrophys. J. **95**, 532 (1942).
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Fe III

Configuration	Term	J	Level (cm^{-1})	Leading components (%)	
				First	Second
$3d^6$	^5D	4	0.0	100	
		3	436.2	100	
		2	738.9	100	
		1	932.4	100	
		0	1027.3	100	
$3d^6$	$^3P2$	2	19 404.8	61	38 $^3P1$
		1	20 688.4	62	38
		0	21 208.5	62	37
$3d^6$	^3H	6	20 051.1	100	
		5	20 300.8	99	
		4	20 481.9	97	
$3d^6$	$^3F2$	4	21 462.2	74	21 $^3F1$
		3	21 699.9	77	21
		2	21 857.2	79	20
$3d^6$	^3G	5	24 558.8	99	
		4	24 940.9	97	
		3	25 142.4	98	
$3d^5(^6S)4s$	^7S	3	30 088.84		
$3d^6$	^1I	6	30 356.2	100	
$3d^6$	^3D	2	30 716.2	99	
		1	30 725.8	100	
		3	30 857.8	100	

Fe III – Continued

Configuration	Term	J	Level (cm^{-1})	Leading components (%) First	Second
$3d^6$	^{1}G2	4	30 886.4	65	34 ^{1}G1
$3d^6$	^{1}S2	0	34 812.4	76	23 ^{1}S1
$3d^6$	^{1}D2	2	35 803.7	77	22 ^{1}D1
$3d^5(^6S)4s$	^{5}S	2	40 999.87		
$3d^6$	^{1}F	3	42 896.9	99	
$3d^6$	^{3}P1	0	49 148	62	38 ^{3}P2
		1	49 576.9	62	38
		2	50 412.3	61	39
$3d^6$	^{3}F1	2	50 184.9	80	20 ^{3}F2
		4	50 276.1	78	22
		3	50 295.2	78	21
$3d^6$	^{1}G1	4	57 221.7	65	35 ^{1}G2
$3d^5(^4G)4s$	^{5}G	6	63 425.17		
		5	63 466.39		
		4	63 486.78		
		3	63 494.00		
		2	63 494.56		
$3d^5(^4P)4s$	^{5}P	3	66 464.64		
		2	66 522.95		
		1	66 591.68		
$3d^5(^4D)4s$	^{5}D	4	69 695.73		
		0	69 747.40		
		1	69 788.19		
		3	69 836.83		
		2	69 837.76		
$3d^5(^4G)4s$	^{3}G	5	70 694.03		
		3	70 725.01		
		4	70 728.75		
$3d^5(^4P)4s$	^{3}P	2	73 727.64		
		1	73 849.10		
		0	73 935.96		
$3d^5(^4D)4s$	^{3}D	3	76 956.79		
		1	77 075.30		
		2	77 102.43		
$3d^5(^2I)4s$	^{3}I	7	79 840.12		
		6	79 844.74		
		5	79 860.42		

Fe III – Continued

Configuration	Term	J	Level (cm^{-1})	Leading components (%) First	Second
$3d^5(^6\mathrm{S})4p$	$^7\mathrm{P}^\circ$	2	*82 001.73*	100	
		3	*82 333.92*	99	
		4	*82 846.59*	100	
$3d^5(^2\mathrm{D}3)4s$	$^3\mathrm{D}$	3	82 382.87	76	16 (^{2}F2) ^{3}F
		2	82 410.94	69	17 (^{4}F) ^{5}F
		1	82 494.88	66	34 (^{4}F) ^{5}F
$3d^5(^4\mathrm{F})4s$	$^5\mathrm{F}$	5	83 138.23		
		4	83 161.48		
		3	83 237.86		
		2	83 358.88	77	15 (^{2}F2) ^{3}F
		1	83 646.98	66	34 (^{2}D3) ^{3}D
$3d^5(^2\mathrm{I})4s$	$^1\mathrm{I}$	6	83 429.61		
$3d^5(^2\mathrm{F}2)4s$	$^3\mathrm{F}$	4	84 159.55		
		2	84 369.92	60	17 (^{2}D3) ^{3}D
		3	84 671.87	77	18 (^{2}D3) ^{3}D
$3d^5(^2\mathrm{D}3)4s$	$^1\mathrm{D}$	2	86 847.11		
$3d^5(^2\mathrm{F}2)4s$	$^1\mathrm{F}$	3	87 901.87		
$3d^5(^2\mathrm{H})4s$	$^3\mathrm{H}$	4	88 663.87		
		5	88 694.67		
		6	88 923.07		
$3d^5(^6\mathrm{S})4p$	$^5\mathrm{P}^\circ$	3	*89 084.79*	98	
		2	*89 334.51*	98	
		1	*89 491.39*	98	
$3d^5(^2\mathrm{G}2)4s$	$^3\mathrm{G}$	3	89 697.52		
		4	89 783.59		
		5	89 907.85		
$3d^5(^4\mathrm{F})4s$	$^3\mathrm{F}$	2	90 423.68		
		4	90 472.53		
		3	90 483.94		
$3d^5(^2\mathrm{H})4s$	$^1\mathrm{H}$	5	92 523.91		
$3d^5(^2\mathrm{F}1)4s$	$^3\mathrm{F}$	4	93 388.75	58	41 (^{2}G2) ^{1}G
		3	93 392.45		
		2	93 412.93		
$3d^5(^2\mathrm{G}2)4s$	$^1\mathrm{G}$	4	93 512.64	55	40 (^{2}F1) ^{3}F
$3d^5(^2\mathrm{F}1)4s$	$^1\mathrm{F}$	3	97 041.38		
$3d^5(^2\mathrm{S})4s$	$^3\mathrm{S}$	1	98 662.68		

Fe III – Continued

Configuration	Term	J	Level (cm^{-1})	Leading components (%)	
				First	Second
$3d^5(^2D2)4s$	^3D	1	105 895.35		
		2	105 906.23		
		3	105 929.16		
$3d^5(^2D2)4s$	^1D	2	109 570.84		
$3d^5(^4G)4p$	$^5G°$	2	*113 584.20*	96	
		3	*113 605.37*	91	5 (^4G) $^5H°$
		4	*113 635.34*	89	8
		5	*113 677.01*	88	9
		6	*113 739.62*	90	7
$3d^5(^2G1)4s$	^3G	5	114 325.35		
		4	114 339.95		
		3	114 351.92		
$3d^5(^4G)4p$	$^5H°$	3	*114 948.55*	94	5 (^4G) $^5G°$
		4	*115 110.92*	90	8
		5	*115 289.91*	90	9
		6	*115 474.25*	92	7
		7	*115 642.23*	100	
$3d^5(^4G)4p$	$^5F°$	5	*116 316.63*	90	5 (^4D) $^5F°$
		4	*116 467.41*	81	7 (^4D) $^5F°$
		3	*116 475.44*	55	22 (^4P) $^5D°$
		1	*116 937.57*	76	12 (^4P) $^5D°$
		2	*116 975.05*	57	28 (^4P) $^5D°$
$3d^5(^4P)4p$	$^5D°$	0	*116 364.76*	80	16 (^4D) $^5D°$
		1	*116 380.07*	67	16 (^4D) $^5D°$
		2	*116 419.39*	46	29 (^4G) $^5F°$
		3	*117 068.56*	49	32 (^4G) $^5F°$
		4	*117 521.91*	75	14 (^4D) $^5D°$
$3d^5(^4P)4p$	$^5S°$	2	*116 898.22*	92	
$3d^5(^2G1)4s$	^1G	4	117 950.32		
$3d^5(^4G)4p$	$^3F°$	2	*118 163.56*	90	
		3	*118 246.52*	75	10 (^4P) $^5P°$
		4	*118 350.24*	89	
$3d^5(^4G)4p$	$^3H°$	6	*118 355.01*	96	
		5	*118 557.25*	97	
		4	*118 686.25*	95	
$3d^5(^4P)4p$	$^5P°$	3	*118 442.92*	53	22 (^4D) $^5P°$
		2	*118 721.60*	69	19
		1	*118 867.87*	78	14
$3d^5(^4P)4p$	$^3P°$	2	*119 697.64*	66	18 (^4D) $^3P°$
		1	*119 982.26*	71	18
		0	*120 179.95*	76	17

Fe III – Continued

Configuration	Term	J	Level (cm^{-1})	Leading components (%) First	Second
$3d^5(^4D)4p$	$^5F^\circ$	1	*120 697.10*	85	11 $(^4G)\ ^5F^\circ$
		2	*120 826.17*	84	10
		3	*121 008.78*	84	8
		4	*121 241.67*	87	7
		5	*121 468.82*	92	6
$3d^5(^4G)4p$	$^3G^\circ$	3	*121 919.74*	94	
		4	*121 941.29*	95	
		5	*121 949.62*	95	
$3d^5(^4D)4p$	$^5D^\circ$	2	*122 628.34*	36	46 $(^4P)\ ^3D^\circ$
		3	*122 829.55*	36	31 $(^4P)\ ^3D^\circ$
		1	*122 843.03*	35	46 $(^4P)\ ^3D^\circ$
		4	*122 944.15*	78	16 $(^4P)\ ^5D^\circ$
		0	*123 455.92*	75	19 $(^4P)\ ^5D^\circ$
$3d^5(^4P)4p$	$^3D^\circ$	3	*122 346.61*	53	29 $(^4D)\ ^5D^\circ$
		2	*122 898.84*	40	25 $(^4D)\ ^5D^\circ$
		1	*122 921.37*	41	22 $(^4D)\ ^5P^\circ$
$3d^5(^4D)4p$	$^5P^\circ$	1	*123 552.95*	56	20 $(^4D)\ ^5D^\circ$
		2	*123 697.18*	55	18 $(^4P)\ ^5P^\circ$
		3	*123 750.39*	45	23 $(^4P)\ ^5P^\circ$
$3d^5(^4D)4p$	$^3D^\circ$	3	*124 854.04*	71	12 $(^4D)\ ^5P^\circ$
		2	*124 903.92*	84	7 $(^4F)\ ^3D^\circ$
		1	*124 954.88*	84	8 $(^4F)\ ^3D^\circ$
$3d^5(^4D)4p$	$^3F^\circ$	4	*125 443.58*	90	6 $(a\ ^2G)\ ^3F^\circ$
		3	*125 637.98*	86	6
		2	*125 672.83*	88	6
$3d^5(^4P)4p$	$^3S^\circ$	1	*126 390.57*	95	
$3d^5(^4D)4p$	$^3P^\circ$	0	*128 371.53*	77	18 $(^4P)\ ^3P^\circ$
		1	*128 605.65*	74	19
		2	*128 917.51*	72	21
$3d^5(^2I)4p$	$^3K^\circ$	6	*129 854.80*	83	15 $(^2I)\ ^3I^\circ$
		7	*130 040.56*	76	17
		8	*130 852.25*	100	
$3d^5(^2I)4p$	$^3I^\circ$	5	*130 256.27*	82	9 $(^2I)\ ^1H^\circ$
		6	*130 756.84*	78	16 $(^2I)\ ^3K^\circ$
		7	*131 035.07*	71	21 $(^2I)\ ^3K^\circ$
$3d^5(a\ ^2D)4p$	$^1D^\circ$	2	*131 445.03*	32	26 $(a\ ^2F)\ ^3F^\circ$
$3d^5(^2I)4p$	$^1H^\circ$	5	*131 710.79*	69	13 $(^2I)\ ^3I^\circ$
$3d^5(^2I)4p$	$^1K^\circ$	7	*131 991.58*	89	9 $(^2I)\ ^3I^\circ$

Fe III – Continued

Configuration	Term	J	Level (cm^{-1})	Leading components (%) First	Second
$3d^5(a\ ^2D)4p$	$^3F°$	3	*132 079.91*	58	25 $(a\ ^2F)\ ^3F°$
		2	*132 104.94*	42	26 $(a\ ^2D)\ ^1D°$
		4	*132 785.36*	58	22 $(a\ ^2F)\ ^3F°$
$3d^5(^2I)4p$	$^3H°$	6	*132 262.66*	90	
		5	*132 564.71*	86	6 $(^2I)\ ^1H°$
		4	*132 659.17*	84	
$3d^5(a\ ^2D)4p$	$^3P°$	2	*134 265.42*	67	25 $(a\ ^2F)\ ^3D°$
		1	*134 549.38*	59	20 $(a\ ^2D)\ ^3D°$
		0	*135 088.60*	90	6 $(^4F)\ ^5D°$
$3d^5(a\ ^2F)4p$	$^1G°$	4	*134 360.40*	57	17 $(a\ ^2F)\ ^3G°$
$3d^5(a\ ^2F)4p$	$^3G°$	3	*134 549.00*	53	25 $(a\ ^2D)\ ^1F°$
		5	*135 316.42*	55	35 $(^4F)\ ^5G°$
		4	*135 554.41*	54	36 $(a\ ^2F)\ ^3F°$
$3d^5(^4F)4p$	$^5G°$	2	*134 937.84*	75	10 $(a\ ^2F)\ ^3F°$
		3	*135 096.84*	54	27 $(a\ ^2D)\ ^3D°$
		4	*135 239.74*	81	8 $(a\ ^2F)\ ^1G°$
		6	*135 582.08*	50	44 $(^2I)\ ^1I°$
		5	*135 735.31*	58	39 $(a\ ^2F)\ ^3G°$
$3d^5(a\ ^2D)4p$	$^3D°$	3	*134 976.22*	32	25 $(a\ ^2F)\ ^3D°$
		1	*135 217.17*	60	22 $(a\ ^2D)\ ^3P°$
		2	*135 279.04*	62	12 $(^4F)\ ^5G°$
$3d^5(a\ ^2F)4p$	$^3D°$	3	*135 705.57*	65	11 $(a\ ^2D)\ ^3D°$
		1	*136 464.9*	66	19 $(a\ ^2D)\ ^1P°$
		2	*136 793.82*	36	37 $(^4F)\ ^5F°$
$3d^5(^2I)4p$	$^1I°$	6	*135 739.47*	50	46 $(^4F)\ ^5G°$
$3d^5(^4F)4p$	$^5F°$	4	*135 990.62*	74	17 $(^4F)\ ^5D°$
		3	*136 008.74*	65	13 $(^4F)\ ^5D°$
		2	*136 117.94*	38	36 $(a\ ^2F)\ ^3D°$
		5	*136 185.17*	88	
		1	*136 235.84*	76	10 $(a\ ^2D)\ ^3D°$
$3d^5(a^2D)4p$	$^1F°$	3	*136 200.13*	31	24 $(a\ ^2F)\ ^3G°$
$3d^5(a\ ^2F)4p$	$^3F°$	2	*136 532.45*	46	19 $(a\ ^2D)\ ^3F°$
		4	*136 612.78*	42	28
		3	*136 797.05*	41	14
$3d^5(^4F)4p$	$^5D°$	4	*137 209.73*	75	16 $(^4F)\ ^5F°$
		3	*137 423.00*	74	14 $(^4F)\ ^5F°$
		2	*137 544.60*	77	9 $(^4F)\ ^5F°$
		1	*137 561.1*	85	6 $(a\ ^2D)\ ^3P°$
		0	*137 573.2*	91	6 $(a\ ^2D)\ ^3P°$

Fe III – Continued

Configuration	Term	J	Level (cm^{-1})	Leading components (%)	
				First	Second
$3d^5(^2H)4p$	$^3H°$	4	*137 527.92*	46	44 $(a\ ^2G)\ ^3H°$
		5	*137 763.70*	43	42
		6	*138 264.47*	46	41
$3d^5(^2H)4p$	$^3G°$	5	*138 054.59*	47	29 $(^4F)\ ^3G°$
		4	*138 103.12*	43	30
		3	*138 187.93*	41	28
$3d^5(a\ ^2D)4p$	$^1P°$	1	*138 691.81*	71	17 $(a\ ^2F)\ ^3D°$
$3d^5(^4F)4p$	$^3G°$	5	*139 463.36*	43	25 $(a\ ^2G)\ ^3G°$
		4	*139 625.17*	42	36
		3	*139 680.47*	42	41
$3d^5(^2H)4p$	$^3I°$	5	*139 509.44*	79	8 $(^2H)\ ^3H°$
		6	*139 846.18*	87	5
		7	*140 196.33*	96	
$3d^5(a\ ^2F)4p$	$^1D°$	2	*139 764.48*	56	38 $(a\ ^2D)\ ^1D°$
$3d^5(a\ ^2G)4p$	$^1G°$	4	*139 827.17*	40	19 $(a\ ^2F)\ ^1G°$
$3d^5(a\ ^2F)4p$	$^1F°$	3	*140 453.10*	72	8 $(a\ ^2D)\ ^1F°$
$3d^5(a\ ^2G)4p$	$^3F°$	3	*140 693.36*	42	26 $(^4F)\ ^3F°$
		2	*140 750.98*	42	31
		4	*141 002.99*	45	26
$3d^5(^4F)4p$	$^3D°$	2	*141 399.04*	68	8 $(a\ ^2G)\ ^3F°$
		3	*141 466.53*	64	7 $(a\ ^2G)\ ^3F°$
		1	*141 469.45*	84	6 $(^4D)\ ^3D°$
$3d^5(^2H)4p$	$^1I°$	6	*141 539.55*	88	5 $(^2H)\ ^3H°$
$3d^5(^4F)4p$	$^3F°$	4	*142 047.0*	50	25 $(a\ ^2G)\ ^3F°$
		3	*142 312.90*	50	24
		2	*142 535.07*	48	24
$3d^5(a\ ^2G)4p$	$^3H°$	4	*142 855.59*	45	47 $(^2H)\ ^3H°$
		5	*142 908.48*	46	38
		6	*143 320.85*	50	40
$3d^5(a\ ^2G)4p$	$^3G°$	5	*143 883.74*	40	20 $(a\ ^2F)\ ^3G°$
		4	*144 085.97*	42	23
		3	*144 116.64*	43	24
$3d^5(b\ ^2F)4p$	$^1G°$	4	*144 332.21*	35	30 $(a\ ^2F)\ ^3F°$
$3d^5(b\ ^2F)4p$	$^3F°$	2	*144 501.74*	66	19 $(a\ ^2G)\ ^3F°$
		3	*144 570.53*	73	11 $(a\ ^2G)\ ^3F°$
		4	*144 968.50*	48	20 $(b\ ^2F)\ ^1G°$
$3d^5(a\ ^2G)4p$	$^1H°$	5	*144 586.83*	66	18 $(^2H)\ ^1H°$

Fe III – Continued

Configuration	Term	J	Level (cm^{-1})	Leading components (%)	
				First	Second
$3d^5(^2H)4p$	$^1H^\circ$	5	*144 843.24*	70	23 $(a\ ^2G)\ ^1H^\circ$
$3d^5(a\ ^2G)4p$	$^1F^\circ$	3	*145 038.61*	76	5 $(b\ ^2F)\ ^1F^\circ$
$3d^5(b\ ^2F)4p$	$^1D^\circ$	2	*145 618.39*	82	7 $(b\ ^2F)\ ^3F^\circ$
$3d^5(b\ ^2F)4p$	$_3G^\circ$	3	*146 891.04*	55	36 $(^2H)\ ^3G^\circ$
		4	*147 161.36*	59	32
		5	*147 406.14*	66	28
$3d^5(^6S)4d$	^7D	1	147 281.69		
		2	147 291.21		
		3	147 305.97		
		4	147 326.85		
		5	147 354.70		
$3d^5(b\ ^2F)4p$	$^3D^\circ$	1	*147 556.45*	90	
		2	*147 614.65*	89	
		3	*147 635.95*	86	7 $(^4F)\ ^3D^\circ$
$3d^5(^2S)4p$	$^3P^\circ$	0	*148 655*	85	12 $(b\ ^2D)\ ^3P^\circ$
		1	*148 915.3*	82	13
		2	*149 525.63*	82	14
$3d^5(^2H)4p$	$^1G^\circ$	4	*149 013.36*	34	44 $(b\ ^2F)\ ^1G^\circ$
$3d^5(^6S)5s$	^7S	3	149 285.00		
$3d^5(b\ ^2F)4p$	$^1F^\circ$	3	*150 654.9*	93	
$3d^5(^6S)4d$	^5D	3	151 534.13		
		2	151 534.90		
		1	151 536.68		
		4	151 537.80		
		0	151 537.91		
$3d^5(^2S)4p$	$^1P^\circ$	1	*151 637.3?*	78	19 $(b\ ^2D)\ ^1P^\circ$
$3d^5(^6S)5s$	^5S	2	151 757.67		
$3d^5(b\ ^2D)4p$	$^3F^\circ$	2	*157 684.3*	75	18 $(b\ ^2D)\ ^3D^\circ$
		3	*157 982.0*	61	27
		4	*158 562.7*	94	
$3d^5(b\ ^2D)4p$	$^3D^\circ$	1	*158 257.37*	95	
		2	*158 417.31*	76	18 $(b\ ^2D)\ ^3F^\circ$
		3	*158 729.89*	67	29
$3d^5(b\ ^2D)4p$	$^1F^\circ$	3	*159 493.0*	82	12 $(b\ ^2G)\ ^1F^\circ$
$3d^5(b\ ^2D)4p$	$^3P^\circ$	2	*160 037.9*	81	14 $(^2S)\ ^3P^\circ$

Fe III – Continued

Configuration	Term	J	Level (cm^{-1})	Leading components (%) First	Second
$3d^5(b\ ^2D)4p$	$^1D°$	2	*162 084.8?*	92	6 $(b\ ^2F)\ ^1D°$
$3d^5(b\ ^2G)4p$	$^3H°$	4	*165 719.20*	93	5 $(b\ ^2G)\ ^3G°$
		5	*165 939.47*	90	6
		6	*166 187.50*	98	
$3d^5(^6S)5p$	$^7P°$	2	*166 144.63*		
		3	*166 252.74*		
		4	*166 421.33*		
$3d^5(b\ ^2G)4p$	$^3F°$	4	*166 222.2*	81	11 $(b\ ^2G)\ ^3F°$
		3	*166 498*	50	46 $(b\ ^2G)\ ^3G°$
		2	*167 002*	93	5 $(c\ ^2D)\ ^3F°$
$3d^5(b\ ^2G)4p$	$^3G°$	3	*167 085.12*	53	44 $(b\ ^2G)\ ^3F°$
		4	*167 207.30*	85	11 $(b\ ^2G)\ ^3F°$
		5	*167 299.60*	91	7 $(b\ ^2G)\ ^3H°$
$3d^5(^6S)5p$	$^5P°$	3	*168 329.67*		
		2	*168 420.99*		
		1	*168 477.36*		
$3d^5(b\ ^2G)4p$	$^1H°$	5	*168 780.1*	95	
$3d^5(b\ ^2G)4p$	$^1G°$	4	*169 277.6?*	96	
$3d^5(b\ ^2G)4p$	$^1F°$	3	*170 310.6?*	87	12 $(c\ ^2D)\ ^1F°$
$3d^5(^4G)4d$	^5H	3	179 178.62		
		4	179 194.22		
		5	179 207.57		
		6	179 216.47		
		7	179 221.45		
$3d^5(^4G)4d$	^5F	5	179 579.83		
		4	179 630.77		
		3	179 661.48		
		2	179 676.89		
		1	179 682.94		
$3d^5(^4G)4d$	^5G	6	179 725.31		
		5	179 748.17		
		4	179 757.98		
		2	179 759.49		
		3	179 760.72		
$3d^5(^4G)4d$	^5I	4	179 876.71		
		8	179 889.03		
		5	179 893.56		
		7	179 904.56		
		6	179 904.56		

Fe III – Continued

Configuration	Term	J	Level (cm^{-1})	Leading components (%)	
				First	Second
$3d^5(^4G)5s$	^5G	6	181 772.59		
		5	181 808.70		
		4	181 825.67		
		2	181 828.66		
		3	181 830.02		
$3d^5(^4P)4d$	^5F	5	182 379.86		
		4	182 412.65		
		3	182 444.70		
		2	182 480.72		
		1	182 486.40		
$3d^5(^4G)4d$	^3F	2	182 392.55		
		3	182 408.91		
		4	182 418.70		
$3d^5(^4G)4d$	^3I	5	182 810.66		
		6	182 830.76		
		7	182 852.05		
$3d^5(^4G)5s$	^3G	5	183 431.28		
		3	183 456.69		
		4	183 457.15		
$3d^5(^6S)4f$	$^7F^\circ$	1	*184 181.39*		
		2	*184 247.16*		
		3	*184 316.58*		
		4	*184 374.59*		
		5	*184 417.27*		
		6	*184 447.38*		
$3d^5(^6S)4f$	$^5F^\circ$	1	*184 777.3*		
		2	*184 777.6*		
		3	*184 778.5*		
		4	*184 779.5*		
		5	*184 780.8*		
$3d^5(^4P)5s$	^5P	3	184 951.62		
		2	185 003.35		
		1	185 061.35		
$3d^5(^4D)4d$	^5G	2	186 268.69		
		3	186 303.44		
		4	186 378.94		
		5	186 454.09		
		6	186 597.30		
$3d^5(^4D)4d$	^5D	1	186 712.02		
		2	186 791.78		
		3	186 882.98		
		4	186 998.60		

Fe III – Continued

Configuration	Term	J	Level (cm^{-1})	Leading components (%)	
				First	Second
$3d^5(^4D)5s$	^5D	4	188 013.40		
		0	188 109.32		
		3	188 109.58		
		1	188 131.70		
		2	188 142.64		
$3d^5(^4D)4d$	^3G	3	188 955.56		
		4	189 011.84		
		5	189 024.53		
$3d^5(^4D)5s$	^3D	3	189 679.07		
		2	189 784.52		
		1	189 796.03		
$3d^5(^6S)5d$	^7D	1	190 393.27		
		2	190 397.71		
		3	190 404.31		
		4	190 413.57		
		5	190 425.72		
$3d^5(^6S)6s$	^7S	3	190 918.17		
$3d^5(^6S)6s$	^5S	2	192 006.94		
$3d^5(^6S)5d$	^5D	0	193 595.30		
		1	193 599.54		
		2	193 605.99		
		3	193 610.92		
		4	193 611.37		
$3d^5(^2I)5s$	^3I	7	196 881.47		
		6	196 886.01		
		5	196 901.27		
$3d^5(^4G)5p$	$^5G^\circ$	2	*198 333.56*		
		6	*198 333.76*		
		5	*198 336.58*		
		3	*198 337.06*		
		4	*198 338.62*		
$3d^5(^6S)6p$	$^7P^\circ$	2	*198 606.37*		
		3	*198 655.66*		
		4	*198 737.05*		
$3d^5(^4G)5p$	$^5H^\circ$	3	*198 658.80*		
		4	*198 717.60*		
		5	*198 773.95*		
		6	*198 821.39*		
		7	*198 848.38*		

Fe III – Continued

Configuration	Term	J	Level (cm^{-1})	Leading components (%) First	Second
$3d^5(^4G)5p$	$^5F^\circ$	5	*199 139.76*		
		4	*199 212.72*		
		3	*199 262.44*		
		2	*199 300.15*		
		1	*199 327.95*		
$3d^5(^4G)5p$	$^3F^\circ$	2	*199 577.71*		
		3	*199 595.30*		
		4	*199 603.61*		
$3d^5(^4G)5p$	$^3H^\circ$	6	*199 634.92*		
		5	*199 660.84*		
		4	*199 700.83*		
$3d^5(^4F)4d$	^5H	3	199 701.82		
		4	199 804.81		
		5	199 884.39		
		6	199 906.03		
		7	200 003.70		
$3d^5(^4F)4d$	^5G	4	200 325.56		
		3	200 384.28		
		5	200 395.33		
		2	200 437.94		
		6	200 656.02		
$3d^5(^4G)5p$	$^3G^\circ$	3	*200 504.99*		
		4	*200 514.46*		
		5	*200 524.12*		
$3d^5(^4P)5p$	$^5D^\circ$	2	*201 164.21*		
		3	*201 166.35*		
		0	*201 170.10*		
		1	*201 178.01*		
		4	*201 207.29*		
$3d^5(^4P)5p$	$^5S^\circ$	2	*201 293.75*		
$3d^5(^4F)5s$	^5F	5	201 892.44		
		4	201 919.53		
		3	202 030.38		
		2	202 156.13		
		1	202 429.04		
$3d^5(^4P)5p$	$^5P^\circ$	3	*202 200.51*		
		2	*202 282.65*		
		1	*202 334.39*		

Fe III – Continued

Configuration	Term	J	Level (cm⁻¹)	Leading components (%)	
				First	Second
$3d^5(^4D)5p$	$^5F^°$	1	*204 907.13*		
		2	*204 943.26*		
		3	*205 002.47*		
		4	*205 092.53*		
		5	*205 195.15*		
$3d^5(^4D)5p$	$^5D^°$	4	*205 672.01*		
		1	*205 694.09*		
		3	*205 732.37*		
		2	*205 737.51*		
$3d^5(^4D)5p$	$^3D^°$	3	*206 180.41*		
		2	*206 233.31*		
		1	*206 295.81*		
$3d^5(^4D)5p$	$^3F^°$	4	*206 261.33*		
		2	*206 324.89*		
		3	*206 328.22*		
$3d^5(^6S)5f$	$^7F^°$	6	*207 118.1*		
		5	*207 118.6*		
		4	*207 119.1*		
		3	*207 119.6*		
		2	*207 120.1*		
$3d^5(^6S)5f$	$^5F^°$	1	*207 252.5*		
		2	*207 257.8*		
		3	*207 263.0*		
		4	*207 268.2*		
		5	*207 273.23*		
$3d^5(^6S)5g$	^7G	7	207 640.8		
		6	207 640.8		
		5	207 640.9		
		4	207 640.9		
		3	207 641.1		
		2	207 641.3		
$3d^5(^6S)5g$	^5G	6	207 642.9		
		5	207 643.1		
		4	207 643.3		
		3	207 643.3		
		2	207 643.5		
$3d^5(^6S)6d$	^7D	1	210 393.67		
		2	210 396.00		
		3	210 399.57		
		4	210 404.61		
		5	210 411.32		

Fe III – Continued

Configuration	Term	*J*	Level (cm^{-1})	Leading components (%)	
				First	Second
$3d^5(^6S)7s$	^7S	3	210 615.21		
$3d^5(^2I)5p$	$^3I°$	7	*213 457.82*		
		6	*213 505.73*		
		5	*213 563.08*		
$3d^5(^2I)5p$	$^3H°$	6	*213 974.42*		
		5	*214 010.32*		
		4	*214 047.38*		
$3d^5(^4F)5p$	$^5G°$	2	*218 860.43*		
		3	*218 923.08*		
		4	*219 004.53*		
		5	*219 092.86*		
		6	*219 162.42*		
$3d^5(^4F)5p$	$^5F°$	5	*219 415.61*		
		4	*219 471.97*		
		3	*219 566.08*		
		2	*219 655.55*		
		1	*219 743.04*		
$3d^5(^6S)6g$	^7G	1-7	219 740		
$3d^5(^6S)6g$	^5G	6	219 741.9		
		5	219 741.9		
		4	219 742.0		
		3	219 742.1		
		2	219 742.1		
$3d^5(^6S)6h$	$^7H°$	2-8	*219 780.2*		
$3d^5(^6S)6h$	$^5H°$	3-7	*219 780.6*		
$3d^5(^4G)5d$	^5H	7	222 590.86		
		6	222 602.50		
		3	222 605.24		
		4	222 605.82		
		5	222 611.16		
$3d^5(^4G)5d$	^5F	5	222 699.09		
		4	222 734.33		
		3	222 750.23		
		2	222 774.22		
		1	222 776.89		
$3d^5(^4G)5d$	^5G	6	222 714.30		
		5	222 744.69		
		2	222 758.28		
		4	222 765.97		
		3	222 766.04		

Fe III – Continued

Configuration	Term	J	Level (cm^{-1})	Leading components (%)	
				First	Second
$3d^5(^4G)5d$	^5I	8	222 797.97		
		4	222 823.33		
		7	222 824.71		
		5	222 832.48		
		6	222 834.77		
$3d^5(^4G)6s$	^5G	6	223 272.06		
		5	223 309.37		
		4	223 326.76		
		2	223 327.87		
		3	223 330.71		
$3d^5(^4G)6s$	^3G	5	224 038.73		
		3	224 051.63		
		4	224 058.70		
$3d^5(^4P)6s$	^5P	3	226 381.91		
		2	226 447.88		
		1	226 506.54		
$3d^5(^4D)6s$	^5D	4	229 421.73		
		3	229 509.56		
		1	229 530.67		
		2	229 570.36		
$3d^5(^4D)6s$	^3D	3	230 192.86		
		1	230 248.26		
		2	230 257.15		
Fe IV ($^6S_{5/2}$)	***Limit***	....	**247 220**		

Fe IV

23 electrons $Z=26$

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

Ionization energy $=442\,000$ cm^{-1} (54.8 eV)

Kruger and Gilroy identified the $3d^4(^5D)4p\ ^6P°$ term in 1935 by observing the three ^6S–$^6P°$ resonance lines [1]. Not until the recent work of Edlén [2] was anything further discovered about this spectrum. Edlén reported the levels of the $3d^4(^5D)4s$ and $3d^4(^5D)4p$ subconfigurations and all terms of $3d^5$ except for ^2S, ^2P, and the highest of the three possible ^2D terms.

Theoretical interpretations of the Fe IV energy levels have been made by Warner and Kirkpatrick [3] and by Noorman and Schrijver [4]. Their calculations and results are very similar. The percentage compositions from ref. 4 are quoted here.

Transitions between levels of the $3d^5$ configuration observed in nebular spectra have been given by Bowen [5].

The ionization energy is taken from an isoelectronic extrapolation by Lotz [6].

References

[1] Kruger, P. G., and Gilroy, H. T., Phys. Rev. **48,** 720 (1935).
[2] Edlén, B., Mon. Not. Roy. Astron. Soc. **144,** 391 (1969).
[3] Warner, B., and Kirkpatrick, R. C., Mon. Not. Roy. Astron. **147,** 115 (1970); unpublished material (1973).
[4] Noorman, P. E., and Schrijver, J. Physica **36,** 547 (1967); unpublished material (1973).
[5] Bowen, I. S., Astrophys. J. **132,** 1 (1960).
[6] Lotz, W., J. Opt. Soc. Am. **57,** 873 (1967).

Fe IV

Configuration	Term	J	Level (cm^{-1})	Leading components (%)	
				First	Second
$3d^5$	^6S	5/2	0.0	100	
$3d^5$	^4G	11/2	32 245.7	100	
		9/2	32 293.0	100	
		5/2	32 299.6	100	
		7/2	32 305.4	100	
$3d^5$	^4P	5/2	35 251.5	95	
		3/2	35 329.9	96	
		1/2	35 403.8	99	
$3d^5$	^4D	7/2	38 775.6	100	
		1/2	38 893.4	99	
		5/2	38 931.6	96	
		3/2	38 935.1	96	
$3d^5$	^2I	11/2	47 032.5	99	
		13/2	47 089.7	100	
$3d^5$	$^2D3$	5/2	49 539.9	55	25 $^2F1$
		3/2	50 049.2	73	23 $^2D1$
$3d^5$	$^2F1$	7/2	51 396.3	99	
		5/2	52 165.7	71	17 $^2D3$
$3d^5$	^4F	9/2	52 620.4	98	
		7/2	52 693.5	99	
		3/2	52 835.3	96	
		5/2	52 837.1	93	

Fe IV – Continued

Configuration	Term	J	Level (cm^{-1})	Leading components (%)	
				First	Second
$3d^5$	^{2}H	9/2	56 011.6	85	15 ^{2}G2
		11/2	56 367.9	99	
$3d^5$	^{2}G2	7/2	57 594.0	99	
		9/2	57 720.0	83	15 ^{2}H
$3d^5$	^{2}F2	5/2	61 156.0	98	
		7/2	61 253.3	99	
$3d^5$	^{2}D2	5/2	73 842.2	100	
$3d^5$	^{2}G1	7/2	82 851.4	100	
		9/2	82 893.2	100	
$3d^4(^5D)4s$	^{6}D	1/2	127 764.7	100	
		3/2	127 928.1	100	
		5/2	128 190.1	100	
		7/2	128 540.4	100	
		9/2	128 966.3	100	
$3d^4(^5D)4s$	^{4}D	1/2	137 698.9	100	
		3/2	137 947.5	100	
		5/2	138 336.3	100	
		7/2	138 841.3	100	
$3d^4(^5D)4p$	^{6}F°	1/2	*187 877.1*	100	
		3/2	*188 084.9*	100	
		5/2	*188 427.5*	100	
		7/2	*188 902.7*	99	
		9/2	*189 513.7*	99	
		11/2	*190 275.0*	100	
$3d^4(^5D)4p$	^{6}P°	3/2	*189 884.2*	97	
		5/2	*190 006.7*	98	
		7/2	*190 224.6*	99	
$3d^4(^5D)4p$	^{4}P°	1/2	*191 019.4*	70	27 (^{5}D) 6d
		3/2	*191 692.0*	62	33
		5/2	*193 546.8*	54	44
$3d^4(^5D)4p$	^{6}D°	5/2	*192 593.0*	54	42 (^{5}D) ^{4}P°
		1/2	*193 118.8*	72	27 (^{5}D) ^{4}P°
		3/2	*193 268.7*	66	33 (^{5}D) ^{4}P°
		7/2	*193 383.5*	98	
		9/2	*193 787.0*	95	4 (^{5}D) ^{4}F°
$3d^4(^5D)4p$	^{4}F°	3/2	*196 184.9*	96	
		5/2	*196 332.6*	96	
		7/2	*196 547.3*	94	
		9/2	*196 844.5*	92	4 (^{5}D) 6d

Fe IV – Continued

Configuration	Term	J	Level (cm^{-1})	Leading components (%)	
				First	Second
$3d^4(^5D)4p$	$^4D°$	1/2	*201 917.3*	98	
		3/2	*202 082.6*	98	
		5/2	*202 325.4*	98	
		7/2	*202 604.7*	98	
Fe V ($^5D_0$)	***Limit***	....	**442 000**		

Fe V

22 electrons $Z = 26$

Ground state: $1s^2 2s^2 2p^6 3s^2 3d^4\ ^5D_0$

Ionization energy = 605 000 cm^{-1} (75.0 eV)

Bowen's contribution [1] in 1937 established terms of $3d^4$, $3d^3 4s$, and $3d^3 4p$, greatly expanding the start made by White [2]. Additions to all three configurations have been made by Fawcett and Henrichs [3]. The analysis has been greatly extended by Ekberg [4], who has also provided improved level values. The level values and percentage compositions given below are due to Ekberg [4].

Bowen has identified transitions between levels of the $3d^4$ configuration from nebular spectra [5].

The ionization energy is from the isoelectronic extrapolation of Lotz [6].

References

[1] Bowen, I. S., Phys. Rev. **52**, 1153 (1937).
[2] White, H. E., Phys. Rev. **33**, 914 (1929).
[3] Fawcett, B. C., and Henrichs, H. F., Astron. Astrophys. **18**, 157 (1974).
[4] Ekberg, J. O., to be published in Phys. Scr., 1975.
[5] Bowen, I. S., Astrophys. J. **132**, 1 (1960).
[6] Lotz, W., J. Opt. Soc. Am. **57**, 873 (1967).

Fe V

Configuration	Term	J	Level (cm^{-1})	Leading components (%) First	Second
$3d^4$	^{5}D	0	0.0	100	
		1	142.1	100	
		2	417.3	100	
		3	803.1	100	
		4	1282.8	100	
$3d^4$	^{3}P2	0	24 055.4	59	40 ^{3}P1
		1	24 972.9	60	40
		2	26 468.3	60	39
$3d^4$	^{3}H	4	24 932.5	97	
		5	25 225.9	99	
		6	25 528.5	100	
$3d^4$	^{3}F2	2	26 760.7	78	22 ^{3}F1
		3	26 842.3	75	20
		4	26 974.0	75	19
$3d^4$	^{3}G	3	29 817.1	96	
		4	30 147.0	94	
		5	30 430.1	99	
$3d^4$	^{1}G2	4	36 586.3	65	33 ^{1}G1
$3d^4$	^{3}D	3	36 630.1	100	
		2	36 758.5	99	
		1	36 925.4	100	
$3d^4$	^{1}I	6	37 511.7	100	
$3d^4$	^{1}S2	0	39 633.4	78	21 ^{1}S1
$3d^4$	^{1}D2	2	46 291.2	78	21 ^{1}D1

Fe v – Continued

Configuration	Term	J	Level (cm^{-1})	Leading components (%)	
				First	Second
$3d^4$	^1F	3	52 732.7	99	
$3d^4$	$^3P1$	2	61 854.4	61	39 $^3P2$
		1	62 914.2	60	40
		0	63 420.0	60	40
$3d^4$	$^3F1$	4	62 238.1	80	20 $^3F2$
		2	62 321.1	78	22
		3	62 364.4	78	21
$3d^4$	$^1G1$	4	71 280.3	66	34 $^1G2$
$3d^4$	$^1D1$	2	93 832.3	78	22 $^1D2$
$3d^4$	$^1S1$	0	121 130.2	79	21 $^1S2$
$3d^3(^4F)4s$	^5F	1	186 433.6	100	
		2	186 725.5	100	
		3	187 157.5	100	
		4	187 719.0	100	
		5	188 395.3	100	
$3d^3(^4F)4s$	^3F	2	195 196.3	100	
		3	195 933.0	100	
		4	196 838.6	100	
$3d^3(^4P)4s$	^5P	1	204 729.9	99	
		2	204 975.4	99	
		3	205 536.4	100	
$3d^3(^2G)4s$	^3G	3	208 838.2	100	
		4	209 110.1	99	
		5	209 523.9	98	
$3d^3(^4P)4s$	^3P	0	212 542.1	85	15 $(^2P)\ ^3P$
		1	212 818.1	88	6
		2	213 649.2	91	8
$3d^3(^2G)4s$	^1G	4	213 534.1	94	5 $(^2H)\ ^3H$
$3d^3(^2P)4s$	^3P	2	214 525.8	61	23 $(^2D2)\ ^3D$
		1	214 611.4	72	14
$3d^3(^2D2)4s$	^3D	1	215 782.6	56	20 $(^2P)\ ^3P$
		3	216 538.1	80	20 $(^2D1)\ ^3D$
		2	216 592.7	55	28 $(^2P)\ ^3P$
$3d^3(^2H)4s$	^3H	4	216 779.1	94	5 $(^2G)\ ^1G$
		5	216 860.4	99	
		6	217 122.5	100	
$3d^3(^2P)4s$	^1P	1	219 486.9	90	5 $(^2D2)\ ^3D$

Fe v – Continued

Configuration	Term	J	Level (cm^{-1})	Leading components (%)	
				First	Second
$3d^3(^2D2)4s$	^1D	2	220 621.0	77	20 (^{2}D1) ^{1}D
$3d^3(^2H)4s$	^1H	5	221 305.2	99	
$3d^3(^2F)4s$	^3F	4	233 633.6	100	
		3	233 848.9	100	
		2	234 027.4	100	
$3d^3(^2F)4s$	^1F	3	237 729.6	100	
$3d^3(^4F)4p$	$^5G^\circ$	2	*254 803.3*	99	
		3	*255 399.2*	99	
		4	*256 177.9*	99	
		5	*257 138.0*	99	
		6	*258 297.4*	100	
$3d^3(^4F)4p$	$^5F^\circ$	1	*257 742.3*	38	36 (^{4}F) $^3D^\circ$
		2	*259 376.1*	51	42 (^{4}F) $^5D^\circ$
		3	*259 954.7*	78	19 (^{4}F) $^5D^\circ$
		4	*260 521.0*	90	6 (^{4}F) $^5D^\circ$
		5	*261 051.9*	94	
$3d^3(^4F)4p$	$^5D^\circ$	2	*258 128.5*	48	25 (^{4}F) $^5F^\circ$
		0	*258 619.5*	96	
		3	*258 680.0*	71	15 (^{4}F) $^5F^\circ$
		1	*258 891.5*	72	20 (^{4}F) $^5F^\circ$
		4	*259 344.8*	89	7 (^{4}F) $^5F^\circ$
$3d^3(^2D1)4s$	^3D	3	258 434.1	80	20 (^{2}D2) ^{3}D
		2	258 628.5	79	21
		1	258 769.5	78	22
$3d^3(^4F)4p$	$^3D^\circ$	1	*259 995.2*	49	42 (^{4}F) $^5F^\circ$
		2	*260 411.4*	62	23 (^{4}F) $^5F^\circ$
		3	*261 179.6*	76	8 (^{4}P) $^3D^\circ$
$3d^3(^2D1)4s$	^1D	2	262 509.3	79	21 (^{2}D2) ^{1}D
$3d^3(^4F)4p$	$^3G^\circ$	3	*263 898.6*	92	5 (^{2}G) $^3G^\circ$
		4	*264 434.2*	91	
		5	*265 112.6*	88	6 (^{4}F) $^5F^\circ$
$3d^3(^4F)4p$	$^3F^\circ$	2	*266 612.8*	94	
		3	*267 240.1*	94	
		4	*267 928.6*	94	
$3d^3(^4P)4p$	$^5P^\circ$	1	*273 643.1*	98	
		2	*274 136.1*	96	
		3	*274 930.3*	98	

Fe v – Continued

Configuration	Term	J	Level (cm^{-1})	Leading components (%)	
				First	Second
$3d^3(^4P)4p$	$^5D°$	0	*274 753.3*	54	36 (^4P) $^3P°$
		1	*275 146.6*	59	34
		2	*276 759.2*	58	32
		3	*277 068.5*	94	
		4	*278 075.8*	96	
$3d^3(^4P)4p$	$^3P°$	2	*275 374.3*	52	36 (^4P) $^5D°$
		0	*276 434.9*	43	40
		1	*276 765.9*	54	35
$3d^3(3[G)4p$	$^3H°$	4	*276 429.7*	79	16 (^2H) $^3H°$
		5	*277 292.7*	73	18
		6	*278 650.7*	78	21
$3d^3(^2G)4p$	$^3G°$	3	*278 794.2*	77	7 (^2G) $^1F°$
		4	*279 502.6*	78	9 (^2G) $^3F°$
		5	*280 039.6*	79	7 (^2G) $^3H°$
$3d^3(^2G)4p$	$^3F°$	4	*280 367.2*	46	35 (^2G) $^1G°$
		2	*280 539.7*	60	17 $(^2D2)$ $^3F°$
		3	*280 832.2*	64	11 (^2G) $^3G°$
$3d^3(^2P)4p$	$^3P°$	1	*281 944.9*	52	22 $(^2D2)$ $^3P°$
		0	*282 234.5*	50	17 $(^2D2)$ $^3P°$
		2	*283 686.3*	27	22 (^4P) $^5S°$
$3d^3(^2G)4p$	$^1G°$	4	*282 038.1*	50	30 (^2G) $^3F°$
$3d^3(^2P)4p$	$^1D°$	2	*282 423.5*	12	27 (^4P) $^5S°$
$3d^3(^2G)4p$	$^1F°$	3	*282 571.6*	67	13 $(^2D2)$ $^1F°$
$3d^3(^4P)4p$	$^5S°$	2	*282 604.8*	49	21 (^2P) $^1D°$
$3d^3(^2G)4p$	$^1H°$	5	*282 871.9*	72	18 (^2H) $^1H°$
$3d^3(^2P)4p$	$^3D°$	1	*283 754.0*	81	8 (^4P) $^3D°$
		2	*284 911.2*	66	9 (^2P) $^1D°$
		3	*285 474.0*	54	15 $(^2D2)$ $^3F°$
$3d^3(^2H)4p$	$^3H°$	4	*284 690.3*	69	15 (^2G) $^3H°$
		5	*284 790.8*	78	19
		6	*285 196.1*	77	21
$3d^3(^2D2)4p$	$^1P°$	1	*285 961.7*	40	21 (^2P) $^1P°$
$3d^3(^2D2)4p$	$^3F°$	2	*286 154.9*	45	15 (^2G) $^3F°$
		3	*287 109.6*	23	33 (^2P) $^3D°$
		4	*287 620.2*	70	16 $(^2D1)$ $^3F°$
$3d^3(^2P)4p$	$^3S°$	1	*286 187.7*	83	6 (^2P) $^3P°$

Fe v—Continued

Configuration	Term	J	Level (cm^{-1})	Leading components (%)	
				First	Second
$3d^3(^4P)4p$	$^3D°$	3	*286 431.3*	41	24 (^{2}D2) $^3F°$
		1	*286 855.3*	48	15 (^{2}D2) $^3D°$
		2	*286 862.7*	52	20 (^{2}P) $^3D°$
$3d^3(^2H)4p$	$^3I°$	5	*287 440.5*	93	5 (^{2}G) $^1H°$
		6	*288 167.2*	98	
		7	*289 171.9*	100	
$3d^3(^2D2)4p$	$^3D°$	1	*288 669.8*	58	20 (^{4}P) $^3D°$
		2	*289 389.7*	65	15
		3	*289 913.0*	57	10
$3d^3(^2H)4p$	$^1G°$	4	*289 545.9*	75	17 (^{2}F) $^1G°$
$3d^3(^2H)4p$	$^1H°$	5	*290 099.1*	75	17 (^{2}G) $^1H°$
$3d^3(^2D2)4p$	$^3P°$	2	*290 407.7*	38	42 (^{2}P) $^3P°$
		1	*290 583.7*	43	33
		0	*290 903.4*	45	35
$3d^3(^2D2)4p$	$^1F°$	3	*291 231.4*	53	16 (^{2}D1) $^1F°$
$3d^3(^2H)4p$	$^3G°$	5	*292 287.6*	83	6 (^{2}F) $^3G°$
		4	*292 430.7*	82	7
		3	*292 513.2*	82	7
$3d^3(^2H)4p$	$^1I°$	6	*292 365.9*	98	
$3d^3(^4P)4p$	$^3S°$	1	*294 644.0*	83	8 (^{2}P) $^1P°$
$3d^3(^2D2)4p$	$^1D°$	2	*295 716.4*	46	41 (^{2}P) $^1D°$
$3d^3(^2P)4p$	$^1P°$	1	*295 973.2*	62	18 (^{2}D2) $^1P°$
$3d^3(^2F)4p$	$^3F°$	2	*302 292.7*	92	
		3	*302 377.1*	90	
		4	*302 602.5*	90	
$3d^3(^2F)4p$	$^3G°$	3	*306 193.9*	86	8 (^{2}H) $^3G°$
		4	*306 622.8*	86	8
		5	*307 064.4*	93	7
$3d^3(^2F)4p$	$^3D°$	3	*307 288.7*	85	8 (^{2}D1) $^3D°$
		2	*308 165.0*	75	12 (^{2}F) $^1D°$
		1	*308 671.5*	90	8 (^{2}D1) $^3D°$
$3d^3(^2F)4p$	$^1D°$	2	*307 644.4*	62	18 (^{2}D1) $^1D°$
$3d^3(^2F)4p$	$^1G°$	4	*311 180.9*	80	18 (^{2}H) $^1G°$
$3d^3(^2F)4p$	$^1F°$	3	*311 538.7*	92	

Fe v – Continued

Configuration	Term	J	Level (cm^{-1})	Leading components (%) First	Second
$3d^3(^2D1)4p$	$^3D^\circ$	1	*327 533.8*	76	18 $(^2D2)$ $^3D^\circ$
		2	*327 605.4*	75	16
		3	*327 924.4*	76	15
$3d^3(^2D1)4p$	$^1D^\circ$	2	*329 848.6*	47	18 $(^2D2)$ $^1D^\circ$
$3d^3(^2D1)4p$	$^3F^\circ$	2	*331 333.8*	57	18 $(^2D2)$ $^3F^\circ$
		3	*331 367.0*	70	21
		4	*332 017.3*	76	22
$3d^3(^2D1)4p$	$^3P^\circ$	2	*334 509.1*	75	22 $(^2D2)$ $^3P^\circ$
		1	*335 267.8*	75	24
		0	*335 642.7*	75	24
$3d^3(^2D1)4p$	$^1F^\circ$	3	*335 947.4*	75	19 $(^2D2)$ $^1F^\circ$
$3d^3(^2D1)4p$	$^1P^\circ$	1	*342 462.2*	76	23 $(^2D2)$ $^1P^\circ$
Fe VI $(^4F_{3/2})$	***Limit***	....	**605 000**		

Fe VI

21 electrons $Z = 26$

Ground state: $1s^2 2s^2 2p^6 3s^2 3p^6 3d^3\ {}^4F_{3/2}$

Ionization energy = 799 000 cm^{-1} (99.1 eV)

The original analysis was by Bowen [1], whose observations yielded levels of the $3d^3$ and $3d^2 4p$ configurations. Several levels due to Bowen were given in a later paper by Pasternak [2]. Fawcett and Henrichs [3] have classified a number of lines of the $3d^2 4s$–$3d^2 4p$ array. The present list of energy levels and percentage compositions is due to Ekberg [4], who kindly made this material available to us in advance of publication.

Bowen [5] has observed lines due to transitions within the $3d^3$ configuration in nebular spectra.

The ionization energy is from an isoelectronic extrapolation by Lotz [6].

References

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[2] Pasternak, S., Astrophys. J. **92**, 140 (1940).
[3] Fawcett, B. C., and Henrichs, H. F., Astron. Astrophys. **18**, 157 (1974).
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[5] Bowen, I. S., Astrophys. J. **132**, 1 (1960).
[6] Lotz, W., J. Opt. Soc. Am. **57**, 873 (1967).

Fe VI

Configuration	Term	J	Level (cm^{-1})	Leading components (%)	
				First	Second
$3d^3$	^{4}F	3/2	0	100	
		5/2	512	100	
		7/2	1188	100	
		9/2	2001	100	
$3d^3$	^{4}P	1/2	18 738	99	
		3/2	18 942	98	
		5/2	19 611	100	
$3d^3$	^{2}G	7/2	20 617	100	
		9/2	21 315	98	
$3d^3$	^{2}P	3/2	26 215	58	31 ^{2}D2
		1/2	26 496	99	
$3d^3$	^{2}D2	5/2	28 485	80	20 ^{2}D1
		3/2	28 628	46	40 ^{2}P
$3d^3$	^{2}H	9/2	28 725	98	
		11/2	29 203	100	
$3d^3$	^{2}F	7/2	46 218	100	
		5/2	46 604	100	
$3d^3$	^{2}D1	5/2	71 708	80	20 ^{2}D2
		3/2	72 049	78	22
$3d^2(^3F)4s$	^{4}F	3/2	261 842	100	
		5/2	262 369	99	
		7/2	263 137	99	
		9/2	264 119	100	
$3d^2(^3F)4s$	^{2}F	5/2	269 141	99	
		7/2	270 673	99	

Fe VI – Continued

Configuration	Term	*J*	Level (cm^{-1})	Leading components (%)	
				First	Second
$3d^2(^1D)4s$	^2D	5/2	280 902	61	38 (^3P) ^4P
		3/2	281 218	51	49
$3d^2(^3P)4s$	^4P	1/2	281 478	100	
		3/2	282 036	51	47 (^1D) ^2D
		5/2	282 953	62	38 (^1D) ^2D
$3d^2(^3P)4s$	^2P	1/2	287 920	100	
		3/2	288 639	98	
$3d^2(^1G)4s$	^2G	9/2	292 314	100	
		7/2	292 331	100	
$3d^2(^3F)4p$	$^4G^\circ$	5/2	*338 256*	91	6 (^3F) $^2F^\circ$
		7/2	*339 477*	92	5 (^3F) $^4F^\circ$
		9/2	*340 935*	93	7 (^3F) $^4F^\circ$
		11/2	*342 731*	100	
$3d^2(^3F)4p$	$^4F^\circ$	3/2	*339 540*	94	
		5/2	*340 344*	94	
		7/2	*341 366*	94	5 (^3F) $^4G^\circ$
		9/2	*342 435*	91	7 (^3F) $^4G^\circ$
$3d^2(^3F)4p$	$^2F^\circ$	5/2	*342 572*	58	16 (^3F) $^4D^\circ$
		7/2	*343 609*	54	40
$3d^2(^3F)4p$	$^4D^\circ$	3/2	*343 211*	55	30 (^3F) $^2D^\circ$
		1/2	*343 619*	92	7 (^3P) $^4D^\circ$
		5/2	*344 273*	63	23 (^3F) $^2F^\circ$
		7/2	*345 423*	53	37 (^3F) $^2F^\circ$
$3d^2(^3F)4p$	$^2D^\circ$	3/2	*344 653*	47	36 (^3F) $^4D^\circ$
		5/2	*345 907*	62	15 (^3P) $^2D^\circ$
$3d^2(^3F)4p$	$^2G^\circ$	7/2	*348 962*	94	4 (^1G) $^2G^\circ$
		9/2	*350 018*	94	4
$3d^2(^3P)4p$	$^2S^\circ$	1/2	*351 806*	98	
$3d^2(^3P)4p$	$^4S^\circ$	3/2	*355 657*	90	9 (^1D) $^2P^\circ$
$3d^2(^1D)4p$	$^2P^\circ$	3/2	*357 755*	80	9 (^3P) $^4S^\circ$
		1/2	*359 396*	51	40 (^3P) $^4D^\circ$
$3d^2(^1D)4p$	$^2F^\circ$	5/2	*358 334*	83	6 (^3F) $^2F^\circ$
		7/2	*359 884*	77	12 (^3P) $^4D^\circ$
$3d^2(^3P)4p$	$^4D^\circ$	1/2	*359 100*	52	44 (^1D) $^2P^\circ$
		3/2	*359 781*	90	7 (^3F) $^4D^\circ$
		5/2	*360 707*	85	6 (^3F) $^4D^\circ$
		7/2	*362 271*	82	12 (^1D) $^2F^\circ$

Fe VI – Continued

Configuration	Term	J	Level (cm^{-1})	Leading components (%)	
				First	Second
$3d^2(^1D)4p$	$^2D^\circ$	3/2	*361 858*	80	6 (^3F) $^2D^\circ$
		5/2	*362 603*	76	11 (^3P) $^4P^\circ$
$3d^2(^3P)4p$	$^4P^\circ$	1/2	*363 946*	98	
		3/2	*364 393*	97	
		5/2	*365 496*	87	13 (^1D) $^2D^\circ$
$3d^2(^1G)4p$	$^2G^\circ$	7/2	*365 077*	93	5 (^3F) $^2G^\circ$
		9/2	*365 267*	94	4
$3d^2(^3P)4p$	$^2D^\circ$	3/2	*370 538*	78	12 (^3F) $^2D^\circ$
		5/2	*370 580*	80	15
$3d^2(^1G)4p$	$^2H^\circ$	9/2	*372 096*	98	
		11/2	*373 706*	100	
$3d^2(^3P)4p$	$^2P^\circ$	1/2	*374 088*	98	
		3/2	*374 426*	95	
$3d^2(^1G)4p$	$^2F^\circ$	7/2	*377 952*	95	4 (^1D) $^2F^\circ$
		5/2	*379 078*	97	
$3d^2(^1S)4p$	$^2P^\circ$	1/2	*408 208*	97	
		3/2	*410 390*	98	
Fe VII $(^3F_2)$	***Limit***	....	**799 000**		

Fe VII

20 electrons $Z=26$

Ground state: $1s^22s^22p^63s^23p^63d^2\ ^3F_2$

Ionization energy = 1 010 000 cm^{-1} (125 eV)

The level system consists largely of Edlén's [1] unpublished extension of the previous analyses by Cady [2] and by Bowen and Edlén [3], as given in the original AEL compilation [4]. The only published line list is that of Cady [2]. We have added here the $^1S_0$ level of $3d^2$ and the $^3F^\circ_2$, $^3D^\circ_2$, and $^1P^\circ_1$ levels of $3d4p$ from further unpublished work of Edlén [5].

The $3d^2$, $3d4p$, and $3d4f$ configurations have been calculated by Warner and Kirkpatrick [6]. Their percentage compositions for $3d^2$ and $3d4p$ as communicated privately to us are given here. For the $3d4f$ configuration we have given the percentages from the calculation published by Shadmi [7]. In order to get a physically meaningful fit for these levels, Shadmi had to omit the levels at 659 923 cm^{-1} ($^1G_4$) and 669 978 ($^1H_5$), which are evidently perturbed.

A number of transitions between levels of the $3d^2$ configuration have been listed by Bowen [8].

The ionization energy is from the isoelectronic extrapolation of Lotz [9].

References

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[9] Lotz, W., J. Opt. Soc. Am. **57**, 873 (1967).

Fe VII

Configuration	Term	J	Level (cm^{-1})	Leading components (%)	
				First	Second
$3d^2$	^3F	2	0	100	
		3	1047	100	
		4	2327	100	
$3d^2$	^1D	2	17 475	93	6 ^3P
$3d^2$	^3P	0	20 037	100	
		1	20 428	100	
		2	21 275	94	6 ^1D
$3d^2$	^1G	4	28 915	100	
$3d^2$	^1S	0	65 707	100	
$3d4p$	$^1D^\circ$	2	*425 388*	76	21 $^3F^\circ$
$3d4p$	$^3D^\circ$	2	*427 780*	83	7 $^1D^\circ$
$3d4p$	$^3F^\circ$	2	*430 215*	72	15 $^1D^\circ$
		3	*431 606*	77	23 $^3D^\circ$
		4	*433 870*	100	
$3d4p$	$^3P^\circ$	1	*436 963*	92	6 $^1P^\circ$
		0	*437 010*	100	
		2	*437 567*	96	
$3d4p$	$^1F^\circ$	3	*439 812*	98	

Fe VII – Continued

Configuration	Term	J	Level (cm^{-1})	Leading components (%)	
				First	Second
3d 4p	$^1P^\circ$	1	*443 455*	92	6 $^3P^\circ$
3d 4f	$^1G^\circ$	4	*659 923*	85	9 $^3F^\circ$
3d 4f	$^3F^\circ$	2	*660 022*	95	
		3	*660 360*	96	
		4	*661 176*	64	22 $^3H^\circ$
3d 4f	$^3G^\circ$	3	*663 104*	88	
		4	*663 953*	94	
		5	*664 483*	97	
3d 4f	$^1D^\circ$	2	*663 882*	93	
3d 4f	$^1F^\circ$	3	*665 425*	70	19 $^3D^\circ$
3d 4f	$^3D^\circ$	1	*665 843*	90	
		2	*665 925*	83	14 $^3P^\circ$
		3	*666 663*	79	20 $^1F^\circ$
3d 4f	$^3P^\circ$	2	*667 903*	83	15 $^3D^\circ$
		1	*668 265*	91	
		0	*668 497*	100	
3d 4f	$^1H^\circ$	5	*669 978*	99	
3d 4f	$^1P^\circ$	1	*671 470*	96	
Fe VIII ($^2D_{3/2}$)	***Limit***	....	**1 010 000**		

Fe VIII

19 electrons $Z = 26$

Ground state: $1s^22s^22p^63s^23p^63d\ ^2D_{3/2}$

Ionization energy = 1 218 400 cm^{-1} (151.06 eV)

The ground-term splitting was determined by Cowan and Peacock [1] by means of four pairs of lines arising from the $3p^53d^2$ configuration. This upper configuration was interpreted and assigned composition percentages by the same authors. Earlier, Kruger and Weissberg reported [2] the one-electron terms $5s$, $6s$, $4p$, $4f$, $5f$, $6f$, and $7f$. With light sources allowing differentiation among highly ionized species Alexander, Feldman, and Fraenkel [3] determined that the lines used in ref. 2 to establish $5s$, $6s$, and $4p$ were erroneously assigned to Fe VIII. This finding has recently been confirmed by Ekberg [4].

The levels of $3p^53d4s$ were deduced by Cowan [5] from lines reported by Feldman and Fraenkel [6].

The ionization energy was derived by Alexander, Feldman, and Fraenkel [3] from the nf series by utilizing their new measurements of the resonance lines from the $6f$ and $7f$ terms.

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Fe VIII

Configuration	Term	J	Level (cm^{-1})	Leading components (%)	
				First	Second
$3p^6(^1S)3d$	^2D	3/2	0		
		5/2	1838		
$3p^5(^2P^\circ)3d^2(^3F)$	$^2F^\circ$	5/2	*535 970*	53	47 $(^1G)\ ^2F^\circ$
		7/2	*541 820*	50	49
$3p^5(^2P^\circ)3d^2(^3P)$	$^2P^\circ$	1/2	*591 960*	73	14 $(^1D)\ ^2P^\circ$
		3/2	*595 100*	75	16
$3p^5(^2P^\circ)3d^2(^3F)$	$^2D^\circ$	5/2	*596 440*	71	17 $(^1D)\ ^2D^\circ$
		3/2	*597 010*	72	17
$3p^6(^1S)4f$	$^2F^\circ$	5/2	*763 789*		
		7/2	*763 821*		
$3p^53d(^3P^\circ)4s$	$^4P^\circ$	3/2	*833 000?*		
$3p^53d(^3P^\circ)4s$	$^2P^\circ$	1/2	*837 750*		
		3/2	*842 930*		
$3p^53d(^3F^\circ)4s$	$^4F^\circ$	7/2	*847 250*		
		5/2	*849 990*		
$3p^53d(^3F^\circ)4s$	$^2F^\circ$	7/2	*855 190*		
		5/2	*860 710*		
$3p^53d(^3D^\circ)4s$	$^4D^\circ$	7/2	*874 770*		
		5/2	*876 810*		
$3p^53d(^1F^\circ)4s$	$^2F^\circ$	7/2	*887 320*		

Fe VIII – Continued

Configuration	Term	J	Level (cm^{-1})	Leading components (%)	
				First	Second
$3p^53d(^3D^\circ)4s$	$^2D^\circ$	3/2	*889 110*		
		5/2	*890 810*		
$3p^6(^1S)5f$	$^2F^\circ$	5/2	*927 025*		
		7/2	*927 053*		
$3p^6(^1S)6f$	$^2F^\circ$	5/2	*1 016 530*		
		7/2	*1 016 570*		
$3p^6(^1S)7f$	$^2F^\circ$	5/2	*1 069 870*		
		7/2	*1 070 030*		
Fe IX ($^1S_0$)	***Limit***	....	**1 218 400**		

Fe IX

18 electrons $Z=26$

Ground state: $1s^2 2s^2 2p^6 3s^2 3p^6\ ^1S_0$

Ionization energy = 1 884 000 cm^{-1} (233.6 eV)

This spectrum was first investigated by Kruger, Weissberg, and Phillips [1], who identified the resonance lines arising from the two $J=1$ levels of the $3p^5 4s$ configuration. The present values of these levels are taken from the paper of Fawcett, Cowan, Kononov, and Hayes [2].

The analysis of the $3p^5 3d$ configuration was begun with the identification of the resonance transition from the $^1P_1^\circ$ level by Alexander, Feldman, Fraenkel, and Hoory [3] and independently by Gabriel, Fawcett, and Jordan [4, 5]. The composition of this level has been calculated to be 99.8 percent $^1P_1^\circ$ and 0.2 percent $^3D_1^\circ$ by Cowan and Peacock [6]. More recently, the complete $3p^5 3d$ configuration has been established by means of combinations with the $3s3p^6 3d$ configuration by Svensson, Ekberg, and Edlén [7]. Only the $3p^5 3d$ level values have as yet been published [7].

The $3p^5 4d$ and $3p^5 5s$ levels are from the paper of Alexander, Feldman, and Fraenkel [8]. Only levels with $J=1$ are known for these two configurations. The present values for the two $3p^5 4d$ levels are obtained from the recent measurements of Fawcett, Cowan, Kononov, and Hayes [2].

The $3p^5 4f$ level values given here were derived by combining the $3p^5 3d$–$3p^5 4f$ line identifications of Wagner and House [9] and of Fawcett, Cowan, Kononov, and Hayes [2] with the level values of $3p^5 3d$ of Svensson, Ekberg, and Edlén [7]. The $3p^5 4f$ levels clearly follow a $J_1\ell$ coupling scheme, and $J_1\ell$ designations have therefore been adopted. The K-values for the $J=3$ levels at 1 323 650 and 1 324 710 cm^{-1} have been assigned by comparing the intensities of their combinations with $3p^5 3d$ with those in similar spectra. We note that the ordering of these two $J=3$ levels is the reverse of the theoretical order.

We have derived the ionization energy from the $3p^5 4s$ and $3p^5 5s$ configurations under the assumption of a change in effective quantum number Δn^* of 1.024, as observed in similar spectra. The uncertainty in the ionization energy is ± 3000 cm^{-1} (0.4 eV), based on an estimated uncertainty of ± 0.005 in the value of Δn^*.

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Fe IX

Configuration	Term	J	Level (cm^{-1})
$3p^6$	^1S	0	0
$3p^5 3d$	$^3P^\circ$	0	*405 765*
		1	*408 307*
		2	*413 667*
$3p^5 3d$	$^3F^\circ$	4	*425 800*
		3	*429 311*
		2	*433 807*
$3p^5 3d$	$^3D^\circ$	3	*455 612*
		1	*460 609*
		2	*462 616*
$3p^5 3d$	$^1D^\circ$	2	*456 744*

Fe IX—Continued

Configuration	Term	J	Level (cm^{-1})
$3p^5 3d$	$^1F°$	3	*465 836*
$3p^5 3d$	$^1P°$	1	*584 547*
$3p^5(^2P°_{3/2})4s$	(3/2,1/2)°	1	*950 500*
$3p^5(^2P°_{1/2})4s$	(1/2,1/2)°	1	*965 570*
$3p^5 4d$	$^3P°$	1	*1 198 220*
$3p^5 4d$	$^1P°$	1	*1 213 150*
$3p^5(^2P°_{3/2})4f$	$^2[3/2]$	1	1 300 920
		2	1 302 830
$3p^5(^2P°_{3/2})4f$	$^2[9/2]$	5	1 304 590
		4	1 306 320
$3p^5(^2P°_{3/2})4f$	$^2[5/2]$	3	1 305 760
$3p^5(^2P°_{3/2})4f$	$^2[7/2]$	3	1 310 150
		4	1 311 750
$3p^5(^2P°_{1/2})4f$	$^2[5/2]$	3	1 323 650
$3p^5(^2P°_{1/2})4f$	$^2[7/2]$	3	1 324 710
		4	1 324 800
$3p^5(^2P°_{3/2})5s$	(3/2,1/2)°	1	1 358 140
$3p^5(^2P°_{1/2})5s$	(1/2,1/2)°	1	1 372 670
Fe X ($^2P°_{3/2}$)	***Limit***	....	**1 884 000**

Fe X

17 electrons $Z=26$

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

Ionization energy = 2 114 000 cm^{-1} (262.1 eV)

Only the ground term $3s^23p^5\ ^2P^\circ$ and levels that combine with it are known for this ion. The $3s^23p^44s$ levels and the $3s^23p^5\ ^2P^\circ$ term interval were established by the identification of a group of lines at about 95 Å by Edlén [1] in 1937. The value of the $3s^23p^5\ ^2P^\circ$ interval was later more precisely determined by Grotrian [2] through his identification of the solar coronal line at 6374.51 Å as the magnetic dipole transition $3s^23p^5\ ^2P^\circ_{3/2}$–$3s^23p^5\ ^2P^\circ_{1/2}$ in Fe X.

The $3s^23p^43d$ level values are obtained from the line identifications of Fawcett and Gabriel [3]; the $3s^23p^44d$ level values are derived from the line identifications of Fawcett, Cowan, Kononov, and Hayes [4]. The percentage compositions for $3s^23p^43d$ are taken from the paper by Cowan and Peacock [5], those for $3s^23p^44d$ are from Fawcett et al. [4].

Fawcett et al. [4] have identified several lines of the type $3s^23p^43d$–$3s^23p^44p$ and $3s^23p^43d$–$3s^23p^44f$, but no levels can be derived from them. Fawcett [6] has given the position of the $3s3p^6\ ^2S$ term.

Edlén [1] derived the ionization energy by isoelectronic extrapolation.

References

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Fe X

Configuration	Term	J	Level (cm^{-1})	Leading components (%)	
				First	Second
$3s^23p^5$	$^2P^\circ$	3/2	*0*		
		1/2	*15 683*		
$3s3p^6$	^2S	1/2	289 230		
$3s^23p^4(^1D)3d$	^2S	1/2	541 930		
$3s^23p^4(^3P)3d$	^2P	3/2	564 200	55	41 $(^1D)\ ^2P$
		1/2	569 860	55	45
$3s^23p^4(^3P)3d$	^2D	5/2	572 800	68	22 $(^1D)\ ^2D$
		3/2	586 250	64	19
$3s^23p^4(^3P)4s$	^4P	5/2	1 022 100		
		3/2	1 029 630		
$3s^23p^4(^3P)4s$	^2P	3/2	1 040 350		
		1/2	1 048 900		
$3s^23p^4(^1D)4s$	^2D	5/2	1 063 690		
		3/2	1 064 190		
$3s^23p^4(^3P)4d$	^2D	5/2	1 284 270		
		3/2	1 285 180		
$3s^23p^4(^3P)4d$	^4F	5/2	1 286 540	77	14 $(^3P)\ ^2D$
$3s^23p^4(^3P)4d$	^2F	5/2	1 288 210		

Fe X – Continued

Configuration	Term	J	Level (cm^{-1})	Leading components (%)	
				First	Second
$3s^23p^4(^3P)4d$	^2P	3/2	1 295 260	82	10 (^3P) ^2D
$3s^23p^4(^1D)4d$	^2P	3/2	1 315 690		
		1/2	1 317 390	79	18 (^3P) ^2P
$3s^23p^4(^1D)4d$	^2D	5/2	1 321 270		
		3/2	1 322 960		
Fe XI ($^3P_2$)	*Limit*	....	**2 114 000**		

Fe XI

16 electrons $Z=26$

Ground state: $1s^22s^22p^63s^23p^4\ ^3P_2$ Ionization energy = 2 341 000 cm^{-1} (290.3 eV)

This spectrum was first investigated by Edlén [1], who observed and identified the group of $3s^23p^4$–$3s^23p^34s$ transitions occurring at about 90 Å. He established most of the levels of these two configurations. In 1939, Grotrian [2] identified a solar coronal line at 7871 Å as a transition between the $3s^23p^4\ ^3P_2$ and $^3P_1$ levels. This was subsequently confirmed by Edlén [3], who further identified a coronal line at 3987 Å as the $3s^23p^4\ ^3P_1$–$^3D_2$ transition.

The present values for the $3s^23p^4\ ^3P_1$ and $^1D_2$ levels are taken from the coronal observations of Jeffries [4]. The $3s^23p^4\ ^1S_0$ level is derived from the solar line at 1467.42 Å observed by Burton and Ridgeley [5]. This line has been identified by both Svensson [6] and Jordan [7] as the $3s^23p^4\ ^3P_1$–$^1S_0$ transition. The $3s^23p^4\ ^3P_0$ level is derived from the line at 358.64 Å given by Fawcett [8].

The $3s^23p^34s$ levels are derived from the 1937 observations of Edlén [1], with the dropping of the identification of the original singlet-triplet intercombination lines at 86.149 and 89.771 Å, as noted by Edlén [3] in 1942. The line at 89.771 Å has recently been given by Fawcett, Cowan, Kononov, and Hayes [9] as the $3s^23p^4\ ^1S_0$–$3s^23p^3(^2P)4s\ ^1P_1^\circ$ transition in Fe XI. However, this identification is inconsistent with Edlén's identification of the line at 86.513 Å as the $3s^23p^4\ ^1D_2$–$3s^23p^34s\ ^1P_1^\circ$ transition, which fixes the position of the $3s^23p^34s\ ^1P_1^\circ$ level. The $3s^23p^34s\ ^5S^\circ$ and $^3P^\circ$ terms have not yet been located.

The values for the levels of the $3s3p^5$ configuration and most of $3s^23p^33d$ configuration are taken from the observations and identifications of Fawcett [8]. The $3s^23p^3(^2P)3d\ ^3P^\circ$ levels result from an identification by Goldsmith, Oren (Katz), Crooker, and Cohen [10] of the solar lines at 188.305 and 188.498 Å observed by Behring, Cohen, and Feldman [11].

The $3s^23p^34d$ levels are taken from the work of Fawcett, Cowan, Kononov, and Hayes [9]. These authors have also observed a number of lines identified as $3s^23p^33d$–$3s^23p^34f$ and $3s^23p^33d$–$3s^23p^34p$ transitions of Fe XI. However, it is not possible to derive level values from these identifications inasmuch as none of the $3s^23p^33d$ levels involved is part of the known system of levels. The percentage composition for the $3s^23p^34d\ ^1D_2^\circ$ level is from ref. [9].

The ionization energy is from an isoelectronic extrapolation by Lotz [12].

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Fe XI

Configuration	Term	J	Level (cm^{-1})	Leading components (%)	
				First	Second
$3s^23p^4$	^3P	2	0		
		1	12 667.9		
		0	14 300		
$3s^23p^4$	^1D	2	37 743.6		
$3s^23p^4$	^1S	0	80 815		
$3s3p^5$	$^3P^\circ$	2	*283 520*		
		1	*293 130*		
		0	*299 230*		

Fe XI – Continued

Configuration	Term	J	Level (cm^{-1})	Leading components (%) First	Second
$3s3p^5$	$^1P^\circ$	1	*361 780*		
$3s^23p^3(^2P^\circ)3d$	$^3P^\circ$	1	*530 510*		
		2	*531 053*		
$3s^23p^3(^2D^\circ)3d$	$^3P^\circ$	1	*531 160*		
		2	*531 220*		
$3s^23p^3(^4S^\circ)3d$	$^3D^\circ$	3	*554 260*		
		2	*561 640*		
		1	*566 380*		
$3s^23p^3(^2D^\circ)3d$	$^1D^\circ$	2	*578 930*		
$3s^23p^3(^2D^\circ)3d$	$^1F^\circ$	3	*594 070*		
$3s^23p^3(^2D^\circ)3d$	$^1P^\circ$	1	*623 080*		
$3s^23p^3(^4S^\circ)4s$	$^3S^\circ$	1	*1 121 230*		
$3s^23p^3(^2D^\circ)4s$	$^3D^\circ$	1	*1 148 580*		
		2	*1 149 100*		
		3	*1 152 450*		
$3s^23p^3(^2D^\circ)4s$	$^1D^\circ$	2	*1 160 030*		
$3s^23p^3(^2P^\circ)4s$	$^1P^\circ$	1	*1 193 640*		
$3s^23p^3(^4S^\circ)4d$	$^3D^\circ$	3	*1 376 750*		
$3s^23p^3(^2D^\circ)4d$	$^1D^\circ$	2	*1 420 680*	72	10 $(^2D^\circ)$ $^3D^\circ$
$3s^23p^3(^2D^\circ)4d$	$^1F^\circ$	3	*1 423 440*		
Fe XII $(^4S^\circ_{3/2})$	***Limit***	....	**2 341 000**		

Fe XII

15 electrons $Z=26$

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

Ionization energy = 2 668 000 cm^{-1} (330.8 eV)

The classifications of four solar coronal lines as transitions within the ground $3s^23p^3$ configuration [1–4] permit the construction of an energy level scheme incorporating most of the classified lines of this ion. The lines at 1240.02 Å and 1349.47 Å were identified in ref. [1] as $3s^23p^3\ ^4S^\circ_{3/2}-3s^23p^3\ ^2P^\circ_{1/2,3/2}$. In refs. [2], [3], and [4] the line at 2169.7 Å (air λ) was classified as $3s^23p^3\ ^4S^\circ_{3/2}-3s^23p^3\ ^2D^\circ_{5/2}$, and in refs. [3] and [4] the transition $3s^23p^3\ ^4S^\circ_{3/2}-3s^23p^3\ ^2D^\circ_{3/2}$ was assigned to the line at 3072.0 Å (air λ).

The $3s3p^4$ and $3s^23p^23d$ configurations are largely due to line identifications by Fawcett [5], who points out that these lines account for most of the intense solar emission between 170 Å and 400 Å. Earlier line identifications of $3s^23p^3-3s^23p^23d$ transitions are given in refs. [6] and [7].

Lines classified as transitions between the $3s^23p^3$ configuration and the $3s^23p^24s$ and $4d$ configurations are given by Fawcett, Cowan, Kononov, and Hayes [8]. Only the line at 79.48 Å in this group was previously classified [9]. Classified lines from $3s^23p^24p$ and $4f$ are also given in ref. [8] but are not connected with known lower levels. The percentage compositions for $3p^24s$ and $3p^24d$ are given in the same paper.

The ionization energy is an extrapolated value by Lotz [10].

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Fe XII

Configuration	Term	J	Level (cm^{-1})	Leading components (%)	
				First	Second
$3s^23p^3$	$^4S^\circ$	3/2	*0*		
$3s^23p^3$	$^2D^\circ$	3/2	*41 560*		
		5/2	*46 110*		
$3s^23p^3$	$^2P^\circ$	1/2	*74 103*		
		3/2	*80 514*		
$3s3p^4$	^4P	5/2	274 360		
		3/2	283 990		
		1/2	288 340		
$3s3p^4$	^2P	3/2	389 760		
		1/2	394 120		
$3s3p^4$	^2D	3/2	340 010		
		5/2	341 730		
$3s^23p^2(^3P)3d$	^2P	3/2	501 840		
		1/2	513 900		
$3s^23p^2(^3P)3d$	^4P	5/2	512 450		
		3/2	516 720		
		1/2	519 700		

Fe XII – Continued

Configuration	Term	J	Level (cm^{-1})	Leading components (%)	
				First	Second
$3s^23p^2(^1D)3d$	^2D	3/2	553 900		
		5/2	554 600		
$3s^23p^2(^1D)3d$	^2P	1/2	569 790		
		3/2	577 680		
$3s^23p^2(^3P)3d$	^2F	7/2	581 240		
$3s^23p^2(^3P)3d$	^2D	5/2	603 910		
		3/2	605 420		
$3s^23p^2(^3P)4s$	^4P	1/2	1 242 200		
		3/2	1 249 660		
		5/2	1 258 050		
$3s^23p^2(^3P)4s$	^2P	1/2	1 257 720		
		3/2	1 266 380	81	17 $(^1D)\ ^2D$
$3s^23p^2(^1D)4s$	^2D	5/2	1 287 700		
		3/2	1 289 060	82	16 $(^3P)\ ^2P$
$3s^23p^2(^3P)4d$	^4P	5/2	1 508 360	35	35 $(^3P)\ ^4F$
		3/2	1 517 340	65	19 $(^3P)\ ^2P$
$3s^23p^2(^3P)4d$	^4F	5/2	1 514 070	49	48 $(^3P)\ ^4D$
$3s^23p^2(^3P)4d$	^2F	5/2	1 516 030	77	9 $(^3P)\ ^4F$
		7/2	1 523 170	39	12 $(^1D)\ ^2F$
$3s^23p^2(^3P)4d$	^4D	7/2	1 532 190	48	48 $(^3P)\ ^2F$
$3s^23p^2(^3P)4d$	^2D	5/2	1 534 990	67	26 $(^1D)\ ^2F$
		3/2	1 536 840		
$3s^23p^2(^1D)4d$	^2F	7/2	1 549 280	81	14 $(^3P)\ ^4D$
		5/2	1 551 450?	40	39 $(^1D)\ ^2D$
$3s^23p^2(^1D)4d$	^2D	5/2	1 551 640	40	24 $(^3P)\ ^2D$
$3s^23p^2(^1D)4d$	^2P	3/2	1 565 750		
$3s^23p^2(^1D)4d$	^2S	1/2	1 569 410		
Fe XIII $(^3P_0)$	***Limit***	....	**2 668 000**		

Fe XIII

14 electrons $Z = 26$

Ground state: $1s^22s^22p^63s^23p^2\ ^3P_0$ Ionization energy = 2 912 000 cm^{-1} (361.0 eV)

The level structure of the $3s^23p^2$ configuration was derived from solar coronal line identifications; the ^3P and ^1D terms are due to Edlén [1] and the ^1S term is due to Gabriel et al. [2]. The classification of lines observed in the laboratory by Fawcett [3] provided the data for all levels of the $3s3p^3$ configuration except for $^3D^\circ_1$, which is established through a solar identification by Widing, Sandlin, and Cowan [4]. The $3s^23p3d$ configuration is entirely due to Fawcett's identifications [3]. The higher lying configurations $3s^23p4s$, $4p$, $4d$, and $4f$ were reported by Fawcett, Cowan, Kononov, and Hayes [5]. Some of the lines they identified involve transitions to the unknown $^3F^\circ$ term of $3s^23p3d$ from $3s^23p4f$ levels, and therefore cannot be used to establish connected levels of the latter configuration. In the same paper percentage compositions are given for levels whose first component is not "high", generally less than 90 percent.

The ionization energy was extrapolated by Lotz [6].

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Fe XIII

Configuration	Term	J	Level (cm^{-1})	Leading components (%)	
				First	Second
$3s^23p^2$	^3P	0	0.0		
		1	9302.5		
		2	18 561.0		
$3s^23p^2$	^1D	2	48 068		
$3s^23p^2$	^1S	0	91 740		
$3s3p^3$	^3D	1	287 190		
		2	287 370		
		3	290 210		
$3s3p^3$	$^3P^\circ$	2	*330 160*		
$3s3p^3$	$^1D^\circ$	2	*362 330*		
$3s3p^3$	$^3S^\circ$	1	*415 420*		
$3s3p^3$	$^1P^\circ$	1	*438 050*		
$3s^23p3d$	$^3P^\circ$	2	*486 290*		
		1	*494 850*		
$3s^23p3d$	$^1D^\circ$	2	*498 870*	83	12 $^3F^\circ$
$3s^23p3d$	$^3D^\circ$	1	*506 490*		
		2	*509 220*		
		3	*509 240*		

Fe XIII – Continued

Configuration	Term	J	Level (cm^{-1})	Leading components (%)	
				First	Second
$3s^23p3d$	$^1F^\circ$	3	*556 870*		
$3s^23p3d$	$^1P^\circ$	1	*570 950*		
$3s^23p4s$	$^3P^\circ$	1	*1 336 220*	84	16 $^1P^\circ$
		2	*1 354 680*		
$3s^23p4s$	$^1P^\circ$	1	*1 361 830*	84	16 $^3P^\circ$
$3s^23p4p$	^1D	2	1 488 110	86	13 ^3P
$3s^23p4p$	^1P	1	1 515 260?	39	35 ^3D
$3s^23p4d$	$^3D^\circ$	2	*1 604 350*	61	17 $^3F^\circ$
		3	*1 606 490*	45	41
$3s^23p4d$	$^1F^\circ$	3	*1 630 570*	84	12 $^3F^\circ$
$3s^23p4f$	^3F	4	1 741 360	57	43 ^3G
$3s^23p4f$	^1G	4	1 743 460		
Fe XIV ($^2P^\circ_{1/2}$)	***Limit***	....	**2 912 000**		

Fe XIV

13 electrons $Z = 26$

Ground state: $1s^2 2s^2 2p^6 3s^2 3p\ ^2P^\circ_{1/2}$

Ionization energy = 3 163 000 cm^{-1} (392.2 eV)

The early laboratory work on this one-electron spectrum consisted of Edlén's [1] 1936 identification of the $3p$–$4d$ resonance lines at about 59 Å. Later Edlén [2] identified a solar coronal line at 5302.86 Å as the transition between the $3s^2 3p\ ^2P^\circ_{1/2}$ and $^2P^\circ_{3/2}$ levels. This identification still serves as the basis for the ground term splitting in this ion.

The first excited configuration in Fe XIV is $3s3p^2$. The values for the levels of this configuration have been derived by using the laboratory observations of Fawcett and Peacock [3] and those of Fawcett [4]. The value of $3s3p^2\ ^2D_{3/2}$ is obtained by use of an identification of a solar line at 334.13 Å as the $3s^2 3p\ ^2P^\circ_{1/2}$–$3s3p^2\ ^2D_{3/2}$ transition by Widing, Sandlin, and Cowan [5].

The $3s^2 3d$ levels are obtained from the observations of Peacock, Cowan, and Sawyer [6]. The $3s^2 4s$, $3s^2 4p$, and $3s^2 4f$ levels are derived from the recent work of Fawcett, Cowan, Kononov, and Hayes [7].

The $3s^2 4d$ levels are still obtained from Edlén's [1] original identifications.

A number of Fe XIV transitions of the type $3s3p^2$–$3p^3$, $3s3p^2$–$3s3p4s$, and $3s3p3d$–$3s3p4f$ are also listed in refs. [4] and [7]. However, the levels involved in these transitions cannot yet be connected to the level system given here.

The ionization energy is the value given by Lotz [8] from his isoelectronic extrapolation.

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Fe XIV

Configuration	Term	J	Level (cm^{-1})
$3s^2 3p$	$^2P^\circ$	1/2	*0.0*
		3/2	*18 852.5*
$3s3p^2$	^2D	3/2	299 280
		5/2	301 460
$3s3p^2$	^2S	1/2	364 670
$3s3p^2$	^2P	1/2	388 490
		3/2	396 510
$3s^2 3d$	^2D	3/2	473 210
		5/2	475 200
$3s^2 4s$	^2S	1/2	1 435 020
$3s^2 4p$	$^2P^\circ$	1/2	*1 568 820*
		3/2	*1 573 990*
$3s^2 4d$	^2D	3/2	1 695 980
		5/2	1 697 290
$3s^2 4f$	$^2F^\circ$	7/2	*1 788 360*
		5/2	*1 788 620*
Fe XV ($^1S_0$)	***Limit***	....	**3 163 000**

Fe XV

12 electrons $Z=26$

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

Ionization energy = 3 686 000 cm^{-1} (457.0 eV)

Edlén's early work on this spectrum consisted of the observation of the three line groups $3s^2\ ^1S$–$3s4p\ ^1P°$; $3s3p\ ^3P°$–$3s4d\ ^3D$; $3s3d\ ^3D$–$3s4f\ ^3F°$ and $3s3d\ ^3D$–$3s5f\ ^3F°$. As these three groups were unconnected and only the principal lines of the multiplet arrays were observed, the relative positions of the terms could only be estimated. This was done by isoelectronic extrapolation. Only the $3s4p\ ^1P_1^\circ$ level could actually be established relative to the ground state.

In the present compilation, the absolute energy of the system of excited triplet levels is based on the identification of a solar line at 417 Å as the $3s^2\ ^1S_0$–$3s3p\ ^3P_1^\circ$ transition by Zirin, Hall, and Hinteregger [2]. Later solar observations with higher resolution showed this line to be a blend of two lines, one due to S XIV and the other due to Fe XV. The Fe XV line was found to have a wavelength of 417.24 Å. This identification is now confirmed by the identification in further solar spectra of the intercombination lines $3s3p\ ^3P_{1,2}^\circ$–$3p^2\ ^1D_2$ at 312.55 and 327.03 Å by Cowan and Widing [4].

The values of the levels of the $3s3p$ and $3p^2$ configurations are derived from the observations of Peacock, Cowan, and Sawyer [5], and those of Fawcett [6, 7]. The $3p^2\ ^1S_0$ level has been tentatively located by Cowan and Widing [4]. The $3s3d$ levels are mainly derived from the measurements of Peacock, Cowan, and Sawyer [5]. The $3s3d\ ^1D_2$ level is obtained from the recent work of Fawcett, Cowan, and Hayes [8], whose designations for the lines at 481.52 Å ($3s3p\ ^1P°$–$3p^2\ ^1D$) and 243.783 Å ($3s3p\ ^1P°$–$3s3d\ ^1D$) have been used here. The 1970 observations of Fawcett [6] also provide values for the three levels of the $3p3d\ ^3F°$ term.

With the foregoing level determinations, the 1936 measurements of Edlén [1] can now be used to obtain the absolute values of the $3s4f\ ^3F°$, $3s4d\ ^3D$, and $3s5f\ ^3F°$ levels.

The levels of $3s4s\ ^3S$ and $3s5d\ ^3D$ given here are derived from the work of Feldman, Katz, Behring, and Cohen [9]. The $3s4d\ ^1D_1$, $3s4f\ ^1F°$ and $3p4f\ ^3G°$, $^1F°$ levels are taken from the paper of Fawcett, Cowan, Kononov and Hayes [10]. The $3s5s\ ^3S$, $3s5p\ ^1P°$, $3s5f\ ^1F°$ and $3s6f\ ^{1,3}F°$ levels are from Fawcett, Gabriel, Irons, Peacock, and Saunders [11]. According to Ekberg [12] the $3s5f\ ^1F$ and $3s6f\ ^1F$ levels are questionable.

The ionization energy has been derived here from the $3snf\ ^3F_4^\circ$ $(n=4$–$6)$ levels. Comparison with lower members of the isoelectronic sequence indicates that the ionization energy has an uncertainty of about ± 20 000 cm^{-1} (2.5 eV).

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Fe XV

Configuration	Term	J	Level (cm^{-1})
$3s^2$	^1S	0	0
$3s3p$	$^3P°$	0	*233 950*
		1	*239 670*
		2	*253 820*
$3s3p$	$^1P°$	1	*351 930*
$3p^2$	^3P	0	554 510
		1	564 580
		2	581 710

Fe xv – Continued

Configuration	Term	J	Level (cm^{-1})
$3p^2$	^{1}D	2	559 610
$3p^2$	^{1}S	0	660 980?
$3s3d$	^{3}D	1	678 860
		2	679 790
		3	681 410
$3s3d$	^{1}D	2	762 130
$3p3d$	^{3}F°	2	*928 450*
		3	*938 190*
		4	*949 660*
$3s4s$	^{3}S	1	1 763 670
$3s4p$	^{1}P°	1	*1 889 970*
$3s4d$	^{3}D	1	2 031 340
		2	2 032 020
		3	2 033 180
$3s4d$	^{1}D	2	2 035 320
$3s4f$	^{3}F°	2	*2 108 550*
		3	*2 108 630*
		4	*2 108 880*
$3s4f$	^{1}F°	3	*2 123 170*
$3p4f$	^{1}F	3	2 380 190
$3p4f$	^{3}G	4	2 386 710
		5	2 402 110
$3s5s$	^{3}S	1	2 544 800
$3s5p$	^{1}P°	1	*2 567 400*
$3s5d$	^{3}D	1	2 640 170
		2	2 639 880
		3	2 640 280
$3s5f$	^{3}F°	2	*2 676 380*
		3	*2 676 400*
		4	*2 676 620*
$3s5f$	^{1}F°	3	*2 782 700?*
$3s6f$	^{3}F°	4	*2 986 100*
$3s6f$	^{1}F°	3	*3 091 500?*
Fe XVI ($^2S_{1/2}$)	***Limit***	....	**3 686 000**

Fe XVI

11 electrons $Z = 26$

Ground state: $1s^22s^22p^63s\ ^2S_{1/2}$

Ionization energy = 3 946 150 cm^{-1} (489.264 eV)

The original work on this spectrum by Edlén [1] gave the position only of the $4p\ ^2P°$ term relative to the ground state, but included transitions from $4s$, $4d$, and $5d$ to the $3p\ ^2P°$ term, and transitions from $4f$ and $5f$ to $3d\ ^2D$. Later work by Peacock, Cowan, and Sawyer [2] brought these unconnected systems together by identifying the $3s$–$3p$ and $3p$–$3d$ transitions. We have used improved wavelengths of Feldman, Katz, Behring, and Cohen [3] for the energy level determinations.

Higher series members of *ns*, *np*, *nd*, and *nf* were identified by Fawcett, Gabriel, Irons, Peacock, and Saunders [4]. The values of the $5p$, $6p$, $7d$, $8d$, $6f$, $7f$, and $8f$ terms given below were derived by using the new wavelengths of ref. [3].

The inner shell transitions $2p^63s$–$2p^53s^2$ were identified by Feldman and Cohen [5]. Other inner shell transitions have been tentatively identified by Connerade, Peacock, and Speer [6].

The ionization energy was determined from the *np*, *nd*, and *nf* series by Feldman, Katz, Behring, and Cohen [3]. Their stated uncertainty is ±210 cm^{-1} (0.026 eV).

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Fe XVI

Configuration	Term	J	Level (cm^{-1})
$2p^6(^1S)3s$	^2S	1/2	0
$2p^6(^1S)3p$	$^2P°$	1/2	*277 160*
		3/2	*298 140*
$2p^6(^1S)3d$	^2D	3/2	675 470
		5/2	678 420
$2p^6(^1S)4s$	^2S	1/2	1 867 530
$2p^6(^1S)4p$	$^2P°$	1/2	*1 978 040*
		3/2	*1 986 100*
$2p^6(^1S)4d$	^2D	3/2	2 124 080
		5/2	2 125 360
$2p^6(^1S)4f$	$^2F°$	5/2	*2 184 610*
		7/2	*2 185 170*
$2p^6(^1S)5s$	^2S	1/2	2 662 000
$2p^6(^1S)5p$	$^2P°$	1/2	*2 717 170*
		3/2	*2 721 160*
$2p^6(^1S)5d$	^2D	3/2	2 788 020
		5/2	2 788 610

Fe XVI – Continued

Configuration	Term	J	Level (cm^{-1})
$2p^6(^1S)5f$	$^2F^\circ$	5/2	*2 818 590*
		7/2	*2 818 920*
$2p^6(^1S)6s$	^2S	1/2	3 076 000
$2p^6(^1S)6p$	$^2P^\circ$	1/2	*3 106 360*
		3/2	*3 108 870*
$2p^6(^1S)6d$	^2D	3/2	3 146 020
		5/2	3 146 660
$2p^6(^1S)6f$	$^2F^\circ$	5/2	*3 163 090*
		7/2	*3 163 200*
$2p^6(^1S)7s$	^2S	1/2	3 325 000
$2p^6(^1S)7p$	$^2P^\circ$	3/2	*3 341 000*
$2p^6(^1S)7d$	^2D	3/2	3 360 440
		5/2	3 360 740
$2p^6(^1S)7f$	$^2F^\circ$	7/2	*3 371 080*
		5/2	*3 371 180*
$2p^6(^1S)8p$	$^2P^\circ$	3/2	*3 488 000*
$2p^6(^1S)8d$	^2D	3/2	3 498 710
		5/2	3 498 960
$2p^6(^1S)8f$	$^2F^\circ$	5/2	*3 505 690*
		7/2	*3 505 830*
$2p^6(^1S)9p$	$^2P^\circ$	3/2	*3 587 000*
$2p^6(^1S)9d$	^2D	5/2	3 595 000
		3/2	3 599 000
$2p^6(^1S)9f$	$^2F^\circ$	7/2	*3 602 000*
Fe XVII ($^1S_0$)	***Limit***	....	**3 946 150**
$2p^5 3s^2$	$^2P^\circ$	3/2	*5 718 000*
		1/2	*5 811 000*

Fe XVII

10 electrons $Z=26$

Ground state: $1s^22s^22p^6\ ^1S_0$ Ionization energy = 10 210 000 cm^{-1} (1266 eV)

Tyrén [1] identified the resonance lines arising from the $2p^53s$, $2p^53d$, $2p^54d$, and $2s2p^63p$ configurations. A magnetic dipole transition from a $J=2$ state of the $2p^53s$ configuration to the ground level was observed by Parkinson [2]. Resonance lines from $2p^54s$, $2p^54d$, $2p^55d$, and $2p^56d$ were identified by Swartz, Kastner, Rothe, and Neupert [3]. The $j\ell$-coupling designations were assigned to the $2p^5nd$ levels by comparing them with similar rare gas spectra. We derived the ionization energy from the nd ($n=4$, 5, 6) series. The estimated uncertainty is ±20 000 cm^{-1} (3 eV).

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Fe XVII

Configuration	Term	J	Level (cm^{-1})
$2s^22p^6$	^1S	0	0
$2s^22p^5(^2P^\circ_{3/2})3s$	$(3/2,1/2)^\circ$	2	*5 852 700*
		1	*5 864 800*
$2s^22p^5(^2P^\circ_{1/2})3s$	$(1/2,1/2)^\circ$	1	*5 961 600*
$2s^22p^5(^2P^\circ_{3/2})3d$	$^2[1/2]^\circ$	1	*6 471 200*
$2s^22p^5(^2P^\circ_{3/2})3d$	$^2[3/2]^\circ$	1	*6 552 700*
$2s^22p^5(^2P^\circ_{1/2})3d$	$^2[3/2]^\circ$	1	*6 661 300*
$2s2p^63p$	$^3P^\circ$	1	*7 201 000*
$2s2p^63p$	$^1P^\circ$	1	*7 235 900*
$2s^22p^5(^2P^\circ_{3/2})4s$	$(3/2,1/2)^\circ$	1	*7 886 000*
$2s^22p^5(^2P^\circ_{1/2})4s$	$(1/2,1/2)^\circ$	1	*7 994 000*
$2s^22p^5(^2P^\circ_{3/2})4d$	$^2[1/2]^\circ$	1	*8 117 000*
$2s^22p^5(^2P^\circ_{3/2})4d$	$^2[3/2]^\circ$	1	*8 155 000*
$2s^22p^5(^2P^\circ_{1/2})4d$	$^2[3/2]^\circ$	1	*8 250 000*
$2s^22p^5(^2P^\circ_{3/2})5d$	$^2[3/2]^\circ$	1	*8 889 000*
$2s^22p^5(^2P^\circ_{1/2})5d$	$^2[3/2]^\circ$	1	*8 985 000*
$2s^22p^5(^2P^\circ_{3/2})6d$	$^2[3/2]^\circ$	1	*9 294 000*
$2s^22p^5(^2P^\circ_{1/2})6d$	$^2[3/2]^\circ$	1	*9 390 000*
Fe XVIII ($^2P^\circ_{3/2}$)	***Limit***	....	**10 210 000**

Fe XVIII

9 electrons $Z=26$

Ground state: $1s^22s^22p^5\,{}^2P^\circ_{3/2}$

Ionization energy = 10 950 000 cm^{-1} (1358 eV)

This spectrum was first observed in the laboratory in 1967 by Fawcett, Gabriel, and Saunders. [1], who classified six lines in the region of 15 Å as transitions to the $2s^22p^5\,{}^2P^\circ_{3/2}$ ground state from levels of the $2p^43s$ and $2p^43d$ configurations.

The two expected transitions to the ${}^2P^\circ$ ground term from the first excited configuration $2s2p^6\,{}^2S$ were identified in 1970 by Boiko, Voinov, Gribkov, and Sklizkov [2].

The level values given here are from the recent paper of Feldman, Doschek, Cowan, and Cohen [3], who have made an extensive study of the Fe XVIII isoelectronic sequence, in which a number of the lines observed earlier were remeasured and a number of new lines identified.

The percentage compositions for the $2s^22p^43d$ levels are taken from the *ab initio* calculation given by Feldman et al. [3]. The designations for the $2s^22p^43d$ levels are those implied by these percentages. For some levels, these designations differ from those listed by Feldman et al. [3], which were assigned by analogy with low members of the isoelectronic sequence.

The percentage compositions for the $2s^22p^43s$ levels are from an *ab initio* calculation by Chapman and Shadmi [4].

The value of the $1s2s^22p^6\,{}^2S_{1/2}$ level was obtained from the recent x-ray observation of Fraenkel and Schwob [5].

The ionization energy is from the isoelectronic extrapolation of Lotz [6].

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[1] Fawcett, B. C., Gabriel, A. H., and Saunders, P. A. H., Proc. Phys. Soc. (London) **90**, 863 (1967).

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Fe XVIII

Configuration	Term	J	Level (cm^{-1})	Leading components (%) First	Second
$2s^22p^5$	${}^2P^\circ$	3/2	*0*		
		1/2	*102 650*		
$2s2p^6$	${}^2S$	1/2	1 064 610		
$2s^22p^4({}^3P)3s$	${}^4P$	5/2	6 221 600	91	
		1/2	6 310 500	80	
		3/2	6 318 700	64	31 (${}^3P$) ${}^2P$
$2s^22p^4({}^3P)3s$	${}^2P$	3/2	6 248 800	56	32 (${}^3P$) ${}^4P$
		1/2	6 343 600	88	
$2s^22p^4({}^1D)3s$	${}^2D$	5/2	6 400 800	91	
		3/2	6 404 400	86	
$2s^22p^4({}^1S)3s$	${}^2S$	1/2	6 558 200	74	13 (${}^3P$) ${}^4P$
$2s^22p^4({}^3P)3d$	${}^4P$	1/2	6 858 200	60	23 (${}^3P$) ${}^2P$
		3/2	6 872 500	48	27 (${}^3P$) ${}^2D$
		5/2	6 935 300	42	36 (${}^3P$) ${}^2F$
$2s^22p^4({}^3P)3d$	${}^2F$	5/2	6 879 500	27	22 (${}^3P$) ${}^4P$
$2s^22p^4({}^3P)3d$	${}^4F$	5/2	6 903 700	52	18 (${}^3P$) ${}^4P$

Fe XVIII – Continued

Configuration	Term	J	Level (cm^{-1})	Leading components (%)	
				First	Second
$2s^22p^4(^3P)3d$	^2D	5/2	6 957 500	42	28 $(^3P)\ ^2F$
$2s^22p^4(^1D)3d$	^2S	1/2	7 015 100	83	10 $(^3P)\ ^4P$
$2s^22p^4(^1D)3d$	^2D	5/2	7 042 000	44	26 $(^3P)\ ^2D$
		3/2	7 067 100	65	27
$2s^22p^4(^1S)3d$	^2D	5/2	7 166 400	80	6 $(^3P)\ ^2F$
		3/2	7 185 000	71	13 $(^3P)\ ^2D$
Fe XIX $(^3P_2)$	*Limit*	....	**10 950 000**		
$1s2s^22p^6$	^2S	1/2	51 902 000		

Fe XIX

8 electrons $Z=26$

Ground state: $1s^2 2s^2 2p^4\ {}^3P_2$

Ionization energy = 11 740 000 cm^{-1} (1456 eV)

The values for the levels of the ground configuration $2s^2 2p^4$ and the first excited configuration $2s2p^5$ were derived from the spectral observations of iron plasmas produced by high power laser pulses by Feldman, Doschek, Nagel, Behring, and Cohen [1]. Since no intercombination lines have been observed in this spectrum the singlet system is not experimentally connected to the triplet system. The singlet levels are given below relative to the $2s^2 2p^4\ {}^1D_2$ level, which has been estimated to be at about 169 800 cm^{-1} by Feldman et al. [1].

The levels of the $2s^2 2p^3 3d$ configuration have been derived from the recent work of Fawcett, Cowan, and Hayes [2]. The two levels of $2s^2 2p^3 3d$ at 7 397 500 cm^{-1}, $(^2D)\,{}^3D_3$ and $(^2D)\,{}^3P_2$, have identical energies here, because the line at 13.518 Å, which is doubly classified, is the only source for these two levels.

The position of the $1s2s^2 2p^5$ configuration results from the observation of $K\alpha$ for Fe XIX by Lie and Elton [3].

The ionization potential is from the isoelectronic extrapolation by Lotz [4].

References

[1] Feldman, U., Doschek, G. A., Nagel, D. J., Behring, W. E., and Cohen, L., Astrophys. J. **183,** L43 (1973).
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Fe XIX

Configuration	Term	J	Level (cm^{-1})
$2s^2 2p^4$	^{3}P	2	0
		0	75 290
		1	89 410
$2s^2 2p^4$	^{1}D	2	169 800+x
$2s^2 2p^4$	^{1}S	0	326 160+x
$2s2p^5$	^{3}P°	2	*922 770*
		1	*984 650*
		0	*1 029 830*
$2s2p^5$	^{1}P°	1	*1 268 440*+x
$2s^2 2p^3(^4$S°$)3d$	^{3}D°	3	*7 265 900*
$2s^2 2p^3(^2$D°$)3d$	^{3}D°	2	*7 386 000*
		3	*7 397 500*
$2s^2 2p^3(^2$D°$)3d$	^{3}P°	2	*7 397 500*
$2s^2 2p^3(^2$D°$)3d$	^{3}S°	1	*7 427 200*
$2s^2 2p^3(^2$D°$)3d$	^{1}F°	3	*7 451 500*+x
$2s^2 2p^3(^2$P°$)3d$	^{3}D°	1	*7 514 700*
$2s^2 2p^3(^2$P°$)3d$	^{1}F°	3	*7 567 900*+x

Fe XIX – Continued

Configuration	Term	J	Level (cm^{-1})
$2s^22p^3(^2P°)3d$	$^1P°$	1	*7 628 100+x*
Fe XX ($^4S°_{3/2}$)	***Limit***	....	**11 740 000**
$1s2s^22p^5$			*52 138 000*

Fe XX

7 electrons $Z = 26$

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

Ionization energy = 12 760 000 cm^{-1} (1582 eV)

The ^4P term of the $2s2p^4$ configuration is given relative to the ground state by Doschek, Feldman, Cowan, and Cohen [1]. The doublets are obtained by means of lines identified by the same authors as transitions to higher levels of the $2s^22p^3$ ground configuration. Their positions are fixed relative to a calculated value for the $2s^22p^3\ ^2P^\circ_{1/2}$ level of 250 000 cm^{-1} by Fawcett, Cowan, and Hayes [2].

In the $2s^22p^23d$ configuration [2] the ^4P term is known relative to the ground state, but the rest of the levels are derived from combinations with higher $2s^22p^3$ levels and therefore their positions contain the uncertainty x of the lower levels.

The identification of the inner shell excitation giving the position of the $1s2s^22p^4$ configuration was made by Lie and Elton [3].

The value for the ionization energy was obtained by extrapolation by Lotz [4].

References

[1] Doschek, G. A., Feldman, U., Cowan, R. D., and Cohen, L., Astrophys. J. **188**, 417 (1974).

[2] Fawcett, B. C., Cowan, R. D., and Hayes, R. W., Astrophys. J. **187**, 377 (1974).

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Fe XX

Configuration	Term	J	Level (cm^{-1})	Leading components (%)	
				First	Second
$2s^22p^3$	$^4S^\circ$	3/2	*0*		
$2s^22p^3$	$^2D^\circ$	3/2	*128 300*+x		
		5/2	*165 800*+x		
$2s^22p^3$	$^2P^\circ$	1/2	*250 000*+x		
		3/2	*313 100*+x		
$2s2p^4$	^4P	5/2	752 700		
		3/2	820 800		
		1/2	842 700		
$2s2p^4$	^2D	3/2	1 032 100+x		
		5/2	1 047 900+x		
$2s2p^4$	^2P	3/2	1 232 100+x		
		1/2	1 329 700+x		
$2s^22p^2(^3P)3d$	^4P	5/2	7 786 900	39	37 $(^3P)\ ^4D$
		3/2	7 803 400	69	
$2s^22p^2(^3P)3d$	^2F	7/2	7 851 000+x	38	32 $(^1D)\ ^2G$
$2s^22p^2(^1D)3d$	^2F	7/2	7 928 700+x	33	38 $(^3P)\ ^2F$
		5/2	7 974 800+x	34	34 $(^3P)\ ^2D$
$2s^22p^2(^3P)3d$	^2D	3/2	7 956 000+x	66	
Fe XXI $(^3P_0)$	*Limit*	....	**12 760 000**		
$1s2s^22p^4$			*52 470 000*		

Fe XXI

6 electrons $Z=26$

Ground state: $1s^22s^22p^2\ ^3P_0$

Ionization energy = 13 620 000 cm^{-1} (1689 eV)

Very little is known of this spectrum. In a recent communication, Feldman, Doschek, Cowan, and Cohen [1] report the identification of six lines of Fe XXI as follows:

Wavelength (Å)	Int.	Wave no. (cm^{-1})	Designation
91.28	20	1 095 500	$2s^22p^2\ ^3P_0$–$2s2p^3\ ^3S^\circ_1$
97.87	26	1 021 800	$^3P_1$– $^3S^\circ_1$
98.37	40	1 016 500	$^1D_2$– $^1P^\circ_1$
102.21	34	978 400	$^3P_2$– $^3S^\circ_1$
121.16	20	825 400	$^3P_2$– $^3P^\circ_2$
113.31	40	882 500	$^1D_2$– $^1D^\circ_2$

This establishes the levels of the $2s^22p^2\ ^3P$ ground term as well as the values of the $2s2p^3\ ^3S^\circ_1$ and $^3P^\circ_2$ levels. The $2s2p^3\ ^1D^\circ_2$ and $^1P^\circ_1$ levels cannot yet be connected to the triplet system.

Several authors [2–6] have identified solar lines and iron spark lines at about 12 Å as being $2s^22p^2$–$2s^22p3d$ transitions in this ion. The value for the $2s^22p3d\ ^3D^\circ_3$ level is from ref. [6].

The position of the $1s2s^22p^3$ configuration is obtained from the $K\alpha$ observation of Lie and Elton [7].

The ionization energy is from the isoelectronic extrapolation by Lotz [8].

References

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Fe XXI

Configuration	Term	J	Level (cm^{-1})
$2s^22p^2$	^3P	0	0
		1	73 700
		2	117 100
$2s2p^3$	$^3P^\circ$	2	*942 500*
$2s2p^3$	$^3S^\circ$	1	*1 095 500*
$2s^22p3d$	$^3D^\circ$	3	*8 064 000*
Fe XXII ($^2P^\circ_{1/2}$)	***Limit***	....	**13 620 000**
$1s2s^22p^3$			*52 910 000*

Fe XXII

5 electrons $Z=26$

Ground state: $1s^22s^22p\ ^2P^\circ_{1/2}$

Ionization energy = 14 510 000 cm^{-1} (1799 eV)

The two principal lines of the $2p\ ^2P^\circ - 3d\ ^2D$ multiplet have been identified [1] on spectrograms of solar flares at 11.76 and 11.93 Å. The first line is a transition to the ground level and gives the position of $3d\ ^2D_{3/2}$. Without knowledge of the $^2P^\circ$ ground term splitting, the second line cannot be used to derive a value for the $3d\ ^2D_{5/2}$ level. The position of the $4d$ term is derived from an unresolved blend in solar flare spectrograms [2].

The position of the $1s2s^22p^2$ configuration is derived from the measurement of $K\alpha$ for Fe XXII by Lie and Elton [3].

A prediction of the $2s^22p$, $2s2p^2$, $2p^3$, $2s^23s$, $2s^23p$, $2s^23d$, $2s^24s$, $2s^24p$, and $2s^24d$ levels of Fe XXII from *ab initio* calculations has been published by Shamey [4].

The ionization energy is from Lotz's isoelectronic extrapolation [5].

References

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Fe XXII

Configuration	Term	J	Level (cm^{-1})
$1s^22s^22p$	$^2P^\circ$	1/2	*0*
$1s^22s^23d$	^2D	3/2	8 450 000
$1s^22s^24d$	^2D		11 100 000?
Fe XXIII ($^1S_0$)	*Limit*	....	**14 510 000**
$1s2s^22p^2$			53 020 000

Fe XXIII

4 electrons $Z=26$

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

Ionization energy = 15 730 000 cm^{-1} (1950 eV)

The solar flare line at 11.01 Å was identified as the $2s^2\ ^1S_0-2s3p\ ^1P^\circ_1$ resonance line by Fawcett, Cowan, and Hayes [1]. The flare line at 8.307 Å was identified by Doschek, Meekins, and Cowan as the $2s^2\ ^1S_0-2s4p\ ^1P^\circ_1$ transition [2]. The $K\alpha$ line measured by Lie and Elton [3] giving the level $1s2s^22p\ ^1P^\circ_1$ was revised by Grineva et al. [4] whose wavelength of 1.870 Å is used here.

The value for the ionization energy was obtained by isoelectronic extrapolation by Lotz [5].

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Fe XXIII

Configuration	Term	J	Level (cm^{-1})
$1s^22s^2$	^1S	0	0
$1s^22s3p$	$^1P^\circ$	1	*9 080 000*
$1s^22s4p$	$^1P^\circ$	1	*12 038 000*
Fe XXIV ($^2S_{1/2}$)	***Limit***	....	**15 730 000**
$1s2s^22p$	$^1P^\circ$	1	*53 480 000*

Fe XXIV

3 electrons $Z = 26$

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

Ionization energy = 16 ~~320 000~~ 336 000 cm^{-1} (~~2024~~ 2026.4 eV)

The data used for this brief compilation have been taken from a variety of sources, mainly astrophysical. Purcell and Widing [1] have tentatively identified the solar lines at 192.14 and 255.29 Å as the $1s^2 2s\ ^2S$–$1s^2 2p\ ^2P^\circ$ doublet.

The $1s^2 3p$ and $1s^2 3d$ levels result from solar identifications by Fawcett, Cowan, and Hayes [2]. The $1s^2 3d$ levels are tentative since they are based on transitions to the $1s^2 2p$ levels. The $1s^2 3s$ configuration is taken from the solar classifications of Neupert, Gates, Swartz, and Young [3]. The $1s^2 4s$, $1s^2 4p$, and $1s^2 4d$ levels are derived from the solar identifications of Doschek, Meekins, and Cowan [4].

The values for the levels arising from inner shell excitations, the $1s2s2p$ and $1s2p^2$ configurations, are taken from the recent solar x-ray observations of Grineva et al. [5]. The notation used here for the $1s2s2p$ levels reflects the expected order of coupling in this configuration. The $1s2s2p\ ^4P^\circ$ level is from the solar observations of Neupert [6].

The $1s2s3p$ configuration results from laboratory x-ray measurements by Lie and Elton [7]. They also made the original measurements of the $1s^2 2s\ ^2S$–$1s2s2p\ ^2P^\circ$ transitions [7].

We have calculated the ionization energy given above from the observed $1s^2 ns$ ($n = 2, 3, 4$) series. The estimated uncertainty is $\pm 20\,000\ cm^{-1}$ (3 eV). The value extrapolated by Lotz [8] is 2045 eV.

References

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Fe XXIV

Configuration	Term	J	Level (cm^{-1})
$1s^2 2s$	^2S	1/2	0
$1s^2 2p$	$^2P^\circ$	1/2	*391 710?*
		3/2	*520 450?*
$1s^2 3p$	$^2P^\circ$	1/2	*9 390 000*
		3/2	*9 430 000*
$1s^2 3s$	^2S	1/2	9 400 000
$1s^2 3d$	^2D	3/2	9 470 000?
		5/2	9 470 000?
$1s^2 4s$	^2S	1/2	12 455 000
$1s^2 4p$	$^2P^\circ$	1/2,3/2	*12 516 000*
$1s^2 4d$	^2D	3/2	12 538 000
		5/2	12 554 000

Fe XXIV—Continued

Configuration	Term	J	Level (cm^{-1})
Fe XXV ($^1S_0$)	***Limit***	....	**16 ~~320 000~~** 338 00
$1s(^2S)2s2p(^3P^\circ)$	$^4P^\circ$		*53 330 000*
$1s(^2S)2s2p(^3P^\circ)$	$^2P^\circ$	1/2	*53 680 000*
		3/2	*53 735 000*
$1s(^2S)2s2p(^1P^\circ)$	$^2P^\circ$	1/2	*53 850 000*
$1s2p^2$	^2D	5/2	54 110 000
$1s2p^2$	^2P	3/2	54 230 000
$1s2p^2$	^2S	1/2	54 373 000
$1s2s3p$	$^2P^\circ$	1/2,3/2	*62 420 000*

Fe XXV

2 electrons $Z = 26$

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

Ionization energy = 71 200 000 cm^{-1} (8828 eV)

Lie and Elton reported laboratory observations of lines belonging to the $1s^2$–$1snp$ series [1]. The $1s^2$–$1s2p$ transitions were obtained at higher resolution by Grineva et al. [2] from solar flare observations. They also identified the $1s^2$–$1s2s$ solar line. Results from ref. [2] are used here for the $1s2p$ term. The position of the $1s3d$ configuration results from the identification of a solar feature at 10.2 Å as the $1s2p$–$1s3d$ transition by Neupert, Gates, Swartz, and Young [3].

The ionization energy is the value extrapolated by Lotz [4]. This value is significantly higher than the limit obtained from the observed $1snp\ ^1P^{\circ}_1$ (n = 2–4) series, which indicates that these $^1P^{\circ}$ levels are probably perturbed.

References

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Fe XXV

Configuration	Term	J	Level (cm^{-1})
$1s^2$	^1S	0	0
$1s2s$	^3S	1	53 530 000
$1s2p$	$^3P^{\circ}$	1 2	*53 807 000* *53 894 000*
$1s2p$	$^1P^{\circ}$	1	*54 050 000*
$1s3p$	$^1P^{\circ}$	1	*62 810 000*
$1s3d$			64 000 000
$1s4p$	$^1P^{\circ}$	1	*65 880 000*
Fe XXVI ($^2S_{1/2}$)	***Limit***	....	**71 200 000**

Fe XXVI

1 electron $Z = 26$

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

Ionization energy = 74 828 700 cm^{-1} (~~77.65~~ eV)

The $2p\ ^2P^\circ$ term was observed by Lie and Elton [1]. Neupert, Gates, Swartz, and Young [2] identified the $3p$ configuration from solar data. The values for these terms may be compared with the theoretical values for this hydrogen-like ion recently provided by Erickson [3]: 56 184 600 cm^{-1} for $2p$ and 66 544 600 cm^{-1} for $3p$.

The ionization energy is the theoretical value calculated by Erickson [3].

References

[1] Lie, T. N., and Elton, R. C., Phys. Rev. A **3,** 865 (1971).
[2] Neupert, W. M., Gates, W., Swartz, M., and Young, R., Astrophys. J. **149,** L79 (1967).
[3] Erickson, G. W., to be published in J. Phys. Chem. Ref. Data.

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Configuration	Term	J	Level (cm^{-1})
$1s$	^2S	1/2	0
$2p$	$^2P^\circ$	1/2,3/2	*56 210 000*
$3p$	$^2P^\circ$	1/2,3/2	*64 500 000*
	Limit	....	**74 ~~830 000~~**