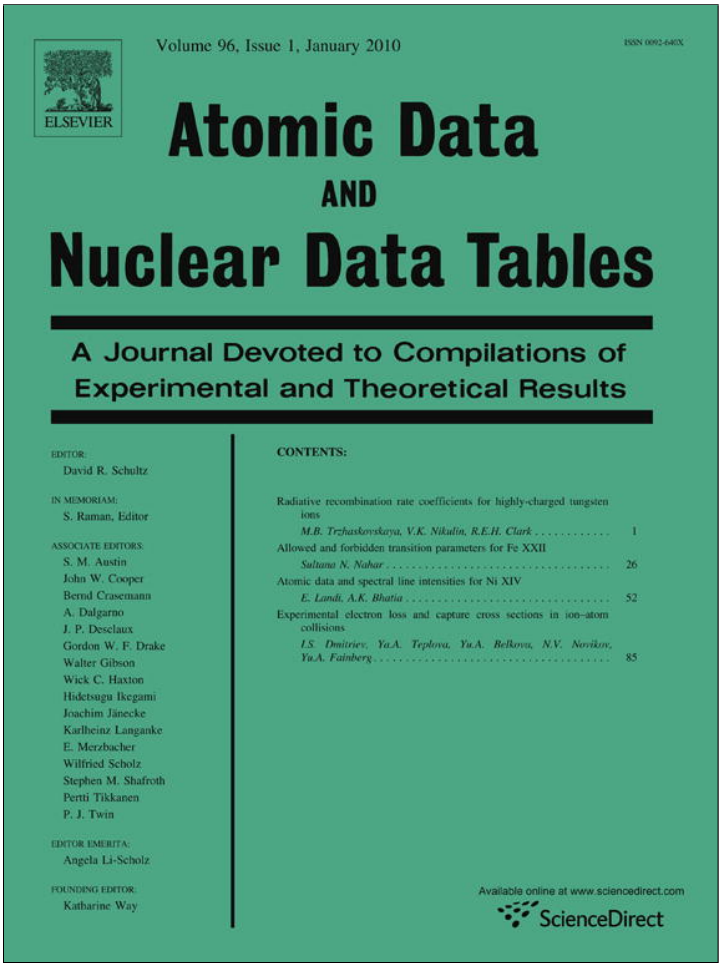

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Allowed and forbidden transition parameters for Fe XXII

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ABSTRACT

Radiative transitions for photo-excitations and de-excitations in Fe XXII are studied in the relativistic Breit–Pauli approximation. A comprehensive set of fine structure energy levels, oscillator strengths (f), line strengths (S), and radiative decay rates (A) for electric dipole (E1), same spin multiplicity and intercombination, fine structure transitions is presented. These are obtained from the first calculations in the close coupling approximation using the Breit–Pauli R-matrix method for this ion, all existing theoretical results having been obtained from various other atomic structure calculations. The present work obtains a set of 771 fine structure energy levels with $n \leqslant 10$, $l \leqslant 9$, and $1/2 \leqslant J \leqslant 17/2$, only 52 of which have been observed. The f, S, and A values are reported for 70,372 allowed E1 transitions, exceeding by far those published previously. The calculated fine structure levels have been identified spectroscopically using a procedure based on quantum defect analysis. The energies agree with the available observed energies to within less than one to a few percent. The A values for E1 transitions are in good agreement with other existing values for most transitions. Using the atomic structure code SUPERSTRUCTURE (SS), S and A values are also presented for 38,215 forbidden transitions of the types electric quadrupole (E2), electric octupole (E3), magnetic dipole (M1), and magnetic quadrupole (M2) among 274 fine structure levels formed from 25 configurations with orbitals ranging from 1s to 4f. Some of these levels lie above the ionization limit and hence can form autoionizing lines. Such lines for 1s–2p K_α transitions have been observed in experiments. The energies from the SS calculations agree with observed energies within a few percent. The A values for E2 and M1 transitions agree very well with the available values. The atomic parameters for both allowed and forbidden transitions should be applicable for diagnostics as well as complete spectral modeling in the X-ray, ultraviolet, and optical regimes of astrophysical and laboratory plasmas.

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Contents

1. Introduction

Lines of the boron-like iron ion, Fe XXII, with ground configuration $1s^22s^22p$ are widely seen in astrophysical spectra, for example, in solar flares [1–3], in the Capella binary system [4], the Seyfert 2 galaxy NGC 1068 [5]. Lines of Fe XXII have also been studied in the laboratory plasmas (e.g., Refs. [6,7]). Identification and analysis of these spectra require accurate parameters, such as energy levels and oscillator strengths, as presented here. These lines are used as diagnostics for determination of physical properties such as temperature, density, and other quantities such as chemical abundances in astrophysical and laboratory plasmas.

Among the theoretical studies, a large number of transitions among *LS* states of Fe XXII were obtained [8] under the Opacity Project [9] using the close coupling approximation and nonrelativistic R-matrix codes. However, various high resolution spectra and diagnostics studies require fine structure transitions instead of *LS* multiplets. Relativistic close coupling calculations for the collision strengths of Fe XXII were carried out by Zhang and Pradhan [11] within the Iron Project [10] using target fine structure levels by splitting the *LS* term energies from the SUPERSTRUCTURE (SS) code. The present work within the Iron Project reports a large set of photo-excitations and de-excitations of fine structure levels of Fe XXII. The fine structure radiative transitions were studied earlier by a number of investigators. The National Institute of Standards and Technology (NIST) [12] evaluated these transitions and has provided a compiled table of *A* values from the works of Refs. [13–15], and from another compilation [16]. The recent calculations by Jonouskas et al. [17] present the latest and the largest atomic data set for radiative transitions in Fe XXII. The present work reports results for allowed transitions obtained in the close coupling approximation using the relativistic Breit–Pauli R-matrix (BPRM) method. The forbidden transitions of higher order electric and magnetic multipoles obtained from atomic structure calculations are also reported.

2. Theory

Some details of the theory can be found in earlier papers, such as Ref. [18]. A brief outline is given here. In the close coupling approximation, the atomic system is described as an *N*-electron target (core) interacting with a $(N+1)$th electron and the total wavefunction expansion, Ψ_E, of the $(N+1)$-electron system is written as (e.g., Ref. [19])

$$\Psi_E(\mathrm{e}+\mathrm{ion}) = A\sum_i \chi_i(\mathrm{ion})\theta_i + \sum_j c_j\Phi_j(\mathrm{e}+\mathrm{ion}), \tag{1}$$

where χ_i is the target ion wavefunction of a specific *LS* state, $S_iL_i\pi_i$, or fine structure level, $J_i\pi_i$, and θ_i is the wavefunction of the interacting $(N+1)$th electron in a channel labeled as $S_iL_i(J_i)\pi_ik_i^2\ell_i$ ($SL\pi$ or $J\pi$) where k_i^2 is the incident kinetic energy. Φ_j's are correlation wavefunctions of the $(N+1)$-electron system that (a) compensate the orthogonality conditions between the continuum and the bound orbitals and (b) represent additional short-range correlation.

In the Breit–Pauli approximation, the relativistic Hamiltonian for the $(N+1)$-electron system is given by (e.g., Ref. [20])

$$H^{\mathrm{BP}}_{N+1} = H_{N+1} + H^{\mathrm{mass}}_{N+1} + H^{\mathrm{Dar}}_{N+1} + H^{\mathrm{so}}_{N+1} + \frac{1}{2} \times \sum_{i\neq j}^{N}\left[g_{ij}(so+so') + g_{ij}(ss') + g_{ij}(css') + g_{ij}(d) + g_{ij}(oo')\right], \tag{2}$$

where H_{N+1} is the nonrelativistic Hamiltonian,

$$H_{N+1} = \sum_{i=1}^{N+1}\left\{-\nabla_i^2 - \frac{2Z}{r_i} + \sum_{j>i}^{N+1}\frac{2}{r_{ij}}\right\}. \tag{3}$$

H^{mass}_{N+1} is the mass correction, H^{Dar}_{N+1} is the Darwin, and H^{so}_{N+1} is the spin–orbit interaction term. The two-body interaction terms are with notation *c* for contraction, *d* for Darwin, *o* for orbit, *s* for spin, and a prime indicates 'other'. All terms improve the energies while the fine structure (*J*-dependent) terms split the energies into fine structure components. The Breit–Pauli R-matrix Hamiltonian used in the Iron Project [10] includes the first three one-body corrections and some of the two-body terms. However, the atomic structure calculations for the forbidden transitions using the SS code [21,22,18] include the contributions of the full Breit interaction term consisting of the fine structure terms, that is, spin-other-orbit (os') and spin-other-spin (ss') terms, but ignore the last three two-body nonfine structure terms.

Substitution of the wavefunction expansion in

$$H^{BP}_{N+1}\Psi = E\Psi \tag{4}$$

results in a set of coupled equations that are solved using the R-matrix approach. In the BPRM method, the set of $SL\pi$ are recoupled to obtain (e + ion) states with total $J\pi$, following the diagonalization of the $(N+1)$-electron Hamiltonian. At negative total energies ($E<0$), the solutions of the close coupling equations occur at discrete eigenvalues of the (e + ion) Hamiltonian that correspond to pure bound states, Ψ_B.

The transition matrix elements $\langle\Psi_B||\mathbf{D}||\Psi_{B'}\rangle$ for E1 bound–bound transitions, where $\mathbf{D}=\sum_i \mathbf{r}_i$ is the dipole operator of i electrons, are reduced to generalized line strengths as

$$S=\left|\left\langle\Psi_f\left|\sum_{j=1}^{N+1} r_j\right|\Psi_i\right\rangle\right|^2 \quad (5)$$

where Ψ_i and Ψ_f are the initial and final bound wavefunctions, respectively. The line strengths are energy independent quantities and are related to the oscillator strength, f_{ij}, and radiative decay rate or Einstein's A-coefficient (in atomic units, a.u.) as

$$f_{ij}=\frac{E_{ji}}{3g_iS},\quad A_{ji}(\mathrm{a.u.})=\frac{1}{2}\alpha^3\frac{g_i}{g_j}E_{ji}^2 f_{ij}. \quad (6)$$

E_{ji} is the energy difference between the initial and final states, α is the fine structure constant, and g_i and g_j are the statistical weight factors of the initial and final states, respectively.

The forbidden transitions correspond to higher order transition matrix elements. The radiative decay rates for various types of forbidden transitions can be obtained from the generalized line strength,

$$S^{X\lambda}(ij)=\left|\left\langle\Psi_j\left\|O^{X\lambda}\right\|\Psi_i\right\rangle\right|^2,\quad S(ji)=S(ij), \quad (7)$$

where X represents the electric or magnetic type and λ represents various multipoles, such as 1 for dipole, 2 for quadrupole, 3 for octupole [18], etc. The radiative decay rates for various higher order radiative transitions can be obtained from line strength, $S^{X\lambda}(ij)$ as follows (e.g., Refs. [22,20]):

electric quadrupole (E2) and magnetic dipole (M1)

$$g_jA_{ji}^{\mathrm{E2}}=2.6733\times10^3\ \mathrm{s}^{-1}(E_j-E_i)^5S^{\mathrm{E2}}(i,j), \quad (8)$$

$$g_jA_{ji}^{\mathrm{M1}}=3.5644\times10^4\ \mathrm{s}^{-1}(E_j-E_i)^3S^{\mathrm{M1}}(i,j); \quad (9)$$

and for electric octupole (E3) and magnetic quadrupole (M2)

$$g_jA_{ji}^{\mathrm{E3}}=1.2050\times10^{-3}\ \mathrm{s}^{-1}(E_j-E_i)^7S^{\mathrm{E3}}(i,j), \quad (10)$$

$$g_jA_{ji}^{\mathrm{M2}}=2.3727\times10^{-2}\ \mathrm{s}^{-1}(E_j-E_i)^5S^{\mathrm{M2}}(i,j). \quad (11)$$

The lifetime of a level can be obtained from the A values as,

$$\tau_k(s)=\frac{1}{\sum_i A_{ki}(s^{-1})}, \quad (12)$$

where the sum is over all radiative decay rates from the level k, and $A_{ji}(s^{-1})=A_{ji}(\mathrm{a.u.})/\tau_0$, where $\tau_0 = 2.4191\times10^{-17}$ s is the atomic unit of time.

3. Calculations

The BPRM calculations are carried out through a suite of codes [23,24]. The initial step starts with computation of the orbital wavefunctions for the target or core. For Fe XXII, the target, Fe XXIII, wavefunctions were obtained through atomic structure calculations using SS code [18] with a set of 30 configurations. The configurations are $2s^2$(1), $2s2p$(2), $2p^2$(3), $2s3s$(4), $2s3p$(5), $2s3d$(6), $2s4s$(7), $2s4p$(8), $2s4d$(9), $2s4f$(10), $2s5s$(11), $2s5p$(12), $2s5d$(13), $2s5f$(14), $2s5g$(15), $2p3s$(16), $2p3p$(17), $2p3d$(18), $2p4s$(19), $2p4p$(20), $2p4d$(21), $2p4f$(22), $2p5s$(23), $2p5p$(24), $2p5d$(25), $2p5f$(26), $2p5g$(27), $3s^2$(28), $3p^2$(29), and $3d2$(30) where in all configurations the $1s$ orbital is filled. All configurations are treated as spectroscopic.

The Fe XXII wavefunction was represented by an expansion of the lowest 10 levels of Fe XXIII as given in Table A. The second term of the wavefunction (Eq. (1)) included all possible (N + 1) configurations with filled $1s$ orbital, and other orbitals $2s$(0–2), $2p$(0–3), $3s$(0–2), $3p$(0–3), $3d$(0–2), $4s$(0–2), $4p$(0–2), $4d$(0–2), $4f$(0–1), $5s$(0–1), $5p$(0–1), $5d$(0–1), $5f$(0–1), $5g$(0–1) where the numbers within parentheses are the minimum and maximum occupancies for the orbital in those configurations.

The computational steps for BPRM calculations have been described in earlier papers (e.g., Ref. [18]). STGB calculates the energy eigenvalues from the BP Hamiltonian. The fine structure bound levels are obtained by scanning through the poles in the (e + ion) Hamiltonian with a fine mesh of the effective quantum number ν. The mesh spacing $\Delta\nu$ is equal to 0.001 or smaller. The energies were identified through a procedure based on quantum defect analysis, percentage of channel contributions, and angular momenta algebra as described in Ref. [25] and using the code PRCBPID. The oscillator strengths for bound–bound transitions were obtained from STGBB. The transitions were processed for energies and transition wavelengths using the code PBPRAD. For levels that have been measured, the oscillator strengths and A values were recalculated from BPRM line strengths and the measured transition energies in order to improve the accuracy. This is a common practice of accuracy improvement, especially by the NIST, since measured energies, in general, are more accurate than the calculated ones.

Forbidden transitions of type E2, E3, M1, and M2 for Fe XXII were obtained from an optimized set of 25 configurations with orbitals up to $4f$ as listed in Table 3. All configurations are treated spectroscopically. The Thomas–Fermi–Amaldi λ_{nl} parameters for the orbitals are 1.30($1s$), 1.20($2s$), 1.12($2p$), 1.12($3s$), 1.1($3p$), 1.1($3d$), 1.1($4s$), 1.1($4p$), 1.0($4d$), and 1.0($4f$). The transitions have been processed by using the code PRCSS.

4. Results and discussion

Fine structure energy levels, oscillator strengths, line strengths, and radiative decay rates for a large number of allowed and forbidden transitions in Fe XXII are presented. Results from the BPRM calculations for E1 transitions and from SS calculations for forbidden transitions are discussed in separate sections below.

4.1. Energies and allowed E1 transitions in the BPRM approximation

A set of 771 bound fine structure levels of Fe XXII, with $n\leqslant10$, $0\leqslant l\leqslant9$, and $1/2\leqslant J\leqslant17/2$ of even and odd parities, and all possible E1 transitions among them, are presented. The calculated energy levels have been identified through analysis of quantum defects, percentage of channel contributions, and angular momentum algebra, and have been designated spectroscopically. Hund's rule has also implemented for levels from the same configurations such that the level with higher orbital angular momentum L and/or higher spin multiplicity will lie lower than those with lower L and lower spin multiplicity. The computational procedure of the BPRM method provides the energy eigenvalues without any identification. Hence, the levels require spectroscopic identifications for various applications. The identification is a lengthy and laborious process where a level is identified as $C_t(S_tL_t\pi_t)J_tnlJ(SL)\pi$, where C_t, $S_tL_t\pi_t$, J_t are the configuration, LS term, parity, and total angular momentum of the target or the core, nl are the principal and orbital quantum numbers of the outer or the valence electron, and J and $SL\pi$ are the total angular momentum, LS term and parity of the (N + 1)-electron system. The present level identification procedure also establishes a unique correspondence between the fine structure levels and their LS terms such that an exact number of fine structure levels are accounted for in each LS term. However, there may be uncertainties in identifications when the spectroscopic designations are swapped due to similar quantum defects and strong mixing of channels. Therefore, each level is assigned with one or more possible designations.

The identified levels are presented in two formats for various practical purposes: (i) in *LSJ* component format where fine structure levels are grouped into a *LS* term and (ii) in a $J\pi$ set where levels of the symmetry are listed in ascending order of energy positions. Format (i) is useful for spectroscopic diagnostics and format (ii) is useful for modeling code applications. A partial set of energies in format (i) is given in Table 1. The identification program PRCBPID [25] checks the completeness of the set of energy levels that belong to the *LS* term(s), and states it if the set is complete, otherwise lists the missing levels. Table B presents a partial set of energy levels in format (ii). In this table, the calculated energies have been replaced by observed energies whenever available giving the scope to improve the *f* and *A* values. The complete set of 771 energy levels of Fe XXII is available electronically.

The BPRM energies are compared with the observed values in Table C. They agree with those in the NIST compiled table [12] within 1% for most of the levels as seen in Table C. However, a large difference of about 6% is found for the NIST identified level, $2s3p(^3Po)3d(^2Po_{1/2})$. The reason for this difference is not clear since the other component of the term, $2s3p(^3Po)3d(^2Po_{3/2})$, shows an agreement to within about 2.28%.

This is the first reporting of *f*, *S*, and *A* values for Fe XXII from a close coupling approximation using relativistic BPRM method, all published results for fine structure transitions having been obtained from various atomic structure calculations. A sample set of *f*, *S*, *A* values for E1 transitions is presented in Table D. The complete set containing 70,372 E1 transitions among the 771 fine structure levels is the largest set compared to the existing published sets. In Table D, the top line specifies the nuclear charge ($Z = 26$) and number of electrons in the ion ($N_{elc} = 5$). This line is followed by sets of oscillator strengths belonging to various pairs of symmetries $J_i\pi_i–J_k\pi_k$. The transition symmetries are expressed in the form of the statistical weight factors, $g = 2J + 1$, and parity π (= 0 for even and = 1 for odd parity). The transitional levels can be identified spectroscopically by matching the indices I_i and I_k with those in Table B. The third column in Table D is an approximate transition wavelength (λ) in Å obtained using E (Å) = $911.2671/E_{ik}$(Ry). The fourth and fifth columns provide the energies E_i and E_k in Rydbergs of the transitional levels. The sixth column is *f*, the oscillator strength in length formulation. The sign of *f* indicates the upper and lower levels in transitions such that a negative value means that *i* is the lower level, while a positive value means *k* is the lower level. Column seven is line strength *S*, and the last column is transition probability or the radiative decay rate $A_{ki}(s^{-1})$. Calculated energies have been replaced by the observed energies wherever available for improved accuracy in *A* values where calculated line strengths are multiplied by the observed transition energies. The electronic file containing the complete set of transitions also includes complete set of energies of Table B for easy correspondence of transitional levels.

Table 2 presents a set of transitions among the observed energies and with complete standard spectroscopic notations for direct comparison with experiments and other applications, such as for diagnostics. These transitions have been grouped together as fine structure components of *LS* multiplets. Fine structure transitions with same-spin multiplicity can be added statistically for *f*, *S*, and *A* values of dipole allowed *LS* multiplets. These multiplet values are given in Table 2.

Table E presents a comparison of the present BPRM *A* values for Fe XXII with the existing results. The NIST [12] table of evaluated and compiled values includes results from a number of authors (e.g., Refs. [13–15]) and from another compilation by Shirai et al. [16]. The most recent calculations for the *S* values were carried out by Jonouskas et al. [17] in relativistic multiconfiguration Dirac–Fock approximation using the code GRASP [26,27]. Comparison of the present BRPM *A* values with the existing values show very good agreement for most of the E1 transitions. Jonouskas et al. report *S* values where they compared their results with those of NIST. BPRM results agree relatively better with Jonouskas et al. than the earlier ones in the NIST table. For example, the increase or decrease in *A* values of the present BPRM calculations with respect to those in the NIST table is also reflected in an increase or decrease of *S* values by Jonouskas et al. Based on the agreement of the present results with the energies and transition parameters by others and the accuracy of the BPRM method, the present results should be accurate to within 10% for most of the transitions.

Lifetimes of all 770 excited levels using BPRM E1 transition probabilities are also presented. The complete set is available electronically while a partial set is presented in Table F. The last column in the table lists the number of transitions of the level to lower levels.

4.2. Energies and forbidden E2, E3, M1, M2 transitions from SUPERSTRUCTURE

A and *S* values for forbidden transitions of type E2, E3, M1, and M2 have also been obtained in the Breit–Pauli approximation from atomic structure calculations. A set of 25 configurations with orbitals from 1*s* to 4*f* was considered. It provided 274 fine structure levels where 209 levels lie below the ionization threshold. Table 3 lists these configurations and the fine structure levels. The levels have been processed with spectroscopic identification. For improved accuracy of the *A* values, calculated energies were replaced by the 52 observed energies. Table 3 contains all calculated energies except these 52 observed available energies The calculated energies agree with the measured values in the NIST compilation within less than one percent for most cases. However, a large difference of about 8% was found for the level $2s^22p(^2Po_{3/2})$.

A partial set of *S* and *A* values of a total of 38,215 forbidden transitions is presented in Table 4. The parity does not change for the E2 and M1 transitions and these are presented together. On the other hand, the parity changes for E3 and M2 transitions, and they are also presented together. The complete set of transitions from SS with standard spectroscopic notation is available electronically.

Comparison of the present *A* values with those available is made in Table E. NIST presents *A* values for one E2 and one M1 transition obtained by Cheng et al. [14]. Jonouskas et al. [17] also computed the *S* value for the E2 transition. The present *A* values agree very well with these two atomic structure calculations.

X-ray lines from Fe XXII due to K_α (1*s*–2*p*) and K_β (1*s*–3*p*) transitions can be observed in high temperature magnetic fusion (tokamak) plasmas and can serve in diagnostics of extreme nonequilibrium or transient ionization conditions [7]. Table G presents the *A* values for such emissions. These are part of the allowed E1 transitions obtained by SS from the same set of configurations that was used for the forbidden transitions. Hence configuration numbers C_i and C_j match those in Table 3. It may be noted in Table G that some transitions are strong. The summed value of the oscillator strengths of various component transitions of a particular pair of configurations can be used in analysis of blended lines. Hence the summed values are also given in the table.

5. Conclusions

Photo-excitations and de-excitations of Fe XXII have been studied in the relativistic Breit–Pauli approximation and an extensive set of transition parameters for oscillator strengths, line strengths, and radiative decay rates has been presented. The allowed transitions were treated with a large scale relativistic BPRM method.

The energies show good agreement with the available observed energies within a few percent. The transition parameters agree very well with the available values, especially with the latest ones from the Dirac–Fock approximation [17]. The forbidden transitions were treated through relativistic atomic structure calculations using the SS code. The SS energies agree to within a few percent with the measured values. Comparison with other data for the few forbidden transitions that exist shows very good agreement among the present SS, NIST, and the latest Dirac–Fock values.

The BPRM results represent the largest set available with over 70,000 E1 transitions. Based on the accuracy of the close coupling approximation, inclusion of configuration interactions, and agreement with the best available calculations, they are expected to be accurate and complete enough for most astrophysical and laboratory applications. A large set of forbidden transitions from atomic structure calculations have been presented and are expected to be accurate to within 10–30% as they agree very well with the available rates. The calculations also included a set of allowed E1 transitions corresponding to K_α and K_β lines.

All data are available electronically at the journal database and at the NORAD website, www.astronomy.ohio-state.edu/~ahar/nahar_radiativeatomicdata/index.html, and as supplemental material on the journal's website.

Acknowledgments

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Appendix A

See Table A, Table B, Table C, Table D, Table E, Table F, and Table G.

Table A
Levels and energies (E_t) of the target, Fe XXIII, in the wavefunction expansion of Fe XXII. The present (SS) energies are compared with the observed energies in the NIST compilation [12].

	Level	J_t	E_t(Ry) NIST	E_t(Ry) SS
1	$1s^22s^2(^1S)$	0	0.0	0.000
2	$1s^22s2p(^3P^o)$	0	3.1510	3.1729
3	$1s^22s2p(^3P^o)$	1	3.4408	3.4549
4	$1s^22s2p(^3P^o)$	2	4.26763	4.2992
5	$1s^22s2p(^1P^o)$	1	6.88348	6.8604
6	$1s^22p^2(^3P)$	0	8.68537	8.7126
7	$1s^22p^2(^3P)$	1	9.31112	9.3605
8	$1s^22p^2(^3P)$	2	9.75035	9.7661
9	$1s^22p^2(^1D)$	2	10.959	10.973
10	$1s^22p^2(^1S)$	0	12.9719	12.967

Table B
Partial set of fine structure energy levels of Fe XXII in $J\pi$ order. I_J is the energy index of the level in its symmetry. The last column is the encoded identification of the level.

771 = number of levels, $n \leqslant 10$, $l \leqslant 9$

i_e	$J\pi$	I_J	E(Ry)	Config	$^{2S+1}L^\pi$	jjpiiii
1	0.5e	1	−1.28540E+02	$1s^22s2p2$	^4Pe	100001
2	0.5e	2	−1.24450E+02	$1s^22s2p2$	^2Pe	100002
3	0.5e	3	−1.23310E+02	$1s^22s2p2$	^2Se	100003
4	0.5e	4	−5.82465E+01	$1s^22s21Se3s$	^2Se	100004
5	0.5e	5	−5.40020E+01	$1s^22s2p3p$	^2Pe	100005
6	0.5e	6	−5.28736E+01	$1s^22s2p3Po3p$	^4PDe	100006
7	0.5e	7	−5.26403E+01	$1s^22s2p3Po3p$	^2SPe	100007
8	0.5e	8	−5.1^{2}232E+01	$1s^22p23Pe3s$	^4Pe	100008
9	0.5e	9	−4.96042E+01	$1s^22s2p3Po3p$	^2SPe	100009
10	0.5e	10	−4.91270E+01	$1s^22s2p1Po3p$	^2SPe	100010
11	0.5e	11	−4.88332E+01	$1s^22s2p1Po3p$	^2SPe	100011
12	0.5e	12	−4.78912E+01	$1s^22p23Pe3s$	^2Pe	100012
13	0.5e	13	−4.54396E+01	$1s^22p21Se3s$	^2Se	100013
14	0.5e	14	−4.47664E+01	$1s^22p23Pe3d$	^4PDe	100014
15	0.5e	15	−4.45614E+01	$1s^22p23Pe3d$	^4PDe	100015
16	0.5e	16	−4.45186E+01	$1s^22p23Pe3d$	^2Pe	100016
17	0.5e	17	−4.32584E+01	$1s^22p21De3d$	^2SPe	100017
18	0.5e	18	−4.28928E+01	$1s^22p21De3d$	^2SPe	100018
19	0.5e	19	−3.15300E+01	$1s^22s24s$	^2Se	100019
20	0.5e	20	−2.66615E+01	$1s^22s2p3Po4p$	^4PDe	100020
21	0.5e	21	−2.62047E+01	$1s^22s2p3Po4p$	^4PDe	100021
22	0.5e	22	−2.61686E+01	$1s^22s2p3Po4p$	^2SPe	100022
23	0.5e	23	−2.56840E+01	$1s^22s2p3Po4f$	^4De	100023
24	0.5e	24	−2.51005E+01	$1s^22s2p3Po4p$	^2SPe	100024
25	0.5e	25	−2.28575E+01	$1s^22s2p1Po4p$	^2SPe	100025
26	0.5e	26	−2.26355E+01	$1s^22s2p1Po4p$	^2SPe	100026
27	0.5e	27	−2.13596E+01	$1s^22p23Pe4s$	^4Pe	100027
28	0.5e	28	−2.06520E+01	$1s^22p23Pe4s$	^2Pe	100028
29	0.5e	29	−2.03843E+01	$1s^22p23Pe4d$	^4PDe	100029
30	0.5e	30	−1.97920E+01	$1s^22p23Pe4d$	^4PDe	100030
31	0.5e	31	−1.97354E+01	$1s^22p23Pe4d$	^2Pe	100031
32	0.5e	32	−1.85998E+01	$1s^22s21Se5s$	^2Se	100032
33	0.5e	33	−1.84467E+01	$1s^22p21De4d$	^2SPe	100033

Table C
Comparison of calculated BPRM energies for Fe XXII with observed values [12]. I_J is the calculated level index for its position in its $J\pi$ symmetry.

Level		J:I_J	E(Ry,NIST)	E(Ry,BPRM)
$2s^22p$	$^2P^o$	1.5:1	1.3115E+02	1.3131E+02
$2s^22p$	$^2P^o$	0.5:1	1.3222E+02	1.3240E+02
$2s2p2$	^4P	2.5:1	1.2755E+02	1.2768E+02
$2s2p2$	^4P	1.5:1	1.2803E+02	1.2820E+02
$2s2p2$	^4P	0.5:1	1.2854E+02	1.2872E+02
$2s2p2$	^2D	2.5:2	1.2530E+02	1.2542E+02
$2s2p2$	^2D	1.5:2	1.2551E+02	1.2563E+02
$2s2p2$	^2P	1.5:3	1.2318E+02	1.2328E+02
$2s2p2$	^2P	0.5:2	1.2445E+02	1.2456E+02
$2s2p2$	^2S	0.5:3	1.2331E+02	1.2341E+02
$2p3$	$^4S^o$	1.5:2	1.2078E+02	1.2089E+02
$2p3$	$^2D^o$	2.5:1	1.1922E+02	1.1929E+02
$2p3$	$^2D^o$	1.5:3	1.1950E+02	1.1960E+02
$2p3$	$^2P^o$	1.5:4	1.1739E+02	1.1743E+02
$2p3$	$^2P^o$	0.5:2	1.1792E+02	1.1798E+02
$2s23d$	^2D	2.5:3	5.4703E+01	5.4684E+01
$2s23d$	^2D	1.5:4	5.4785E+01	5.4781E+01
$2s2p3p$	^2P	1.5:5	5.3054E+01	5.3298E+01
$2s2p3p$	^2P	0.5:5	5.4002E+01	5.3549E+01
$2s2p3p$	^2D	2.5:5	5.1623E+01	5.1939E+01
$2s2p3p$	^2D	1.5:7	5.2580E+01	5.2476E+01
$2s2p(3P^*)3d$	$^4F^o$	3.5*:1	5.1450E+01	5.1452E+01
$2s2p(3P^*)3d$	$^4P^o$	2.5:4	5.1359E+01	5.1355E+01
$2s2p(3P^*)3d$	$^4P^o$	1.5:12	5.0466E+01	5.0427E+01
$2s2p(3P^*)3d$	$^4P^o$	0.5:8	5.0457E+01	5.0405E+01
$2s2p(3P^*)3d$	$^4D^o$	3.5:2	5.0557E+01	5.0572E+01
$2s2p(3P^*)3d$	$^4D^o$	2.5:6	5.0457E+01	5.0475E+01
$2s2p(3P^*)3d$	$^4D^o$	1.5:9	5.1286E+01	5.1270E+01
$2s2p(3P^*)3d$	$^4D^o$	0.5:6	5.1231E+01	5.1246E+01
$2s2p(3P^*)3d$	$^2D^o$	2.5*:5	5.0776E+01	5.0806E+01
$2s2p(3P^*)3d$	$^2P^o$	1.5:15	4.8571E+01	4.7464E+01
$2s2p(3P^*)3d$	$^2P^o$	0.5:11	5.0512E+01	4.7497E+01
$2s2p(3P^*)3d$	$^2F^o$	3.5:3	4.9646E+01	4.9626E+01
$2s2p(3P^*)3d$	$^2F^o$	2.5:7	4.9937E+01	5.0136E+01

Table D
Sample set of *f*, *S* and *A* values for allowed E1 transitions in Fe XXII.

Z = 26		N_{elc} = 5					
I_i	I_k	λ (Å)	E_i(Ry)	E_k(Ry)	*f*	*S*	A_{ki} (s^{-1})
1	1	247.63	−1.2854E+02	−1.3222E+02	7.579E−04	1.236E−03	8.245E+07
1	2	85.81	−1.2854E+02	−1.1792E+02	−2.309E−04	1.304E−04	2.092E+08
1	3	12.67	−1.2854E+02	−5.6611E+01	−1.428E−05	1.191E−06	5.931E+08
1	4	12.39	−1.2854E+02	−5.4991E+01	−1.196E−02	9.754E−04	5.196E+11
1	5	12.24	−1.2854E+02	−5.4079E+01	−2.639E−05	2.126E−06	1.175E+09
1	6	11.79	−1.2854E+02	−5.1231E+01	−5.119E−01	3.973E−02	2.458E+13
1	7	11.78	−1.2854E+02	−5.1204E+01	−5.882E−02	4.563E−03	2.825E+12
1	8	11.67	−1.2854E+02	−5.0457E+01	−1.027E−03	7.888E−05	5.027E+10
1	9	11.52	−1.2854E+02	−4.9465E+01	−2.932E−03	2.225E−04	1.473E+11
1	10	11.29	−1.2854E+02	−4.7800E+01	−4.034E−02	2.998E−03	2.112E+12
1	11	11.68	−1.2854E+02	−5.0512E+01	−5.356E−03	4.119E−04	2.618E+11
1	12	11.21	−1.2854E+02	−4.7257E+01	−4.679E−03	3.454E−04	2.483E+11
1	13	11.14	−1.2854E+02	−4.6710E+01	−8.816E−03	6.464E−04	4.740E+11
1	14	10.99	−1.2854E+02	−4.5650E+01	−6.561E−04	4.749E−05	3.622E+10
1	15	10.87	−1.2854E+02	−4.4687E+01	−6.412E−05	4.588E−06	3.621E+09
1	16	10.66	−1.2854E+02	−4.3087E+01	−1.305E−06	9.165E−08	7.658E+07
1	17	9.23	−1.2854E+02	−2.9791E+01	−6.773E−05	4.115E−06	5.303E+09
1	18	8.98	−1.2854E+02	−2.7020E+01	−2.595E−03	1.533E−04	2.148E+11
1	19	8.94	−1.2854E+02	−2.6569E+01	−6.644E−06	3.909E−07	5.548E+08
1	20	8.91	−1.2854E+02	−2.6213E+01	−1.101E−01	6.453E−03	9.256E+12
1	21	8.84	−1.2854E+02	−2.5402E+01	−6.010E−06	3.496E−07	5.135E+08
1	22	8.81	−1.2854E+02	−2.5063E+01	−3.095E−03	1.794E−04	2.661E+11
1	23	8.66	−1.2854E+02	−2.3290E+01	−9.834E−06	5.606E−07	8.751E+08
1	24	8.61	−1.2854E+02	−2.2687E+01	−2.379E−05	1.349E−06	2.141E+09
1	25	8.48	−1.2854E+02	−2.1066E+01	−1.967E−02	1.098E−03	1.825E+12
1	26	8.43	−1.2854E+02	−2.0484E+01	−1.439E−03	7.991E−05	1.349E+11
1	27	8.42	−1.2854E+02	−2.0257E+01	−1.242E−05	6.885E−07	1.170E+09
1	28	8.41	−1.2854E+02	−2.0207E+01	−3.664E−03	2.029E−04	3.453E+11
1	29	8.36	−1.2854E+02	−1.9600E+01	−1.881E−04	1.036E−05	1.793E+10
1	30	8.31	−1.2854E+02	−1.8941E+01	−8.087E−08	4.427E−09	7.802E+06
1	31	8.29	−1.2854E+02	−1.8553E+01	−7.713E−09	4.207E−10	7.495E+05
1	32	8.18	−1.2854E+02	−1.7153E+01	−1.644E−06	8.855E−08	1.638E+08
1	33	8.15	−1.2854E+02	−1.6678E+01	−5.611E−06	3.010E−07	5.640E+08

Table E
Comparison of *S* and *A* values for E1 (BPRM) and forbidden E2, M1 transitions in Fe XXII with those in Refs. [14][a], [16][b], [13][c], [15][d], [17][e]. Alphabetical symbols indicate the evaluated accuracy by NIST.

λ (Å)	*A* (s^{-1})		*S*		C_i–C_j	$SL\pi_i$–$SL\pi_j$	g_i–g_j:type
	Others	Present	NIST	Ref. [17][e]			
253.17	7.0e+07[a]:E	7.212+07	3.4e−03	3.5e−03	$2s^22p$–$2s2p^2$	$^2P^o$–^4P	4–6:E1
292.46	8.6e+06[a]:E	8.96e+06	4.2e−04	4.16e−04	$2s^22p$–$2s2p^2$	$^2P^o$–^4P	4–4:E1
349.3	1.4e+07[a]:E	1.33E+07			$2s^22p$–$2s2p^2$	$^2P^o$–^4P	4–2:E1
247.19	8.7e+07[a]:E	8.24e+07	1.3e−03	1.24e−03	$2s^22p$– $2s2p^2$	$^2P^o$–^4P	2–2:E1
85.652	2.9e+08[a]:E	3.00E+08	3.6e−4	3.97e−04	$2s2p^2$–$2p^3$	^4P–$^2P^o$	4–4:E1
247.445	4.4e+07[a]:E	5.22E+07	1.3e−03	1.56e−03	$2s2p^2$–$2p^3$	^2P–$2D^o$	4–4:E1
248.620	1.2e+08[a]:E	1.33E+08	3.6e−03	3.97e−03	$2s2p^2$–$2p^3$	^2P–$^4S^o$	2–4:E1
360.386	1.2e+07[a]:E	9.97E+06	1.1e−03	1.02e−03	$2s2p^2$–$2p^3$	^2S–$^4S^o$	2–4:E1
379.636	3.1e+07[a]:E	2.91E+07	3.3e−03	3.24e−03	$2s2p^2$–$2p^3$	^2P–$^4S^o$	4–4:E1
85.831	2.3e+08[a]:E	2.09E+08	1.4e−04	1.32e−04	$2s2p^2$–$2p^3$	^4P–$^2P^o$	2–2:E1
12.077	1.0e+13[c]:D	7.83E+12	3.5e−02	2.63e−02	$2s2p^2$–$2s2p(^1P^o)3d$	^2P–$^2D^o$	2–4:E1
11.748	1.6e+13[c]:D	1.87E+13	7.7e−02	9.12e−02	$2s2p^2$–$2s2p(^1P^o)3d$	^2D–$^2F^o$	4–6:E1
12.027	6.9e+12[b]:D	7.10E+12	2.4e−02	3.8e−03	$2s2p^2$–$2s2p(^1P^o)3d$	^2P–$^2P^o$	2–4:E1
12.077	2.4e+13[c]:D	2.26E+13	1.3e−01	1.19e−01	$2s2p^2$–$2s2p(^1P^o)3d$	^2P–$^2D^o$	4–6:E1
11.748	1.2e+13[c]:D	1.13E+13			$2s2p^2$–$2s2p(^3P^o)3d$	^4P–$^4P^o$	4–4:E1
12.518	1.5e+13[c]:D	1.30E+13			$2s2p^2$–$2s2p(^3P^o)3d$	^2S–$^2P^o$	2–2:E1
11.767	1.6e+13[d]:D	1.62E+13			$2s^22p$–$2s^23d$	$^2P^o$–^2D	2–4:E1
11.921	1.8e+13[d]:D	1.87E+13			$2s^22p$–$2s^23d$	$^2P^o$–^2D	4–6:E1
11.935	3.0e+12[d]:D	3.12E+12			$2s^22p$–$2s^23d$	$^2P^o$–^2D	4–4:E1
9.06	1.9e+11[d]:E	3.16E+11	1.4e−04	2.1e−04	$2s^22p$–$2s^24s$	$^2P^o$–$2S$	2–2:E1
9.14	5.5e+11[d]:E	6.92E+11	4.2e−04	5.02e−04	$2s^22p$–$2s^24s$	$^2P^o$–^2S	4–2:E1
8.976	4.6e+12[d]:D	5.45E+12			$2s^22p$–$2s24d$	$^2P^o$–^2D	2–4:E1
9.073	5.5e+12[d]:D	6.44E+12			$2s^22p$–$2s24d$	$^2P^o$–^2D	4–6:E1
9.073	8e+11[d]:D	1.07E+12			$2s^22p$–$2s24d$	$^2P^o$–^2D	4–4:E1
8.960	3.8e+12[c]:D	4.81E+12			$2s2p^2$–$2s2p(^1P^o)4d$	^2D–$^2F^o$	4–6:E1
8.977	2.5e+12[c]:D	3.34E+12	6.6e−03	7.26e−03	$2s2p^2$–$2s2p(^3P^o)4d$	^2D–$^2F^o$	6–8:E1
8.992	4.9e+12[c]:D	5.30E+12	7.0e−03	7.25e−03	$2s2p^2$– $2s2p(^3P^o)4d$	^4P–$^4D^o$	2–4:E1
9.006	5.7e+12[c]:D	3.63E+12	1.1e−02	1.0e−02	$2s2p^2$–$2s2p(^3P^o)4d$	^4P–$^4D^o$	6–8:E1
9.163	6.9e+12[c]:D	7.79E+12	1.6e−02	1.64e−02	$2s2p^2$–$2s2p(^1P^o)4d$	^2P–$^2D^o$	4–6:E1
9.183	8.3e+12[c]:D	9.41E+12	2.5e−02	8.88e−03	$2s2p^2$–$2s2p(^1P^o)4d$	^2D–$^2F^o$	6–8:E1
9.215	2.7e+12[c]:D	2.90E+12	6.3−03	6.32e−02	$2s2p^2$–$2s2p(^3P^o)4d$	^2D–$^2D^o$	6–6:E1
9.241	5.1e+12[c]:D	5.37E+12	1.2e−02	1.23e−02	$2s2p^2$–$2s2p(^3P^o)4d$	^2D–$^2F^o$	4–6:E1
845.52	1.39[a]:C	1.39	1.33	1.33	$2s^22p$–$2s^22p$	$^2P^o$–$^2P^o$	2–4:E2
845.55	1.48e+04[a]:C	1.48E+04			$2s^22p$–$2s^22p$	$^2P^o$–$^2P^o$	2–4:M1

Table F
Sample set of lifetimes of Fe XXII levels obtained from E1 transitions. Number of transitions included is given in column 'Transitions'.

	Level				J	I_j	E(Ry)	Lifetime(s)	Transitions
1	$2s2p2$			2Pe	0.5	2	−1.2445E+02	2.620E−11	2
2	$2s2p2$			2Se	0.5	3	−1.2331E+02	2.850E−11	2
3	$1s^22s2$	1Se	$3s$	2Se	0.5	4	−5.8246E+01	3.669E−13	6
4	$2s2p3p$			2Pe	0.5	5	−5.4002E+01	5.672E−13	11
5	$1s^22s2p$	3Po	$3p$	4PDe	0.5	6	−5.2874E+01	1.408E−13	12
6	$1s^22s2p$	3Po	$3p$	2SPe	0.5	7	−5.2640E+01	2.359E−12	12
7	$1s^22p2$	3Pe	$3s$	4Pe	0.5	8	−5.1223E+01	1.067E−13	15
8	$1s^22s2p$	3Po	$3p$	2SPe	0.5	9	−4.9604E+01	2.898E−13	21
9	$1s^22s2p$	1Po	$3p$	2SPe	0.5	10	−4.9127E+01	7.331E−13	22
10	$1s^22s2p$	1Po	$3p$	2SPe	0.5	11	−4.8833E+01	7.967E−13	23
11	$1s^22p2$	3Pe	$3s$	2Pe	0.5	12	−4.7891E+01	2.504E−13	25
12	$1s^22p2$	1Se	$3s$	2Se	0.5	13	−4.5440E+01	5.625E−13	34
13	$1s^22p2$	3Pe	$3d$	4PDe	0.5	14	−4.4766E+01	1.449E−13	35
14	$1s^22p2$	3Pe	$3d$	4PDe	0.5	15	−4.4561E+01	1.061E−13	36
15	$1s^22p2$	3Pe	$3d$	2Pe	0.5	16	−4.4519E+01	4.006E−14	36

Table G
f, S, and A values for the K_α (1s–2p) and K_β (1s–3p) transitions in Fe XXII.

Z	N_e	$SL\pi C_i$	$SL\pi C_j$	g_i	g_j	λ (Å)	E (keV)	E_i(Ry)	E_j(Ry)	f_{ij}	S	A_{ji} (s^{-1})
$C_i(1) = 1s^22s^22P$, $C_j(23) = 1s2s^22p^2$												
26	5	2Po 1	2De23	2	4	1.8760	6.609	0.00	485.71	3.01E−01	3.72E−03	2.85E+14
26	5	2Po 1	2De23	4	4	1.8810	6.591	1.08	485.71	1.75E−02	4.34E−04	3.31E+13
26	5	2Po 1	2Pe23	2	2	1.8760	6.609	0.00	485.76	2.59E−01	3.20E−03	4.90E+14
26	5	2Po 1	2Pe23	4	2	1.8800	6.595	1.08	485.76	3.23E−02	7.99E−04	1.22E+14
26	5	2Po 1	2De23	4	6	1.8790	6.598	1.08	486.19	1.53E−01	3.77E−03	1.92E+14
26	5	2Po 1	2Pe23	2	4	1.8710	6.627	0.00	487.02	9.41E−03	1.16E−04	8.96E+12
26	5	2Po 1	2Pe23	4	4	1.8760	6.609	1.08	487.02	2.90E−01	7.16E−03	5.50E+14
26	5	2Po 1	2Se23	2	2	1.8680	6.637	0.00	487.87	1.47E−03	1.81E−05	2.81E+12
26	5	2Po 1	2Se23	4	2	1.8720	6.623	1.08	487.87	6.29E−02	1.55E−03	2.40E+14
26	5	2Po 1	4Pe23	2	2	1.8850	6.577	0.00	483.32	1.19E−02	1.48E−04	2.23E+13
26	5	2Po 1	4Pe23	4	2	1.8900	6.560	1.08	483.32	1.88E−04	4.67E−06	7.01E+11
26	5	2Po 1	4Pe23	2	4	1.8830	6.584	0.00	483.93	7.39E−05	9.16E−07	6.95E+10
26	5	2Po 1	4Pe23	4	4	1.8880	6.567	1.08	483.93	3.79E−03	9.41E−05	7.09E+12
26	5	2Po 1	4Pe23	4	6	1.8860	6.574	1.08	484.44	2.10E−02	5.21E−04	2.63E+13
Number of transitions = 14, f-total =										1.16E+00		
$C_i(1) = 1s^22s^22p$, $C_j(24) = 1s2s^22p3p$												
26	5	2Po 1	2De24	2	4	1.6200	7.653	0.00	562.44	9.81E−03	1.05E−04	1.25E+13
26	5	2Po 1	2De24	4	4	1.6240	7.634	1.08	562.44	1.92E−03	4.10E−05	4.85E+12
26	5	2Po 1	2Pe24	2	2	1.6190	7.658	0.00	562.71	2.51E−02	2.68E−04	6.39E+13
26	5	2Po 1	2Pe24	4	2	1.6230	7.639	1.08	562.71	6.04E−04	1.29E−05	3.06E+12
26	5	2Po 1	2Pe24	2	4	1.6170	7.668	0.00	563.48	5.48E−03	5.84E−05	6.99E+12
26	5	2Po 1	2Pe24	4	4	1.6210	7.649	1.08	563.48	1.44E−02	3.08E−04	3.67E+13
26	5	2Po 1	2De24	4	6	1.6190	7.658	1.08	564.10	5.82E−02	1.24E−03	9.89E+13
26	5	2Po 1	2Se24	2	2	1.6150	7.677	0.00	564.13	8.85E−03	9.41E−05	2.26E+13
26	5	2Po 1	2Se24	4	2	1.6190	7.658	1.08	564.13	1.29E−02	2.76E−04	6.59E+13
26	5	2Po 1	2Pe24	2	4	1.6140	7.682	0.00	564.72	3.33E−06	3.54E−08	4.26E+09
26	5	2Po 1	2Pe24	4	4	1.6170	7.668	1.08	564.72	5.64E−03	1.20E−04	1.44E+13
26	5	2Po 1	2Pe24	2	2	1.6140	7.682	0.00	564.76	3.32E−03	3.53E−05	8.50E+12
26	5	2Po 1	2Pe24	4	2	1.6170	7.668	1.08	564.76	8.79E−03	1.87E−04	4.48E+13
26	5	2Po 1	2De24	4	6	1.6170	7.668	1.08	564.80	6.06E−03	1.29E−04	1.03E+13
26	5	2Po 1	2De24	2	4	1.6120	7.691	0.00	565.16	2.55E−03	2.71E−05	3.28E+12
26	5	2Po 1	2De24	4	4	1.6160	7.672	1.08	565.16	1.78E−02	3.78E−04	4.54E+13
26	5	2Po 1	2Se24	2	2	1.6120	7.691	0.00	565.35	5.54E−04	5.87E−06	1.42E+12
26	5	2Po 1	2Se24	4	2	1.6150	7.677	1.08	565.35	7.83E−04	1.67E−05	4.00E+12
26	5	2Po 1	4De24	2	2	1.6220	7.644	0.00	561.79	2.68E−03	2.86E−05	6.78E+12
26	5	2Po 1	4De24	4	2	1.6250	7.630	1.08	561.79	1.54E−04	3.30E−06	7.79E+11
26	5	2Po 1	4De24	2	4	1.6210	7.649	0.00	562.00	5.96E−03	6.36E−05	7.56E+12
26	5	2Po 1	4De24	4	4	1.6250	7.630	1.08	562.00	9.66E−04	2.07E−05	2.44E+12
26	5	2Po 1	4De24	4	6	1.6230	7.639	1.08	562.48	5.65E−05	1.21E−06	9.53E+10
26	5	2Po 1	4Pe24	2	2	1.6190	7.658	0.00	562.92	5.89E−03	6.28E−05	1.50E+13
26	5	2Po 1	4Pe24	4	2	1.6220	7.644	1.08	562.92	9.50E−06	2.03E−07	4.82E+10
26	5	2Po 1	4Se24	2	4	1.6190	7.658	0.00	562.95	6.67E−02	7.11E−04	8.49E+13
26	5	2Po 1	4Se24	4	4	1.6220	7.644	1.08	562.95	1.30E−05	2.78E−07	3.31E+10
26	5	2Po 1	4Pe24	2	4	1.6170	7.668	0.00	563.54	3.82E−03	4.06E−05	4.87E+12
26	5	2Po 1	4Pe24	4	4	1.6200	7.653	1.08	563.54	5.31E−03	1.13E−04	1.35E+13
26	5	2Po 1	4Pe24	4	6	1.6200	7.653	1.08	563.66	6.51E−03	1.39E−04	1.10E+13
Number of transitions = 30, f-total =										2.81E−01		

Appendix B. Supplementary data

Complete data associated with this article can be found, in the online version, at doi:10.1016/j.adt.2009.09.001.

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Explanation of Tables

Table 1. **Partial set of 771 energy levels of Fe XXII, group as fine structure components of *LS* terms.**

This table presents a partial set of 771 energy levels of Fe XXII. The levels are grouped as fine structure components of the *LS* terms. They are designated as $C_t(S_tL_t\pi_t)J_tnlJ(SL)\pi$. The top line of each set provides the expected number of fine structure levels (*Nlv*) for the possible ${}^{(2S+1)}L^{\pi}$ terms with the given configuration. In the set, the spin multiplicity $(2S+1)$ and parity π are fixed, but L varies. Within parentheses next to each L, all possible J values associated with the given *LS* term are specified. This line is followed by the set of energy levels of the same configuration. *Nlv*(c) at the end specifies the total number of calculated J levels found for the set. If *Nlv* = *Nlv*(c), the calculated energy set for the given terms is complete.

The levels are designated as $C_t(S_tL_t\pi_t)J_tnlJ(SL)\pi$.

C_t	Target configuration
$S_tL_t\pi_t$	$SL\pi$ symmetry of the target
J_t	Total angular momentum of the target state
nl	Configuration of the valence electron
J	Total angular momentum of the level
E(Ry)	Level energy in Rydberg
ν	Effective quantum number (No ν for equivalent electron states; set to 0 for convenience)
$SL\pi$	Symmetry of the level

Table 2. **E1 transition probabilities for observed levels of Fe XXII, grouped as fine structure components of *LS* multiplets.**

This table presents E1 transition probabilities for observed levels of Fe XXII. The transitions are grouped as fine structure components of *LS* multiplets.

$C_{i,k}$	Configurations of transition levels
T_i	*LS* term designation of the level
g_i	Statistical weight factor $(2J+1)$ of the level
I	Position index of the level in its $SL\pi$ symmetry
E_{ik}	Transition energy
f, S, A	Oscillator strength, line strength, radiative decay rate

Table 3. **Fine structure energy levels of Fe XXII for which forbidden (E2, E3, M1, M2) transitions are presented.**

The indices (cf) correspond to configurations $1s^22s^22p$(1), $1s^22s2p^2$(2), $1s^22p^3$(3), $1s^22s^23s$(4), $1s^22s^23p$(5), $1s^22s^23d$(6), $1s^22s2p3s$(7), $1s^22s2p3p$(8), $1s^22s2p3d$(9), $1s^22s^24s$(10), $1s^22s^24p$(11), $1s^22s^24d$(12), $1s^22s^24f$(13), $1s^22s2p4s$(14), $1s^22s2p4p$(15), $1s^22s2p4d$(16), $1s^22s3d^2$(17), $1s^22p^23s$(18), $1s^22p^23p$(19), $1s^22p^23d$(20), $1s^22p^24s$(21), $1s^22p^24p$(22), $1s2s^22p^2$(23), $1s2s^22p3p$(24), $1s2s^22p3d$(25).

L^e	Level index
$SLp(cf)$	*LS* term of the level and configuration number *cf*
$2J$	J is total angular momentum
E(Ry)	Relative energy in Rydberg of the level

Table 4. **Partial set of radiative decay rates for forbidden E2, E3, M1, M2 transitions in Fe XXII.**

The indices (cf) correspond to configurations $1s^22s^22p$(1), $1s^22s2p^2$(2), $1s^22p^3$(3), $1s^22s^23s$(4), $1s^22s^23p$(5), $1s^22s^23d$(6), $1s^22s2p3s$(7), $1s^22s2p3p$(8), $1s^22s2p3d$(9), $1s^22s^24s$(10), $1s^22s^24p$(11), $1s^22s^24d$(12), $1s^22s^24f$(13), $1s^22s2p4s$(14), $1s^22s2p4p$(15), $1s^22s2p4d$(16), $1s^22s3d^2$(17), $1s^22p^23s$(18), $1s^22p^23p$(19), $1s^22p^23d$(20), $1s^22p^24s$(21), $1s^22p^24p$(22), $1s2s^22p^2$(23), $1s2s^22p3p$(24), $1s2s^22p3d$(25).

N_{tr}	Total number of transitions
i, j	Energy indices of the levels as given in Table 3
T_i	*LS* term designation of the level
C_i	Configuration number of the transitional level
g_i	Statistical weight factor $(2J+1)$ of the level
λ	transition energy. The default value for a very large λ is 10,000 Å
E_i, E_f	Energies of the levels
AE2	Radiative decay rate for E2 transition
AE3	Radiative decay rate for E3 transition
AM1	Radiative decay rate for M1 transition
AM2	Radiative decay rate for M2 transition

Table 1
Partial set of 771 energy levels of Fe XXII, grouped as fine structure components of *LS* terms. See page 34 for explanation of Table.

$C_t(S_tL_t\pi_t)$	J_t	*nl*	*J*	*E*(Ry)	ν	*SL*π
Nlv = 2, $^2L^o$:P (3 1)/2						
$1s^22s2$ (1Se)	0	2*p*	1	−1.32401E+02	1.91	2Po
$1s^22s2$ (1Se)	0	2*p*	3	−1.31311E+02	1.91	2Po
Nlv(c) = 2: set complete						
Eqv electron/unidentified levels, parity: e						
2s2p2			1	−1.28716E+02	0.00	4Pe
2s2p2			3	−1.28202E+02	0.00	4Pe
2s2p2			5	−1.27683E+02	0.00	4Pe
Nl(c) = 3: set complete						
Eqv electron/unidentified levels, parity: e						
2s2p2			3	−1.25634E+02	0.00	2De
2s2p2			5	−1.25415E+02	0.00	2De
Nlv(c) = 2: set complete						
Eqv electron/unidentified levels, parity: e						
2s2p2			1	−1.24562E+02	0.00	2Pe
2s2p2			3	−1.23279E+02	0.00	2Pe
Nlv(c) = 2: set complete						
Eqv electron/unidentified levels, parity: e						
2s2p2			1	−1.23407E+02	0.00	2Se
Nlv(c) = 1: set complete						
Eqv electron/unidentified levels, parity: o						
2p3			3	−1.20892E+02	0.00	4So
Nlv(c) = 1: set complete						
Eqv electron/unidentified levels, parity: o						
2p3			3	−1.19598E+02	0.00	2Do
2p3			5	−1.19289E+02	0.00	2Do
Nlv(c) = 2: set complete						
Eqv electron/unidentified levels, parity: o						
2p3			1	−1.17983E+02	0.00	2Po
2p3			3	−1.17432E+02	0.00	2Po
Nlv(c) = 2: set complete						
Nlv = 1, $^2L^e$: S (1)/2						
$1s^22s2$ (1Se)	0	3*s*	1	−5.82465E+01	2.88	2Se
Nlv(c) = 1: set complete						
Nlv = 3, $^4L^o$: P (5 3 1)/2						
$1s^22s2p$ (3Po)	0	3*s*	1	−5.66106E+01	2.88	4Po
$1s^22s2p$ (3Po)	0	3*s*	3	−5.63008E+01	2.88	4Po
$1s^22s2p$ (3Po)	2	3*s*	5	−5.39670E+01	2.88	4Po
Nlv(c) = 3: set complete						
Nlv = 2, $^2L^o$: P (3 1)/2						
$1s^22s2$ (1Se)	0	3*p*	1	−5.49906E+01	2.91	2Po
$1s^22s2$ (1Se)	0	3*p*	3	−5.32869E+01	2.91	2Po
Nlv(c) = 2: set complete						
Nlv = 2, $^2L^e$: D (5 3)/2						
$1s^22s2$ (1Se)	0	3*d*	3	−5.47806E+01	2.97	2De
$1s^22s2$ (1Se)	0	3*d*	5	−5.46838E+01	2.97	2De
Nlv(c) = 2: set complete						
Nlv = 2, $^2L^o$: P (3 1)/2						
$1s^22s2p$ (3Po)	0	3*s*	3	−5.47089E+01	2.88	2Po
$1s^22s2p$ (3Po)	0	3*s*	1	−5.40793E+01	2.88	2Po
Nlv(c) = 2: set complete						
Nlv = 8, $^4L^e$: S (3)/2 P (5 3 1)/2 D (7 5 3 1)/2						
$1s^22s2p$ (3Po)	2	3*p*	1	−5.35488E+01	2.91	4PDe
$1s^22s2p$ (3Po)	0	3*p*	3	−5.29559E+01	2.91	4SPDe
$1s^22s2p$ (3Po)	0	3*p*	1	−5.28736E+01	2.91	4PDe
$1s^22s2p$ (3Po)	0	3*p*	5	−5.28388E+01	2.91	4PDe
$1s^22s2p$ (3Po)	0	3*p*	7	−5.21660E+01	2.91	4De
$1s^22s2p$ (3Po)	0	3*p*	3	−5.21103E+01	2.91	4SPDe
$1s^22s2p$ (3Po)	1	3*p*	5	−5.19395E+01	2.91	4PDe
$1s^22s2p$ (3Po)	1	3*p*	3	−4.95466E+01	2.91	4SPDe
Nlv(c) = 8: set complete						
Nlv = 5, $^2L^e$: S (1)/2 P (3 1)/2 D (5 3)/2						
$1s^22s2p$ (3Po)	0	3*p*	3	−5.32976E+01	2.91	2PDe
$1s^22s2p$ (3Po)	1	3*p*	1	−5.26403E+01	2.91	2SPe
$1s^22s2p$ (3Po)	1	3*p*	3	−5.24762E+01	2.91	2PDe
$1s^22s2p$ (3Po)	1	3*p*	1	−4.96042E+01	2.91	2SPe
$1s^22s2p$ (3Po)	2	3*p*	5	−4.93675E+01	2.91	2De

Table 1 (*continued*)

$C_t(S_tL_t\pi_t)$	J_t	*nl*	*J*	*E*(Ry)	ν	*SL*π
Nlv(c) = 5: set complete						
Nlv = 3, $^4L^e$: P (5 3 1)/2						
$1s^22p2$ (3Pe)	0	3*s*	3	−5.19274E+01	2.88	4Pe
$1s^22p2$ (3Pe)	0	3*s*	5	−5.15024E+01	2.88	4Pe
$1s^22p2$ (3Pe)	0	3*s*	1	−5.12232E+01	2.88	4Pe
Nlv(c) = 3: set complete						
Nlv = 2, $^2L^o$: P (3 1)/2						
$1s^22s2p$ (1Po)	1	3*s*	3	−5.19226E+01	2.88	2Po
$1s^22s2p$ (1Po)	1	3*s*	1	−5.12043E+01	2.88	2Po
Nlv(c) = 2: set complete						
Nlv = 11, $^4L^o$: P (5 3 1)/2 D (7 5 3 1)/2 F (9 7 5 3)/2						
$1s^22s2p$ (3Po)	0	3*d*	5	−5.17401E+01	2.97	4PDFo
$1s^22s2p$ (3Po)	0	3*d*	7	−5.14521E+01	2.97	4DFo
$1s^22s2p$ (3Po)	0	3*d*	5	−5.13548E+01	2.97	4PDFo
$1s^22s2p$ (3Po)	1	3*d*	3	−5.12696E+01	2.97	4PDFo
$1s^22s2p$ (3Po)	1	3*d*	1	−5.12459E+01	2.97	4PDo
$1s^22s2p$ (3Po)	2	3*d*	3	−5.11907E+01	2.97	4PDFo
$1s^22s2p$ (3Po)	0	3*d*	9	−5.08394E+01	2.97	4Fo
$1s^22s2p$ (3Po)	2	3*d*	7	−5.05722E+01	2.97	4DFo
$1s^22s2p$ (3Po)	2	3*d*	5	−5.04754E+01	2.97	4PDFo
$1s^22s2p$ (3Po)	1	3*d*	3	−5.04270E+01	2.97	4PDFo
$1s^22s2p$ (3Po)	2	3*d*	1	−5.04052E+01	2.97	4PDo
Nlv(c) = 11: set complete						
Nlv = 6, $^2L^o$: P (3 1)/2 D (5 3)/2 F (7 5)/2						
$1s^22s2p$ (3Po)	1	3*d*	3	−5.09395E+01	2.97	2PDo
$1s^22s2p$ (3Po)	1	3*d*	5	−5.08055E+01	2.97	2DFo
$1s^22s2p$ (3Po)	2	3*d*	5	−5.01356E+01	2.97	2DFo
$1s^22s2p$ (3Po)	2	3*d*	7	−4.96265E+01	2.97	2Fo
$1s^22s2p$ (3Po)	1	3*d*	1	−4.74974E+01	2.97	2Po
$1s^22s2p$ (3Po)	0	3*d*	3	−4.74637E+01	2.97	2PDo
Nlv(c) = 6: set complete						
Nlv = 6, $^2L^o$: P (3 1)/2 D (5 3)/2 F (7 5)/2						
$1s^22s2p$ (1Po)	1	3*d*	3	−4.97804E+01	2.97	2PDo
$1s^22s2p$ (1Po)	1	3*d*	1	−4.94648E+01	2.97	2Po
$1s^22s2p$ (1Po)	1	3*d*	7	−4.79176E+01	2.97	2Fo
$1s^22s2p$ (1Po)	1	3*d*	5	−4.79049E+01	2.97	2DFo
$1s^22s2p$ (1Po)	1	3*d*	3	−4.78021E+01	2.97	2PDo
$1s^22s2p$ (1Po)	1	3*d*	5	−4.76791E+01	2.97	2DFo
Nlv(c) = 6: set complete						
Nlv = 5, $^2L^e$: S (1)/2 P (3 1)/2 D (5 3)/2						
$1s^22s2p$ (1Po)	1	3*p*	3	−4.92756E+01	2.91	2PDe
$1s^22s2p$ (1Po)	1	3*p*	1	−4.91270E+01	2.91	2SPe
$1s^22s2p$ (1Po)	1	3*p*	1	−4.88332E+01	2.91	2SPe
$1s^22s2p$ (1Po)	1	3*p*	5	−4.80474E+01	2.91	2De
$1s^22s2p$ (1Po)	1	3*p*	3	−4.75315E+01	2.91	2PDe
Nlv(c) = 5: set complete						
Nlv = 2, $^2L^e$: P (3 1)/2						
$1s^22p2$ (3Pe)	0	3*s*	3	−4.84794E+01	2.88	2Pe
$1s^22p2$ (3Pe)	1	3*s*	1	−4.78912E+01	2.88	2Pe
Nlv(c) = 2: set complete						
Nlv = 8, $^4L^o$: S (3)/2 P (5 3 1)/2 D (7 5 3 1)/2						
$1s^22p2$ (3Pe)	0	3*p*	1	−4.78001E+01	2.91	4PDo
$1s^22p2$ (3Pe)	0	3*p*	3	−4.73214E+01	2.91	4SPDo
$1s^22p2$ (3Pe)	0	3*p*	1	−4.72566E+01	2.91	4PDo
$1s^22p2$ (3Pe)	0	3*p*	3	−4.69470E+01	2.91	4SPDo
$1s^22p2$ (3Pe)	1	3*p*	5	−4.68584E+01	2.91	4PDo
$1s^22p2$ (3Pe)	1	3*p*	5	−4.66652E+01	2.91	4PDo
$1s^22p2$ (3Pe)	1	3*p*	3	−4.65331E+01	2.91	4SPDo
$1s^22p2$ (3Pe)	0	3*p*	7	−4.64271E+01	2.91	4Do
Nlv(c) = 8: set complete						
Nlv = 2, $^2L^e$: D (5 3)/2						
$1s^22p2$ (1De)	2	3*s*	5	−4.67266E+01	2.88	2De
$1s^22p2$ (1De)	2	3*s*	3	−4.61813E+01	2.88	2De
Nlv(c) = 2: set complete						
Nlv = 5, $^2L^o$: S (1)/2 P (3 1)/2 D (5 3)/2						
$1s^22p2$ (3Pe)	1	3*p*	1	−4.67103E+01	2.91	2SPo
$1s^22p2$ (3Pe)	2	3*p*	3	−4.60478E+01	2.91	2PDo
$1s^22p2$ (3Pe)	0	3*p*	3	−4.59534E+01	2.91	2PDo
$1s^22p2$ (3Pe)	2	3*p*	5	−4.59196E+01	2.91	2Do
$1s^22p2$ (3Pe)	2	3*p*	1	−4.56504E+01	2.91	2SPo
Nlv(c) = 5: set complete						

(*continued on next page*)

Table 1 (*continued*)

$C_t(S_tL_t\pi_t)$		J_t	*nl*	*J*	*E*(Ry)	*v*	*SLπ*
Nlv = 11, $^4L^e$: P (5 3 1)/2 D (7 5 3 1)/2 F (9 7 5 3)/2							
$1s^22p2$	(3Pe)	0	3*d*	3	−4.65594E+01	2.97	4PDFe
$1s^22p2$	(3Pe)	0	3*d*	5	−4.59523E+01	2.97	4PDFe
$1s^22p2$	(3Pe)	0	3*d*	7	−4.55187E+01	2.97	4DFe
$1s^22p2$	(3Pe)	0	3*d*	3	−4.55102E+01	2.97	4PDFe
$1s^22p2$	(3Pe)	0	3*d*	5	−4.54439E+01	2.97	4PDFe
$1s^22p2$	(3Pe)	0	3*d*	7	−4.51727E+01	2.97	4DFe
$1s^22p2$	(3Pe)	0	3*d*	9	−4.51480E+01	2.97	4Fe
$1s^22p2$	(3Pe)	1	3*d*	3	−4.51439E+01	2.97	4PDFe
$1s^22p2$	(3Pe)	1	3*d*	5	−4.51294E+01	2.97	4PDFe
$1s^22p2$	(3Pe)	2	3*d*	1	−4.47664E+01	2.97	4PDe
$1s^22p2$	(3Pe)	2	3*d*	1	−4.45614E+01	2.97	4PDe
Nlv(c) = 11: set complete							
Nlv = 1, $^2L^e$: S (1)/2							
$1s^22p2$	(1Se)	0	3*s*	1	−4.54396E+01	2.88	2Se
Nlv(c) = 1: set complete							
Nlv = 6, $^2L^o$: P (3 1)/2 D (5 3)/2 F (7 5)/2							
$1s^22p2$	(1De)	2	3*p*	5	−4.52292E+01	2.91	2DFo
$1s^22p2$	(1De)	2	3*p*	7	−4.50909E+01	2.91	2Fo
$1s^22p2$	(1De)	2	3*p*	3	−4.49688E+01	2.91	2PDo
$1s^22p2$	(1De)	2	3*p*	5	−4.48265E+01	2.91	2DFo
$1s^22p2$	(1De)	2	3*p*	1	−4.46865E+01	2.91	2Po
$1s^22p2$	(1De)	2	3*p*	3	−4.40463E+01	2.91	2PDo
Nlv(c) = 6: set complete							
Nlv = 6, $^2L^e$: P (3 1)/2 D (5 3)/2 F (7 5)/2							
$1s^22p2$	(3Pe)	2	3*d*	5	−4.47303E+01	2.97	2DFe
$1s^22p2$	(3Pe)	2	3*d*	3	−4.46085E+01	2.97	2PDe
$1s^22p2$	(3Pe)	2	3*d*	1	−4.45186E+01	2.97	2Pe
$1s^22p2$	(3Pe)	2	3*d*	7	−4.44698E+01	2.97	2Fe
$1s^22p2$	(3Pe)	1	3*d*	5	−4.41339E+01	2.97	2DFe
$1s^22p2$	(3Pe)	1	3*d*	3	−4.41060E+01	2.97	2PDe
Nlv(c) = 6: set complete							
Nlv = 9, $^2L^e$: S (1)/2 P (3 1)/2 D (5 3)/2 F (7 5)/2 G (9 7)/2							
$1s^22p2$	(1De)	2	3*d*	7	−4.39116E+01	2.97	2FGe
$1s^22p2$	(1De)	2	3*d*	9	−4.37581E+01	2.97	2Ge
$1s^22p2$	(1De)	2	3*d*	3	−4.35155E+01	2.97	2PDe
$1s^22p2$	(1De)	2	3*d*	5	−4.34726E+01	2.97	2DFe
$1s^22p2$	(1De)	2	3*d*	7	−4.32830E+01	2.97	2FGe
$1s^22p2$	(1De)	2	3*d*	1	−4.32584E+01	2.97	2SPe
$1s^22p2$	(1De)	2	3*d*	5	−4.29262E+01	2.97	2DFe
$1s^22p2$	(1De)	2	3*d*	1	−4.28928E+01	2.97	2SPe
$1s^22p2$	(1De)	2	3*d*	3	−4.28735E+01	2.97	2PDe
Nlv(c) = 9: set complete							
Nlv = 2, $^2L^o$: P (3 1)/2							
$1s^22p2$	(1Se)	0	3*p*	1	−4.30874E+01	2.91	2Po
$1s^22p2$	(1Se)	0	3*p*	3	−4.29043E+01	2.91	2Po
Nlv(c) = 2: set complete							
Nlv = 2, $^2L^e$: D (5 3)/2							
$1s^22p2$	(1Se)	0	3*d*	5	−4.14881E+01	2.97	2De
$1s^22p2$	(1Se)	0	3*d*	3	−4.14233E+01	2.97	2De
Nlv(c) = 2: set complete							
Nlv = 1, $^2L^e$: S (1)/2							
$1s^22s2$	(1Se)	0	4*s*	1	−3.02172E+01	3.88	2Se
Nlv(c) = 1: set complete							
Nlv = 3, $^4L^o$: P (5 3 1)/2							
$1s^22s2p$	(3Po)	0	4*s*	5	−3.00064E+01	3.88	4Po
$1s^22s2p$	(3Po)	0	4*s*	1	−2.97912E+01	3.88	4Po
$1s^22s2p$	(3Po)	1	4*s*	3	−2.67542E+01	3.88	4Po
Nlv(c) = 3: set complete							
Nlv = 2, $^2L^o$: F (7 5)/2							
$1s^22s2$	(1Se)	0	4*f*	7	−2.99871E+01	4.00	2Fo
$1s^22s2$	(1Se)	0	4*f*	5	−2.59364E+01	4.00	2Fo
Nlv(c) = 2: set complete							
Nlv = 2, $^2L^e$: D (5 3)/2							
$1s^22s2$	(1Se)	0	4*d*	3	−2.97163E+01	3.97	2De
$1s^22s2$	(1Se)	0	4*d*	5	−2.96738E+01	3.97	2De
Nlv(c) = 2: set complete							

Table 2
E1 transition probabilities for observed levels of Fe XXII, grouped as fine structure components of *LS* multiplets. See page 34 for explanation of Table.

C_i–C_k	T_i–T_k	g_i:I–g_j:K	E_{ik} (Å)	f	S	A (s^{-1})
$2s^22p$–$2s2p2$	2Po–4Pe	2:1–2:1	247.63	7.58E−04	1.24E−03	8.24E+07
$2s^22p$–$2s2p2$	2Po–4Pe	4:1–2:1	349.14	1.22E−04	5.61E−04	1.33E+07
$2s^22p$–$2s2p2$	2Po–4Pe	2:1–4:1	217.49	2.70E−05	3.87E−05	1.91E+06
$2s^22p$–$2s2p2$	2Po–4Pe	4:1–4:1	292.07	1.15E−04	4.41E−04	8.96E+06
$2s^22p$–$2s2p2$	2Po–4Pe	4:1–6:1	253.13	1.04E−03	3.46E−03	7.21E+07
2s2p2–2p3	4Pe–2Po	2:1–2:2	85.81	2.31E−04	1.30E−04	2.09E+08
2s2p2–2p3	4Pe–2Po	2:1–4:4	81.73	1.77E−05	9.51E−06	8.82E+06
2s2p2–2p3	4Pe–2Po	4:1–2:2	90.14	3.07E−05	3.65E−05	5.04E+07
2s2p2–2p3	4Pe–2Po	4:1–4:4	85.65	3.30E−04	3.72E−04	3.00E+08
2s2p2–2p3	4Pe–2Po	6:1–4:4	89.69	1.18E−04	2.10E−04	1.47E+08
2s2p2–2s2p(3P*)3d	4Pe–4Do	2:1–2:6	11.79	5.12E−01	3.97E−02	2.46E+13
2s2p2–2s2p(3P*)3d	4Pe–4Do	2:1–4:9	11.80	6.72E−01	5.22E−02	1.61E+13
2s2p2–2s2p(3P*)3d	4Pe–4Do	4:1–2:6	11.87	1.25E−02	1.95E−03	1.18E+12
2s2p2–2s2p(3P*)3d	4Pe–4Do	4:1–4:9	11.87	1.08E−01	1.68E−02	5.10E+12
2s2p2–2s2p(3P*)3d	4Pe–4Do	4:1–6:6	11.75	1.18E−01	1.83E−02	3.81E+12
2s2p2–2s2p(3P*)3d	4Pe–4Do	6:1–4:9	11.95	3.03E−03	7.14E−04	2.12E+11
2s2p2–2s2p(3P*)3d	4Pe–4Do	6:1–6:6	11.82	3.54E−01	8.26E−02	1.69E+13
2s2p2–2s2p(3P*)3d	4Pe–4Do	6:1–8:2	11.84	6.73E−01	1.57E−01	2.40E+13
LS	4Pe–4Do	12–20		7.92E−01	3.69E−01	2.27E+13
2s2p2–2s2p(3P*)3d	4Pe–4Po	2:1–2:8	11.67	1.03E−03	7.89E−05	5.03E+10
2s2p2–2s2p(3P*)3d	4Pe–4Po	2:1–4:12	11.67	4.97E−03	3.82E−04	1.22E+11
2s2p2–2s2p(3P*)3d	4Pe–4Po	4:1–2:8	11.75	1.79E−01	2.76E−02	1.73E+13
2s2p2–2s2p(3P*)3d	4Pe–4Po	4:1–4:12	11.75	2.34E−01	3.63E−02	1.13E+13
2s2p2–2s2p(3P*)3d	4Pe–4Po	4:1–6:4	11.89	4.35E−01	6.81E−02	1.37E+13
2s2p2–2s2p(3P*)3d	4Pe–4Po	6:1–4:12	11.82	1.12E−01	2.62E−02	8.03E+12
2s2p2–2s2p(3P*)3d	4Pe–4Po	6:1–6:4	11.96	2.34E−02	5.52E−03	1.09E+12
LS	4Pe–4Po	12–12		3.51E−01	1.64E−01	1.68E+13
2s2p2–2s2p(3P*)3d	4Pe–2Po	2:1–2:11	11.68	5.36E−03	4.12E−04	2.62E+11
2s2p2–2s2p(3P*)3d	4Pe–2Po	2:1–4:15	11.40	2.88E−02	2.16E−03	7.39E+11
2s2p2–2s2p(3P*)3d	4Pe–2Po	4:1–2:11	11.76	1.24E−04	1.92E−05	1.20E+10
2s2p2–2s2p(3P*)3d	4Pe–2Po	4:1–4:15	11.47	3.99E−04	6.03E−05	2.03E+10
2s2p2–2s2p(3P*)3d	4Pe–2Po	6:1–4:15	11.54	1.53E−04	3.48E−05	1.15E+10
$2s^22p$–$2s2p2$	2Po–2Pe	2:1–2:2	117.28	7.85E−02	6.06E−02	3.80E+10
$2s^22p$–$2s2p2$	2Po–2Pe	4:1–2:2	136.01	1.87E−04	3.35E−04	1.35E+08
$2s^22p$–$2s2p2$	2Po–2Pe	2:1–4:3	100.80	1.87E−02	1.24E−02	6.13E+09
$2s^22p$–$2s2p2$	2Po–2Pe	4:1–4:3	114.34	8.59E−02	1.29E−01	4.38E+10
LS	2Po–2Pe	6–6		8.98E−02	2.02E−01	4.60E+10
2s2p2–2p3	2Pe–2Po	2:2–2:2	139.55	8.33E−03	7.66E−03	2.85E+09
2s2p2–2p3	2Pe–2Po	2:2–4:4	129.07	1.69E−02	1.44E−02	3.38E+09
2s2p2–2p3	2Pe–2Po	4:3–2:2	173.24	4.58E−03	1.05E−02	2.04E+09
2s2p2–2p3	2Pe–2Po	4:3–4:4	157.39	6.87E−02	1.42E−01	1.85E+10
LS	2Pe–2Po	6–6		5.73E−02	1.75E−01	1.60E+10
2s2p2–2s2p(3P*)3d	2Pe–4Do	2:2–2:6	12.45	5.48E−04	4.49E−05	2.36E+10
2s2p2–2s2p(3P*)3d	2Pe–4Do	2:2–4:9	12.46	1.91E−02	1.57E−03	4.10E+11
2s2p2–2s2p(3P*)3d	2Pe–4Do	4:3–2:6	12.67	1.59E−03	2.66E−04	1.32E+11
2s2p2–2s2p(3P*)3d	2Pe–4Do	4:3–4:9	12.68	2.89E−05	4.82E−06	1.20E+09
2s2p2–2s2p(3P*)3d	2Pe–4Do	4:3–6:6	12.53	4.38E−04	7.22E−05	1.24E+10
2s2p2–2s2p(3P*)3d	2Pe–4Po	2:2–2:8	12.32	4.60E−05	3.73E−06	2.02E+09
2s2p2–2s2p(3P*)3d	2Pe–4Po	2:2–4:12	12.32	6.95E−03	5.64E−04	1.53E+11
2s2p2–2s2p(3P*)3d	2Pe–4Po	4:3–2:8	12.53	4.82E−04	7.95E−05	4.09E+10
2s2p2–2s2p(3P*)3d	2Pe–4Po	4:3–4:12	12.53	2.81E−04	4.64E−05	1.19E+10
2s2p2–2s2p(3P*)3d	2Pe–4Po	4:3–6:4	12.69	6.62E−03	1.11E−03	1.83E+11
2s2p2–2s2p(3P*)3d	2Pe–2Po	2:2–2:11	12.32	2.17E−01	1.76E−02	9.55E+12
2s2p2–2s2p(3P*)3d	2Pe–2Po	2:2–4:15	12.01	4.40E−02	3.48E−03	1.02E+12
2s2p2–2s2p(3P*)3d	2Pe–2Po	4:3–2:11	12.54	3.44E−02	5.67E−03	2.91E+12
2s2p2–2s2p(3P*)3d	2Pe–2Po	4:3–4:15	12.21	1.58E−01	2.53E−02	7.04E+12
LS	2Pe–2Po	6–6		2.15E−01	5.21E−02	9.58E+12
$2s^22p$–$2s2p2$	2Po–2Se	2:1–2:3	102.27	2.69E−03	1.81E−03	1.72E+09
$2s^22p$–$2s2p2$	2Po–2Se	4:1–2:3	116.23	3.38E−02	5.17E−02	3.34E+10
LS	2Po–2Se	6–2		2.34E−02	5.35E−02	3.51E+10
2s2p2–2p3	2Se–2Po	2:3–2:2	169.07	4.55E−02	5.06E−02	1.06E+10
2s2p2–2p3	2Se–2Po	2:3–4:4	153.93	1.32E−02	1.33E−02	1.85E+09
LS	2Se–2Po	2–6		5.87E−02	6.39E−02	4.77E+09
2s2p2–2s2p(3P*)3d	2Se–4Do	2:3–2:6	12.64	9.17E−03	7.64E−04	3.83E+11
2s2p2–2s2p(3P*)3d	2Se–4Do	2:3–4:9	12.65	3.60E−03	3.00E−04	7.50E+10
2s2p2–2s2p(3P*)3d	2Se–4Po	2:3–2:8	12.51	4.07E−04	3.35E−05	1.73E+10
2s2p2–2s2p(3P*)3d	2Se–4Po	2:3–4:12	12.51	1.23E−03	1.01E−04	2.62E+10
2s2p2–2s2p(3P*)3d	2Se–2Po	2:3–2:11	12.52	1.56E−03	1.29E−04	6.66E+10

(continued on next page)

Table 2 (*continued*)

C_i–C_k	T_i–T_k	g_i:I–g_j:K	E_{ik} (Å)	f	S	A (s^{-1})
2s2p2–2s2p(3P*)3d	2Se–2Po	2:3–4:15	12.19	2.14E–01	1.71E–02	4.79E+12
LS	2Se–2Po	2–6		2.16E–01	1.72E–02	3.25E+12
2s22p–2s2p3p	2Po–2Pe	2:1–2:5	11.65	3.11E–02	2.39E–03	1.53E+12
2s22p–2s2p3p	2Po–2P	4:1–2:5	11.81	2.26E–03	3.52E–04	2.16E+11
2s22p–2s2p3p	2Po–2Pe	2:1–4:5	11.51	2.88E–02	2.18E–03	7.26E+11
2s22p–2s2p3p	2Po–2Pe	4:1–4:5	11.67	1.49E–02	2.30E–03	7.32E+11
LS	2Po–2Pe	6–6		3.14E–02	7.22E–03	1.55E+12
2p3–2s2p3p	2Po–2Pe	2:2–2:5	14.26	7.08E–05	6.65E–06	2.32E+09
2p3–2s2p3p	2Po–2Pe	4:4–2:5	14.38	5.91E–06	1.12E–06	3.82E+08
2p3–2s2p3p	2Po–2Pe	2:2–4:5	14.05	1.25E–04	1.16E–05	2.12E+09
2p3–2s2p3p	2Po–2Pe	4:4–4:5	14.16	2.38E–06	4.44E–07	7.91E+07
LS	2Po–2Pe	6–6		7.08E–05	1.98E–05	2.35E+09
2s2p3p–2s2p(3P*)3d	2Pe–4Do	2:5–2:6	328.86	5.54E–03	1.20E–02	3.42E+08
2s2p3p–2s2p(3P*)3d	2Pe–4Do	2:5–4:9	335.52	4.92E–04	1.09E–03	1.46E+07
2s2p3p–2s2p(3P*)3d	2Pe–4Do	4:5–2:6	499.87	1.26E–03	8.27E–03	6.71E+07
2s2p3p–2s2p(3P*)3d	2Pe–4Do	4:5–4:9	515.42	7.71E–03	5.23E–02	1.94E+08
2s2p3p–2s2p(3P*)3d	2Pe–4Do	4:5–6:6	350.89	1.84E–06	8.52E–06	6.66E+04
2s2p3p–2s2p(3P*)3d	2Pe–4Po	2:5–2:8	257.06	1.33E–03	2.24E–03	1.34E+08
2s2p3p–2s2p(3P*)3d	2Pe–4Po	2:5–4:12	257.71	2.62E–04	4.45E–04	1.32E+07
2s2p3p–2s2p(3P*)3d	2Pe–4Po	4:5–2:8	350.89	4.53E–04	2.09E–03	4.91E+07
2s2p3p–2s2p(3P*)3d	2Pe–4Po	4:5–4:12	352.11	9.05E–04	4.20E–03	4.87E+07
2s2p3p–2s2p(3P*)3d	2Pe–4Po	4:5–6:4	537.62	3.56E–03	2.52E–02	5.47E+07
2s2p3p–2s2p(3P*)3d	2Pe–2Po	2:5–2:11	261.11	5.63E–04	9.68E–04	5.51E+07
2s2p3p–2s2p(3P*)3d	2Pe–2Po	2:5–4:15	167.79	1.25E–03	1.39E–03	1.49E+08
2s2p3p–2s2p(3P*)3d	2Pe–2Po	4:5–2:11	358.48	1.13E–03	5.31E–03	1.17E+08
2s2p3p–2s2p(3P*)3d	2Pe–2Po	4:5–4:15	203.27	2.76E–04	7.38E–04	4.45E+07
LS	2Pe–2Po	6–6		1.54E–03	8.41E–03	1.35E+08
2s22p–2s24s	2Po–2Se	2:1–2:19	9.05	3.88E–03	2.31E–04	3.16E+11
2s22p–2s24s	2Po–2Se	4:1–2:19	9.15	4.34E–03	5.23E–04	6.92E+11
LS	2Po–2Se	6–2		4.19E–03	7.54E–04	1.01E+12
2p3–2s24s	2Po–2Se	2:2–2:19	10.55	4.52E–08	3.14E–09	2.71E+06
2p3–2s24s	2Po–2Se	4:4–2:19	10.61	1.95E–07	2.72E–08	2.31E+07
LS	2Po–2Se	6–2		1.45E–07	3.03E–08	2.59E+07
2s2p(3P*)3d–2s24s	4Do–2Se	2:6–2:19	46.25	2.59E–06	7.87E–07	8.06E+06
2s2p(3P*)3d–2s24s	4Do–2Se	4:9–2:19	46.13	4.25E–06	2.58E–06	2.66E+07
2s2p(3P*)3d–2s24s	4Po–2Se	2:8–2:19	48.15	1.06E–08	3.36E–09	3.05E+04
2s2p(3P*)3d–2s24s	4Po–2Se	4:12–2:19	48.12	9.56E–08	6.06E–08	5.51E+05
2s2p(3P*)3d–2s24s	2Po–2Se	2:11–2:19	48.01	1.75E–04	5.54E–05	5.07E+08
2s2p(3P*)3d–2s24s	2Po–2Se	4:15–2:19	53.47	1.28E–04	9.03E–05	5.98E+08
LS	2Po–2Se	6–2		1.44E–04	1.46E–04	1.09E+09
2s2p2–2p3	4Pe–4So	2:1–4:2	117.43	4.13E–02	3.19E–02	9.99E+09
2s2p2–2p3	4Pe–4So	4:1–4:2	125.69	3.44E–02	5.70E–02	1.45E+10
2s2p2–2p3	4Pe–4So	6:1–4:2	134.60	3.41E–02	9.08E–02	1.89E+10
LS	4Pe–4So	12–4		3.54E–02	1.80E–01	4.29E+10
2s2p2–2p3	4Pe–2Do	2:1–4:3	100.80	1.41E–04	9.36E–05	4.63E+07
2s2p2–2p3	4Pe–2Do	4:1–4:3	106.83	3.95E–03	5.55E–03	2.31E+09
2s2p2–2p3	4Pe–2Do	4:1–6:1	103.44	1.14E–04	1.55E–04	4.73E+07
2s2p2–2p3	4Pe–2Do	6:1–4:3	113.20	3.09E–04	6.92E–04	2.42E+08
2s2p2–2p3	4Pe–2Do	6:1–6:1	109.40	3.48E–03	7.52E–03	1.94E+09
2s2p2–2s2p(1P*)3d	4Pe–2Po	2:1–4:13	11.41	3.63E–03	2.73E–04	9.30E+10
2s2p2–2s2p(1P*)3d	4Pe–2Po	4:1–4:13	11.48	2.21E–03	3.34E–04	1.12E+11
2s2p2–2s2p(1P*)3d	4Pe–2Po	6:1–4:13	11.55	2.87E–04	6.55E–05	2.15E+10
2s2p2–2s2p(1P*)3d	4Pe–2Do	2:1–4:14	11.46	2.91E–04	2.19E–05	7.39E+09
2s2p2–2s2p(1P*)3d	4Pe–2Do	4:1–4:14	11.53	1.24E–04	1.89E–05	6.25E+09
2s2p2–2s2p(1P*)3d	4Pe–2Do	4:1–6:9	11.35	2.01E–04	3.01E–05	6.95E+09
2s2p2–2s2p(1P*)3d	4Pe–2Do	6:1–4:14	11.60	2.00E–05	4.59E–06	1.49E+09
2s2p2–2s2p(1P*)3d	4Pe–2Do	6:1–6:9	11.42	8.54E–05	1.93E–05	4.37E+09
2s2p2–2s2p(3P*)4d	4Pe–4Do	2:1–4:27	8.99	1.28E–01	7.61E–03	5.30E+12
2s2p2–2s2p(3P*)4d	4Pe–4Do	4:1–4:27	9.04	1.73E–02	2.06E–03	1.41E+12
2s2p2–2s2p(3P*)4d	4Pe–4Do	4:1–6:20	8.96	3.96E–02	4.68E–03	2.19E+12
2s2p2–2s2p(3P*)4d	4Pe–4Do	6:1–4:27	9.08	9.60E–04	1.72E–04	1.17E+11
2s2p2–2s2p(3P*)4d	4Pe–4Do	6:1–6:20	9.00	5.81E–02	1.03E–02	4.78E+12
2s2p2–2s2p(3P*)4d	4Pe–4Do	6:1–8:8	9.00	5.88E–02	1.05E–02	3.63E+12
LS	4Pe–4Do	12–20		9.92E–02	3.53E–02	4.89E+12
2s2p2–2p3	2Pe–4So	2:2–4:2	248.30	2.45E–03	4.01E–03	1.33E+08
2s2p2–2p3	2Pe–4So	4:3–4:2	379.69	6.28E–04	3.14E–03	2.91E+07
2s2p2–2p3	2Pe–2Do	2:2–4:3	184.09	6.46E–02	7.83E–02	6.36E+09

Table 2 (*continued*)

C_i–C_k	T_i–T_k	g_i:I–g_j:K	E_{ik} (Å)	f	S	A (s^{-1})
2s2p2–2p3	2Pe–2Do	4:3–4:3	247.63	4.79E–04	1.56E–03	5.22E+07
2s2p2–2p3	2Pe–2Do	4:3–6:1	230.12	3.75E–02	1.14E–01	3.15E+09
LS	2Pe–2Do	6–10		4.69E–02	1.94E–01	4.27E+09
2s2p2–2s2p(1P*)3d	2Pe–2Po	2:2–4:13	12.03	3.08E–01	2.44E–02	7.10E+12
2s2p2–2s2p(1P*)3d	2Pe–2Po	4:3–4:13	12.23	5.22E–02	8.41E–03	2.33E+12
LS	2Pe–2Po	6–6		1.37E–01	3.28E–02	6.28E+12
2s2p2–2s2p(1P*)3d	2Pe–2Do	2:2–4:14	12.08	3.42E–01	2.72E–02	7.83E+12
2s2p2–2s2p(1P*)3d	2Pe–2Do	4:3–4:14	12.28	6.49E–02	1.05E–02	2.87E+12
2s2p2–2s2p(1P*)3d	2Pe–2Do	4:3–6:9	12.08	7.42E–01	1.18E–01	2.26E+13
LS	2Pe–2Do	6–10		6.52E–01	1.56E–01	1.78E+13
2s2p2–2s2p(3P*)4d	2Pe–4Do	2:2–4:27	9.37	9.78E–04	6.03E–05	3.71E+10
2s2p2–2s2p(3P*)4d	2Pe–4Do	4:3–4:27	9.49	6.21E–04	7.77E–05	4.60E+10
2s2p2–2s2p(3P*)4d	2Pe–4Do	4:3–6:20	9.41	2.10E–03	2.60E–04	1.05E+11
2s2p2–2p3	2Se–4So	2:3–4:2	360.18	3.88E–04	9.20E–04	9.97E+06
2s2p2–2p3	2Se–2Do	2:3–4:3	239.18	1.11E–02	1.75E–02	6.47E+08
2s2p2–2s2p(1P*)3d	2Se–2Po	2:3–4:13	12.21	2.18E–01	1.75E–02	4.87E+12
2s2p2–2s2p(1P*)3d	2Se–2Do	2:3–4:14	12.26	3.88E–01	3.14E–02	8.61E+12
2s2p2–2s2p(3P*)4d	2Se–4Do	2:3–4:27	9.48	2.62E–03	1.64E–04	9.72E+10
2p3–2s2p3p	4–2	4:2–2:5	13.65	2.07E–05	3.72E–06	1.48E+09
2p3–2s2p3p	4–2	4:2–4:5	13.46	1.70E–06	3.02E–07	6.27E+07
2p3–2s2p3p	2Do–2Pe	4:3–2:5	13.91	1.95E–04	3.57E–05	1.34E+10
2p3–2s2p3p	2Do–2Pe	4:3–4:5	13.71	7.01E–06	1.27E–06	2.49E+08
2p3–2s2p3p	2Do–2Pe	6:1–4:5	13.77	1.76E–04	4.79E–05	9.28E+09
LS	2Do–2Pe	10–6		1.86E–04	8.49E–05	1.08E+10
2s2p3p–2s2p(1P*)3d	2Pe–2Po	2:5–4:13	171.23	1.21E–03	1.36E–03	1.37E+08
2s2p3p–2s2p(1P*)3d	2Pe–2Po	4:5–4:13	208.34	3.36E–03	9.22E–03	5.16E+08
LS	2Pe–2Po	6–6		2.64E–03	1.06E–02	4.29E+08
2s2p3p–2s2p(1P*)3d	2Pe–2Do	2:5–4:14	181.82	1.73E–04	2.07E–04	1.74E+07
2s2p3p–2s2p(1P*)3d	2Pe–2Do	4:5–4:14	224.23	9.18E–06	2.71E–05	1.22E+06
2s2p3p–2s2p(1P*)3d	2Pe–2Do	4:5–6:9	171.23	1.54E–04	3.46E–04	2.33E+07
LS	2Pe–2Do	6–10		1.66E–04	5.80E–04	2.14E+07
2s2p3p–2s2p(3P*)4d	2Pe–4Do	2:5–4:27	33.99	3.01E–04	6.73E–05	8.68E+08
2s2p3p–2s2p(3P*)4d	2Pe–4Do	4:5–4:27	35.24	7.38E–02	3.42E–02	3.96E+11
2s2p3p–2s2p(3P*)4d	2Pe–4Do	4:5–6:20	34.13	2.23E–04	1.00E–04	8.53E+08
2p3–2s24s	4So–2Se	4:2–2:19	10.21	3.07E–07	4.13E–08	3.93E+07
2p3–2s24s	2Do–2Se	4:3–2:19	10.36	2.14E–07	2.91E–08	2.66E+07
2s2p(1P*)3d–2s24s	2Po–2Se	4:13–2:19	53.14	1.67E–05	1.17E–05	7.89E+07
2s2p(1P*)3d–2s24s	2Do–2Se	4:14–2:19	52.19	9.44E–08	6.49E–08	4.62E+05
2s24s–2s2p(3P*)4d	2Se–4Do	2:19–4:27	210.07	8.41E–05	1.16E–04	6.36E+06
$2s^22p$–2s2p2	2Po–2De	2:1–4:2	135.81	5.90E–02	5.28E–02	1.07E+10
$2s^22p$–2s2p2	2Po–2De	4:1–4:2	161.57	1.09E–04	2.33E–04	2.79E+07
$2s^22p$–2s2p2	2Po–2De	4:1–6:2	155.77	3.22E–02	6.61E–02	5.90E+09
LS	2Po–2De	6–10		4.12E–02	1.19E–01	7.70E+09
$2s^22p$–2s23d	2Po–2De	2:1–4:4	11.77	6.72E–01	5.21E–02	1.62E+13
$2s^22p$–2s23d	2Po–2De	4:1–4:4	11.93	6.66E–02	1.05E–02	3.12E+12
$2s^22p$–2s23d	2Po–2De	4:1–6:3	11.92	5.98E–01	9.38E–02	1.87E+13
LS	2Po–2De	6–10		6.67E–01	1.56E–01	1.89E+13
$2s^22p$–2s2p3p	2Po–2De	2:1–4:7	11.44	1.89E–01	1.42E–02	4.81E+12
$2s^22p$–2s2p3p	2Po–2De	4:1–4:7	11.60	6.42E–04	9.80E–05	3.18E+10
$2s^22p$–2s2p3p	2Po–2De	4:1–6:5	11.46	6.58E–02	9.92E–03	2.23E+12
LS	2Po–2De	6–10		1.07E–01	2.42E–02	3.29E+12
$2s^22p$–2s24d	2Po–2De	2:1–4:23	8.96	1.31E–01	7.74E–03	5.45E+12
$2s^22p$–2s24d	2Po–2De	4:1–4:23	9.06	1.32E–02	1.57E–03	1.07E+12
$2s^22p$–2s24d	2Po–2De	4:1–6:18	9.07	1.19E–01	1.42E–02	6.44E+12
LS	2Po–2De	6–10		1.32E–01	2.35E–02	6.47E+12
2s2p2–2p3	2De–2Po	4:2–2:2	120.06	2.97E–02	4.70E–02	2.75E+10
2s2p2–2p3	2De–2Po	4:2–4:4	112.22	8.90E–03	1.31E–02	4.71E+09
2s2p2–2p3	2De–2Po	6:2–4:4	115.20	1.78E–02	4.05E–02	1.34E+10
LS	2De–2Po	10–6		2.61E–02	1.01E–01	2.12E+10
2p3–2s23d	2Po–2De	2:2–4:4	14.43	9.94E–08	9.45E–09	1.59E+06
2p3–2s23d	2Po–2De	4:4–4:4	14.56	5.86E–07	1.12E–07	1.84E+07
2p3–2s23d	2Po–2De	4:4–6:3	14.54	1.42E–05	2.71E–06	2.98E+08
LS	2Po–2De	6–10		9.89E–06	2.83E–06	1.88E+08
2p3–2s2p3p	2Po–2De	2:2–4:7	13.95	4.97E–04	4.56E–05	8.51E+09

(*continued on next page*)

Table 2 (*continued*)

C_i–C_k	T_i–T_k	g_i:I–g_j:K	E_{ik} (Å)	f	S	A (s^{-1})
2p3–2s2p3p	2Po–2De	4:4–4:7	14.06	1.20E−06	2.22E−07	4.05E+07
2p3–2s2p3p	2Po–2De	4:4–6:5	13.86	4.23E−04	7.72E−05	9.80E+09
LS	2Po–2De	6–10		4.48E−04	1.23E−04	9.31E+09
2p3–2s24d	2Po–2De	2:2–4:23	10.43	2.61E−05	1.79E−06	8.00E+08
2p3–2s24d	2Po–2De	4:4–4:23	10.49	5.04E−06	6.96E−07	3.05E+08
2p3–2s24d	2Po–2De	4:4–6:18	10.50	3.60E−05	4.97E−06	1.45E+09
LS	2Po–2De	6–10		3.61E−05	7.46E−06	1.32E+09
2s2p2–2s2p(3P*)3d	2De–4Do	4:2–2:6	12.27	4.86E−03	7.86E−04	4.31E+11
2s2p2–2s2p(3P*)3d	2De–4Do	4:2–4:9	12.28	2.72E−02	4.40E−03	1.20E+12
2s2p2–2s2p(3P*)3d	2De–4Do	4:2–6:6	12.14	4.27E−02	6.82E−03	1.29E+12
2s2p2–2s2p(3P*)3d	2De–4Do	6:2–4:9	12.31	4.74E−04	1.15E−04	3.13E+10
2s2p2–2s2p(3P*)3d	2De–4Do	6:2–6:6	12.18	6.89E−03	1.66E−03	3.10E+11
2s2p2–2s2p(3P*)3d	2De–4Do	6:2–8:2	12.19	7.28E−03	1.75E−03	2.45E+11
2s23d–2s2p(3P*)3d	2De–4Do	4:4–2:6	256.41	2.09E−04	7.05E−04	4.24E+07
2s23d–2s2p(3P*)3d	2De–4Do	4:4–4:9	260.44	5.71E−04	1.96E−03	5.62E+07
2s23d–2s2p(3P*)3d	2De–4Do	4:4–6:6	210.55	2.99E−05	8.29E−05	3.00E+06
2s23d–2s2p(3P*)3d	2De–4Do	6:3–4:9	266.69	1.82E−04	9.57E−04	2.56E+07
2s23d–2s2p(3P*)3d	2De–4Do	6:3–6:6	214.62	1.59E−04	6.74E−04	2.30E+07
2s23d–2s2p(3P*)3d	2De–4Do	6:3–8:2	219.79	1.68E−05	7.29E−05	1.74E+06
2s2p3p–2s2p(3P*)3d	2De–4Do	4:7–2:6	675.51	6.98E−04	6.21E−03	2.04E+07
2s2p3p–2s2p(3P*)3d	2De–4Do	4:7–4:9	704.22	6.90E−03	6.40E−02	9.28E+07
2s2p3p–2s2p(3P*)3d	2De–4Do	4:7–6:6	429.24	8.39E−03	4.74E−02	2.03E+08
2s2p3p–2s2p(3P*)3d	2De–4Do	6:5–4:9	2704.04	1.80E−05	9.59E−04	2.46E+04
2s2p3p–2s2p(3P*)3d	2De–4Do	6:5–6:6	781.53	1.10E−02	1.70E−01	1.20E+08
2s2p3p–2s2p(3P*)3d	2De–4Do	6:5–8:2	854.85	1.96E−02	3.30E−01	1.34E+08
2s2p(3P*)3d–2s24d	4Do–2De	2:6–4:23	43.99	1.03E−03	2.97E−04	1.77E+09
2s2p(3P*)3d–2s24d	4Do–2De	4:9–4:23	43.88	3.67E−06	2.12E−06	1.27E+07
2s2p(3P*)3d–2s24d	4Do–2De	6:6–4:23	45.70	4.15E−07	3.74E−07	1.99E+06
2s2p(3P*)3d–2s24d	4Do–2De	4:9–6:18	44.11	2.03E−05	1.18E−05	4.64E+07
2s2p(3P*)3d–2s24d	4Do–2De	6:6–6:18	45.96	7.79E−08	7.07E−08	2.46E+05
2s2p(3P*)3d–2s24d	4Do–2De	8:2–6:18	45.73	1.10E−06	1.33E−06	4.69E+06
2s2p2–2s2p(3P*)3d	2De–4Po	4:2–2:8	12.14	3.82E−04	6.10E−05	3.45E+10
2s2p2–2s2p(3P*)3d	2De–4Po	4:2–4:12	12.14	1.51E−03	2.42E−04	6.84E+10
2s2p2–2s2p(3P*)3d	2De–4Po	4:2–6:4	12.29	1.95E−02	3.16E−03	5.74E+11
2s2p2–2s2p(3P*)3d	2De–4Po	6:2–4:12	12.18	4.84E−03	1.16E−03	3.26E+11
2s2p2–2s2p(3P*)3d	2De–4Po	6:2–6:4	12.32	2.82E−02	6.87E−03	1.24E+12
2s23d–2s2p(3P*)3d	2De–4Po	4:4–2:8	210.55	2.23E−06	6.17E−06	6.70E+05
2s23d–2s2p(3P*)3d	2De–4Po	4:4–4:12	210.99	2.82E−05	7.83E−05	4.22E+06
2s23d–2s2p(3P*)3d	2De–4Po	4:4–6:4	265.99	2.00E−04	7.02E−04	1.26E+07
2s23d–2s2p(3P*)3d	2De–4Po	6:3–4:12	215.07	7.22E−07	3.07E−06	1.56E+05
2s23d–2s2p(3P*)3d	2De–4Po	6:3–6:4	272.51	5.78E−04	3.11E−03	5.19E+07
2s2p3p–2s2p(3P*)3d	2De–4Po	4:7–2:8	429.24	3.68E−04	2.08E−03	2.66E+07
2s2p3p–2s2p(3P*)3d	2De–4Po	4:7–4:12	431.06	8.13E−04	4.61E−03	2.92E+07
2s2p3p–2s2p(3P*)3d	2De–4Po	4:7–6:4	746.33	3.95E−03	3.89E−02	3.16E+07
2s2p3p–2s2p(3P*)3d	2De–4Po	6:5–4:12	787.61	4.16E−03	6.48E−02	6.71E+07
2s2p3p–2s2p(3P*)3d	2De–4Po	6:5–6:4	3451.77	1.70E−05	1.16E−03	9.51E+03
2s2p(3P*)3d–2s24d	4Po–2De	2:8–4:23	45.70	4.69E−06	1.41E−06	7.49E+06
2s2p(3P*)3d–2s24d	4Po–2De	4:12–4:23	45.68	5.59E−07	3.36E−07	1.79E+06
2s2p(3P*)3d–2s24d	4Po–2De	6:4–4:23	43.72	6.86E−07	5.92E−07	3.59E+06
2s2p(3P*)3d–2s24d	4Po–2De	4:12–6:18	45.94	5.66E−06	3.42E−06	1.19E+07
2s2p(3P*)3d–2s24d	4Po–2De	6:4–6:18	43.96	5.36E−07	4.65E−07	1.85E+06
2s2p2–2s2p(3P*)3d	2De–2Po	4:2–2:11	12.15	1.00E−02	1.60E−03	9.05E+11
2s2p2–2s2p(3P*)3d	2De–2Po	4:2–4:15	11.84	2.46E−03	3.83E−04	1.17E+11
2s2p2–2s2p(3P*)3d	2De–2Po	6:2–4:15	11.88	2.97E−03	6.97E−04	2.11E+11
LS	2De–2Po	10–6		6.77E−03	2.68E−03	5.20E+11
2s23d–2s2p(3P*)3d	2De–2Po	4:4–2:11	213.26	1.79E−02	5.03E−02	5.25E+09
2s23d–2s2p(3P*)3d	2De–2Po	4:4–4:15	146.65	5.26E−03	1.02E−02	1.63E+09
2s23d–2s2p(3P*)3d	2De–2Po	6:3–4:15	148.61	2.51E−02	7.38E−02	1.14E+10
LS	2De–2Po	10–6		2.43E−02	1.34E−01	9.61E+09
2s2p3p–2s2p(3P*)3d	2De–2Po	4:7–2:11	440.65	7.81E−05	4.53E−04	5.37E+06
2s2p3p–2s2p(3P*)3d	2De–2Po	4:7–4:15	227.31	3.18E−03	9.52E−03	4.10E+08
2s2p3p–2s2p(3P*)3d	2De–2Po	6:5–4:15	298.58	1.96E−05	1.16E−04	2.20E+06
LS	2De–2Po	10–6		1.32E−03	1.01E−02	2.69E+08
2s2p(3P*)3d–2s24d	2Po–2De	2:11–4:23	45.58	4.07E−03	1.22E−03	6.53E+09
2s2p(3P*)3d–2s24d	2Po–2De	4:15–4:23	50.48	3.23E−04	2.15E−04	8.45E+08
2s2p(3P*)3d–2s24d	2Po–2De	4:15–6:18	50.79	2.73E−03	1.82E−03	4.70E+09
LS	2Po–2De	6–10		3.39E−03	3.25E−03	5.75E+09
2s2p2–2p3	2De–4So	4:2–4:2	192.66	7.94E−04	2.02E−03	1.43E+08
2s2p2–2p3	2De–4So	6:2–4:2	201.61	5.78E−05	2.30E−04	1.42E+07
2s2p2–2p3	2De–2Do	4:2–4:3	151.63	2.47E−02	4.94E−02	7.18E+09

Table 2 (*continued*)

C_i–C_k	T_i–T_k	g_i:I–g_j:K	E_{ik} (Å)	*f*	*S*	*A* (s^{-1})
2s2p2–2p3	2De–2Do	4:2–6:1	144.88	1.57E−02	3.00E−02	3.34E+09
2s2p2–2p3	2De–2Do	6:2–4:3	157.11	1.15E−02	3.56E−02	4.64E+09
2s2p2–2p3	2De–2Do	6:2–6:1	149.88	4.08E−02	1.21E−01	1.21E+10
LS	2De–2Do	10–10		4.75E−02	2.36E−01	1.39E+10
2s2p2–2s2p(1P*)3d	2De–2Po	4:2–4:13	11.86	6.77E−03	1.06E−03	3.21E+11
2s2p2–2s2p(1P*)3d	2De–2Po	6:2–4:13	11.89	1.43E−02	3.36E−03	1.01E+12
LS	2De–2Po	10–6		1.13E−02	4.42E−03	8.87E+11
2s2p2–2s2p(1P*)3d	2De–2Do	4:2–4:14	11.91	6.48E−02	1.02E−02	3.05E+12
2s2p2–2s2p(1P*)3d	2De–2Do	4:2–6:9	11.72	1.05E−02	1.62E−03	3.40E+11
2s2p2–2s2p(1P*)3d	2De–2Do	6:2–4:14	11.94	1.58E−03	3.72E−04	1.11E+11
2s2p2–2s2p(1P*)3d	2De–2Do	6:2–6:9	11.75	1.71E−02	3.98E−03	8.29E+11
LS	2De–2Do	10–10		4.13E−02	1.62E−02	1.95E+12
2s2p2–2s2p(3P*)4d	2De–4Do	4:2–4:27	9.27	3.69E−03	4.50E−04	2.86E+11
2s2p2–2s2p(3P*)4d	2De–4Do	4:2–6:20	9.19	2.43E−03	2.94E−04	1.28E+11
2s2p2–2s2p(3P*)4d	2De–4Do	6:2–4:27	9.29	2.70E−04	4.96E−05	3.13E+10
2s2p2–2s2p(3P*)4d	2De–4Do	6:2–6:20	9.21	1.36E−04	2.48E−05	1.07E+10
2s2p2–2s2p(3P*)4d	2De–4Do	6:2–8:8	9.21	6.82E−03	1.24E−03	4.02E+11
2p3–2s23d	4So–2De	4:2–4:4	13.81	3.88E−06	7.05E−07	1.36E+08
2p3–2s23d	4So–2De	4:2–6:3	13.79	6.64E−06	1.21E−06	1.55E+08
2p3–2s23d	2Do–2De	4:3–4:4	14.08	4.12E−05	7.65E−06	1.39E+09
2p3–2s23d	2Do–2De	6:1–4:4	14.14	8.68E−07	2.42E−07	4.34E+07
2p3–2s23d	2Do–2De	4:3–6:3	14.06	4.30E−07	7.97E−08	9.67E+06
2p3–2s23d	2Do–2De	6:1–6:3	14.12	3.67E−05	1.02E−05	1.23E+09
LS	2Do–2De	10–10		3.92E−05	1.82E−05	1.32E+09
2s23d–2s2p(1P*)3d	2De–2Po	4:4–4:13	149.27	1.26E−03	2.49E−03	3.78E+08
2s23d–2s2p(1P*)3d	2De–2Po	6:3–4:13	151.30	3.82E−04	1.14E−03	1.67E+08
LS	2De–2Po	10–6		7.33E−04	3.63E−03	3.60E+08
2s23d–2s2p(1P*)3d	2De–2Do	4:4–4:14	157.25	4.26E−02	8.81E−02	1.15E+10
2s23d–2s2p(1P*)3d	2De–2Do	4:4–6:9	129.20	1.83E−03	3.11E−03	4.87E+08
2s23d–2s2p(1P*)3d	2De–2Do	6:3–4:14	159.51	3.41E−03	1.07E−02	1.34E+09
2s23d–2s2p(1P*)3d	2De–2Do	6:3–6:9	130.72	5.47E−02	1.41E−01	2.13E+10
LS	2De–2Do	10–10		5.26E−02	2.43E−01	1.79E+10
2s23d–2s2p(3P*)4d	2De–4Do	4:4–4:27	33.03	3.52E−05	1.53E−05	2.15E+08
2s23d–2s2p(3P*)4d	2De–4Do	4:4–6:20	32.05	1.15E−05	4.84E−06	4.96E+07
2s23d–2s2p(3P*)4d	2De–4Do	6:3–4:27	33.12	1.81E−05	1.19E−05	1.65E+08
2s23d–2s2p(3P*)4d	2De–4Do	6:3–6:20	32.14	1.30E−05	8.28E−06	8.42E+07
2s23d–2s2p(3P*)4d	2De–4Do	6:3–8:8	32.14	5.39E−04	3.42E−04	2.61E+09
2p3–2s2p3p	4So–2De	4:2–4:7	13.36	1.87E−04	3.30E−05	7.00E+09
2p3–2s2p3p	4So–2De	4:2–6:5	13.18	4.38E−04	7.60E−05	1.12E+10
2p3–2s2p3p	2Do–2De	4:3–4:7	13.62	3.14E−04	5.63E−05	1.13E+10
2p3–2s2p3p	2Do–2De	6:1–4:7	13.67	6.21E−04	1.68E−04	3.32E+10
2p3–2s2p3p	2Do–2De	4:3–6:5	13.43	3.09E−05	5.46E−06	7.62E+08
2p3–2s2p3p	2Do–2De	6:1–6:5	13.48	3.65E−04	9.72E−05	1.34E+10
LS	2Do–2De	10–10		7.30E−04	3.27E−04	2.63E+10
2s2p3p–2s2p(1P*)3d	2De–2Po	4:7–4:13	233.66	8.50E−03	2.62E−02	1.04E+09
2s2p3p–2s2p(1P*)3d	2De–2Po	6:5–4:13	309.64	3.40E−04	2.08E−03	3.55E+07
LS	2De–2Po	10–6		3.60E−03	2.83E−02	7.05E+08
2s2p3p–2s2p(1P*)3d	2De–2Do	4:7–4:14	253.83	1.51E−04	5.05E−04	1.56E+07
2s2p3p–2s2p(1P*)3d	2De–2Do	4:7–6:9	187.97	6.66E−05	1.65E−04	8.39E+06
2s2p3p–2s2p(1P*)3d	2De–2Do	6:5–4:14	346.09	6.91E−05	4.72E−04	5.77E+06
2s2p3p–2s2p(1P*)3d	2De–2Do	6:5–6:9	234.20	4.58E−04	2.12E−03	5.57E+07
LS	2De–2Do	10–10		4.03E−04	3.26E−03	4.46E+07
2s2p3p–2s2p(3P*)4d	2De–4Do	4:7–4:27	35.89	7.40E−02	3.50E−02	3.83E+11
2s2p3p–2s2p(3P*)4d	2De–4Do	4:7–6:20	34.75	5.45E−04	2.49E−04	2.01E+09
2s2p3p–2s2p(3P*)4d	2De–4Do	6:5–4:27	37.30	4.53E−04	3.34E−04	3.26E+09
2s2p3p–2s2p(3P*)4d	2De–4Do	6:5–6:20	36.06	1.48E−01	1.06E−01	7.61E+11
2s2p3p–2s2p(3P*)4d	2De–4Do	6:5–8:8	36.06	3.29E−02	2.34E−02	1.26E+11
2p3–2s24d	4So–2De	4:2–4:23	10.10	1.25E−06	1.66E−07	8.17E+07
2p3–2s24d	4So–2De	4:2–6:18	10.11	1.13E−05	1.51E−06	4.92E+08
2p3–2s24d	2Do–2De	4:3–4:23	10.24	1.07E−06	1.44E−07	6.79E+07
2p3–2s24d	2Do–2De	6:1–4:23	10.27	8.67E−09	1.76E−09	8.22E+05
2p3–2s24d	2Do–2De	4:3–6:18	10.25	1.49E−05	2.01E−06	6.30E+08
2p3–2s24d	2Do–2De	6:1–6:18	10.29	7.97E−08	1.62E−08	5.03E+06
LS	2Do–2De	10–10		6.44E−06	2.17E−06	4.09E+08
2s2p(1P*)3d–2s24d	2Po–2De	4:13–4:23	50.17	2.01E−06	1.33E−06	5.33E+06
2s2p(1P*)3d–2s24d	2Po–2De	4:13–6:18	50.48	2.72E−05	1.81E−05	4.74E+07
LS	2Po–2De	6–10		1.95E−05	1.94E−05	3.05E+07

(*continued on next page*)

Table 2 (*continued*)

C_i–C_k	T_i–T_k	g_i:I–g_j:K	E_{ik} (Å)	f	S	A (s^{-1})
2s2p(1P*)3d–2s24d	2Do–2De	4:14–4:23	49.33	8.75E−07	5.69E−07	2.40E+06
2s2p(1P*)3d–2s24d	2Do–2De	6:9–4:23	52.94	1.01E−05	1.05E−05	3.59E+07
2s2p(1P*)3d–2s24d	2Do–2De	4:14–6:18	49.63	4.98E−06	3.26E−06	8.99E+06
2s2p(1P*)3d–2s24d	2Do–2De	6:9–6:18	53.28	8.84E−07	9.30E−07	2.08E+06
LS	2Do–2De	10–10		8.93E−06	1.53E−05	2.21E+07
2s24d–2s2p(3P*)4d	2De–4Do	4:23–4:27	273.98	4.49E−04	1.62E−03	3.99E+07
2s24d–2s2p(3P*)4d	2De–4Do	4:23–6:20	218.84	6.56E−06	1.89E−05	6.09E+05
2s24d–2s2p(3P*)4d	2De–4Do	6:18–4:27	265.21	1.82E−04	9.56E−04	2.59E+07
2s24d–2s2p(3P*)4d	2De–4Do	6:18–6:20	213.21	6.57E−05	2.77E−04	9.64E+06
2s24d–2s2p(3P*)4d	2De–4Do	6:18–8:8	213.21	3.13E−04	1.32E−03	3.44E+07
2s2p2–2s2p(3P*)3d	4Pe–2Do	4:1–6:5	11.80	1.56E−01	2.42E−02	4.99E+12
2s2p2–2s2p(3P*)3d	4Pe–2Do	6:1–6:5	11.87	6.33E−03	1.48E−03	3.00E+11
2s2p2–2s2p(3P*)3d	4Pe–2Fo	4:1–6:7	11.67	3.49E−03	5.37E−04	1.14E+11
2s2p2–2s2p(3P*)3d	4Pe–2Fo	6:1–6:7	11.74	9.95E−03	2.31E−03	4.81E+11
2s2p2–2s2p(3P*)3d	4Pe–2Fo	6:1–8:3	11.70	3.77E−03	8.71E−04	1.38E+11
2s2p2–2s2p(1P*)3d	4Pe–2Fo	4:1–6:8	11.38	6.71E−04	1.01E−04	2.30E+10
2s2p2–2s2p(1P*)3d	4Pe–2Fo	6:1–6:8	11.45	5.41E−04	1.22E−04	2.75E+10
2s2p2–2s2p(1P*)3d	4Pe–2Fo	6:1–8:4	11.46	4.81E−03	1.09E−03	1.83E+11
2s2p2–2s2p(3P*)4d	4Pe–4Fo	4:1–6:16	9.06	6.98E−02	8.33E−03	3.78E+12
2s2p2–2s2p(3P*)4d	4Pe–4Fo	6:1–6:16	9.11	4.20E−04	7.55E−05	3.37E+10
LS	4Pe–4Fo	12–28		2.35E−02	8.41E−03	8.17E+11
2s2p2–2s2p(3P*)4d	4Pe–2Fo	4:1–6:18	9.01	1.84E−02	2.19E−03	1.01E+12
2s2p2–2s2p(3P*)4d	4Pe–2Fo	6:1–6:18	9.05	3.57E−03	6.38E−04	2.90E+11
2s2p2–2s2p(3P*)4d	4Pe–2Fo	6:1–8:11	8.78	3.70E−04	6.42E−05	2.40E+10
2s2p2–2s2p(3P*)4d	4Pe–2Do	4:1–6:21	8.97	7.48E−05	8.83E−06	4.13E+09
2s2p2–2s2p(3P*)4d	4Pe–2Do	6:1–6:21	9.01	7.97E−03	1.42E−03	6.54E+11
2s2p2–2s2p(1P*)4d	4Pe–2Fo	4:1–6:22	8.74	5.13E−05	5.90E−06	2.98E+09
2s2p2–2s2p(1P*)4d	4Pe–2Fo	6:1–6:22	8.78	3.21E−05	5.57E−06	2.77E+09
2s2p2–2s2p(1P*)4d	4Pe–2Fo	6:1–8:10	8.98	8.16E−05	1.45E−05	5.06E+09
2s2p2–2s2p(1P*)4d	4Pe–2Do	4:1–6:23	8.74	3.50E−05	4.03E−06	2.04E+09
2s2p2–2s2p(1P*)4d	4Pe–2Do	6:1–6:23	8.78	1.30E−05	2.26E−06	1.13E+09
2s2p2–2s2p(3P*)3d	2De–2Do	4:2–6:5	12.19	2.53E−01	4.07E−02	7.58E+12
2s2p2–2s2p(3P*)3d	2De–2Do	6:2–6:5	12.23	2.67E−02	6.45E−03	1.19E+12
LS	2De–2Do	10–10		1.17E−01	4.72E−02	5.24E+12
2s2p2–2s2p(3P*)3d	2De–2Fo	4:2–6:7	12.06	2.18E−01	3.46E−02	6.66E+12
2s2p2–2s2p(3P*)3d	2De–2Fo	6:2–6:7	12.09	1.54E−01	3.67E−02	7.01E+12
2s2p2–2s2p(3P*)3d	2De–2Fo	6:2–8:3	12.05	6.43E−01	1.53E−01	2.22E+13
LS	2De–2Fo	10–14		5.65E−01	2.24E−01	1.86E+13
2s2p2–2s2p(1P*)3d	2De–2Fo	4:2–6:8	11.75	5.82E−01	9.00E−02	1.87E+13
2s2p2–2s2p(1P*)3d	2De–2Fo	6:2–6:8	11.78	3.03E−02	7.04E−03	1.46E+12
2s2p2–2s2p(1P*)3d	2De–2Fo	6:2–8:4	11.79	3.83E−01	8.92E−02	1.38E+13
LS	2De–2Fo	10–14		4.81E−01	1.86E−01	1.65E+13
2s2p2–2s2p(3P*)4d	2De–4Fo	4:2–6:16	9.30	9.60E−03	1.18E−03	4.94E+11
2s2p2–2s2p(3P*)4d	2De–4Fo	6:2–6:16	9.32	5.98E−05	1.10E−05	4.59E+09
2s2p2–2s2p(3P*)4d	2De–2Fo	4:2–6:18	9.24	1.03E−01	1.25E−02	5.37E+12
2s2p2–2s2p(3P*)4d	2De–2Fo	6:2–6:18	9.26	2.73E−04	4.99E−05	2.12E+10
2s2p2–2s2p(3P*)4d	2De–2Fo	6:2–8:11	8.98	5.37E−02	9.53E−03	3.34E+12
LS	2De–2Fo	10–14		7.36E−02	2.21E−02	4.22E+12
2s2p2–2s2p(3P*)4d	2De–2Do	4:2–6:21	9.20	1.75E−02	2.11E−03	9.18E+11
2s2p2–2s2p(3P*)4d	2De–2Do	6:2–6:21	9.22	3.69E−02	6.73E−03	2.90E+12
LS	2De–2Do	10–10		2.91E−02	8.84E−03	2.29E+12
2s2p2–2s2p(1P*)4d	2De–2Fo	4:2–6:22	8.96	8.69E−02	1.03E−02	4.81E+12
2s2p2–2s2p(1P*)4d	2De–2Fo	6:2–6:22	8.98	4.83E−03	8.56E−04	3.99E+11
2s2p2–2s2p(1P*)4d	2De–2Fo	6:2–8:10	9.18	1.59E−01	2.88E−02	9.41E+12
LS	2De–2Fo	10–14		1.33E−01	4.00E−02	7.62E+12
2s2p2–2s2p(1P*)4d	2De–2Do	4:2–6:23	8.95	2.64E−03	3.12E−04	1.47E+11
2s2p2–2s2p(1P*)4d	2De–2Do	6:2–6:23	8.97	4.39E−03	7.78E−04	3.64E+11
LS	2De–2Do	10–10		3.69E−03	1.09E−03	3.06E+11
2s2p2–2s2p(3P*)3d	2Pe–2Do	4:3–6:5	12.59	2.16E−02	3.58E−03	6.06E+11
2s2p2–2s2p(3P*)3d	2Pe–2Fo	4:3–6:7	12.44	3.63E−02	5.95E−03	1.04E+12
2s2p2–2s2p(1P*)3d	2Pe–2Fo	4:3–6:8	12.11	4.51E−04	7.19E−05	1.37E+10
2s2p2–2s2p(3P*)4d	2Pe–4Fo	4:3–6:16	9.52	8.82E−05	1.11E−05	4.32E+09
2s2p2–2s2p(3P*)4d	2Pe–2Fo	4:3–6:18	9.46	1.72E−03	2.14E−04	8.53E+10
2s2p2–2s2p(3P*)4d	2Pe–2Do	4:3–6:21	9.42	2.37E−02	2.94E−03	1.19E+12
2s2p2–2s2p(1P*)4d	2Pe–2Fo	4:3–6:22	9.17	1.26E−03	1.52E−04	6.65E+10
2s2p2–2s2p(1P*)4d	2Pe–2Do	4:3–6:23	9.16	1.47E−01	1.78E−02	7.79E+12

Table 2 (*continued*)

C_i–C_k	T_i–T_k	g_i:I–g_j:K	E_{ik} (Å)	f	S	A (s^{-1})
2s23d–2s2p(3P*)3d	2De–2Do	4:4–6:5	227.31	4.74E−04	1.42E−03	4.08E+07
2s23d–2s2p(3P*)3d	2De–2Do	6:3–6:5	232.05	1.60E−05	7.35E−05	1.99E+06
LS	2De–2Do	10–10		1.99E−04	1.49E−03	2.56E+07
2s23d–2s2p(3P*)3d	2De–2Fo	4:4–6:7	187.97	3.48E−04	8.61E−04	4.38E+07
2s23d–2s2p(3P*)3d	2De–2Fo	6:3–6:7	191.20	1.31E−03	4.96E−03	2.40E+08
2s23d–2s2p(3P*)3d	2De–2Fo	6:3–8:3	180.20	4.01E−04	1.43E−03	6.17E+07
LS	2De–2Fo	10–14		1.17E−03	7.25E−03	1.56E+08
2s23d–2s2p(1P*)3d	2De–2Fo	4:4–6:8	133.17	4.64E−02	8.13E−02	1.16E+10
2s23d–2s2p(1P*)3d	2De–2Fo	6:3–6:8	134.78	4.06E−05	1.08E−04	1.49E+07
2s23d–2s2p(1P*)3d	2De–2Fo	6:3–8:4	136.07	4.17E−02	1.12E−01	1.13E+10
LS	2De–2Fo	10–14		4.36E−02	1.93E−01	1.14E+10
2s23d–2s2p(3P*)4d	2De–4Fo	4:4–6:16	33.40	2.15E−04	9.45E−05	8.56E+08
2s23d–2s2p(3P*)4d	2De–4Fo	6:3–6:16	33.50	7.85E−06	5.19E−06	4.66E+07
2s23d–2s2p(3P*)4d	2De–2Fo	4:4–6:18	32.68	7.80E−06	3.36E−06	3.25E+07
2s23d–2s2p(3P*)4d	2De–2Fo	6:3–6:18	32.78	8.04E−06	5.21E−06	4.99E+07
2s23d–2s2p(3P*)4d	2De–2Fo	6:3–8:11	29.47	1.47E−03	8.54E−04	8.45E+09
LS	2De–2Fo	10–14		8.90E−04	8.63E−04	4.89E+09
2s23d–2s2p(3P*)4d	2De–2Do	4:4–6:21	32.12	3.98E−05	1.68E−05	1.71E+08
2s23d–2s2p(3P*)4d	2De–2Do	6:3–6:21	32.22	4.49E−05	2.86E−05	2.89E+08
LS	2De–2Do	10–10		4.29E−05	4.54E−05	2.76E+08
2s23d–2s2p(1P*)4d	2De–2Fo	4:4–6:22	29.42	1.66E−03	6.44E−04	8.54E+09
2s23d–2s2p(1P*)4d	2De–2Fo	6:3–6:22	29.50	1.31E−04	7.65E−05	1.01E+09
2s23d–2s2p(1P*)4d	2De–2Fo	6:3–8:10	31.83	3.18E−04	2.00E−04	1.57E+09
LS	2De–2Fo	10–14		9.33E−04	9.21E−04	4.96E+09
2s23d–2s2p(1P*)4d	2De–2Do	4:4–6:23	29.34	1.98E−04	7.64E−05	1.02E+09
2s23d–2s2p(1P*)4d	2De–2Do	6:3–6:23	29.42	1.30E−04	7.58E−05	1.00E+09
LS	2De–2Do	10–10		1.57E−04	1.52E−04	1.21E+09
2s2p3p–2s2p(3P*)3d	2Pe–2Do	4:5–6:5	400.03	4.06E−03	2.14E−02	1.13E+08
2s2p3p–2s2p(3P*)3d	2Pe–2Fo	4:5–6:7	292.35	9.49E−06	3.65E−05	4.94E+05
2s2p3p–2s2p(1P*)3d	2Pe–2Fo	4:5–6:8	178.26	1.38E−04	3.24E−04	1.93E+07
2s2p3p–2s2p(3P*)4d	2Pe–4Fo	4:5–6:16	35.66	1.82E−01	8.56E−02	6.37E+11
2s2p3p–2s2p(3P*)4d	2Pe–2Fo	4:5–6:18	34.84	2.11E−02	9.70E−03	7.74E+10
2s2p3p–2s2p(3P*)4d	2Pe–2Do	4:5–6:21	34.21	4.77E−04	2.15E−04	1.81E+09
2s2p3p–2s2p(1P*)4d	2Pe–2Fo	4:5–6:22	31.16	5.19E−06	2.13E−06	2.38E+07
2s2p3p–2s2p(1P*)4d	2Pe–2Do	4:5–6:23	31.07	1.91E−05	7.83E−06	8.81E+07
2s2p3p–2s2p(3P*)3d	2De–2Do	4:7–6:5	505.14	4.61E−02	3.07E−01	8.03E+08
2s2p3p–2s2p(3P*)3d	2De–2Do	6:5–6:5	1075.88	8.36E−04	1.78E−02	4.82E+06
LS	2De–2Do	10–10		1.89E−02	3.25E−01	4.66E+08
2s2p3p–2s2p(3P*)3d	2De–2Fo	4:7–6:7	344.78	2.66E−03	1.21E−02	9.97E+07
2s2p3p–2s2p(3P*)3d	2De–2Fo	6:5–6:7	540.49	1.65E−04	1.76E−03	3.76E+06
2s2p3p–2s2p(3P*)3d	2De–2Fo	6:5–8:3	460.93	1.17E−02	1.07E−01	2.76E+08
LS	2De–2Fo	10–14		8.18E−03	1.21E−01	1.94E+08
2s2p3p–2s2p(1P*)3d	2De–2Fo	4:7–6:8	196.48	4.99E−05	1.29E−04	5.75E+06
2s2p3p–2s2p(1P*)3d	2De–2Fo	6:5–6:8	247.56	8.04E−05	3.93E−04	8.75E+06
2s2p3p–2s2p(1P*)3d	2De–2Fo	6:5–8:4	251.94	1.96E−05	9.76E−05	1.55E+06
LS	2De–2Fo	10–14		8.00E−05	6.20E−04	6.88E+06
2s2p3p–2s2p(3P*)4d	2De–4Fo	4:7–6:16	36.34	2.84E−03	1.36E−03	9.55E+09
2s2p3p–2s2p(3P*)4d	2De–4Fo	6:5–6:16	37.78	3.74E−07	2.79E−07	1.75E+06
2s2p3p–2s2p(3P*)4d	2De–2Fo	4:7–6:18	35.49	3.43E−01	1.60E−01	1.21E+12
2s2p3p–2s2p(3P*)4d	2De–2Fo	6:5–6:18	36.86	5.81E−03	4.23E−03	2.85E+10
2s2p3p–2s2p(3P*)4d	2De–2Fo	6:5–8:11	32.73	5.53E−04	3.57E−04	2.58E+09
LS	2De–2Fo	10–14		1.41E−01	1.65E−01	5.35E+11
2s2p3p–2s2p(3P*)4d	2De–2Do	4:7–6:21	34.83	8.96E−03	4.11E−03	3.28E+10
2s2p3p–2s2p(3P*)4d	2De–2Do	6:5–6:21	36.15	2.80E−04	2.00E−04	1.43E+09
LS	2De–2Do	10–10		3.75E−03	4.31E−03	2.06E+10
2s2p3p–2s2p(1P*)4d	2De–2Fo	4:7–6:22	31.68	1.37E−03	5.72E−04	6.08E+09
2s2p3p–2s2p(1P*)4d	2De–2Fo	6:5–6:22	32.77	7.53E−05	4.88E−05	4.68E+08
2s2p3p–2s2p(1P*)4d	2De–2Fo	6:5–8:10	35.66	4.49E−02	3.16E−02	1.77E+11
LS	2De–2Fo	10–14		2.75E−02	3.22E−02	1.04E+11
2s2p3p–2s2p(1P*)4d	2De–2Do	4:7–6:23	31.59	7.54E−05	3.13E−05	3.36E+08
2s2p3p–2s2p(1P*)4d	2De–2Do	6:5–6:23	32.67	3.06E−04	1.97E−04	1.91E+09
LS	2De–2Do	10–10		2.14E−04	2.28E−04	1.35E+09
2s2p(3P*)3d–2s24d	2Do–2De	6:5–4:23	44.98	6.15E−06	5.47E−06	3.04E+07
2s2p(3P*)3d–2s24d	2Do–2De	6:5–6:18	45.23	1.20E−06	1.08E−06	3.93E+06

(continued on next page)

Table 2 (*continued*)

C_i–C_k	T_i–T_k	g_i:I–g_j:K	E_{ik} (Å)	f	S	A (s^{-1})
LS	2Do–2De	10–10		4.41E−06	6.55E−06	1.45E+07
2s2p(3P*)3d–2s24d	2Fo–2De	6:7–4:23	46.93	4.54E−06	4.21E−06	2.06E+07
2s2p(3P*)3d–2s24d	2Fo–2De	6:7–6:18	47.19	8.36E−07	7.79E−07	2.50E+06
2s2p(3P*)3d–2s24d	2Fo–2De	8:3–6:18	47.92	2.22E−07	2.81E−07	8.61E+05
LS	2Fo–2De	14–10		2.43E−06	5.27E−06	1.03E+07
2s2p(1P*)3d–2s24d	2Fo–2De	6:8–4:23	52.30	3.85E−04	3.98E−04	1.41E+09
2s2p(1P*)3d–2s24d	2Fo–2De	6:8–6:18	52.63	2.93E−05	3.04E−05	7.05E+07
2s2p(1P*)3d–2s24d	2Fo–2De	8:4–6:18	52.44	4.28E−04	5.91E−04	1.38E+09
LS	2Fo–2De	14–10		4.22E−04	1.02E−03	1.44E+09
2s24d–2s2p(3P*)4d	2De–4Fo	4:23–6:16	302.14	1.47E−05	5.86E−05	7.17E+05
2s24d–2s2p(3P*)4d	2De–4Fo	6:18–6:16	291.51	1.63E−07	9.40E−07	1.28E+04
2s24d–2s2p(3P*)4d	2De–2Fo	4:23–6:18	251.94	7.04E−04	2.34E−03	4.93E+07
2s24d–2s2p(3P*)4d	2De–2Fo	6:18–6:18	244.50	3.23E−04	1.56E−03	3.60E+07
2s24d–2s2p(3P*)4d	2De–2Fo	6:18–8:11	133.15	5.58E−02	1.47E−01	1.57E+10
LS	2De–2Fo	10–14		3.40E−02	1.51E−01	8.88E+09
2s24d–2s2p(3P*)4d	2De–2Do	4:23–6:21	222.26	8.74E−05	2.56E−04	7.87E+06
2s24d–2s2p(3P*)4d	2De–2Do	6:18–6:21	216.45	2.23E−04	9.54E−04	3.18E+07
LS	2De–2Do	10–10		1.69E−04	1.21E−03	2.37E+07
2s24d–2s2p(1P*)4d	2De–2Fo	4:23–6:22	135.87	6.09E−02	1.09E−01	1.47E+10
2s24d–2s2p(1P*)4d	2De–2Fo	6:18–6:22	133.68	3.76E−06	9.93E−06	1.40E+06
2s24d–2s2p(1P*)4d	2De–2Fo	6:18–8:10	199.97	2.34E−04	9.24E−04	2.93E+07
LS	2De–2Fo	10–14		2.45E−02	1.10E−01	6.29E+09
2s24d–2s2p(1P*)4d	2De–2Do	4:23–6:23	134.23	4.49E−04	7.93E−04	1.11E+08
2s24d–2s2p(1P*)4d	2De–2Do	6:18–6:23	132.09	5.37E−02	1.40E−01	2.05E+10
LS	2De–2Do	10–10		3.24E−02	1.41E−01	1.24E+10
2s2p2–2s2p(3P*)3d	4Pe–4Fo	6:1–8:1	11.97	1.62E−01	3.84E−02	5.66E+12
2s2p2–2s2p(3P*)3d	2De–4Fo	6:2–8:1	12.34	6.98E−03	1.70E−03	2.29E+11
2s23d–2s2p(3P*)3d	2De–4Fo	6:3–8:1	280.13	1.02E−04	5.63E−04	6.49E+06
2s2p3p–2s2p(3P*)3d	2De–4Fo	6:5–8:1	5267.43	4.89E−05	5.09E−03	8.82E+03
2s2p(3P*)3d–2s24d	4Fo–2De	8:1–6:18	43.76	6.86E−06	7.91E−06	3.19E+07

Table 3
Fine structure energy levels of Fe XXII for which forbidden (E2,E3,M1,M2) transitions are presented. See page 34 for explanation of Table.

ie	SLp(cf)	2*J*	*E*(Ry)
1	2Po(1)	1	0.00000E+00
2	2Po(1)	3	1.07780E+00
3	4Pe(2)	1	3.68650E+00
4	4Pe(2)	3	4.19370E+00
5	4Pe(2)	5	4.67720E+00
6	2De(2)	3	6.74977E+00
7	2De(2)	5	6.92220E+00
8	2Pe(2)	1	7.77750E+00
9	2Se(2)	1	8.91420E+00
10	2Pe(2)	3	9.04240E+00
11	4So(3)	3	1.14430E+01
12	2Do(3)	3	1.27250E+01
13	2Do(3)	5	1.30030E+01
14	2Po(3)	1	1.43040E+01
15	2Po(3)	3	1.48330E+01
16	2Se(4)	1	7.42635E+01
17	2Po(5)	1	7.58952E+01
18	2Po(5)	3	7.62096E+01
19	4Po(7)	1	7.74842E+01
20	2De(6)	3	7.74390E+01
21	4Po(7)	3	7.77780E+01
22	2De(6)	5	7.75210E+01
23	2Po(7)	1	7.84922E+01
24	4Po(7)	5	7.85586E+01
25	4De(8)	1	7.88461E+01
26	4De(8)	3	7.91090E+01
27	2Po(7)	3	7.93019E+01
28	2De(8)	3	7.96450E+01
29	2Pe(8)	1	7.82230E+01
30	4De(8)	5	7.95942E+01
31	4Pe(8)	1	7.98538E+01
32	4Se(8)	3	7.99748E+01
33	4De(8)	7	8.03042E+01
34	2Pe(8)	3	7.91710E+01
35	4Fo(9)	3	8.05120E+01
36	4Pe(8)	3	8.05606E+01
37	4Pe(8)	5	8.05735E+01
38	4Fo(9)	5	8.07025E+01
39	4Fo(9)	7	8.07750E+01
40	2De(8)	5	8.06020E+01
41	4Po(9)	5	8.08660E+01
42	4Do(9)	3	8.09390E+01
43	4Do(9)	1	8.09930E+01
44	2Se(8)	1	8.12666E+01
45	2Po(7)	1	8.13231E+01
46	2Po(7)	3	8.13400E+01
47	2Do(9)	3	8.15381E+01
48	4Fo(9)	9	8.16556E+01
49	2Do(9)	5	8.14490E+01
50	4Do(9)	7	8.16680E+01
51	4Do(9)	5	8.17680E+01
52	4Po(9)	3	8.17590E+01
53	4Po(9)	1	8.17680E+01
54	2Fo(9)	5	8.22870E+01
55	2Po(9)	3	8.36540E+01
56	2Pe(8)	1	8.28851E+01
57	2Fo(9)	7	8.25790E+01
58	2De(8)	3	8.29606E+01
59	2Po(9)	1	8.30276E+01
60	2De(8)	5	8.31462E+01
61	2Pe(8)	3	8.32289E+01
62	4Pe(18)	1	8.33367E+01
63	2Se(8)	1	8.36695E+01
64	4Pe(18)	3	8.40145E+01
65	4Pe(18)	5	8.44611E+01
66	2Po(9)	1	8.45660E+01
67	2Fo(9)	7	8.42190E+01
68	2Fo(9)	5	8.42830E+01
69	2Pe(18)	1	8.46272E+01
70	2Do(9)	3	8.47073E+01
71	2Do(9)	5	8.48363E+01
72	4Do(19)	3	8.49823E+01
73	2Pe(18)	3	8.49860E+01
74	4Do(19)	1	8.50231E+01
75	2Po(9)	3	8.51457E+01
76	4Po(19)	1	8.51499E+01
77	2Do(19)	3	8.54736E+01
78	4Do(19)	5	8.55727E+01
79	2So(19)	1	8.57203E+01
80	4Po(19)	5	8.57681E+01
81	2De(18)	5	8.58218E+01
82	4Po(19)	3	8.59108E+01
83	2De(18)	3	8.60027E+01
84	4Do(19)	7	8.60232E+01
85	4Fe(20)	3	8.62306E+01
86	4So(19)	3	8.64278E+01
87	4Fe(20)	5	8.64726E+01
88	2Po(19)	3	8.65375E+01
89	2Do(19)	5	8.65464E+01
90	2Po(19)	1	8.68321E+01
91	4De(20)	3	8.69340E+01
92	4Fe(20)	7	8.69453E+01
93	4De(20)	1	8.70047E+01
94	2Fe(20)	5	8.70095E+01
95	2Do(19)	5	8.72619E+01
96	4De(20)	7	8.72865E+01
97	2Pe(20)	3	8.73088E+01
98	4Fe(20)	9	8.73302E+01
99	4De(20)	5	8.73318E+01
100	2Fo(19)	7	8.74045E+01
101	2Po(19)	3	8.75627E+01
102	2Fo(19)	5	8.77176E+01
103	2Se(18)	1	8.77180E+01
104	4Pe(20)	5	8.77210E+01
105	2Po(19)	1	8.78078E+01
106	4Pe(20)	3	8.78414E+01
107	4Pe(20)	1	8.79171E+01
108	2Pe(20)	1	8.79461E+01
109	2Fe(20)	7	8.80245E+01
110	2De(20)	5	8.83469E+01
111	2De(20)	3	8.83646E+01
112	2Do(19)	3	8.84956E+01
113	2Fe(20)	7	8.85853E+01
114	2Ge(20)	9	8.87524E+01
115	2De(20)	3	8.89592E+01
116	2De(20)	5	8.90126E+01
117	2Pe(20)	1	8.92040E+01
118	2Ge(20)	7	8.92483E+01
119	2Po(19)	1	8.94040E+01
120	2Se(20)	1	8.95736E+01
121	2Po(19)	3	8.95804E+01
122	2Fe(20)	5	8.96035E+01
123	2Pe(20)	3	8.96177E+01
124	2De(20)	5	9.09907E+01
125	2De(20)	3	9.10676E+01
126	2Se(10)	1	1.00700E+02
127	2Po(11)	1	1.01193E+02
128	2Po(11)	3	1.01314E+02
129	2De(12)	3	1.01710E+02
130	2De(12)	5	1.01600E+02
131	2Fo(13)	5	1.02753E+02
132	2Fo(13)	7	1.02773E+02
133	4Po(14)	1	1.03690E+02
134	4Po(14)	3	1.03969E+02
135	2Po(14)	1	1.04137E+02
136	4De(15)	1	1.04287E+02
137	4De(15)	3	1.04469E+02
138	2De(15)	3	1.04587E+02
139	4Pe(15)	1	1.04735E+02
140	4De(15)	5	1.04751E+02
141	2Pe(15)	1	1.04773E+02
142	4Po(14)	5	1.04801E+02
143	4Pe(15)	3	1.04859E+02
144	4Fo(16)	3	1.04938E+02
145	2Po(14)	3	1.05007E+02
146	4Fo(16)	5	1.04720E+02
147	2Fo(16)	5	1.05320E+02
148	4Fo(16)	7	1.05301E+02

(continued on next page)

Table 3 (*continued*)

ie	SLp(cf)	2*J*	*E*(Ry)
149	4Do(16)	3	1.05030E+02
150	4Do(16)	1	1.05334E+02
151	2Do(16)	3	1.05443E+02
152	4Po(16)	5	1.05503E+02
153	2Pe(15)	3	1.05517E+02
154	4De(15)	7	1.05540E+02
155	4Pe(15)	5	1.05550E+02
156	4Se(15)	3	1.05617E+02
157	2De(15)	5	1.05760E+02
158	2Se(15)	1	1.05849E+02
159	4Fo(16)	9	1.06070E+02
160	4Do(16)	7	1.05870E+02
161	4Do(16)	5	1.05870E+02
162	4Po(16)	3	1.06179E+02
163	4Po(16)	1	1.06189E+02
164	2Do(16)	5	1.05810E+02
165	2Po(16)	3	1.06356E+02
166	2Fo(16)	7	1.08440E+02
167	2Po(16)	1	1.06486E+02
168	2Po(14)	1	1.07463E+02
169	2Po(14)	3	1.07479E+02
170	2De(15)	3	1.08127E+02
171	2Pe(15)	1	1.08142E+02
172	2De(15)	5	1.08212E+02
173	2Pe(15)	3	1.08262E+02
174	2Se(15)	1	1.08344E+02
175	2Do(16)	3	1.08771E+02
176	2Do(16)	5	1.08500E+02
177	2Fo(16)	7	1.06150E+02
178	2Fo(16)	5	1.08410E+02
179	2Po(16)	1	1.08892E+02
180	2Po(16)	3	1.08931E+02
181	4Pe(21)	1	1.09275E+02
182	4Do(22)	1	1.09797E+02
183	4Pe(21)	3	1.09914E+02
184	4Do(22)	3	1.09997E+02
185	2Pe(21)	1	1.10017E+02
186	4Pe(21)	5	1.10356E+02
187	4Po(22)	1	1.10425E+02
188	2Pe(21)	3	1.10468E+02
189	2Do(22)	3	1.10540E+02
190	4Do(22)	5	1.10594E+02
191	2So(22)	1	1.10685E+02
192	4Po(22)	3	1.10731E+02
193	4Po(22)	5	1.10913E+02
194	4Do(22)	7	1.11018E+02
195	4So(22)	3	1.11085E+02
196	2Po(22)	3	1.11156E+02
197	2Do(22)	5	1.11238E+02
198	2Po(22)	1	1.11291E+02
199	2De(21)	5	1.11632E+02
200	2De(21)	3	1.11669E+02
201	2Fo(22)	5	1.12256E+02
202	2Do(22)	3	1.12278E+02
203	2Do(22)	5	1.12300E+02
204	2Fo(22)	7	1.12304E+02
205	2Po(22)	1	1.12377E+02
206	2Po(22)	3	1.12627E+02
207	2Se(21)	1	1.13593E+02
208	2Po(22)	1	1.14219E+02
209	2Po(22)	3	1.14308E+02
210	4Fe(17)	3	1.60649E+02
211	4Fe(17)	5	1.60682E+02
212	4Fe(17)	7	1.60728E+02
213	4Fe(17)	9	1.60785E+02
214	4Pe(17)	1	1.61091E+02
215	4Pe(17)	3	1.61112E+02
216	4Pe(17)	5	1.61133E+02
217	2De(17)	3	1.61380E+02
218	2De(17)	5	1.61383E+02
219	2Ge(17)	7	1.61545E+02
220	2Ge(17)	9	1.61555E+02
221	2Fe(17)	5	1.61596E+02
222	2Fe(17)	7	1.61684E+02
223	2Pe(17)	1	1.62002E+02
224	2Pe(17)	3	1.62051E+02

Table 3 (*continued*)

ie	SLp(cf)	2*J*	*E*(Ry)
225	2Se(17)	1	1.62368E+02
226	4Pe(23)	1	4.83324E+02
227	4Pe(23)	3	4.83931E+02
228	4Pe(23)	5	4.84442E+02
229	2De(23)	3	4.85710E+02
230	2Pe(23)	1	4.85761E+02
231	2De(23)	5	4.86191E+02
232	2Pe(23)	3	4.87022E+02
233	2Se(23)	1	4.87873E+02
234	4De(24)	1	5.61791E+02
235	4De(24)	3	5.62000E+02
236	2De(24)	3	5.62441E+02
237	4De(24)	5	5.62479E+02
238	2Pe(24)	1	5.62713E+02
239	4Pe(24)	1	5.62925E+02
240	4Se(24)	3	5.62951E+02
241	4De(24)	7	5.63223E+02
242	2Pe(24)	3	5.63481E+02
243	4Pe(24)	3	5.63536E+02
244	4Pe(24)	5	5.63660E+02
245	4Fo(25)	3	5.63932E+02
246	2De(24)	5	5.64097E+02
247	4Fo(25)	5	5.64110E+02
248	2Se(24)	1	5.64132E+02
249	2Fo(25)	5	5.64352E+02
250	4Fo(25)	7	5.64426E+02
251	2Do(25)	3	5.64488E+02
252	4Do(25)	3	5.64643E+02
253	4Do(25)	1	5.64650E+02
254	4Po(25)	5	5.64683E+02
255	2Pe(24)	3	5.64725E+02
256	2Pe(24)	1	5.64760E+02
257	2De(24)	5	5.64801E+02
258	4Fo(25)	9	5.65114E+02
259	2De(24)	3	5.65155E+02
260	2Do(25)	5	5.65295E+02
261	2Se(24)	1	5.65346E+02
262	4Do(25)	7	5.65396E+02
263	4Po(25)	3	5.65507E+02
264	4Do(25)	5	5.65526E+02
265	4Po(25)	1	5.65534E+02
266	2Po(25)	3	5.65681E+02
267	2Fo(25)	7	5.65751E+02
268	2Po(25)	1	5.66038E+02
269	2Do(25)	3	5.66566E+02
270	2Do(25)	5	5.66619E+02
271	2Fo(25)	7	5.66746E+02
272	2Po(25)	1	5.66875E+02
273	2Fo(25)	5	5.66935E+02
274	2Po(25)	3	5.67057E+02

Table 4
Partial set of radiative decay rates for forbidden E2, M1, E3, M2 transitions in Fe XXII. See page 34 for explanation of Table.

E3 and M2, N_{tr} = 9661

E2 and M1, N_{tr} = 28,554

i–*j*	T_iC_i–T_jC_j	g_i–g_j	λ (Å)	E_i(Ry)	E_j(Ry)	*A*E2	*A*M1
1–2	2Po 1–2Po 1	2–4	845.49	0.00E+00	1.08E+00	1.39E+00	1.48E+04
3–4	4Pe 2–4Pe 2	2–4	1796	3.69E+00	4.19E+00	3.75E−03	3.68E+03
3–5	4Pe 2–4Pe 2	2–6	919.82	3.69E+00	4.68E+00	6.43E−01	0.00E+00
4–5	4Pe 2–4Pe 2	4–6	1884	4.19E+00	4.68E+00	2.13E−02	2.32E+03
3–6	4Pe 2–2De 2	2–4	297.48	3.69E+00	6.75E+00	1.50E+01	3.87E+03
4–6	4Pe 2–2De 2	4–4	356.51	4.19E+00	6.75E+00	5.20E−01	8.59E+03
5–6	4Pe 2–2De 2	6–4	439.68	4.68E+00	6.75E+00	3.45E+00	5.60E+03
3–7	4Pe 2–2De 2	2–6	281.63	3.69E+00	6.92E+00	9.07E−01	0.00E+00
4–7	4Pe 2–2De 2	4–6	333.98	4.19E+00	6.92E+00	1.23E+01	1.54E+04
5–7	4Pe 2–2De 2	6–6	405.91	4.68E+00	6.92E+00	1.77E+01	3.29E+04
6–7	2De 2–2De 2	4–6	5284	6.75E+00	6.92E+00	7.83E−05	6.72E+01
3–8	4Pe 2–2Pe 2	2–2	222.75	3.69E+00	7.78E+00	0.00E+00	6.05E+04
4–8	4Pe 2–2Pe 2	4–2	254.27	4.19E+00	7.78E+00	2.21E+00	5.92E+04
5–8	4Pe 2–2Pe 2	6–2	293.93	4.68E+00	7.78E+00	3.43E+00	0.00E+00
6–8	2De 2–2Pe 2	4–2	886.68	6.75E+00	7.78E+00	1.89E+00	6.61E+02
7–8	2De 2–2Pe 2	6–2	1065	6.92E+00	7.78E+00	8.99E−01	0.00E+00
3–9	4Pe 2–2Se 2	2–2	174.32	3.69E+00	8.91E+00	0.00E+00	1.27E+03
4–9	4Pe 2–2Se 2	4–2	193.04	4.19E+00	8.91E+00	2.35E+01	1.10E+05
5–9	4Pe 2–2Se 2	6–2	215.07	4.68E+00	8.91E+00	9.89E+01	0.00E+00
6–9	2De 2–2Se 2	4–2	421.02	6.75E+00	8.91E+00	7.01E+01	5.59E+03
7–9	2De 2–2Se 2	6–2	457.46	6.92E+00	8.91E+00	9.02E+01	0.00E+00
8–9	2Pe 2–2Se 2	2–2	801.68	7.78E+00	8.91E+00	0.00E+00	1.71E+04
3–10	4Pe 2–2Pe 2	2–4	170.14	3.69E+00	9.04E+00	4.00E+00	2.97E+03
4–10	4Pe 2–2Pe 2	4–4	187.94	4.19E+00	9.04E+00	1.67E+01	1.91E+04
5–10	4Pe 2–2Pe 2	6–4	208.76	4.68E+00	9.04E+00	1.96E+01	1.09E+03
6–10	2De 2–2Pe 2	4–4	397.48	6.75E+00	9.04E+00	1.97E+01	2.04E+04
7–10	2De 2–2Pe 2	6–4	429.80	6.92E+00	9.04E+00	6.70E−01	1.13E+04
8–10	2Pe 2–2Pe 2	2–4	720.43	7.78E+00	9.04E+00	1.06E+00	1.44E+04
9–10	2Se 2–2Pe 2	2–4	7108	8.91E+00	9.04E+00	2.39E−05	8.87E+00
1–11	2Po 1–4So 3	2–4	79.64	0.00E+00	1.14E+01	2.04E+03	5.24E+03
2–11	2Po 1–4So 3	4–4	87.92	1.08E+00	1.14E+01	6.52E+01	6.73E+03
1–12	2Po 1–2Do 3	2–4	71.61	0.00E+00	1.27E+01	2.80E+04	3.90E+03
2–12	2Po 1–2Do 3	4–4	78.24	1.08E+00	1.27E+01	5.79E+03	1.24E+04
11–12	4So 3–2Do 3	4–4	710.82	1.14E+01	1.27E+01	6.35E−01	1.48E+04
1–13	2Po 1–2Do 3	2–6	70.08	0.00E+00	1.30E+01	9.54E+03	0.00E+00
2–13	2Po 1–2Do 3	4–6	76.42	1.08E+00	1.30E+01	2.49E+04	3.32E+03
11–13	4So 3–2Do 3	4–6	584.15	1.14E+01	1.30E+01	2.15E+00	1.17E+03
12–13	2Do 3–2Do 3	4–6	3277	1.27E+01	1.30E+01	5.79E−04	2.49E+02
1–14	2Po 1–2Po 3	2–2	63.71	0.00E+00	1.43E+01	0.00E+00	4.19E−03
2–14	2Po 1–2Po 3	4–2	68.90	1.08E+00	1.43E+01	2.92E+04	1.17E+04
11–14	4So 3–2Po 3	4–2	318.51	1.14E+01	1.43E+01	1.36E+01	4.64E+04
12–14	2Do 3–2Po 3	4–2	577.12	1.27E+01	1.43E+01	2.91E+01	1.17E+04
13–14	2Do 3–2Po 3	6–2	700.44	1.30E+01	1.43E+01	9.27E+00	0.00E+00
1–15	2Po 1–2Po 3	2–4	61.44	0.00E+00	1.48E+01	2.90E+03	1.15E+03
2–15	2Po 1–2Po 3	4–4	66.25	1.08E+00	1.48E+01	3.14E+04	2.67E+02
11–15	4So 3–2Po 3	4–4	268.81	1.14E+01	1.48E+01	5.63E−01	4.99E+04
12–15	2Do 3–2Po 3	4–4	432.29	1.27E+01	1.48E+01	3.39E+01	6.60E+04
13–15	2Do 3–2Po 3	6–4	497.96	1.30E+01	1.48E+01	6.97E+01	2.17E+04
14–15	2Po 3–2Po 3	2–4	1722	1.43E+01	1.48E+01	1.36E−02	1.39E+03
3–16	4Pe 2–2Se 4	2–2	12.91	3.69E+00	7.43E+01	0.00E+00	1.72E+02
4–16	4Pe 2–2Se 4	4–2	13.01	4.19E+00	7.43E+01	3.72E+05	3.27E+02
5–16	4Pe 2–2Se 4	6–2	13.10	4.68E+00	7.43E+01	6.40E+06	0.00E+00
6–16	2De 2–2Se 4	4–2	13.50	6.75E+00	7.43E+01	3.73E+07	5.48E+01
7–16	2De 2–2Se 4	6–2	13.53	6.92E+00	7.43E+01	5.98E+07	0.00E+00
8–16	2Pe 2–2Se 4	2–2	13.71	7.78E+00	7.43E+01	0.00E+00	1.02E+04
9–16	2Se 2–2Se 4	2–2	13.94	8.91E+00	7.43E+01	0.00E+00	9.97E+02
10–16	2Pe 2–2Se 4	4–2	13.97	9.04E+00	7.43E+01	1.46E+06	9.24E+02
1–17	2Po 1–2Po 5	2–2	12.01	0.00E+00	7.59E+01	0.00E+00	1.73E+04
2–17	2Po 1–2Po 5	4–2	12.18	1.08E+00	7.59E+01	3.72E+09	8.18E+05
11–17	4So 3–2Po 5	4–2	14.14	1.14E+01	7.59E+01	2.53E+05	1.23E+02
12–17	2Do 3–2Po 5	4–2	14.43	1.27E+01	7.59E+01	1.80E+06	1.77E−02
13–17	2Do 3–2Po 5	6–2	14.49	1.30E+01	7.59E+01	5.71E+05	0.00E+00
14–17	2Po 3–2Po 5	2–2	14.80	1.43E+01	7.59E+01	0.00E+00	1.90E+00
15–17	2Po 3–2Po 5	4–2	14.92	1.48E+01	7.59E+01	4.03E+04	3.82E+01
1–18	2Po 1–2Po 5	2–4	11.96	0.00E+00	7.62E+01	1.87E+09	1.58E+05
2–18	2Po 1–2Po 5	4–4	12.13	1.08E+00	7.62E+01	1.86E+09	1.68E+05
11–18	4So 3–2Po 5	4–4	14.07	1.14E+01	7.62E+01	5.65E+03	1.86E+02
12–18	2Do 3–2Po 5	4–4	14.35	1.27E+01	7.62E+01	1.47E+05	4.96E−01
13–18	2Do 3–2Po 5	6–4	14.42	1.30E+01	7.62E+01	9.23E+05	7.23E+00
14–18	2Po 3–2Po 5	2–4	14.72	1.43E+01	7.62E+01	7.81E+04	2.94E+00
15–18	2Po 3–2Po 5	4–4	14.85	1.48E+01	7.62E+01	3.01E+05	4.95E−04

(*continued on next page*)

Table 4 (*continued*)

E2 and M1, N_{tr} = 28,554							
17–18	2Po 5–2Po 5	2–4	2898	7.59E+01	7.62E+01	1.18E−01	3.68E+02
1–19	2Po 1–4Po 7	2–2	11.76	0.00E+00	7.75E+01	0.00E+00	7.03E+04
2–19	2Po 1–4Po 7	4–2	11.93	1.08E+00	7.75E+01	1.54E+07	1.44E+04
11–19	4So 3–4Po 7	4–2	13.80	1.14E+01	7.75E+01	2.39E+03	1.71E+03
12–19	2Do 3–4Po 7	4–2	14.07	1.27E+01	7.75E+01	1.73E+05	1.61E+02
13–19	2Do 3–4Po 7	6–2	14.13	1.30E+01	7.75E+01	3.81E+05	0.00E+00
14–19	2Po 3–4Po 7	2–2	14.42	1.43E+01	7.75E+01	0.00E+00	7.95E+01
15–19	2Po 3–4Po 7	4–2	14.55	1.48E+01	7.75E+01	6.64E+03	6.48E+01
17–19	2Po 5–4Po 7	2–2	573.49	7.59E+01	7.75E+01	0.00E+00	4.09E+02
18–19	2Po 5–4Po 7	4–2	714.94	7.62E+01	7.75E+01	8.73E−01	1.49E+02
3–20	4Pe 2–2De 6	2–4	12.36	3.69E+00	7.74E+01	1.86E+07	1.60E+02
4–20	4Pe 2–2De 6	4–4	12.44	4.19E+00	7.74E+01	1.48E+06	4.98E+01
5–20	4Pe 2–2De 6	6–4	12.52	4.68E+00	7.74E+01	1.42E+06	4.09E+02
6–20	2De 2–2De 6	4–4	12.89	6.75E+00	7.74E+01	4.71E+06	6.77E+02
7–20	2De 2–2De 6	6–4	12.92	6.92E+00	7.74E+01	7.00E+06	2.59E+03
8–20	2Pe 2–2De 6	2–4	13.08	7.78E+00	7.74E+01	1.23E+08	6.63E+00
9–20	2Se 2–2De 6	2–4	13.30	8.91E+00	7.74E+01	5.81E+07	5.36E+02
10–20	2Pe 2–2De 6	4–4	13.32	9.04E+00	7.74E+01	1.04E+07	1.73E+03
16–20	2Se 4–2De 6	2–4	286.97	7.43E+01	7.74E+01	8.85E+03	4.79E−02
1–21	2Po 1–4Po 7	2–4	11.72	0.00E+00	7.78E+01	2.26E+07	7.14E+04
2–21	2Po 1–4Po 7	4–4	11.88	1.08E+00	7.78E+01	2.34E+07	2.62E+04
11–21	4So 3–4Po 7	4–4	13.74	1.14E+01	7.78E+01	3.32E+04	4.79E+01
12–21	2Do 3–4Po 7	4–4	14.01	1.27E+01	7.78E+01	2.21E+05	1.62E+01
13–21	2Do 3–4Po 7	6–4	14.07	1.30E+01	7.78E+01	3.47E+05	3.34E+02
14–21	2Po 3–4Po 7	2–4	14.36	1.43E+01	7.78E+01	6.96E+04	3.56E+01
15–21	2Po 3–4Po 7	4–4	14.48	1.48E+01	7.78E+01	1.32E+05	1.99E+02
17–21	2Po 5–4Po 7	2–4	484.00	7.59E+01	7.78E+01	7.92E+00	3.77E+00
18–21	2Po 5–4Po 7	4–4	581.02	7.62E+01	7.78E+01	3.34E+00	2.23E+02
19–21	4Po 7–4Po 7	2–4	3101	7.75E+01	7.78E+01	9.08E−06	7.20E+02
3–22	4Pe 2–2De 6	2–6	12.34	3.69E+00	7.75E+01	1.25E+07	0.00E+00
4–22	4Pe 2–2De 6	4–6	12.43	4.19E+00	7.75E+01	2.56E+05	1.12E+02
5–22	4Pe 2–2De 6	6–6	12.51	4.68E+00	7.75E+01	2.38E+06	1.10E+03
6–22	2De 2–2De 6	4–6	12.88	6.75E+00	7.75E+01	7.90E+06	5.25E+02
7–22	2De 2–2De 6	6–6	12.91	6.92E+00	7.75E+01	1.44E+07	7.86E+02
8–22	2Pe 2–2De 6	2–6	13.07	7.78E+00	7.75E+01	5.34E+07	0.00E+00
9–22	2Se 2–2De 6	2–6	13.28	8.91E+00	7.75E+01	1.03E+08	0.00E+00
10–22	2Pe 2–2De 6	4–6	13.31	9.04E+00	7.75E+01	6.31E+06	9.55E+02
16–22	2Se 4–2De 6	2–6	279.75	7.43E+01	7.75E+01	1.01E+04	0.00E+00
20–22	2De 6–2De 6	4–6	11,112	7.74E+01	7.75E+01	2.37E−05	7.85E+00
1–23	2Po 1–2Po 7	2–2	11.61	0.00E+00	7.85E+01	0.00E+00	8.49E+02
2–23	2Po 1–2Po 7	4–2	11.77	1.08E+00	7.85E+01	7.17E+07	4.38E+03
11–23	4So 3–2Po 7	4–2	13.59	1.14E+01	7.85E+01	6.25E+06	2.37E+03
12–23	2Do 3–2Po 7	4–2	13.86	1.27E+01	7.85E+01	5.91E+07	3.21E+00
13–23	2Do 3–2Po 7	6–2	13.91	1.30E+01	7.85E+01	2.65E+07	0.00E+00
14–23	2Po 3–2Po 7	2–2	14.20	1.43E+01	7.85E+01	0.00E+00	1.97E+01
15–23	2Po 3–2Po 7	4–2	14.31	1.48E+01	7.85E+01	1.44E+06	5.37E+01
17–23	2Po 5–2Po 7	2–2	350.89	7.59E+01	7.85E+01	0.00E+00	3.67E+01
18–23	2Po 5–2Po 7	4–2	399.21	7.62E+01	7.85E+01	1.51E+02	2.72E+02
19–23	4Po 7–2Po 7	2–2	903.98	7.75E+01	7.85E+01	0.00E+00	1.96E+03
21–23	4Po 7–2Po 7	4–2	1275	7.78E+01	7.85E+01	3.91E−02	2.77E+00
1–24	2Po 1–4Po 7	2–6	11.60	0.00E+00	7.86E+01	1.01E+05	0.00E+00
2–24	2Po 1–4Po 7	4–6	11.76	1.08E+00	7.86E+01	1.76E+05	5.98E+04
11–24	4So 3–4Po 7	4–6	13.58	1.14E+01	7.86E+01	1.16E+04	4.93E+03
12–24	2Do 3–4Po 7	4–6	13.84	1.27E+01	7.86E+01	2.84E+04	7.67E+01
13–24	2Do 3–4Po 7	6–6	13.90	1.30E+01	7.86E+01	1.05E+05	1.04E+03
14–24	2Po 3–4Po 7	2–6	14.18	1.43E+01	7.86E+01	6.51E+01	0.00E+00
15–24	2Po 3–4Po 7	4–6	14.30	1.48E+01	7.86E+01	2.30E+03	3.17E+02
17–24	2Po 5–4Po 7	2–6	342.15	7.59E+01	7.86E+01	6.86E−03	0.00E+00
18–24	2Po 5–4Po 7	4–6	387.94	7.62E+01	7.86E+01	2.50E−02	8.19E+02
19–24	4Po 7–4Po 7	2–6	848.16	7.75E+01	7.86E+01	1.68E−01	0.00E+00
21–24	4Po 7–4Po 7	4–6	1167	7.78E+01	7.86E+01	5.13E−02	9.38E+03
23–24	2Po 7–4Po 7	2–6	13,736	7.85E+01	7.86E+01	5.12E−09	0.00E+00
3–25	4Pe 2–4De 8	2–2	12.12	3.69E+00	7.88E+01	0.00E+00	6.52E+02
4–25	4Pe 2–4De 8	4–2	12.21	4.19E+00	7.88E+01	2.79E+09	2.26E+05
5–25	4Pe 2–4De 8	6–2	12.29	4.68E+00	7.88E+01	3.00E+08	0.00E+00
6–25	2De 2–4De 8	4–2	12.64	6.75E+00	7.88E+01	5.45E+08	5.12E+05
7–25	2De 2–4De 8	6–2	12.67	6.92E+00	7.88E+01	1.40E+08	0.00E+00
8–25	2Pe 2–4De 8	2–2	12.82	7.78E+00	7.88E+01	0.00E+00	4.84E+04
9–25	2Se 2–4De 8	2–2	13.03	8.91E+00	7.88E+01	0.00E+00	3.80E+01
10–25	2Pe 2–4De 8	4–2	13.05	9.04E+00	7.88E+01	3.78E+06	7.87E+03
16–25	2Se 4–4De 8	2–2	198.85	7.43E+01	7.88E+01	0.00E+00	6.00E+00
20–25	2De 6–4De 8	4–2	647.61	7.74E+01	7.88E+01	6.38E−02	1.01E+02
22–25	2De 6–4De 8	6–2	687.68	7.75E+01	7.88E+01	5.05E−02	0.00E+00
3–26	4Pe 2–4De 8	2–4	12.08	3.69E+00	7.91E+01	6.97E+08	2.39E+04
4–26	4Pe 2–4De 8	4–4	12.16	4.19E+00	7.91E+01	1.15E+09	2.47E+04
5–26	4Pe 2–4De 8	6–4	12.24	4.68E+00	7.91E+01	1.16E+09	3.58E+05

Table 4 (*continued*)

E2 and M1, N_{tr} = 28,554							
6–26	2De 2–4De 8	4–4	12.59	6.75E+00	7.91E+01	3.59E+08	1.34E+05
7–26	2De 2–4De 8	6–4	12.62	6.92E+00	7.91E+01	2.68E+08	8.69E+04
8–26	2Pe 2–4De 8	2–4	12.78	7.78E+00	7.91E+01	1.06E+08	1.08E+04
9–26	2Se 2–4De 8	2–4	12.98	8.91E+00	7.91E+01	4.37E+06	4.14E+03
10–26	2Pe 2–4De 8	4–4	13.01	9.04E+00	7.91E+01	4.95E+06	1.09E+03
16–26	2Se 4–4De 8	2–4	188.07	7.43E+01	7.91E+01	2.57E+01	1.37E−01
20–26	2De 6–4De 8	4–4	545.68	7.74E+01	7.91E+01	2.98E−01	5.41E+01
22–26	2De 6–4De 8	6–4	573.85	7.75E+01	7.91E+01	1.69E−01	1.97E+00
25–26	4De 8–4De 8	2–4	3466	7.88E+01	7.91E+01	3.88E−03	7.17E+02
1–27	2Po 1–2Po 7	2–4	11.49	0.00E+00	7.93E+01	2.96E+07	1.72E+04
2–27	2Po 1–2Po 7	4–4	11.65	1.08E+00	7.93E+01	3.67E+07	5.33E+03
11–27	4So 3–2Po 7	4–4	13.43	1.14E+01	7.93E+01	2.56E+04	4.03E+03
12–27	2Do 3–2Po 7	4–4	13.69	1.27E+01	7.93E+01	8.93E+06	2.26E−01
13–27	2Do 3–2Po 7	6–4	13.74	1.30E+01	7.93E+01	4.14E+07	6.65E+02
14–27	2Po 3–2Po 7	2–4	14.02	1.43E+01	7.93E+01	8.32E+06	4.93E−01
15–27	2Po 3–2Po 7	4–4	14.13	1.48E+01	7.93E+01	1.47E+07	1.43E+01
....							

E3 and M2, N_{tr} = 9661

i–j	T_iC_i–T_jC_j	g_i–g_j	λ (Å)	E_i(Ry)	E_j(Ry)	AE3	AM2
1–5	2Po 1–4Pe 2	2–6	194.83	0.00E+00	4.68E+00	8.90E−05	7.24E+00
1–7	2Po 1–2De 2	2–6	131.64	0.00E+00	6.92E+00	2.21E−02	3.80E+01
3–13	4Pe 2–2Do 3	2–6	97.81	3.69E+00	1.30E+01	1.46E−03	2.15E+01
8–13	2Pe 2–2Do 3	2–6	174.39	7.78E+00	1.30E+01	3.72E−03	1.00E+00
9–13	2Se 2–2Do 3	2–6	222.87	8.91E+00	1.30E+01	4.29E−04	3.09E−01
5–14	4Pe 2–2Po 3	6–2	94.66	4.68E+00	1.43E+01	4.12E−02	2.10E+02
7–14	2De 2–2Po 3	6–2	123.45	6.92E+00	1.43E+01	9.39E−02	3.87E+01
13–16	2Do 3–2Se 4	6–2	14.88	1.30E+01	7.43E+01	1.26E+02	2.03E+02
5–17	4Pe 2–2Po 5	6–2	12.80	4.68E+00	7.59E+01	1.34E+04	4.98E+03
7–17	2De 2–2Po 5	6–2	13.21	6.92E+00	7.59E+01	1.34E+05	3.96E+04
5–19	4Pe 2–4Po 7	6–2	12.52	4.68E+00	7.75E+01	2.67E+03	4.91E+05
7–19	2De 2–4Po 7	6–2	12.91	6.92E+00	7.75E+01	6.35E+04	3.60E+03
1–22	2Po 1–2De 6	2–6	11.76	0.00E+00	7.75E+01	1.93E+06	1.39E+07
14–22	2Po 3–2De 6	2–6	14.41	1.43E+01	7.75E+01	4.06E+02	3.81E+03
17–22	2Po 5–2De 6	2–6	560.50	7.59E+01	7.75E+01	1.23E−04	3.10E−01
19–22	4Po 7–2De 6	2–6	24,749	7.75E+01	7.75E+01	1.58E−18	5.82E−12
5–23	4Pe 2–2Po 7	6–2	12.35	4.68E+00	7.85E+01	1.26E+05	4.07E+05
7–23	2De 2–2Po 7	6–2	12.73	6.92E+00	7.85E+01	1.67E+06	1.13E+05
22–23	2De 6–2Po 7	6–2	938.25	7.75E+01	7.85E+01	3.96E−07	3.43E−03
3–24	4Pe 2–4Po 7	2–6	12.17	3.69E+00	7.86E+01	1.43E+02	1.46E+05
8–24	2Pe 2–4Po 7	2–6	12.87	7.78E+00	7.86E+01	1.22E+02	7.08E+04
9–24	2Se 2–4Po 7	2–6	13.08	8.91E+00	7.86E+01	3.76E+01	4.17E+03
16–24	2Se 4–4Po 7	2–6	212.17	7.43E+01	7.86E+01	4.06E−09	8.41E+00
13–25	2Do 3–4De 8	6–2	13.84	1.30E+01	7.88E+01	1.36E+04	4.06E+03
24–25	4Po 7–4De 8	6–2	3169	7.86E+01	7.88E+01	1.41E−09	1.80E−06
13–29	2Do 3–2Pe 8	6–2	13.97	1.30E+01	7.82E+01	6.96E+04	7.42E+02
24–29	4Po 7–2Pe 8	6–2	2715	7.86E+01	7.82E+01	1.13E−09	8.49E−05
1–30	2Po 1–4De 8	2–6	11.45	0.00E+00	7.96E+01	1.30E+04	8.26E+05
14–30	2Po 3–4De 8	2–6	13.96	1.43E+01	7.96E+01	2.57E+00	1.84E+01
17–30	2Po 5–4De 8	2–6	246.36	7.59E+01	7.96E+01	1.68E−05	3.00E+00
19–30	4Po 7–4De 8	2–6	431.88	7.75E+01	7.96E+01	1.28E−04	9.01E−02
23–30	2Po 7–4De 8	2–6	826.98	7.85E+01	7.96E+01	2.93E−07	3.00E−03
13–31	2Do 3–4Pe 8	6–2	13.63	1.30E+01	7.99E+01	2.57E+02	5.17E+03
24–31	4Po 7–4Pe 8	6–2	703.57	7.86E+01	7.99E+01	4.93E−07	6.07E−03
1–33	2Po 1–4De 8	2–8	11.35	0.00E+00	8.03E+01	9.35E−04	0.00E+00
2–33	2Po 1–4De 8	4–8	11.50	1.08E+00	8.03E+01	5.04E−04	3.70E+06
11–33	4So 3–4De 8	4–8	13.23	1.14E+01	8.03E+01	1.52E+00	1.33E+03
12–33	2Do 3–4De 8	4–8	13.48	1.27E+01	8.03E+01	4.61E+00	1.02E+04
14–33	2Po 3–4De 8	2–8	13.81	1.43E+01	8.03E+01	1.41E−01	0.00E+00
15–33	2Po 3–4De 8	4–8	13.92	1.48E+01	8.03E+01	1.14E−01	5.48E+03
17–33	2Po 5–4De 8	2–8	206.68	7.59E+01	8.03E+01	1.45E−04	0.00E+00
18–33	2Po 5–4De 8	4–8	222.55	7.62E+01	8.03E+01	3.17E−04	1.18E+01
19–33	4Po 7–4De 8	2–8	323.14	7.75E+01	8.03E+01	5.74E−03	0.00E+00
21–33	4Po 7–4De 8	4–8	360.72	7.78E+01	8.03E+01	3.03E−03	5.95E−01
23–33	2Po 7–4De 8	2–8	502.91	7.85E+01	8.03E+01	4.94E−06	0.00E+00
27–33	2Po 7–4De 8	4–8	909.16	7.93E+01	8.03E+01	2.73E−07	1.18E−02
33–35	4De 8–4Fo 9	8–4	4385	8.03E+01	8.05E+01	3.59E−12	1.24E−07
1–37	2Po 1–4Pe 8	2–6	11.31	0.00E+00	8.06E+01	9.41E+05	1.72E+06
14–37	2Po 3–4Pe 8	2–6	13.75	1.43E+01	8.06E+01	1.44E+03	4.87E+03
17–37	2Po 5–4Pe 8	2–6	194.79	7.59E+01	8.06E+01	2.30E−03	3.94E−01
19–37	4Po 7–4Pe 8	2–6	294.97	7.75E+01	8.06E+01	5.27E−04	1.89E+00
23–37	2Po 7–4Pe 8	2–6	437.85	7.85E+01	8.06E+01	2.54E−04	3.15E−01
3–38	4Pe 2–4Fo 9	2–6	11.83	3.69E+00	8.07E+01	8.00E+05	1.97E+06
8–38	2Pe 2–4Fo 9	2–6	12.50	7.78E+00	8.07E+01	1.49E+04	2.80E+05

(continued on next page)

Table 4 (*continued*)

E3 and M2, N_{tr} = 9661							
9–38	2Se 2–4Fo 9	2–6	12.69	8.91E+00	8.07E+01	1.40E+01	2.06E+04
16–38	2Se 4–4Fo 9	2–6	141.52	7.43E+01	8.07E+01	5.30E−04	1.85E−04
25–38	4De 8–4Fo 9	2–6	490.88	7.88E+01	8.07E+01	1.64E−04	8.97E−02
29–38	2Pe 8–4Fo 9	2–6	367.52	7.82E+01	8.07E+01	1.52E−04	4.27E−01
31–38	4Pe 8–4Fo 9	2–6	1073	7.99E+01	8.07E+01	3.89E−07	5.64E−04
3–39	4Pe 2–4Fo 9	2–8	11.82	3.69E+00	8.08E+01	1.86E+06	0.00E+00
4–39	4Pe 2–4Fo 9	4–8	11.90	4.19E+00	8.08E+01	4.46E+05	4.25E+06
6–39	2De 2–4Fo 9	4–8	12.31	6.75E+00	8.08E+01	2.74E+04	3.37E+06
8–39	2Pe 2–4Fo 9	2–8	12.48	7.78E+00	8.08E+01	9.23E+03	0.00E+00
9–39	2Se 2–4Fo 9	2–8	12.68	8.91E+00	8.08E+01	1.03E+03	0.00E+00
10–39	2Pe 2–4Fo 9	4–8	12.70	9.04E+00	8.08E+01	3.10E+03	4.27E+04
16–39	2Se 4–4Fo 9	2–8	139.95	7.43E+01	8.08E+01	1.22E−03	0.00E+00
20–39	2De 6–4Fo 9	4–8	273.16	7.74E+01	8.08E+01	5.35E−06	1.53E+00
25–39	4De 8–4Fo 9	2–8	472.44	7.88E+01	8.08E+01	7.97E−05	0.00E+00
26–39	4De 8–4Fo 9	4–8	546.97	7.91E+01	8.08E+01	5.75E−05	2.73E−02
28–39	2De 8–4Fo 9	4–8	806.43	7.96E+01	8.08E+01	5.83E−06	2.46E−02
29–39	2Pe 8–4Fo 9	2–8	357.08	7.82E+01	8.08E+01	3.09E−04	0.00E+00
31–39	4Pe 8–4Fo 9	2–8	989.21	7.99E+01	8.08E+01	1.04E−06	0.00E+00
32–39	4Se 8–4Fo 9	4–8	1138	8.00E+01	8.08E+01	2.99E−08	2.94E−04
34–39	2Pe 8–4Fo 9	4–8	568.12	7.92E+01	8.08E+01	3.75E−07	5.00E−03
36–39	4Pe 8–4Fo 9	4–8	4250	8.06E+01	8.08E+01	7.93E−13	1.47E−07
1–40	2Po 1–2De 8	2–6	11.31	0.00E+00	8.06E+01	3.14E+06	4.81E+03
14–40	2Po 3–2De 8	2–6	13.75	1.43E+01	8.06E+01	4.80E+03	7.17E+02
17–40	2Po 5–2De 8	2–6	193.61	7.59E+01	8.06E+01	9.60E−03	1.64E+00
19–40	4Po 7–2De 8	2–6	292.28	7.75E+01	8.06E+01	1.68E−04	2.72E−02
23–40	2Po 7–2De 8	2–6	431.93	7.85E+01	8.06E+01	9.05E−04	4.16E−04
3–41	4Pe 2–4Po 9	2–6	11.81	3.69E+00	8.09E+01	5.36E+04	1.90E+06
8–41	2Pe 2–4Po 9	2–6	12.47	7.78E+00	8.09E+01	2.60E+04	9.27E+05
9–41	2Se 2–4Po 9	2–6	12.66	8.91E+00	8.09E+01	5.23E+03	3.26E+06
16–41	2Se 4–4Po 9	2–6	138.02	7.43E+01	8.09E+01	1.25E−05	1.23E+00
25–41	4De 8–4Po 9	2–6	451.15	7.88E+01	8.09E+01	2.27E−06	7.07E−02
29–41	2Pe 8–4Po 9	2–6	344.79	7.82E+01	8.09E+01	9.83E−04	7.84E−03
31–41	4Pe 8–4Po 9	2–6	900.28	7.99E+01	8.09E+01	7.31E−08	2.45E−03
33–42	4De 8–4Do 9	8–4	1435	8.03E+01	8.09E+01	8.20E−09	3.82E−04
5–43	4Pe 2–4Do 9	6–2	11.94	4.68E+00	8.10E+01	4.03E+06	1.49E+06
7–43	2De 2–4Do 9	6–2	12.30	6.92E+00	8.10E+01	6.33E+05	1.27E+06
22–43	2De 6–4Do 9	6–2	262.46	7.75E+01	8.10E+01	5.96E−05	3.00E−02
30–43	4De 8–4Do 9	6–2	651.45	7.96E+01	8.10E+01	5.78E−06	3.19E−02
33–43	4De 8–4Do 9	8–2	1323	8.03E+01	8.10E+01	3.22E−09	0.00E+00
37–43	4Pe 8–4Do 9	6–2	2172	8.06E+01	8.10E+01	9.79E−09	2.11E−07
40–43	2De 8–4Do 9	6–2	2330	8.06E+01	8.10E+01	2.32E−09	1.10E−05
13–44	2Do 3–2Se 8	6–2	13.35	1.30E+01	8.13E+01	5.97E+03	1.22E+04
24–44	4Po 7–2Se 8	6–2	336.50	7.86E+01	8.13E+01	5.19E−05	1.26E+00
38–44	4Fo 9–2Se 8	6–2	1615	8.07E+01	8.13E+01	3.20E−09	3.20E−07
39–44	4Fo 9–2Se 8	8–2	1853	8.08E+01	8.13E+01	3.69E−10	0.00E+00
41–44	4Po 9–2Se 8	6–2	2274	8.09E+01	8.13E+01	2.39E−10	1.80E−04
5–45	4Pe 2–2Po 7	6–2	11.89	4.68E+00	8.13E+01	4.91E+05	4.70E+05
7–45	2De 2–2Po 7	6–2	12.25	6.92E+00	8.13E+01	1.71E+06	4.87E+05
22–45	2De 6–2Po 7	6–2	239.68	7.75E+01	8.13E+01	1.17E−04	1.74E−02
30–45	4De 8–2Po 7	6–2	527.09	7.96E+01	8.13E+01	2.01E−05	2.94E−02
33–45	4De 8–2Po 7	8–2	894.45	8.03E+01	8.13E+01	1.68E−07	0.00E+00
37–45	4Pe 8–2Po 7	6–2	1215	8.06E+01	8.13E+01	5.68E−08	2.42E−08
40–45	2De 8–2Po 7	6–2	1263	8.06E+01	8.13E+01	3.56E−09	4.42E−04
33–46	4De 8–2Po 7	8–4	879.79	8.03E+01	8.13E+01	7.50E−08	1.75E−03
33–47	4De 8–2Do 9	8–4	738.53	8.03E+01	8.15E+01	7.62E−07	4.68E−03
4–48	4Pe 2–4Fo 9	4–10	11.76	4.19E+00	8.17E+01	9.27E+05	0.00E+00
5–48	4Pe 2–4Fo 9	6–10	11.84	4.68E+00	8.17E+01	1.09E+06	5.88E+06
6–48	2De 2–4Fo 9	4–10	12.17	6.75E+00	8.17E+01	2.10E+03	0.00E+00
7–48	2De 2–4Fo 9	6–10	12.19	6.92E+00	8.17E+01	5.39E+04	7.69E+06
10–48	2Pe 2–4Fo 9	4–10	12.55	9.04E+00	8.17E+01	3.71E+03	0.00E+00
20–48	2De 6–4Fo 9	4–10	216.11	7.74E+01	8.17E+01	1.14E−05	0.00E+00
22–48	2De 6–4Fo 9	6–10	220.40	7.75E+01	8.17E+01	4.42E−05	7.51E+00
26–48	4De 8–4Fo 9	4–10	357.83	7.91E+01	8.17E+01	5.67E−04	0.00E+00
28–48	2De 8–4Fo 9	4–10	453.22	7.96E+01	8.17E+01	4.01E−06	0.00E+00
30–48	4De 8–4Fo 9	6–10	442.05	7.96E+01	8.17E+01	5.90E−04	5.07E−01
32–48	4Se 8–4Fo 9	4–10	542.15	8.00E+01	8.17E+01	5.16E−06	0.00E+00
34–48	2Pe 8–4Fo 9	4–10	366.76	7.92E+01	8.17E+01	2.81E−04	0.00E+00
36–48	4Pe 8–4Fo 9	4–10	832.17	8.06E+01	8.17E+01	2.64E−06	0.00E+00
37–48	4Pe 8–4Fo 9	6–10	842.10	8.06E+01	8.17E+01	3.81E−07	8.69E−03
40–48	2De 8–4Fo 9	6–10	864.87	8.06E+01	8.17E+01	3.36E−07	9.75E−03
3–49	4Pe 2–2Do 9	2–6	11.72	3.69E+00	8.14E+01	3.16E+03	3.09E+05
8–49	2Pe 2–2Do 9	2–6	12.37	7.78E+00	8.14E+01	5.94E+05	1.24E+04
9–49	2Se 2–2Do 9	2–6	12.56	8.91E+00	8.14E+01	3.63E+04	2.24E+03
16–49	2Se 4–2Do 9	2–6	126.82	7.43E+01	8.14E+01	5.82E−05	3.02E−02
25–49	4De 8–2Do 9	2–6	350.10	7.88E+01	8.14E+01	5.86E−04	3.20E−03
29–49	2Pe 8–2Do 9	2–6	282.48	7.82E+01	8.14E+01	9.56E−03	4.88E−02

Table 4 (*continued*)

E3 and M2, N_{tr} = 9661							
31–49	4Pe 8–2Do 9	2–6	571.26	7.99E+01	8.14E+01	3.27E−07	3.16E−03
44–49	2Se 8–2Do 9	2–6	4996	8.13E+01	8.14E+01	1.16E−13	8.96E−09
3–50	4Pe 2–4Do 9	2–8	11.69	3.69E+00	8.17E+01	8.51E+05	0.00E+00
4–50	4Pe 2–4Do 9	4–8	11.76	4.19E+00	8.17E+01	2.01E+06	1.31E+06
6–50	2De 2–4Do 9	4–8	12.16	6.75E+00	8.17E+01	3.55E+03	9.45E+05
8–50	2Pe 2–4Do 9	2–8	12.33	7.78E+00	8.17E+01	7.44E+03	0.00E+00
9–50	2Se 2–4Do 9	2–8	12.53	8.91E+00	8.17E+01	8.08E+01	0.00E+00
10–50	2Pe 2–4Do 9	4–8	12.55	9.04E+00	8.17E+01	4.66E+03	2.33E+06
16–50	2Se 4–4Do 9	2–8	123.07	7.43E+01	8.17E+01	5.47E−04	0.00E+00
20–50	2De 6–4Do 9	4–8	215.48	7.74E+01	8.17E+01	2.49E−07	1.27E−03
25–50	4De 8–4Do 9	2–8	322.93	7.88E+01	8.17E+01	2.84E−05	0.00E+00
26–50	4De 8–4Do 9	4–8	356.10	7.91E+01	8.17E+01	4.66E−07	1.39E+00
28–50	2De 8–4Do 9	4–8	450.45	7.96E+01	8.17E+01	2.38E−05	7.75E−02
29–50	2Pe 8–4Do 9	2–8	264.52	7.82E+01	8.17E+01	1.37E−05	0.00E+00
31–50	4Pe 8–4Do 9	2–8	502.30	7.99E+01	8.17E+01	5.26E−05	0.00E+00
32–50	4Se 8–4Do 9	4–8	538.19	8.00E+01	8.17E+01	1.12E−06	4.22E−02
34–50	2Pe 8–4Do 9	4–8	364.94	7.92E+01	8.17E+01	6.74E−04	1.51E−01
36–50	4Pe 8–4Do 9	4–8	822.88	8.06E+01	8.17E+01	2.04E−06	5.79E−03
44–50	2Se 8–4Do 9	2–8	2270	8.13E+01	8.17E+01	1.53E−11	0.00E+00
3–51	4Pe 2–4Do 9	2–6	11.67	3.69E+00	8.18E+01	1.45E+05	7.38E+06
8–51	2Pe 2–4Do 9	2–6	12.32	7.78E+00	8.18E+01	5.55E+04	2.60E+05
9–51	2Se 2–4Do 9	2–6	12.51	8.91E+00	8.18E+01	4.39E+02	2.57E+06
16–51	2Se 4–4Do 9	2–6	121.43	7.43E+01	8.18E+01	5.15E−05	9.93E−01
25–51	4De 8–4Do 9	2–6	311.88	7.88E+01	8.18E+01	8.08E−05	2.05E+00
29–51	2Pe 8–4Do 9	2–6	257.06	7.82E+01	8.18E+01	5.04E−04	2.73E−01
31–51	4Pe 8–4Do 9	2–6	476.06	7.99E+01	8.18E+01	1.37E−05	2.20E−01
44–51	2Se 8–4Do 9	2–6	1817	8.13E+01	8.18E+01	2.19E−10	8.72E−05
33–52	4De 8–4Po 9	8–4	626.40	8.03E+01	8.18E+01	1.45E−05	1.79E−03
5–53	4Pe 2–4Po 9	6–2	11.82	4.68E+00	8.18E+01	4.68E+05	8.69E+06
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