Spectral Data and Grotrian Diagrams for Highly Ionized Manganese, Mn VII through Mn XXV

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Critically evaluated wavelengths, energy levels, ionization energies, line classifications, oscillator strengths, and atomic transition probabilities for Mn VII to Mn XXV are tabulated. A short review of the line identifications and wavelength measurements is given for each stage of ionization. Grotrian diagrams are also presented to provide graphical overviews. The literature has been surveyed to December 1991.

Key words: atomic data; energy levels; Grotrian diagrams; ions; manganese; oscillator strengths; spectra; transition probabilities; wavelengths.

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1. Introduction

We have undertaken publication of a series of compilations of spectra of highly ionized atoms of particular interest to the fusion energy community. These selected elements occur as impurities in wall materials of fusion machines or are specifically injected into the hot plasmas for diagnostics. Much work on these spectra has appeared in recent years. We have critically compiled these data into single monographs for each element, including wavelengths, classifications, intensities, oscillator strengths, radiative transition probabilities, Grotrian diagrams, and a short review of the literature for each ion. Monographs[1-7] of Ti, V, Fe, Co, Ni, Cu and Mo have been published (Cr[8] is in press). The present compilation contains data for Mn VII to Mn XXV.

All relevant papers on wavelengths and energy levels published through December 1991 were collected and surveyed, and the best measurements, in our judgement, were included in the tables. We consulted the following comprehensive compilations: for wavelengths, the tables by Kelly[9], for forbidden lines arising within ground configurations of the type ns^2np^k ($n=2$ and 3, $k=1$ to 5) the paper by Kaufman and Sugar[10], and a review article by Fawcett[11].

Sugar and Corliss[12] have published a comprehensive critical compilation of energy levels for the iron-group elements K to Ni in all stages of ionization. Their values are adopted for this compilation, except where superseded by more recent data. For the He and H sequences, only theoretical results are given since they are considered to be more accurate than the experimental values. The latter are cited in the brief review.

For atomic transition probabilities, calculations based on various multi-configurational approximations, including relativistic multi-configuration Dirac-Fock calculations, have been carried out for allowed and forbidden transitions. Brief reviews of such theoretical data are given in the critical data compilation of allowed and forbidden lines by Martin *et al.*[13], from which the oscillator strength (f) and transition probability (A) data are taken.

In cases where no experimental wavelength data are available but for which f-values exist that are either calculated or derived from systematic trend studies, the quoted wavelengths (λ) are calculated from the known energy levels using the Ritz combination principle. The wavelengths are then used to calculate A-values from the f-values.

We tabulate A-values and gf-values in order to provide a measure of the strengths of the lines. When these data are not available, we list the rough line intensity estimates provided in the literature. A-values (or f-values) may be utilized to obtain line intensities from the general relation between the line intensity (I) and transition probability

$$I = (4\pi\lambda)^{-1}hcAN_u,$$

where N_u is the population of the upper energy level. The level populations are source-dependent and are—especially for low density plasmas—difficult to estimate. However, for small energy ranges, relative populations may follow Boltzmann distributions, or may even be estimated as constant, aside from the statistical weight factors $g_u=2J_u+1$ (where J is the total angular momentum quantum number). Thus for two emission lines originating from closely spaced upper levels one may estimate

$$I_1/I_2 \approx (\lambda_2A_1g_{u1}/\lambda_1A_2g_{u2}).$$

For some spectra, both A-values and intensity estimates are available for many lines. If there is partial overlap, and if the intensity listings are more extensive, we present both A-value data and the intensity estimates in order to make possible rough order of magnitude estimates for A-values of lines with known intensity data. However, we caution that intensity estimates from photographic plates are usually visual estimates of relative plate blackening. There is generally no correlation between intensity estimates by different authors, or by the same author for widely different wavelength ranges.

We give wavelengths in air above 2000 Å and in vacuum below 2000 Å. It is customary, in nearly all of the papers quoted in this compilation, for the authors to give their measurement uncertainty as 1σ. For the conversion of ionization energies from cm^{-1} to eV, we use the conversion factor 8065.5410 ± 0.0024 cm^{-1}/eV given by Cohen and Taylor[14].

In the following section we give brief comments on each ion, including the accuracy of the wavelength data.

1.1. Acknowledgments

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2. Brief Comments on Each Manganese Ion

Mn VII (K sequence)

Ground state $1s^22s^22p^63s^23p^63d\ {}^2\mathrm{D}_{3/2}$

Ionization energy $961\,440 \pm 100$ cm^{-1} (119.204 ± 0.010 eV)

Kruger and Weissberg[1] observed the $4p-ns$ ($n=5,6$), $3d-4p$, and $3d-nf$ ($n=4-9$) doublets in the range of 111 – 468 Å. Gabriel *et al.*[2] and Gabriel *et al.*[3] identified the $3p^63d-3p^53d^2$ doublets in the range of 182 – 204 Å. Feldman and Fraenkel[4] observed 16 lines in the range of 133 – 144 Å, which were subsequently ascribed to the $3p^63d-3p^53d4s$ inner-shell transitions by Cowan[5]. More extensive observations with vacuum spark discharges were carried out by Ramonas and Ryabtsev[6], whose results are quoted here. They identified 55 lines in the range of 114 – 255 Å as transitions from the levels of $3p^53d^2$, $3p^64p$, $3p^53d4s$, and $3p^6nf$ ($n=4-8$) configurations to the ground term, with uncertainties estimated to be ± 0.003 Å. The wavelength of the $3p^63d$ ${}^2\mathrm{D}_{5/2}-3p^5({}^2\mathrm{P}^\circ)3d^2({}^1\mathrm{G})\ {}^2\mathrm{F}^\circ_{7/2}$ line is 252.985 Å from the energy level difference, instead of 252.950 Å given by the authors.

A tentatively identified spin-forbidden ${}^2\mathrm{D}_{5/2}-({}^3\mathrm{P}^\circ){}^4\mathrm{P}_{3/2}$ line at 143.87 Å in Ref. 5 has been deleted, because it was not observed in the stronger spectra of Ramonas and Ryabtsev. Furthermore, the $4p\ {}^2\mathrm{P}^\circ_{3/2,1/2}-ns\ {}^2\mathrm{S}_{1/2}$ ($n=5,6$) lines at 467.662 Å, 462.363 Å, 284.059 Å, and 282.095 Å in Ref. 1 have been omitted here, because the $4p\ {}^2\mathrm{P}^\circ$ splitting is incompatible with that found by Ramonas and Ryabtsev. In addition, the wavelength of 112.260 Å of the $3d\ {}^2\mathrm{D}_{5/2}-9f\ {}^2\mathrm{F}^\circ_{7/2}$ transition is apparently a misprint and should be 112.060 Å.

Mn VIII (Ar sequence)

Ground state $1s^22s^22p^63s^23p^6\ {}^1\mathrm{S}_0$

Ionization energy $1\,569\,000 \pm 3000$ cm^{-1} (194.5 ± 0.4 eV)

The $3p^6-3p^54l$ transitions were observed by Kruger *et al.*[7,8] for $l=s$ at 124.053 Å and 122.168 Å, and by Alexander *et al.*[9] for $l=d$ at 97.411 Å and 96.332 Å. Smitt and Svensson[10] measured the $3p^6\ {}^1\mathrm{S}_0-3p^53d\ {}^1\mathrm{P}^\circ_1$ resonance line at 185.455 Å, previously identified by Alexander *et al.*[11] and Gabriel *et al.*[2,3], and added the ${}^1\mathrm{S}_0-{}^3\mathrm{P}^\circ_1$, ${}^3\mathrm{D}^\circ_1$ spin-forbidden lines at 266.181 Å and 236.218 Å. They also identified 30 lines of the $3s^23p^53d-3s3p^63d$ array in the range of 323 – 668 Å. Observations were made with vacuum sparks with an uncertainty estimated to be $\pm$ 0.01 Å. The wavelengths of 403.497 Å and 402.446 Å for the ${}^1\mathrm{D}^\circ_2-{}^3\mathrm{D}_{1,2}$ transitions are longer by 0.043 Å and 0.017 Å, respectively, than those calculated from level differences. For the blended lines at 415.348 Å, 410.374 Å, 340.234 Å, and 266.181 Å, the differences between the observed and calculated wavelengths are about 0.02 Å.

Wagner and House[12] classified 12 lines of the $3p^53d-3p^54f$ array in the range of 134 – 142 Å, measured with an uncertainty of ± 0.02 Å. We consider the blended ${}^3\mathrm{P}^\circ_2-{}^3\mathrm{D}_2$ line at 135.48 Å to be tentatively classified, although it deviates by 0.09 Å from the wavelength obtained from the energy level difference.

Mn IX (Cl sequence)

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

Ionization energy $1\,789\,000 \pm 4000$ cm^{-1} (221.8 ± 0.5 eV)

The $3s^23p^5\ {}^2\mathrm{P}^\circ_{1/2,3/2}-3s3p^6\ {}^2\mathrm{S}_{1/2}$ transitions were identified by Fawcett and Peacock[13]. Smitt *et al.*[14] measured the values 395.473 ± 0.008 Å and 376.778 ± 0.008 Å in vacuum sparks.

Gabriel *et al.*[2,3] identified the $3p^5-3p^4({}^1\mathrm{D})3d$ array. The wavelengths were remeasured by Fawcett and Gabriel[15], who identified six new lines in the range of 184 – 204 Å using a vacuum spark. The designation of parent term has been changed from ${}^1\mathrm{D}$ to ${}^3\mathrm{P}$ for the upper levels $3p^43d\ {}^2\mathrm{P}$ and ${}^2\mathrm{D}$, as indicated by the calculated states of Fe X by Bromage *et al.*[16]

The $3p^5\ {}^2\mathrm{P}^\circ-3p^44s\ {}^2\mathrm{P}$ doublet was first observed by Weissberg and Kruger[17] in the range of 111 – 114 Å. Edlén[18] reobserved the spectrum in the range of 105 – 114 Å with a vacuum spark and identified the ${}^2\mathrm{P}^\circ-{}^2\mathrm{D}$, ${}^2\mathrm{S}$ lines and the ${}^2\mathrm{P}^\circ-{}^4\mathrm{P}$ spin-forbidden transitions.

Fawcett *et al.*[19] observed the $3p^5-3p^44d$ transitions in the range of 87 – 91 Å, from which the ${}^2\mathrm{P}^\circ_{1/2}-({}^3\mathrm{P})\ {}^2\mathrm{D}_{3/2}$ and ${}^2\mathrm{P}^\circ_{3/2}-({}^1\mathrm{D})\ {}^2\mathrm{P}_{1/2}$ lines at 91.0 Å and 87.79 Å are adopted here. This array was reobserved by Fawcett *et al.*[20] with a reduced uncertainty of ± 0.01 Å in theta-pinch spectra. They also identified six $3p^43d-3p^44f$ transitions in the range of 118 – 124 Å.

Mn X (S sequence)

Ground state $1s^22s^22p^63s^23p^4\ {}^3\mathrm{P}_2$

Ionization energy $2\,003\,000 \pm 4000$ cm^{-1} (248.3 ± 0.5 eV)

Fawcett[21,22] identified the $3s^23p^4-3s3p^5$ array in the range of 333 – 398 Å. Improved measurements with a vacuum spark discharge were made by Smitt *et al.*[14] In addition to the lines observed by Fawcett, the ${}^1\mathrm{S}_0-{}^1\mathrm{P}^\circ_1$ line at 384.827 Å and the $^{3}\mathrm{P}_1-{}^{3}\mathrm{P}^{\circ}_0$ line at 379.368 Å were identified. Wavelengths are from Ref. 14 and have an uncertainty of ±0.008 Å.

Gabriel *et al.*[3] and Fawcett and Gabriel[15] identified the $3p^4-3p^33d$ array with a vacuum spark. They were extended by Fawcett[22], who observed a theta-pinch spectrum with an estimated uncertainty of ±0.05 Å in the range of 193 – 218 Å. He identified 13 lines.

Eleven lines of $3p^4-3p^34s$ transitions in the range of 100 – 105 Å were identified by Edlén[23] in vacuum spark observations. It should be noted that the faint $3s^23p^4$ $^{1}\mathrm{S}_0-3s^23p^3(^{2}\mathrm{P}^{\circ})4s$ $^{1}\mathrm{P}^{\circ}_1$ line is at 104.310 Å, shorter by 0.015 Å than the wavelength calculated from the energy level difference.

After the earlier work of Fawcett *et al.*[19], Fawcett *et al.*[20] reobserved four lines of the $3p^4-3p^34d$ transitions at 82 – 84 Å, and identified nine new lines in the range of 107 – 109 Å as the $3p^33d-3p^34f$ transitions. Most lines are doubly classified. Wavelengths of these transitions were measured in a theta-pinch plasma with an uncertainty of ±0.01 Å.

Mn XI (P sequence)

Ground state $1s^22s^22p^63s^23p^3$ $^{4}\mathrm{S}^{\circ}_{3/2}$

Ionization energy 2 307 000 ± 5000 cm^{-1} (286.0 ± 0.6 eV)

Sandlin *et al.*[24] and Feldman and Doschek[25] identified the magnetic-dipole transition $3p^3$ $^{4}\mathrm{S}^{\circ}_{3/2}-{}^{2}\mathrm{P}^{\circ}_{3/2}$ in the solar corona. The wavelength of 1359.59 Å is adopted from the latter article. Sandlin *et al.* also identified the $^{4}\mathrm{S}^{\circ}_{3/2}-{}^{2}\mathrm{P}^{\circ}_{1/2}$ transition at 1450.49 Å.

Fawcett and Peacock[13] and Fawcett[21,22] identified the $3s^23p^3-3s3p^4$ transition array in the range of 306 – 394 Å. Smitt *et al.*[14] found 14 lines, including 6 new lines, for this array in a vacuum spark discharge. Their results, estimated to have an uncertainty of ±0.008 Å, are given. The blended line at 363.510 Å deviates by 0.07 Å from the value calculated with the energy levels.

Gabriel *et al.*[2,3], observed the $3p^3$ $^{2}\mathrm{D}^{\circ}_{5/2}-3p^2(^{3}\mathrm{P})3d$ $^{2}\mathrm{F}_{7/2}$ transition at 200.67 Å. In their article, the parent term was designated as $^{1}\mathrm{D}$, instead of $^{3}\mathrm{P}$ as given by Fawcett[22]. Fawcett *et al.*[26] identified the $3p^3$ $^{4}\mathrm{S}^{\circ}-3p^2(^{3}\mathrm{P})3d$ $^{4}\mathrm{P}$ resonance transitions in the range of 207 – 210 Å. With data from a theta-pinch plasma, Fawcett[22] classified more completely the $3p^3-3p^23d$ transitions in the range of 200 – 236 Å. The estimated uncertainty of his wavelengths is ±0.05 Å.

The $3p^23d-3p^24f$ and $3p^3-3p^24s$ transitions in the ranges of 98 – 99 Å and 75 – 95 Å were identified by Fawcett *et al.*[20] in a laser-produced plasma with an estimated uncertainty of ±0.01 Å.

Mn XII (Si sequence)

Ground state $1s^22s^22p^63s^23p^2$ $^{3}\mathrm{P}_0$

Ionization energy 2 536 000 ± 5000 cm^{-1} (314.4 ± 0.6 eV)

Jefferies *et al.*[27] ascribed the line at 3685.5 ± 0.4 Å (in air) measured by Jefferies[28] in the solar corona to the magnetic-dipole transition $3s^23p^2$ $^{3}\mathrm{P}_2-{}^{1}\mathrm{D}_2$. Sandlin *et al.*[24] identified a coronal line at 1322.23 ± 0.04 Å as the $^{3}\mathrm{P}_1-{}^{1}\mathrm{S}_0$ transition. The wavelength is from Sandlin and Tousey[29].

Fawcett (1970)[21,22] analyzed the $3s^23p^2-3s3p^3$ transition array in the range of 259 – 553 Å. Two additional $^{3}\mathrm{P}_{2,1}-{}^{5}\mathrm{S}^{\circ}_2$ spin-forbidden transitions at 552.84 ± 0.4 Å and 529.79 ± 0.5 Å were identified by Träbert *et al.*[30] in a beam-foil spectrum.

Fawcett[22] provided classifications of twelve $3p^2-3p3d$ transitions in the range of 210 – 238 Å observed in a theta-pinch plasma discharge. The estimated uncertainty of the wavelengths is ±0.05 Å.

Fawcett *et al.*[31] identified the $3p3d-3p4f$, $3p^2-3p4s$ and $3p^2-3p4d$ transitions in the ranges of ~90 Å, 85 – 87 Å and ~71 Å, respectively. Wavelengths, with an estimated uncertainty of ±0.015 Å, were observed by them in a laser-produced plasma. Kastner *et al.*[32] identified several lines of the $3p^2-3p4d$ array.

Mn XIII (Al sequence)

Ground state $1s^22s^22p^63s^23p$ $^{2}\mathrm{P}^{\circ}_{1/2}$

Ionization energy 2 771 000 ± 6000 cm^{-1} (343.6 ± 0.7 eV)

Jefferies *et al.*[27] ascribed the line at 6536.3 ± 0.4 Å (in air), measured by Jefferies[28] in the solar corona, to the magnetic-dipole transition $3s^23p$ $^{2}\mathrm{P}^{\circ}_{1/2}-{}^{2}\mathrm{P}^{\circ}_{3/2}$.

Träbert *et al.*[30] observed the $3s^23p$ $^{2}\mathrm{P}^{\circ}-3s3p^2$ $^{4}\mathrm{P}$ spin-forbidden transitions in beam-foil spectra, and estimated their uncertainties as ranging from 0.3 Å to 0.5 Å. They adopted the $3s3p^2$ $^{4}\mathrm{P}$ fine structure splitting derived experimentally by Litzén and Redfors[33].

Fawcett *et al.*[26] and Fawcett and Peacock[13] identified the transitions from the $3s^23d$ $^{2}\mathrm{D}$ and $3s3p^2$ $^{2}\mathrm{P}$ configurations to the ground $3s^23p$ $^{2}\mathrm{P}^{\circ}$ configuration. Subsequently Fawcett[21,22] identified the $3s3p^2$ $^{4}\mathrm{P}-3p^3$ $^{4}\mathrm{S}^{\circ}$, $3s^23p$ $^{2}\mathrm{P}^{\circ}-3s3p^2$ $^{2}\mathrm{D}$, $^{2}\mathrm{S}$ and $3s3p^2$ $^{4}\mathrm{P}_{5/2}-3s3p3d$ $^{4}\mathrm{D}^{\circ}_{7/2}$ transitions. These early observations were revised and extended by Litzén and Redfors[33] and Redfors and Litzén[34] who observed laser-produced plasmas in the range of 205 – 425 Å. They reported 44 transitions among levels of the $3s^23p$, $3s3p^2$, $3s^23d$, $3p^3$, and $3s3p3d$ configurations. Wavelengths were measured with an estimated uncertainty of ±0.02 Å. We adopt their wavelengths and energy levels. The designation of the line at 290.114 Å was changed from $3s^23d$ $^{2}\mathrm{D}_{3/2}-3s3p(^{1}\mathrm{P}^{\circ})3d$ $^{2}\mathrm{D}^{\circ}_{3/2}$ to $3s^23d$ $^{2}\mathrm{D}_{3/2}-3s3p(^{1}\mathrm{P}^{\circ})3\mathrm{d}$ $^{2}\mathrm{P}^{\circ}_{3/2}$ by them. These levels cross at this ion, as shown in their calculation. It should be noted that the $3s^23p$ $^{2}\mathrm{P}^{\circ}_{3/2}-3s3p^2$ $^{2}\mathrm{S}_{1/2}$ and $^{2}\mathrm{D}_{3/2}$ lines at 308.92 Å and 382.76 Å in Ref. 22 have been omitted, because they are not observed by Redfors and Litzén. We give calculated values for these lines.

The $3p$ $^{2}\mathrm{P}^{\circ}-4d$ $^{2}\mathrm{D}$ doublet at ~67 Å was identified by Edlén[35]. Fawcett *et al.*[20] identified the $3d$ $^{2}\mathrm{D}-4f$ $^{2}\mathrm{F}^{\circ}$

doublet and the $3s3p3d\ ^4\mathrm{F}^\circ - 3s3p4f\ ^4\mathrm{G}$ and $3s3p^2\ ^4\mathrm{P} - 3s3p4s\ ^4\mathrm{P}^\circ$ quartets in the range of 79 – 87 Å.

Mn XIV (Mg sequence)

Ground state $1s^22s^22p^63s^2\ ^1\mathrm{S}_0$

Ionization energy 3 250 000 ± 2000 cm^{-1} (403.0 ± 0.2 eV)

Classifications of the $n = 3 - 3$ transitions were made in a series of articles of Fawcett *et al.*[26], Fawcett and Peacock[13], Fawcett[21,22], and Fawcett *et al.*[31] for the transitions among the levels of the $3s^2$, $3s3p$, $3s3d$, $3p^2$, and $3p3d$ configurations. Dere[36] reported the $3s^2\ ^1\mathrm{S} - 3s3p\ ^1\mathrm{P}^\circ$ line from solar flare observations. Litzén and Redfors[37] reobserved the spectrum in the range of 212 – 582 Å in a laser-produced plasma and identified 45 lines, including 18 from the earlier works. Wavelengths were measured with an estimated uncertainty of ± 0.02 Å. Their results are adopted together with their energy levels. For the perturbed lines at 418.51 Å and 471.94 Å and the blended line at 257.24 Å, however, the differences between the observed wavelengths and those derived from energy level data are 0.03 – 0.04 Å.

The $3p3d - 3d^2$ transitions were identified by Levashov and Churilov[38] and more completely by Redfors[39] in the range of 235 – 327 Å in a laser-produced plasma. Wavelengths of Redfors with an uncertainty of ± 0.02 Å are adopted together with his energy level values for the $3d^2$ configuration. The $^3\mathrm{D}^\circ_1 - {}^3\mathrm{F}_2$ line at 277.11 ± 0.02 Å is from Ref. 38. The designation of the lower term is given there as $^3\mathrm{P}^\circ_1$, but is $^3\mathrm{D}^\circ_1$ in the level scheme of Litzén and Redfors[37]. We adopt the latter.

Edlén[35] first identified the $3s3p - 3s4s$, $3s3p - 3snd$ ($n = 4{,}5$), and $3s3d - 3s4f$ triplets in the range of 57 – 80 Å, together with the $3s^2\ ^1\mathrm{S} - 3s4p\ ^1\mathrm{P}^\circ$ resonance line at 59.325 Å. Singlet terms were identified by Fawcett *et al.*[20] and Fawcett *et al.*[31], specifically the $3s3d - 3s4f$ transition at 84.09 ± 0.01 Å and the $3s3p - 3s4d$ and $3p^2 - 3s4f$ transitions at 67.02 ± 0.015 Å and 72.45 ± 0.015 Å. Fawcett *et al.*[20] also provided 11 lines of the $3p3d - 3p4f$ array in the range of 78 – 84 Å. Identifications of the $3s3d - 3s6f$, $3p^2 - 3p4s$, $3s3p - 3sns$ ($n = 5{,}6$), $3s3p - 3snd$ ($n = 5{,}6$), $3p^2 - 3p4d$, $3s^2 - 3snp$ ($n = 5{,}6$), and $3s3p - 3p4p$ transitions in the range of 38 – 76 Å are taken from Fawcett *et al.*[40]

Mn XV (Na sequence)

Ground state $1s^22s^22p^63s\ ^2\mathrm{S}_{1/2}$

Ionization energy 3 509 820 ± 300 cm^{-1} (435.166 ± 0.030 eV)

Fawcett *et al.*[26] and Fawcett and Peacock[13] identified the five lines of the $3s - 3p$ and $3p - 3d$ transitions in the ranges of 360 – 385 Å and 261 – 282 Å, respectively, in a laser-produced plasma. The $3s - 3p$ line was remeasured by Widing *et al.*[41] and Dere[36]. An isoelectronic comparison of the measured wavelengths with Dirac-Fock calculations was made by Reader *et al.*[42] for Ar^{7+} to Xe^{43+}, including those for the $3d - 4f$ doublet, and least squares adjusted wavelengths were derived. The overall uncertainty estimate is ± 0.007 Å. We give these results, from which the energy levels for the $2p^63p$, $2p^63d$ and $2p^64f$ configurations were derived.

Edlén[43] identified the transitions $3s - 4p$, $3p - 4s$, $3p - nd$ ($n = 4{,}5$), and $3d - nf$ ($n = 4{,}5$) in vacuum spark discharges, from which the $3p - 4s$, $3p - 4d$ and $3s - 4p$ and $3d - 5f$ lines at ~71 Å, ~61 Å, ~56 Å and 53 Å are quoted. The uncertainty of their wavelengths was estimated to be ± 0.01 to ± 0.02 Å. The $3d - np$ ($n = 4{,}5$) lines at ~87 Å and ~55 Å were identified by Fawcett *et al.*[20] and Fawcett *et al.*[31], respectively.

Identifications along Rydberg series have been taken from Fawcett *et al.*[40] for the $3d - nf$ ($n = 9 - 11$), $3p - 7s$, $3p - nd$ ($n = 8 - 10$) and $3s - np$ ($n = 9{,}10$) transitions and from Cohen and Behring[44] for the $3s - np$ ($n = 5 - 8$), $3p - ns$ ($n = 5{,}6$), $3p - nd$ ($n = 5 - 8$) and $3d - nf$ ($n = 6 - 8$) transitions.

The $4f\ ^2\mathrm{F}^\circ - 5g\ ^2\mathrm{G}$ and $4d\ ^2\mathrm{D} - 5f\ ^2\mathrm{F}^\circ$ doublets at ~178 Å and ~163 Å were identified by Lawson and Peacock[45]. Observations were made in a laser-produced plasma with an uncertainty estimated at ± 0.03 Å. For the $4d - 5f$ doublet, however, there appear discrepancies ranging from 0.06 – 0.1 Å between their results and those calculated from the energy level differences of Edlén. The measurements in Ref. 43 were adopted here to determine the $4d$ and $5f$ levels.

Mn XVI (Ne sequence)

Ground state $1s^22s^22p^6\ ^1\mathrm{S}_0$

Ionization energy 9 152 000 ± 5000 cm^{-1} (1134.7 ± 0.6 eV)

Tyrén[46] identified the transitions from the $2s^22p^53s$, $3d$, $4d$ and $2s2p^63p$ levels to the ground level in the range of 13.4 – 18.9 Å with a vacuum spark discharge. Swartz *et al.*[47] added the identification of the $2p^6 - 2p^54s$, $5d$, $6d$ transitions in the range of 11.8 – 14.1 Å.

Kastner[48] identified a coronal line at 1452.68 Å as the $2p^53s\ (3/2,1/2)^\circ_1 - (1/2,1/2)^\circ_0$ transition, but it is omitted because it is inconsistent with the levels derived by Jupén *et al.*[49]

The $2p^53s - 2p^53p$ and $2p^53p - 2p^53d$ arrays in the ranges of 347 – 439 Å and 288 – 302 Å, respectively, were observed with a laser-produced plasma and classified by Jupén and Litzén[50]. The uncertainty of the wavelengths is estimated to be ± 0.02 Å. The $2p^5(^2\mathrm{P}^\circ_{1/2})3s\ (1/2,1/2)^\circ_1 - 2p^5(^2\mathrm{P}^\circ_{1/2})3p\ ^2[1/2]_1$ line at 377.414 Å is questionable, because it shows a deviation of 0.775 Å from the wavelength 376.639 Å derived from the energy levels.

The $3p - 4d$ transitions were first identified by Kastner *et al.*[51] and also by Fawcett *et al.*[52], together with the $3d - 4f$ transitions. More complete and improved measurements were carried out by Jupén *et al.*[49] with a laser-produced plasma. They found 40 lines, including of the $3p - 4s$ and $3s - 4p$ transitions, in the range of

51 − 67 Å, which are quoted here. The estimated wavelength uncertainties vary from ±0.005 to ±0.01 Å. We have adopted the energy levels of Jupén *et al.* for the $2s^22p^53l$ and $2s^22p^54l$ configurations. Predicted values for several unobserved levels are given in Ref. 49.

Mn XVII (F sequence)

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

Ionization energy 9 872 000 ± 20 000 cm^{-1} (1224 ± 2.5 eV)

The $2s^22p^5\ ^2P^\circ - 2s2p^6\ ^2S$ doublet was observed by Fawcett[53], Doschek *et al.*[54] and Lawson and Peacock[45] in laser-produced plasmas, and by the TFR group[55] in tokamak plasmas. Wavelength values of 109.35 Å and 100.00 Å with estimated uncertainties of ±0.03 Å are taken from Ref. 45.

Feldman *et al.*[56] reported extensive observations in laser-produced plasmas of the transitions $2s2p^6 - 2s2p^53s$, $2p^5 - 2p^43s$ and $2p^5 - 2p^43d$ in the range of 15 − 18 Å with an estimated uncertainty of ±0.01 Å. We give their classifications of these lines.

Mn XVIII (O sequence)

Ground state $1s^22s^22p^4\ ^3P_2$

Ionization energy 10 620 000 ± 20 000 cm^{-1} (1317 ± 3 eV)

The $2s^22p^4 - 2s2p^5$ array was observed by Fawcett[53], Doschek *et al.*[54] and Lawson and Peacock[45] in laser-produced plasmas, and by the TFR group[55] in tokamak plasmas. The measurements of Lawson and Peacock in the range of 84 − 140 Å are the most comprehensive and their wavelengths are adopted here. The uncertainty of the wavelengths is given as ±0.03 Å. They also found the $2s2p^5\ ^1P^\circ_1 - 2p^6\ ^1S_0$ transition at 122.29 Å, identified first by Doschek *et al.*[57], and the $^3P^\circ_1 - {}^1S_0$ transition at 91.90 Å.

The $2p^4 - 2p^33s$ array at approximately 16 Å was identified by Doschek *et al.*[58] Wavelengths with estimated uncertainties of ±0.01 Å were measured by them in laser-produced plasmas. The $^3P_{1,0} - {}^3S^\circ_1$ transitions are not resolved in this array. We give a calculated value for $^3P_0 - {}^3S^\circ_1$ line.

Swartz *et al.*[47] observed five lines at 15 Å in a low-inductance vacuum spark which were tentatively identified by Fawcett and Hayes[59] as the $2p^4 - 2p^33d$ transitions.

Mn XIX (N sequence)

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

Ionization energy 11 590 000 ± 20 000 cm^{-1} (1437 ± 3 eV)

Observations of the $2s^22p^3 - 2s2p^4$ array were made by Doschek *et al*,[54] Feldman *et al.*[60] and Lawson and Peacock[45] in laser-produced plasmas, and by the TFR group[55] in tokamak plasmas. We adopt the wavelengths from the comprehensive measurements of Lawson and Peacock, who identified 20 lines in the range of 85 − 143 Å, including the spin-forbidden transitions from the $^2D_{3/2}$, $^2S_{1/2}$ and $^2P_{3/2}$ terms to the ground $^4S^\circ_{3/2}$. The uncertainty of the wavelengths is estimated to be ±0.03 Å.

Lawson and Peacock[45] also identified nine lines in the range of 88 − 148 Å of the $2s2p^4 - 2p^5$ array, including the $^2D - {}^2P^\circ$ doublet given in the earlier work of Doschek *et al.*[57]

Fawcett and Hayes[59] tentatively identified the $2p^3\ ^4S^\circ_{3/2} - 2p^2(^3P)3d\ ^4P_{3/2,5/2}$ transitions with a blended line at 14.098 Å observed previously by Swartz *et al.*[47] in a low-inductance vacuum spark.

Mn XX (C sequence)

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

Ionization energy 12 410 000 ± 20 000 cm^{-1} (1539 ± 3 eV)

The $2s^22p^2 - 2s2p^3$ array was observed by Feldman *et al.*[60] in a laser-produced plasma, and by the TFR group[55] in a tokamak plasma. The tabulated wavelengths are taken from the more extensive observations with a laser-produced plasma by Lawson and Peacock[45], who gave identifications for 37 lines due to the $2s^22p^2 - 2s2p^3$ and $2s2p^3 - 2p^4$ transitions in the range of 89 − 192 Å. The uncertainties of the wavelengths are estimated to be ±0.03 Å below 180 Å and ±0.06 Å above 180 Å. Smoothed wavelengths along isoelectronic sequence are given by Edlén[61]. They indicate that the $2s2p^3\ ^5S^\circ_2 - 2p^4\ ^3P_2$ transition at 90.76 Å is incorrectly identified. Therefore, we have estimated the position of the $^5S^\circ_2$ level from the smoothed wavelengths of $2s^22p^2\ ^3P - 2s2p^3\ ^5S^\circ$ lines by Edlén.

A line at 13.46 Å, observed with a low-inductance vacuum spark by Swartz *et al*,[47] was tentatively identified as the $2p^2\ ^1D_2 - 2p3d\ ^1F^\circ_3$ transition by Fawcett and Hayes.[59]

Mn XXI (B sequence)

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

Ionization energy 13 260 000 ± 27 000 cm^{-1} (1644 ± 3 eV)

The $2s^22p - 2s2p^2$ array was identified by Doschek *et al.*[62] in a laser-produced plasma and by the TFR group[55] in a tokamak plasma. Extensive measurements for both this array and the $2s2p^2 - 2p^3$ array are from a laser-produced plasma by Lawson and Peacock[45], who classified 26 lines in the range of 108 − 259 Å. Their results are adopted here. The uncertainties of the wavelengths are estimated to be ±0.03 Å below 180 Å and ±0.06 Å above 180 Å. The designation of the two levels $2s2p^2\ ^2P_{1/2}$ and $^2S_{1/2}$ has been interchanged according to Edlén[63] as confirmed by the calculated percentage composition in Sugar and Corliss.[64]

Mn XXII (Be sequence)

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

Ionization energy 14 420 000 ± 29 000 cm^{-1} (1788 ± 4 eV)

The $2s^2\ ^1S_0-2s2p\ ^3P_1^o$ transition was observed in the solar corona by Sandlin *et al.*[65] and Dere[36]. The wavelength of Sandlin *et al.*, 277.80 ± 0.03 Å, is given here. The $2s^2\ ^1S_0-2s2p\ ^1P_1^o$ resonance transition was observed by the TFR group[55] and Davé *et al.*[66] in tokamak plasmas and by Lawson and Peacock[45] in a laser-produced plasma. The wavelength of 141.10 ± 0.02 Å measured by Davé *et al.* is quoted. Lawson and Peacock also identified $2s2p-2p^2$ transitions, including the intercombination $^3P_2^o-{}^1D_2$ transition, in the range of 145 − 240 Å. The uncertainties of the wavelengths are estimated to be ± 0.03 Å below 180 Å and ± 0.06 Å above 180 Å. We give these results.

Fawcett and Hayes[59] tentatively identified the four lines at about 12 Å observed by Swartz *et al.*[47] as the $2s2p-2s3d$ and $2p^2-2p3d$ transitions. More extensive work for the $n=2,3$ transition arrays in the range of 11.7 − 13.2 Å were made by Boiko *et al.*[67] and Boiko *et al.*[68] in laser-produced plasmas. Some of the lines are given as unresolved or blended lines. The uncertainty of the wavelengths is estimated as ± 0.003 Å. Differences of up to ± 0.03 Å between the observed wavelengths and those calculated from the energy level differences occur. The designations of the two lines $2s^2\ ^1S_0-2s3p\ ^{1,3}P_1^o$ at 11.997 Å and 11.971 Å have been interchanged, in accordance with the calculations of Kim *et al.*[69] This places the $2s3p\ ^3P^o$ term below the $^1P^o$ term.

Mn XXIII (Li sequence)

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

Ionization energy 15 162 000 ± 35 000 cm^{-1} (1879.9 ± 0.4 eV)

The $2s-2p$ resonance transitions were identified by Widing and Purcell[70], Sandlin *et al.*[65] and Dere[36] from solar coronal observations and remeasured by Lawson and Peacock[45] with a laser-produced plasma. Kim *et al.*[71] have smoothed the energies of these transitions for Li-like ions with respect to calculated values. We use their predicted values.

The observation of the $n=2,3$ doublets was made with a low-inductance vacuum spark by Goldsmith *et al.*[72] Improved measurements in the extended range of 7.7 − 12.5 Å were carried out with a laser-produced plasma by Boiko *et al.*[68] who provided data for the $2p-3s$, $2p-nd$ ($n=3-5$), and $2s-np$ ($n=3-5$) transitions. The uncertainties of the wavelengths are estimated to be ± 0.002 Å below 10 Å and ± 0.003 Å above 10 Å. Vainshtein and Safronova[73] have calculated the energies of all the $1s^2nl$ levels for $n\leqslant 5$ (except for $1s^24f$) as well as the levels of the doubly excited $1s2s2p$ and $1s2p^2$ configurations. They used the $1/Z$ expansion method with relativistic and QED corrections. All the wavelengths given here are derived from these energy levels. They differ by ± 0.005Å to ± 0.010 Å from the measurements of Boiko *et al.* except for the $1s^22p\ ^2P_{3/2}^o-1s^24d\ ^2D_{5/2}$ transition which differs by 0.035 Å.

Mn XXIV (He sequence)

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

Ionization energy 65 660 000 ± 13 000 cm^{-1} (8140.7 ± 2.0 eV)

Calculated energy levels of the configurations $1snl$ with $l=s$, p, and d have been taken from the work of Drake[74,75] for $n=2,3$. For the levels with $n=4,5$ calculations of Vainshtein and Safronova[76] have been tabulated after adjusting them by adding 1400 cm^{-1} in order to convert to the ground state binding energy obtained by Drake. This value is the arithmetic mean value of the difference between the levels given in the above references for $3s$, $3p$, and $3d$. Wavelengths are calculated from the energy levels by the Ritz combination principle. Vainshtein and Safronova[73] have calculated the energies of the $2s^2$, $2s2p$, and $2p^2$ configurations. We use their calculated wavelengths for the transitions to the $1snl$ configurations.

Mn XXV (H sequence)

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

Ionization energy 69 137 400 ± 300 cm^{-1} (8572.01 ± 0.04 eV)

No observations of this spectrum have been reported. We have tabulated the wavelengths calculated from the theoretical energy levels of Johnson and Soff[77] for the $n=2$ shell whose estimated uncertainty is ± 10 cm^{-1}. Their energy differences are in close agreement with those of Mohr[78]. The binding energies for the levels with $n=3-5$ have been calculated by Erickson.[79] We subtract these energies from the binding energy of the ground state obtained by Johnson and Soff to obtain predicted wavelengths. Our estimate of the error in the value of $3s$ is ± 30 cm^{-1}, assuming the Lamb shift scales as n^{-3}.

Transition probabilities and oscillator strengths were obtained by scaling the data tabulated for the hydrogen spectrum by Wiese *et al.*[80] The scaling was actually performed for the line strengths S, which for a hydrogen-like ion of nuclear charge Z are reduced according to $S_Z = Z^{-2}S_H$, so that

$$S_{\mathrm{Mn\ XXV}} = S_H(25)^{-2} = S_H/625.$$

The f and A values were then obtained from the usual numerical conversion formulas, given for example in Ref. 81. For these conversions the accurate wavelengths listed in the Mn XXV table were used, in which relativistic and QED effects in the energies were taken into account. Relativistic effects in the line strengths are only of the order of 1 − 3% for Mn XXV, according to the work by Younger and Weiss[82], and have been neglected.

3. Explanation of Tables of Spectroscopic Data

Mn VII, Mn XX, etc.

According to spectroscopic convention, Mn I indicates the first spectrum, i.e., the spectrum of the neutral atom; Mn II denotes the second spectrum, belonging to the singly ionized atom; and so on.

H sequence, C sequence, etc.

Indicates that the respective Mn ion has the same number of electrons as neutral hydrogen, neutral carbon, etc.

IP

Principal ionization energy of the tabulated ion in cm^{-1} (eV).

λ(Å)

Wavelength of listed spectral lines in Angstrom units (10^{-8} cm).

C,T,P

Superscripts to the right of a wavelength value have the following meanings:

$^{\rm C}$ wavelength calculated from energy level data using the Ritz combination principle.
$^{\rm T}$ wavelength tentatively classified.
$^{\rm P}$ wavelength predicted along an isoelectronic sequence.

Classification

Standard spectroscopic designation for lower (first) and upper levels generating the spectral lines; electronic configurations are followed by the term in *LS*-, *jj*- or *jK*-coupling notation. The superscript ° on the term indicates odd parity. A term enclosed in parentheses refers to an intermediate state. Where only the total angular momentum *J* is given in successive listings, the preceding configuration and term labels apply.

Energy Levels

Level values (in cm^{-1}) for lower (first) and upper (second) level of the transition. A symbol ? after the level value indicates level was derived from a tentatively classified line. Theoretical levels are given in square brackets.

Int

Approximate relative intensity of a spectral line, generally visually estimated from the blackness (or density) of the line on photographic plates. In case where its *gf*-value is available, the intensity is normally omitted (see also general introduction).

gf

This column lists the product of the statistical weight of lower level and the absorption oscillator strength or *f*-value for electric dipole transitions. 1.23 − 1 means 1.23×10^{-1}. *f*-values are not given for magnetic-dipole (M1) transitions.

A

Radiative transition probability in s^{-1}. 1.23 + 11 means 1.23×10^{11}.

Acc

Accuracy estimate for the oscillator strength and transition probability data, taken from the NIST reference tables on atomic transition probabilities (see, e.g. the introduction of Ref. 13 for detailed explanation). The accuracy is indicated by the following letter symbols, which are identical with the notation used in the NIST reference book:

A for uncertainties within 3%
B for uncertainties within 10%
C for uncertainties within 25%
D for uncertainties within 50%
E for uncertainties greater than 50%

References

Reference sources for the data. The numbers are keyed to the bibliographic listing following the tables. When several references are listed, they are distinguished by superscripts on the numbers as follows:

$^{\circ}$ reference from which the adopted wavelength value is taken.
* reference containing the adopted oscillator strength and/or the transition probability.
$^{\Delta}$ reference from which the estimated intensity is taken.

4. Spectroscopic Data for Mn VII through Mn XXV

Mn VII (K sequence)

λ (Å)	Classification		Energy Levels (cm^{-1})		Int.	*gf*	*A* (s^{-1})	Acc.	References
254.517	$3p^63d$ $^2D_{5/2}$	$3p^5(^2P^\circ)3d^2(^1G)$ $^2F^\circ_{5/2}$	1 338	394 238	15				6
253.654	$_{3/2}$	$_{5/2}$	0	394 238	400				6
252.985	$_{5/2}$	$_{7/2}$	1 338	396 618	750				6
252.760	$3p^63d$ $^2D_{3/2}$	$3p^64p$ $^2P^\circ_{1/2}$	0	395 633	400				6°,1
250.969	$_{5/2}$	$_{3/2}$	1 338	399 795	1000				6°,1
250.127	$_{3/2}$	$_{3/2}$	0	399 795	50				6°,1
247.473	$3p^63d$ $^2D_{3/2}$	$3p^5(^2P^\circ)3d^2(^1D)$ $^2P^\circ_{1/2}$	0	404 085	250	6.8−2	3.8+9	D−	6°,81*
245.739	$_{5/2}$	$_{3/2}$	1 338	408 273	300	1.3−1	3.4+9	D−	6°,81*
244.935	$_{3/2}$	$_{3/2}$	0	408 273	100	1.4−2	3.8+8	E	6°,81*
244.766	$3p^63d$ $^2D_{5/2}$	$3p^5(^2P^\circ)3d^2(^1D)$ $^2F^\circ_{7/2}$	1 338	409 891	500	2.2−1	3.1+9	D−	6°,81*
239.381	$_{5/2}$	$_{5/2}$	1 338	419 081	25	1.1−2	2.2+8	E	6°,81*
238.617	$_{3/2}$	$_{5/2}$	0	419 081	300	1.6−1	3.2+9	D−	6°,81*
204.675	$3p^63d$ $^2D_{5/2}$	$3p^5(^2P^\circ)3d^2(^3F)$ $^2F^\circ_{5/2}$	1 338	489 916	50	2.2−1	5.9+9	E	6°,81*
204.117	$_{3/2}$	$_{5/2}$	0	489 916	400	3.1	8.3+10	D−	6°,81*,3
202.840	$_{5/2}$	$_{7/2}$	1 338	494 337	600	4.5	9.1+10	D−	6°,81*,3
184.538	$3p^63d$ $^2D_{3/2}$	$3p^5(^2P^\circ)3d^2(^3P)$ $^2P^\circ_{1/2}$	0	541 894	200	2.1	2.1+11	D−	6°,81*
184.161	$_{5/2}$	$_{3/2}$	1 338	544 342	300	3.8	1.9+11	D−	6°,81*
183.708	$_{3/2}$	$_{3/2}$	0	544 342	100	4.4−1	2.1+10	E	6°,81*
183.141	$3p^63d$ $^2D_{5/2}$	$3p^5(^2P^\circ)3d^2(^3F)$ $^2D^\circ_{5/2}$	1 338	547 367	500	8.4	2.7+11	D−	6°,81*,2,3
182.945	$_{5/2}$	$_{3/2}$	1 338	547 949	100	6.0−1	3.0+10	E	6°,81*,2,3
182.692	$_{3/2}$	$_{5/2}$	0	547 367	200	6.0−1	2.0+10	E	6°,81*,2,3
182.499	$_{3/2}$	$_{3/2}$	0	547 949	300	5.2	2.7+11	D−	6°,81*,2,3
162.689	$3p^63d$ $^2D_{5/2}$	$3p^64f$ $^2F^\circ_{5/2}$	1 338	616 007	100				6°,1
162.656	$_{5/2}$	$_{7/2}$	1 338	616 132	300				6°,1
162.336	$_{3/2}$	$_{5/2}$	0	616 007	250				6°,1
142.615	$3p^63d$ $^2D_{3/2}$	$3p^53d(^3P^\circ)4s$ $^2P^\circ_{1/2}$	0	701 189	30	1.2−1	2.0+10	D	6°,81*,4,5
142.028	$_{5/2}$	$_{3/2}$	1 338	705 425	50	2.0−1	1.7+10	D	6°,81*,4,5
141.757	$_{3/2}$	$_{3/2}$	0	705 425	25	3.4−2	2.8+9	E	6°,81*,4,5
141.044	$3p^63d$ $^2D_{5/2}$	$3p^53d(^3F^\circ)4s$ $^4F^\circ_{7/2}$	1 338	710 337	20				6°,4,5
140.323	$_{3/2}$	$_{5/2}$	0	712 642	15				6°,4,5
139.862	$_{3/2}$	$_{3/2}$	0	714 990	1				6
139.595	$3p^63d$ $^2D_{5/2}$	$3p^53d(^3F^\circ)4s$ $^2F^\circ_{7/2}$	1 338	717 696	85	6.0−1	2.6+10	D	6°,81*,4,5
138.697	$_{5/2}$	$_{5/2}$	1 338	722 331	3	3.1−2	1.8+9	E	6°,81*,4,5
138.441	$_{3/2}$	$_{5/2}$	0	722 331	70	5.6−1	3.3+10	D	6°,81*,4,5
136.177	$3p^63d$ $^2D_{5/2}$	$3p^53d(^3D^\circ)4s$ $^4D^\circ_{7/2}$	1 338	735 676	35				6°,4,5
135.900	$_{5/2}$	$_{5/2}$	1 338	737 173	15				6°,4,5
135.532	$_{3/2}$	$_{3/2}$	0	737 833	8				6
135.394	$_{3/2}$	$_{1/2}$	0	738 585	3				6
135.609	$3p^63d$ $^2D_{5/2}$	$3p^65f$ $^2F^\circ_{5/2}$	1 338	738 765	10				6°,1
135.475	$_{5/2}$	$_{7/2}$	1 338	739 482	120				6°,1
135.362	$_{3/2}$	$_{5/2}$	0	738 765	100				6°,1
135.148	$3p^63d$ $^2D_{3/2}$	$3p^53d(^1F^\circ)4s$ $^2F^\circ_{5/2}$	0	739 930	75				6
134.190	$_{5/2}$	$_{7/2}$	1 338	746 550	25	2.5−1	1.2+10	D	6°,81*,4,5
134.972	$3p^63d$ $^2D_{3/2}$	$3p^53d(^1D^\circ)4s$ $^2D^\circ_{3/2}$	0	740 894	15				6
134.628	$_{5/2}$	$_{5/2}$	1 338	744 126	30				6
133.875	$3p^63d$ $^2D_{5/2}$	$3p^53d(^3D^\circ)4s$ $^2D^\circ_{3/2}$	1 338	748 302	5	6.6−2	5.9+9	E	6°,81*,4,5
133.655	$_{5/2}$	$_{5/2}$	1 338	749 532	60	4.3−1	2.7+10	D	6°,81*,4,5
133.636	$_{3/2}$	$_{3/2}$	0	748 302	35	2.7−1	2.5+10	D	6°,81*,4,5
133.417	$_{3/2}$	$_{5/2}$	0	749 532	2				6°,4,5

Mn VII (K sequence) – Continued

λ (Å)	Classification		Energy Levels (cm^{-1})		Int.	gf	A (s^{-1})	Acc.	References
123.993	$3p^6 3d$ $^2D_{5/2}$	$3p^6 6f$ $^2F^\circ_{7/2}$	1 338	807 835	50				6°,1
123.790	$_{3/2}$	$_{5/2}$	0	807 820	30				6°,1
117.978	$3p^6 3d$ $^2D_{5/2}$	$3p^6 7f$ $^2F^\circ_{7/2}$	1 338	848 954	15				6°,1
117.793	$_{3/2}$	$_{5/2}$	0	848 947	10				6°,1
114.380	$3p^6 3d$ $^2D_{5/2}$	$3p^6 8f$ $^2F^\circ_{7/2}$	1 338	875 620	2				6°,1
114.205	$_{3/2}$	$_{5/2}$	0	875 620	2				6°,1
112.060	$3p^6 3d$ $^2D_{5/2}$	$3p^6 9f$ $^2F^\circ_{7/2}$	1 338	893 730	1				1
111.889	$_{3/2}$	$_{5/2}$	0	893 730	0				1

Mn VIII (Ar sequence)

λ (Å)	Classification				Energy Levels (cm^{-1})		Int.	gf	A (s^{-1})	Acc.	References
668.288	$3s^2 3p^5 3d$	$^1P^\circ_1$	$3s 3p^6 3d$	$^1D_2$	539 214	688 850	0				10
415.348	$3s^2 3p^5 3d$	$^1F^\circ_3$	$3s 3p^6 3d$	$^3D_2$	427 531	668 308	4*bl*				10
413.582		$_3$		$_3$	427 531	669 326	5				10
411.473	$3s^2 3p^5 3d$	$^3D^\circ_2$	$3s 3p^6 3d$	$^3D_1$	424 641	667 677	0				10
410.374		$_2$		$_2$	424 641	668 308	6*bl*				10
409.270		$_1$		$_1$	423 337	667 677	5				10
408.685		$_2$		$_3$	424 641	669 326	5				10
408.206		$_1$		$_2$	423 337	668 308	0				10
400.075		$_3$		$_3$	419 374	669 326	8				10
403.497	$3s^2 3p^5 3d$	$^1D^\circ_2$	$3s 3p^6 3d$	$^3D_1$	419 817	667 677	2				10
402.446		$_2$		$_2$	419 817	668 308	5				10
400.781		$_2$		$_3$	419 817	669 326	3				10
382.666	$3s^2 3p^5 3d$	$^1F^\circ_3$	$3s 3p^6 3d$	$^1D_2$	427 531	688 850	9				10
378.482	$3s^2 3p^5 3d$	$^3D^\circ_2$	$3s 3p^6 3d$	$^1D_2$	424 641	688 850	5				10
371.090		$_3$		$_2$	419 374	688 850	6				10
371.695	$3s^2 3p^5 3d$	$^1D^\circ_2$	$3s 3p^6 3d$	$^1D_2$	419 817	688 850	8				10
371.586	$3s^2 3p^5 3d$	$^3F^\circ_2$	$3s 3p^6 3d$	$^3D_1$	398 564	667 677	9				10
370.722		$_2$		$_2$	398 564	668 308	5				10
365.779		$_3$		$_2$	394 921	668 308	10				10
364.427		$_3$		$_3$	394 921	669 326	5				10
360.373		$_4$		$_3$	391 836	669 326	11				10
347.602	$3s^2 3p^5 3d$	$^3P^\circ_2$	$3s 3p^6 3d$	$^3D_1$	379 993	667 677	2				10
346.842		$_2$		$_2$	379 993	668 308	8				10
345.617		$_2$		$_3$	379 993	669 326	11				10
342.501		$_1$		$_1$	375 710	667 677	7				10
341.770		$_1$		$_2$	375 710	668 308	10				10
340.114		$_0$		$_1$	373 658	667 677	8				10
344.493	$3s^2 3p^5 3d$	$^3F^\circ_2$	$3s 3p^6 3d$	$^1D_2$	398 564	688 850	3				10
340.234		$_3$		$_2$	394 921	688 850	0*bl*				10
323.782	$3s^2 3p^5 3d$	$^3P^\circ_2$	$3s 3p^6 3d$	$^1D_2$	379 993	688 850	1				10
266.181	$3p^6$	$^1S_0$	$3p^5 3d$	$^3P^\circ_1$	0	375 710	5*bl*				10
236.218	$3p^6$	$^1S_0$	$3p^5 3d$	$^3D^\circ_1$	0	423 337	15				10
185.455	$3p^6$	$^1S_0$	$3p^5 3d$	$^1P^\circ_1$	0	539 214	20	2.87	1.85+11	C	10°,81*,2,3,11

Mn VIII (Ar sequence) – Continued

λ (Å)	Classification				Energy Levels (cm^{-1})		Int.	*gf*	A (s^{-1})	Acc.	References
141.76	$3p^53d$	$^3D^\circ_3$	$3p^54f$	$^1G_4$	419 374	1 124 800	10				12
141.29	$3p^53d$	$^1F^\circ_3$	$3p^54f$	$^3F_4$	427 531	1 135 300	7				12
140.73	$3p^53d$	$^3D^\circ_2$	$3p^54f$	$^3F_3$	424 641	1 135 200	5				12
139.93	$3p^53d$	$^1D^\circ_2$	$3p^54f$	$^1F_3$	419 817	1 134 500	5				12
137.92	$3p^53d$	$^3F^\circ_2$	$3p^54f$	$^3G_3$	398 564	1 123 600	6				12
137.82		$_3$		$_4$	394 921	1 120 500	7				12
137.50		$_4$		$_5$	391 836	1 119 100	10				12
135.48^{T}	$3p^53d$	$^3P^\circ_2$	$3p^54f$	$^3D_2$	379 993	1 117 600	*bl*				12
135.15		$_2$		$_3$	379 993	1 119 900	*bl*				12
135.06		$_1$		$_1$	375 710	1 116 100	3				12
134.79		$_1$		$_2$	375 710	1 117 600	4				12
134.69		$_0$		$_1$	373 658	1 116 100	2				12
124.055	$3p^6$	$^1S_0$	$3p^5(^2P^\circ_{3/2})4s$	$^2[^3/_2]^\circ_1$	0	806 100	10	1.4 − 1	2.0 + 10	D	8°,81*,7
122.168	$3p^6$	$^1S_0$	$3p^5(^2P^\circ_{1/2})4s$	$^2[^1/_2]^\circ_1$	0	818 500	15	2.7 − 1	4.0 + 10	D	8°,81*,7
97.411	$3p^6$	$^1S_0$	$3p^5(^2P^\circ_{3/2})4d$	$^2[^3/_2]^\circ_1$	0	1 026 600	7				9
96.332	$3p^6$	$^1S_0$	$3p^5(^2P^\circ_{1/2})4d$	$^2[^3/_2]^\circ_1$	0	1 038 100	6				9

Mn IX (Cl sequence)

λ (Å)	Classification				Energy Levels (cm^{-1})		Int.	*gf*	A (s^{-1})	Acc.	References
7968.5^{C}	$3s^23p^5$	$^2P^\circ_{3/2}$	$3s^23p^5$	$^2P^\circ_{1/2}$	0	12 546		M1	3.55 + 1	B	81*
395.473	$3s^23p^5$	$^2P^\circ_{1/2}$	$3s3p^6$	$^2S_{1/2}$	12 546	265 408	8	6.8 − 2	1.5 + 9	C −	14°,81*,13,17,21
376.778		$_{3/2}$		$_{1/2}$	0	265 408	10	1.42 − 1	3.33 + 9	C −	14°,81*,13,17,21
204.43	$3s^23p^5$	$^2P^\circ_{1/2}$	$3s^23p^4(^1D)3d$	$^2S_{1/2}$	12 546	501 710		4.94 − 1	3.95 + 10	C −	15°,81*
199.32		$_{3/2}$		$_{1/2}$	0	501 710		1.3	1.1 + 11	C −	15°,81*
196.38	$3s^23p^5$	$^2P^\circ_{1/2}$	$3s^23p^4(^3P)3d$	$^2P_{3/2}$	12 546	521 840					15
194.61		$_{1/2}$		$_{1/2}$	12 546	526 380					15
191.60		$_{3/2}$		$_{3/2}$	0	521 840					15°,2,3
189.98		$_{3/2}$		$_{1/2}$	0	526 380					15
189.16	$3s^23p^5$	$^2P^\circ_{1/2}$	$3s^23p^4(^3P)3d$	$^2D_{3/2}$	12 546	541 160		3.40	1.59 + 11	C	15°,81*,2,3
188.48		$_{3/2}$		$_{5/2}$	0	530 560		5.32	1.66 + 11	C	15°,81*,2,3
184.80		$_{3/2}$		$_{3/2}$	0	541 160		1.2 − 1	6.1 + 9	D	15°,81*
123.85	$3s^23p^4(^1D)3d$	$^2F_{7/2}$	$3s^23p^4(^1D)4f$	$^2G^\circ_{9/2}$							20
121.633	$3s^23p^4(^3P)3d$	$^4F_{7/2}$	$3s^23p^4(^3P)4f$	$^4G^\circ_{9/2}$							20
121.351		$_{9/2}$		$_{11/2}$							20
121.12		$_{5/2}$		$_{7/2}$							20
121.442	$3s^23p^4(^1D)3d$	$^2G_{9/2}$	$3s^23p^4(^1D)4f$	$^2H^\circ_{11/2}$							20
118.510	$3s^23p^4(^3P)3d$	$^4D_{7/2}$	$3s^23p^4(^3P)4f$	$^4F^\circ_{9/2}$							20
114.472	$3s^23p^5$	$^2P^\circ_{3/2}$	$3s^23p^4(^3P)4s$	$^4P_{5/2}$	0	873 580	0				18
113.627		$_{3/2}$		$_{3/2}$	0	880 070	3				18

Mn IX (Cl sequence) – Continued

λ (Å)	Classification				Energy Levels (cm^{-1})		Int.	*gf*	*A* (s^{-1})	Acc.	References
114.023	$3s^23p^5$	$^2P^\circ_{1/2}$	$3s^23p^4(^3P)4s$	$^2P_{3/2}$	12 546	889 560	0				18°,17
113.080		$_{1/2}$		$_{1/2}$	12 546	896 860	2				18°,17
112.415		$_{3/2}$		$_{3/2}$	0	889 560	5				18°,17
111.500		$_{3/2}$		$_{1/2}$	0	896 860	2				18°,17
111.262	$3s^23p^5$	$^2P^\circ_{1/2}$	$3s^23p^4(^1D)4s$	$^2D_{3/2}$	12 546	911 310	4				18
109.783		$_{3/2}$		$_{5/2}$	0	910 890	5				18
105.256	$3s^23p^5$	$^2P^\circ_{3/2}$	$3s^23p^4(^1S)4s$	$^2S_{1/2}$	0	950 060	0				18
91.0	$3s^23p^5$	$^2P^\circ_{1/2}$	$3s^23p^4(^3P)4d$	$^2D_{3/2}$	12 546	1 110 700	8				19
90.134		$_{3/2}$		$_{5/2}$	0	1 109 500	9				20°,19$^\Delta$
90.034		$_{3/2}$		$_{3/2}$	0	1 110 700	8				20°,19$^\Delta$
90.599	$3s^23p^5$	$^2P^\circ_{1/2}$	$3s^23p^4(^3P)4d$	$^2P_{3/2}$	12 546	1 116 300					20
89.914	$3s^23p^5$	$^2P^\circ_{3/2}$	$3s^23p^4(^3P)4d$	$^4F_{5/2}$	0	1 112 200	4				20°,19$^\Delta$
89.783	$3s^23p^5$	$^2P^\circ_{3/2}$	$3s^23p^4(^3P)4d$	$^2F_{5/2}$	0	1 113 800	4				20°,19$^\Delta$
89.448	$3s^23p^5$	$^2P^\circ_{1/2}$	$3s^23p^4(^1D)4d$	$^2S_{1/2}$	12 546	1 130 700					20
88.423		$_{3/2}$		$_{1/2}$	0	1 130 700	6				20°,19$^\Delta$
88.923	$3s^23p^5$	$^2P^\circ_{1/2}$	$3s^23p^4(^1D)4d$	$^2P_{3/2}$	12 546	1 137 000	4				20°,19$^\Delta$
88.773		$_{1/2}$		$_{1/2}$	12 546	1 139 000	4				20°,19$^\Delta$
87.958		$_{3/2}$		$_{3/2}$	0	1 137 000	6				20°,19$^\Delta$
87.79		$_{3/2}$		$_{1/2}$	0	1 139 000	2				19
88.258	$3s^23p^5$	$^2P^\circ_{1/2}$	$3s^23p^4(^1D)4d$	$^2D_{3/2}$	12 546	1 145 700	5				20°,19$^\Delta$
87.552		$_{3/2}$		$_{5/2}$	0	1 142 200	8				20°,19$^\Delta$
87.27		$_{3/2}$		$_{3/2}$	0	1 145 700	3				20°,19$^\Delta$

Mn X (S sequence)

λ (Å)	Classification				Energy Levels (cm^{-1})		Int.	*gf*	*A* (s^{-1})	Acc.	References
9978.3^C	$3s^23p^4$	$^3P_2$	$3s^23p^4$	$^3P_1$	0	10 019		M1	2.18+1	C+	81*
8474.4^C		$_2$		$_0$	0	11 797		E2	4.7−3	D−	81*
4539.4^C	$3s^23p^4$	$^3P_0$	$3s^23p^4$	$^1D_2$	11 797	33 820		E2	9.3−4	E	81*
4200.3^C		$_1$		$_2$	10 019	33 820		M1	6.4	E	81*
2956.0^C		$_2$		$_2$	0	33 820		M1	5.3+1	D−	81*
2516.5^C	$3s^23p^4$	$^1D_2$	$3s^23p^4$	$^1S_0$	33 820	73 545		E2	7.2	D−	81*
1574.2^C	$3s^23p^4$	$^3P_1$	$3s^23p^4$	$^1S_0$	10 019	73 545		M1	5.8+2	E	81*
1359.7^C		$_2$		$_0$	0	73 545		E2	1.3	E	81*
398.322	$3s^23p^4$	$^3P_1$	$3s3p^5$	$^3P^\circ_2$	10 019	261 072					14°,21,22
388.988		$_0$		$_1$	11 797	268 874					14°,21,22
386.316		$_1$		$_1$	10 019	268 874					14°,21,22
383.036		$_2$		$_2$	0	261 072		1.7−1	1.5+9	E	14°,81*,21,22
379.368		$_1$		$_0$	10 019	273 615					14*
371.905		$_2$		$_1$	0	268 874					14°,21,22
384.827	$3s^23p^4$	$^1S_0$	$3s3p^5$	$^1P^\circ_1$	73 545	333 402					14*
333.798	$3s^23p^4$	$^1D_2$	$3s3p^5$	$^1P^\circ_1$	33 820	333 402		3.3−1	6.6+9	D	14°,81*,21,22
218.11	$3s^23p^4$	$^1D_2$	$3s^23p^3(^2D^\circ)3d$	$^3P^\circ_1$	33 820	492 320					22
217.88		$_2$		$_2$	33 820	492 770					22

Mn x (S sequence) – Continued

λ (Å)	Classification				Energy Levels (cm^{-1})		Int.	gf	A (s^{-1})	Acc.	References
207.15	$3s^23p^4$	$^3P_1$	$3s^23p^3(^2D^\circ)3d$	$^3P^\circ_2$	10 019	492 770					22°,15
203.12		$_2$		$_1$	0	492 320					22*
202.93		$_2$		$_2$	0	492 770		3.1	1.0+11	E	22°,81*,15
199.08	$3s^23p^4$	$^1D_2$	$3s^23p^3(^2D^\circ)3d$	$^1D^\circ_2$	33 820	536 130		3.4	1.2+11	D	22°,81*,15
198.42	$3s^23p^4$	$^1S_0$	$3s^23p^3(^2D^\circ)3d$	$^1P^\circ_1$	73 545	577 530		2.4	1.4+11	D	22°,81*
195.85	$3s^23p^4$	$^3P_1$	$3s^23p^3(^4S^\circ)3d$	$^3D^\circ_2$	10 019	520 620					22°,3
195.03		$_0$		$_1$	11 797	524 520					22°,3
194.37		$_1$		$_1$	10 019	524 520					22
194.30		$_2$		$_3$	0	514 670					22°,3
192.08		$_2$		$_2$	0	520 620					22
193.43	$3s^23p^4$	$^1D_2$	$3s^23p^3(^2D^\circ)3d$	$^1F^\circ_3$	33 820	550 800		6.0	1.5+11	D	22°,81*,3
108.97	$3s^23p^3(^2P^\circ)3d$	$^3F^\circ_3$	$3s^23p^3(^2P^\circ)4f$	$^3G_4$							20
108.93		$_4$		$_5$							20
108.97	$3s^23p^3(^2D^\circ)3d$	$^3G^\circ_5$	$3s^23p^3(^2D^\circ)4f$	$^3H_6$							20
108.93		$_4$		$_5$							20
107.472	$3s^23p^3(^4S^\circ)3d$	$^5D^\circ_4$	$3s^23p^3(^4S^\circ)4f$	$^5F_5$							20
107.39		$_3$		$_4$							20
107.34		$_2$		$_3$							20
107.34		$_1$		$_2$							20
107.36	$3s^23p^3(^2D^\circ)3d$	$^3F^\circ_4$	$3s^23p^3(^2D^\circ)4f$	$^3G_5$							20
104.806	$3s^23p^4$	$^3P_0$	$3s^23p^3(^4S^\circ)4s$	$^3S^\circ_1$	11 797	965 970					23
104.608		$_1$		$_1$	10 019	965 970					23
103.521		$_2$		$_1$	0	965 970					23
104.310	$3s^23p^4$	$^1S_0$	$3s^23p^3(^2P^\circ)4s$	$^1P^\circ_1$	73 545	1 032 090					23
103.269	$3s^23p^4$	$^1D_2$	$3s^23p^3(^2D^\circ)4s$	$^1D^\circ_2$	33 820	1 002 160					23
102.030	$3s^23p^4$	$^3P_0$	$3s^23p^3(^2D^\circ)4s$	$^3D^\circ_1$	11 797	991 860					23
101.854		$_1$		$_1$	10 019	991 860					23
101.808		$_1$		$_2$	10 019	992 220					23
100.787		$_2$		$_2$	0	992 220					23
100.585		$_2$		$_3$	0	994 180					23
100.173	$3s^23p^4$	$^1D_2$	$3s^23p^3(^2P^\circ)4s$	$^1P^\circ_1$	33 820	1 032 090					23
84.292	$3s^23p^4$	$^3P_1$	$3s^23p^3(^4S^\circ)4d$	$^3D^\circ_2$	10 019	1 196 370					20°,19$^{\Delta}$
83.518		$_2$		$_3$	0	1 197 350					20°,19$^{\Delta}$
83.068	$3s^23p^4$	$^1D_2$	$3s^23p^3(^2D^\circ)4d$	$^1D^\circ_2$	33 820	1 237 650					20°,19$^{\Delta}$
82.828	$3s^23p^4$	$^1D_2$	$3s^23p^3(^2D^\circ)4d$	$^1F^\circ_3$	33 820	1 241 140					20°,19$^{\Delta}$

Mn XI (P sequence)

λ (Å)	Classification				Energy Levels (cm^{-1})		Int.	*gf*	*A* (s^{-1})	Acc.	References
3809.5^C	$3s^23p^3$	$^2D^o_{5/2}$	$3s^23p^3$	$^2P^o_{1/2}$	42 702	68 945		E2	2.7−1	D−	81*
3381.9^C		3/2		1/2	39 384	68 945		M1	4.5+1	C	81*
3240.6^C		5/2		3/2	42 702	73 552		M1	4.8+1	C	81*
2925.9^C		3/2		3/2	39 384	73 552		M1	1.1+2	C	81*
2538.3^C	$3s^23p^3$	$^4S^o_{3/2}$	$3s^23p^3$	$^2D^o_{3/2}$	0	39 384		M1	2.4+1	D	81*
2341.1^C		3/2		5/2	0	42 702		M1	7.4−1	E	81*
1450.49	$3s^23p^3$	$^4S^o_{3/2}$	$3s^23p^3$	$^2P^o_{1/2}$	0	68 945		M1	1.0+2	D	24°,81*
1359.59		3/2		3/2	0	73 552		M1	2.0+2	D	25°,81*,24
414.972^C	$3s^23p^3$	$^2P^o_{3/2}$	$3s3p^4$	$^2D_{3/2}$	73 552	314 532		9.6−4	9.2+6	E	81*
412.662^C		3/2		5/2	73 552	315 881		7.2−2	4.8+8	D	81*
407.188^C		1/2		3/2	68 945	314 532		2.8−2	2.8+8	D	81*
393.743	$3s^23p^3$	$^4S^o_{3/2}$	$3s3p^4$	$^4P_{5/2}$	0	253 974		1.9−1	1.4+9	D	14°,81*,13,21,22
382.142		3/2		3/2	0	261 683		1.3−1	1.5+9	D	14°,81*,21,22
377.154		3/2		1/2	0	265 144		6.8−2	1.5+9	D	14°,81*,22
367.877	$3s^23p^3$	$^2D^o_{5/2}$	$3s3p^4$	$^2D_{3/2}$	42 702	314 532		5.0−3	6.2+7	E	14°,81*
366.060		5/2		5/2	42 702	315 881		3.0−1	2.5+9	D	14°,81*,21,22
363.510		3/2		3/2	39 384	314 532		2.3−1	3.0+9	D	14°,81*,21
361.668^C		3/2		5/2	39 384	315 881		3.4−3	2.9+7	E	81*
347.404	$3s^23p^3$	$^2P^o_{3/2}$	$3s3p^4$	$^2P_{3/2}$	73 552	361 400					14
341.929		1/2		3/2	68 945	361 400					14
336.995		1/2		1/2	68 945	365 689					14
327.288	$3s^23p^3$	$^2P^o_{3/2}$	$3s3p^4$	$^2S_{1/2}$	73 552	379 093					14
322.427		1/2		1/2	68 945	379 093					14
313.777	$3s^23p^3$	$^2D^o_{5/2}$	$3s3p^4$	$^2P_{3/2}$	42 702	361 400					14°,21,22
310.547		3/2		3/2	39 384	361 400					14°,22
306.458		3/2		1/2	39 384	365 689					14°,22
235.55	$3s^23p^3$	$^2D^o_{5/2}$	$3s^23p^2(^3P)3d$	$^2P_{3/2}$	42 702	467 240					22
228.52		3/2		1/2	39 384	476 980					22
230.17^C	$3s^23p^3$	$^2D^o_{5/2}$	$3s^23p^2(^3P)3d$	$^4P_{5/2}$	42 702	477 170		3.8−2	8.0+8	E	81*
228.42^C		3/2		5/2	39 384	477 170		1.2−2	2.6+8	E	81*
225.40^C		3/2		1/2	39 384	483 040		1.2−2	7.9+8	E	81*
226.42^C	$3s^23p^3$	$^2P^o_{3/2}$	$3s^23p^2(^1D)3d$	$^2D_{3/2}$	73 552	515 210		6.8−3	2.2+8	E	81*
226.31^C		3/2		5/2	73 552	515 430		3.0−1	6.4+9	D	81*
224.08^C		1/2		3/2	68 945	515 210		1.8−1	5.9+9	D	81*
216.60	$3s^23p^3$	$^2P^o_{1/2}$	$3s^23p^2(^1D)3d$	$^2P_{1/2}$	68 945	530 620					22
215.86		3/2		3/2	73 552	536 800		1.4	4.8+10	E	22°,81*
213.75		1/2		3/2	68 945	536 800		4.0−1	1.5+10	E	22°,81*
211.64^C	$3s^23p^3$	$^2D^o_{5/2}$	$3s^23p^2(^1D)3d$	$^2D_{3/2}$	42 702	515 210		2.5−1	9.1+9	D	81*
211.54		5/2		5/2	42 702	515 430		1.9	4.6+10	D	22°,81*
210.16		3/2		3/2	39 384	515 210		1.4	5.5+10	D	22°,81*
210.06^C		3/2		5/2	39 384	515 430		6.8−2	1.7+9	D	81*
209.57	$3s^23p^3$	$^4S^o_{3/2}$	$3s^23p^2(^3P)3d$	$^4P_{5/2}$	0	477 170		3.0	7.7+10	D	22°,81*,26
208.02		3/2		3/2	0	480 720		2.0	7.9+10	D	22°,81*,26
207.02		3/2		1/2	0	483 040		1.1	8.3+10	D	22°,81*
204.98	$3s^23p^3$	$^2P^o_{3/2}$	$3s^23p^2(^3P)3d$	$^2D_{5/2}$	73 552	561 400					22
204.29		3/2		3/2	73 552	563 060					22
202.38		1/2		3/2	68 945	563 060					22
202.39^C	$3s^23p^3$	$^2D^o_{5/2}$	$3s^23p^2(^1D)3d$	$^2P_{3/2}$	42 702	536 800		2.4−2	9.8+8	E	81*

Mn XI (P sequence) – Continued

λ (Å)	Classification				Energy Levels (cm^{-1})		Int.	gf	A (s^{-1})	Acc.	References
201.04^{C}		$_{3/2}$		$_{3/2}$	39 384	536 800		2.6−2	1.1+9	E	81*
200.67	$3s^23p^3$	$^2D^\circ_{5/2}$	$3s^23p^2(^3P)3d$	$^2F_{7/2}$	42 702	541 030		4.7	9.7+10	E	22°,81*,2,3
194.01^{C}	$3s^23p^3$	$^4S^\circ_{3/2}$	$3s^23p^2(^1D)3d$	$^2D_{5/2}$	0	515 430		4.8−3	1.4+8	E	81*
99.356	$3s^23p^2(^1D)3d$	$^2G_{9/2}$	$3s^23p^2(^1D)4f$	$^2H^\circ_{11/2}$							20
99.02		$_{7/2}$		$_{9/2}$							20
99.02	$3s^23p^2(^1D)3d$	$^2F_{7/2}$	$3s^23p^2(^3P)4f$	$^2G^\circ_{9/2}$							20
98.064	$3s^23p^2(^3P)3d$	$^4F_{9/2}$	$3s^23p^2(^3P)4f$	$^4G^\circ_{11/2}$							20
98.023		$_{7/2}$		$_{9/2}$							20
95.390	$3s^23p^3$	$^2P^\circ_{3/2}$	$3s^23p^2(^1D)4s$	$^2D_{3/2}$	73 552	1 121 880					20
94.327	$3s^23p^3$	$^2D^\circ_{5/2}$	$3s^23p^2(^3P)4s$	$^2P_{3/2}$	42 702	1 102 840					20
92.75	$3s^23p^3$	$^2D^\circ_{5/2}$	$3s^23p^2(^1D)4s$	$^2D_{5/2}$	42 702	1 120 870					20
92.75	$3s^23p^3$	$^4S^\circ_{3/2}$	$3s^23p^2(^3P)4s$	$^4P_{1/2}$	0	1 078 200					20
92.240		$_{3/2}$		$_{3/2}$	0	1 084 130					20
91.646		$_{3/2}$		$_{5/2}$	0	1 091 160					20
78.056	$3s^23p^3$	$^2P^\circ_{1/2}$	$3s^23p^2(^3P)4d$	$^2D_{3/2}$	68 945	1 350 080					20
77.556	$3s^23p^3$	$^2P^\circ_{3/2}$	$3s^23p^2(^1D)4d$	$^2D_{5/2}$	73 552	1 362 940					20
77.402	$3s^23p^3$	$^2D^\circ_{3/2}$	$3s^23p^2(^3P)4d$	$^2F_{5/2}$	39 384	1 331 340					20
77.270		$_{5/2}$		$_{7/2}$	42 702	1 336 860					20
76.858	$3s^23p^3$	$^2P^\circ_{3/2}$	$3s^23p^2(^1D)4d$	$^2S_{1/2}$	73 552	1 374 650					20
76.763	$3s^23p^3$	$^2D^\circ_{5/2}$	$3s^23p^2(^3P)4d$	$^4D_{7/2}$	42 702	1 345 410					20
76.380	$3s^23p^3$	$^2D^\circ_{3/2}$	$3s^23p^2(^3P)4d$	$^2D_{5/2}$	39 384	1 348 630					20
75.879	$3s^23p^3$	$^2D^\circ_{5/2}$	$3s^23p^2(^1D)4d$	$^2F_{7/2}$	42 702	1 360 590					20
75.819		$_{5/2}$		$_{5/2}$	42 702	1 361 630					20
75.477	$3s^23p^3$	$^4S^\circ_{3/2}$	$3s^23p^2(^3P)4d$	$^4P_{5/2}$	0	1 324 910					20
75.059		$_{3/2}$		$_{3/2}$	0	1 332 280					20
75.227	$3s^23p^3$	$^4S^\circ_{3/2}$	$3s^23p^2(^3P)4d$	$^4F_{5/2}$	0	1 329 310					20

Mn XII (Si sequence)

λ (Å)	Classification				Energy Levels (cm^{-1})		Int.	gf	A (s^{-1})	Acc.	References
6660^{C}	$3s^23p^2$	$^3P_0$	$3s^23p^2$	$^3P_2$	0	15 010		E2	2.8−3	D−	81*
3685.5	$3s^23p^2$	$^3P_2$	$3s^23p^2$	$^1D_2$	15 010	42 140		M1	4.4+1	E	27°,81*,28
2861^{C}		$_1$		$_2$	7 200	42 140		M1	3.5+1	E	81*
2696^{C}	$3s3p^3$	$^3D^\circ_3$	$3s3p^3$	$^3P^\circ_1$	266 610	303 690		E2	1.6	D−	81*
2674^{C}		$_3$		$_2$	266 610	303 990		M1	5.4+1	E	81*
2554^{C}		$_2$		$_1$	264 550	303 690		E2	3.2−1	E	81*
2535^{C}		$_2$		$_2$	264 550	303 990		M1	4.3+1	E	81*
2457^{C}	$3s^23p^2$	$^1D_2$	$3s^23p^2$	$^1S_0$	42 140	82 830		E2	7.6	D−	81*
1474^{C}	$3s^23p^2$	$^3P_2$	$3s^23p^2$	$^1S_0$	15 010	82 830		E2	2.4	E	81*
1322.23		$_1$		$_0$	7 200	82 830		M1	6.2+2	E	29°,81*,24

Mn XII (Si sequence) – Continued

λ (Å)	Classification				Energy Levels (cm^{-1})		Int.	gf	A (s^{-1})	Acc.	References
552.84	$3s^23p^2$	$^3P_2$	$3s3p^3$	$^5S^\circ_2$	15 010	195 900					30
529.79		$_1$		$_2$	7 200	195 900					30
485.58^{C}	$3s3p^3$	$^3D^\circ_3$	$3s^23p3d$	$^3D^\circ_3$	266 610	472 550		M1	5.0+1	E	81*
445.49^{C}	$3s^23p^2$	$^1D_2$	$3s3p^3$	$^3D^\circ_3$	42 140	266 610		1.1−2	5.2+7	E	81*
400.74^{C}	$3s^23p^2$	$^3P_2$	$3s3p^3$	$^3D^\circ_2$	15 010	264 550		7.5−3	6.3+7	D−	81*
397.46		$_2$		$_3$	15 010	266 610		1.9−1	1.1+9	D	22°,81*,21
388.58		$_1$		$_2$	7 200	264 550		1.4−1	1.2+9	D	22°,81*
386.27		$_0$		$_1$	0	258 890					22
346.40^{C}	$3s^23p^2$	$^3P_2$	$3s3p^3$	$^3P^\circ_1$	15 010	303 690		4.7−2	8.6+8	D−	81*
346.04		$_2$		$_2$	15 010	303 990		2.4−1	2.7+9	D	22°,81*
337.29		$_1$		$_1$	7 200	303 690		7.8−2	1.5+9	D	22°,81*
336.94^{C}		$_1$		$_2$	7 200	303 990		3.6−2	4.2+8	D	81*
329.28		$_0$		$_1$	0	303 690		5.4−2	1.1+9	D	22°,81*
342.67	$3s^23p^2$	$^1D_2$	$3s3p^3$	$^1D^\circ_2$	42 140	333 970					22
275.78	$3s^23p^2$	$^1D_2$	$3s3p^3$	$^1P^\circ_1$	42 140	404 750					22
269.82	$3s^23p^2$	$^3P_2$	$3s3p^3$	$^3S^\circ_1$	15 010	385 630					22°,21
264.26		$_1$		$_1$	7 200	385 630					22
259.33		$_0$		$_1$	0	385 630					22
237.78	$3s^23p^2$	$^1D_2$	$3s^23p3d$	$^1D^\circ_2$	42 140	462 700					22
232.34^{C}	$3s^23p^2$	$^1D_2$	$3s^23p3d$	$^3D^\circ_3$	42 140	472 550		8.5−2	1.5+9	E	81*
228.61	$3s^23p^2$	$^3P_2$	$3s^23p3d$	$^3P^\circ_2$	15 010	452 420					22
224.62		$_1$		$_2$	7 200	452 420					22
217.39		$_0$		$_1$	0	460 000					22
223.56	$3s^23p^2$	$^1S_0$	$3s^23p3d$	$^1P^\circ_1$	82 830	530 140		1.2	5.2+10	D	22°,81*
219.54	$3s^23p^2$	$^3P_1$	$3s^23p3d$	$^1D^\circ_2$	7 200	462 700					22
218.70	$3s^23p^2$	$^3P_2$	$3s^23p3d$	$^3D^\circ_2$	15 010	472 260					22
218.56		$_2$		$_3$	15 010	472 550		3.0	6.1+10	D	22°,81*,26
216.12		$_1$		$_1$	7 200	469 900					22
215.03		$_1$		$_2$	7 200	472 260					22
212.81		$_0$		$_1$	0	469 900					22
210.43	$3s^23p^2$	$^1D_2$	$3s^23p3d$	$^1F^\circ_3$	42 140	517 360		3.0	6.4+10	C	22°,81*,26
199.06^{C}	$3s^23p^2$	$^3P_2$	$3s^23p3d$	$^1F^\circ_3$	15 010	517 360		8.5−2	2.1+9	E	81*
90.701	$3s^23p3d$	$^3F^\circ_3$	$3s^23p4f$	$^3G_4$							31°,20,40
90.373		$_4$		$_5$							31°,20,40
86.71	$3s^23p^2$	$^3P_2$	$3s^23p4s$	$^3P^\circ_1$	15 010	1 168 300					31°,40
85.72		$_2$		$_2$	15 010	1 181 300					31°,40
85.19		$_1$		$_2$	7 200	1 181 300					31°,40
71.69	$3s^23p^2$	$^1D_2$	$3s^23p4d$	$^1F^\circ_3$	42 140	1 437 000					32°,31,40
71.32	$3s^23p^2$	$^3P_2$	$3s^23p4d$	$^3D^\circ_3$	15 010	1 417 100					32°,31,40
71.04		$_1$		$_2$	7 200	1 414 900					32
70.72		$_0$		$_1$	0	1 414 000					32
70.89	$3s^23p^2$	$^3P_2$	$3s^23p4d$	$^3F^\circ_3$	15 010	1 425 600					32

Mn XIII (Al sequence)

λ (Å)	Classification		Energy Levels (cm^{-1})		Int.	*gf*	*A* (s^{-1})	Acc.	References
7130.7^{C}	$3s3p^2\ ^4\mathrm{P}_{1/2}$	$3s3p^2\ ^4\mathrm{P}_{5/2}$	208 443	222 463		E2	3.1−3	D−	81*
6536.3	$3s^23p\ ^2\mathrm{P}^{\circ}_{1/2}$	$3s^23p\ ^2\mathrm{P}^{\circ}_{3/2}$	0	15 295		M1	3.21+1	C+	27°,81*,28
559.397^{C}	$3s3p^2\ ^2\mathrm{P}_{3/2}$	$3p^3\ ^4\mathrm{S}^{\circ}_{3/2}$	367 434	546 198		8.4−3	4.4+7	E	81*
517.56	$3s^23p\ ^2\mathrm{P}^{\circ}_{3/2}$	$3s3p^2\ ^4\mathrm{P}_{1/2}$	15 295	208 443					30
501.20	3/2	3/2	15 295	214 550					30
482.55	3/2	5/2	15 295	222 463					30
479.27	1/2	1/2	0	208 443					30
438.145^{C}	$3s3p^2\ ^2\mathrm{P}_{3/2}$	$3p^3\ ^2\mathrm{P}^{\circ}_{1/2}$	367 434	595 669		3.7−2	6.4+8	E	81*
434.097^{C}	3/2	3/2	367 434	597 797		2.6−1	2.3+9	D	81*
425.038	1/2	1/2	360 396	595 669		1.6−1	2.9+9	D	34°,81*
397.599^{C}	$3s^23d\ ^2\mathrm{D}_{5/2}$	$3s3p(^3\mathrm{P}^{\circ})3d\ ^2\mathrm{F}^{\circ}_{5/2}$	442 217	693 727		4.0−2	2.8+8	E	81*
395.248^{C}	3/2	5/2	440 721	693 727		1.9−1	1.4+9	E	81*
379.269^{C}	5/2	7/2	442 217	705 882		3.4−1	2.0+9	E	81*
389.607^{C}	$3s3p^2\ ^2\mathrm{S}_{1/2}$	$3p^3\ ^2\mathrm{P}^{\circ}_{1/2}$	339 000	595 669		9.4−3	2.0+8	E	81*
386.403^{C}	1/2	3/2	339 000	597 797		1.5−1	1.7+9	D	81*
387.585	$3s3p^2\ ^2\mathrm{D}_{3/2}$	$3p^3\ ^2\mathrm{D}^{\circ}_{3/2}$	276 504	534 512					34
385.827	5/2	5/2	278 106	537 290		3.6−1	2.7+9	E	34°,81*
383.456^{C}	3/2	5/2	276 504	537 290		3.5−2	2.6+8	E	81*
382.835^{C}	$3s^23p\ ^2\mathrm{P}^{\circ}_{3/2}$	$3s3p^2\ ^2\mathrm{D}_{3/2}$	15 295	276 504		7.6−3	8.6+7	E	81*
380.501	3/2	5/2	15 295	278 106		2.2−1	1.7+9	D	34°,81*,21,22
361.659	1/2	3/2	0	276 504		1.5−1	1.9+9	D	34°,81*,21,22
370.791^{C}	$3s3p^2\ ^2\mathrm{D}_{3/2}$	$3p^3\ ^4\mathrm{S}^{\circ}_{3/2}$	276 504	546 198		6.0−3	7.2+7	E	81*
322.692^{C}	$3s^23d\ ^2\mathrm{D}_{5/2}$	$3s3p(^3\mathrm{P}^{\circ})3d\ ^2\mathrm{P}^{\circ}_{3/2}$	442 217	752 110		1.8−2	3.0+8	E	81*
321.142^{C}	3/2	3/2	440 721	752 110		2.4−2	4.0+8	E	81*
313.801	$3s^23d\ ^2\mathrm{D}_{5/2}$	$3s3p(^1\mathrm{P}^{\circ})3d\ ^2\mathrm{F}^{\circ}_{7/2}$	442 217	760 893		2.7	2.4+10	E	34°,81*
311.287^{C}	5/2	5/2	442 217	763 464		8.4−2	1.0+9	E	81*
309.857	3/2	5/2	440 721	763 464		2.0	2.4+10	E	34°,81*
313.337	$3s3p^2\ ^2\mathrm{D}_{3/2}$	$3p^3\ ^2\mathrm{P}^{\circ}_{1/2}$	276 504	595 669		3.4−1	1.2+10	D	34°,81*
312.802	5/2	3/2	278 106	597 797		5.3−1	9.3+9	D	34°,81*
311.242^{C}	3/2	3/2	276 504	597 797		6.8−2	1.2+9	D	81*
308.923	$3s^23p\ ^2\mathrm{P}^{\circ}_{3/2}$	$3s3p^2\ ^2\mathrm{S}_{1/2}$	15 295	339 000		4.8−2	1.6+9	D	81*
294.985	1/2	1/2	0	339 000		3.8−1	1.4+10	D	34°,81*,22
308.895	$3s3p^2\ ^4\mathrm{P}_{5/2}$	$3p^3\ ^4\mathrm{S}^{\circ}_{3/2}$	222 463	546 198		8.4−1	1.5+10	D	33°,81*,21,22
301.525	3/2	3/2	214 550	546 198		6.0−1	1.1+10	D	33°,81*
296.073	1/2	3/2	208 443	546 198		3.0−1	5.9+9	D	33°,81*
293.581	$3s^23d\ ^2\mathrm{D}_{5/2}$	$3s3p(^1\mathrm{P}^{\circ})3d\ ^2\mathrm{D}^{\circ}_{3/2}$	442 217	782 835					34
290.539	5/2	5/2	442 217	786 410		1.4	1.9+10	E	34°,81*
289.277^{C}	3/2	5/2	440 721	786 410		3.2−2	4.4+8	E	81*
293.268	$3s^23d\ ^2\mathrm{D}_{3/2}$	$3s3p(^1\mathrm{P}^{\circ})3d\ ^2\mathrm{P}^{\circ}_{1/2}$	440 721	781 681		7.6−1	3.0+10	D	34°,81*
290.114	3/2	3/2	440 721	785 399					34
289.774	$3s^23p\ ^2\mathrm{P}^{\circ}_{3/2}$	$3s3p^2\ ^2\mathrm{P}_{1/2}$	15 295	360 396		4.8−1	1.9+10	D	34°,81*,13,22
283.984	3/2	3/2	15 295	367 434		1.49	3.08+10	C−	34°,81*,13,21,22
277.469	1/2	1/2	0	360 396		3.2−1	1.4+10	D	34°,81*,13,21,22
272.154	1/2	3/2	0	367 434		3.00−1	6.8+9	C−	34°,81*,13,21,22
274.559^{C}	$3s3p^2\ ^2\mathrm{D}_{5/2}$	$3s3p(^3\mathrm{P}^{\circ})3d\ ^4\mathrm{P}^{\circ}_{5/2}$	278 106	642 326		4.6−2	6.8+8	E	81*
266.597^{C}	$3s3p^2\ ^2\mathrm{D}_{5/2}$	$3s3p(^3\mathrm{P}^{\circ})3d\ ^4\mathrm{D}^{\circ}_{7/2}$	278 106	653 204		2.0−2	2.3+8	E	81*

Mn XIII (Al sequence) — Continued

λ (Å)	Classification		Energy Levels (cm^{-1})		Int.	*gf*	*A* (s^{-1})	Acc.	References
266.429^{C}	$3s3p^2$ $^4P_{5/2}$	$3p^3$ $^2P^\circ_{3/2}$	222 463	597 797		6.6−3	1.6+8	E	81*
260.928^{C}	$3/2$	$3/2$	214 550	597 797		1.3−2	3.3+8	E	81*
256.836^{C}	$1/2$	$3/2$	208 443	597 797		5.6−3	1.5+8	E	81*
259.959^{C}	$3s3p^2$ $^2P_{3/2}$	$3s3p(^3P^\circ)3d$ $^2P^\circ_{3/2}$	367 434	752 110		4.0−1	1.1+10	D	81*
255.288^{C}	$1/2$	$3/2$	360 396	752 110		2.4−2	6.2+8	D	81*
257.234	$3s3p^2$ $^2D_{5/2}$	$3s3p(^3P^\circ)3d$ $^2D^\circ_{5/2}$	278 106	666 857					34
256.497	$3/2$	$3/2$	276 504	666 372					34
252.506^{C}	$3s3p^2$ $^2P_{3/2}$	$3s3p(^1P^\circ)3d$ $^2F^\circ_{5/2}$	367 434	763 464		1.2−2	2.1+8	E	81*
242.066	$3s3p^2$ $^2S_{1/2}$	$3s3p(^3P^\circ)3d$ $^2P^\circ_{3/2}$	339 000	752 110		1.3	3.8+10	D	34°,81*
241.402^{C}	$3s3p^2$ $^2P_{3/2}$	$3s3p(^1P^\circ)3d$ $^2P^\circ_{1/2}$	367 434	781 681		1.42−1	8.5+9	C−	81*
239.255	$3/2$	$3/2$	367 434	785 399					34
237.369	$1/2$	$1/2$	360 396	781 681		1.1−1	6.7+9	D	34°,81*
240.604^{C}	$3s3p^2$ $^2D_{5/2}$	$3s3p(^3P^\circ)3d$ $^2F^\circ_{5/2}$	278 106	693 727		1.1−1	2.2+9	E	81*
239.680	$3/2$	$5/2$	276 504	693 727		6.4−1	1.3+10	E	34°,81*
233.767	$5/2$	$7/2$	278 106	705 882		9.6−1	1.6+10	E	34°,81*
238.675	$3s3p^2$ $^2P_{3/2}$	$3s3p(^1P^\circ)3d$ $^2D^\circ_{5/2}$	367 434	786 410		2.9	5.9+10	E	34°,81*
236.723	$1/2$	$3/2$	360 396	782 835					34
238.173^{C}	$3s3p^2$ $^4P_{5/2}$	$3s3p(^3P^\circ)3d$ $^4P^\circ_{5/2}$	222 463	642 326		1.7−1	3.4+9	E	81*
233.767	$3/2$	$5/2$	214 550	642 326		1.1	2.3+10	E	34°,81*
228.264	$3/2$	$1/2$	214 550	652 639		4.0−1	2.8+10	D	34°,81*
227.445	$3/2$	$3/2$	214 550	654 217					34
225.126^{C}	$1/2$	$1/2$	208 443	652 639		8.2−3	5.6+8	E	81*
235.054	$3s^23p$ $^2P^\circ_{3/2}$	$3s^23d$ $^2D_{3/2}$	15 295	440 721		2.4−1	7.4+9	D	34°,81*,22
234.235	$3/2$	$5/2$	15 295	442 217		1.8	3.7+10	D	34°,81*,22,26
226.905	$1/2$	$3/2$	0	440 721		1.0	3.3+10	D	34°,81*,22,26
232.158	$3s3p^2$ $^4P_{5/2}$	$3s3p(^3P^\circ)3d$ $^4D^\circ_{7/2}$	222 463	653 204		2.48	3.94+10	C−	34°,81*,22
231.868	$5/2$	$5/2$	222 463	653 730		1.2	2.5+10	D	34°,81*
229.355	$1/2$	$3/2$	208 443	644 448					34
228.500	$1/2$	$1/2$	208 443	646 080		6.0−1	3.9+10	D	34°,81*
227.704	$3/2$	$5/2$	214 550	653 730		5.2−1	1.2+10	D	34°,81*
225.896^{C}	$3s3p^2$ $^2S_{1/2}$	$3s3p(^1P^\circ)3d$ $^2P^\circ_{1/2}$	339 000	781 681		2.6−1	1.8+10	D	81*
207.130	$3s3p^2$ $^2D_{5/2}$	$3s3p(^1P^\circ)3d$ $^2F^\circ_{7/2}$	278 106	760 893		1.4	2.8+10	E	34°,81*
206.033^{C}	$5/2$	$5/2$	278 106	763 464		5.5−2	1.5+9	E	81*
205.350	$3/2$	$5/2$	276 504	763 464		9.6−1	2.7+10	E	34°,81*
206.860^{C}	$3s3p^2$ $^4P_{5/2}$	$3s3p(^3P^\circ)3d$ $^2F^\circ_{7/2}$	222 463	705 882		1.5−2	3.0+8	E	81*
197.950^{C}	$3s3p^2$ $^2D_{3/2}$	$3s3p(^1P^\circ)3d$ $^2P^\circ_{1/2}$	276 504	781 681		1.9−3	1.7+8	E	81*
185.725^{C}	$3s3p^2$ $^4P_{5/2}$	$3s3p(^1P^\circ)3d$ $^2F^\circ_{7/2}$	222 463	760 893		9.6−3	2.5+8	E	81*
183.936^{C}	$3s3p^2$ $^4P_{1/2}$	$3s3p(^3P^\circ)3d$ $^2P^\circ_{3/2}$	208 443	752 110		4.6−3	2.4+8	E	81*
87.40	$3s^23d$ $^2D_{5/2}$	$3s^24f$ $^2F^\circ_{7/2}$	442 217	1 586 400					20
87.30	$3/2$	$5/2$	440 721	1 586 200					20
83.52	$3s3p3d$ $^4F^\circ_{7/2}$	$3s3p4f$ $^4G_{9/2}$							20
83.41	$5/2$	$7/2$							20
83.23	$9/2$	$11/2$							20
79.16	$3s3p^2$ $^4P_{5/2}$	$3s3p4s$ $^4P^\circ_{5/2}$	222 463	1 485 730					20
67.215	$3s^23p$ $^2P^\circ_{3/2}$	$3s^24d$ $^2D_{5/2}$	15 295	1 503 060					35
66.574	$1/2$	$3/2$	0	1 502 090					35

Mn xiv (Mg sequence)

λ (Å)	Classification				Energy Levels (cm^{-1})		Int.	*gf*	*A* (s^{-1})	Acc.	References
582.12	$3s3d$	${}^1D_2$	$3p3d$	${}^1D^\circ_2$	711 986	883 772	3	1.7−1		D−	37°,81*
518.05	$3s3p$	${}^1P^\circ_1$	$3p^2$	${}^1D_2$	328 042	521 074	6	2.9−1	1.4+9	E	37°,81*,21,31,40
471.94	$3s3p$	${}^1P^\circ_1$	$3p^2$	${}^3P_2$	328 042	539 919	3				37
430.61	$3s3d$	${}^3D_2$	$3p3d$	${}^3F^\circ_2$	634 185	866 417	1	1.1−1		D	37°,81*
429.13		$_1$		$_2$	633 381	866 417	4	4.2−1	3.0+9	D−	37°,81*,21
418.51		$_3$		$_3$	635 446	874 367	4	1.55−1		C	37°,81*
416.35		$_2$		$_3$	634 185	874 367	5	7.0−1	3.8+9	C−	37°,81*,21
402.96		$_3$		$_4$	635 446	883 609	7	1.15	5.3+9	C	37°,81*,21
358.31	$3s3d$	${}^1D_2$	$3p3d$	${}^1F^\circ_3$	711 986	991 071	7	2.2		D−	37°,81*
354.29	$3s3d$	${}^3D_3$	$3p3d$	${}^3P^\circ_2$	635 446	917 698	5				37
339.10		$_1$		$_1$	633 381	928 282	3				37
352.73	$3s3d$	${}^3D_2$	$3p3d$	${}^3D^\circ_1$	634 185	917 685	5				37
342.58		$_3$		$_3$	635 446	927 351	8	8.4−1	6.8+9	C−	37°,81*,21
339.60		$_2$		$_2$	634 185	928 654	6				37
349.67	$3s3p$	${}^1P^\circ_1$	$3p^2$	${}^1S_0$	328 042	614 024	7	3.3−1	1.8+10	C	37°,81*,21
349.44	$3s3p$	${}^3P^\circ_2$	$3p^2$	${}^1D_2$	234 905	521 074	6	1.4−1	1.6+9	E	37°,81*
335.98		$_1$		$_2$	223 438	521 074	5	7.2−2	8.6+8	E	37°,81*
343.84	$3s3d$	${}^1D_2$	$3p3d$	${}^1P^\circ_1$	711 986	1 002 823	4	6.0−1		D−	37°,81*
343.43	$3s3p$	${}^3P^\circ_2$	$3p^2$	${}^3P_1$	234 905	526 089	7	3.5−1	6.7+9	C	37°,81*,13,22
339.25		$_1$		$_0$	223 438	518 209	5	2.9−1	1.7+10	C−	37°,81*,13,22
330.41		$_1$		$_1$	223 438	526 089	6	2.2−1	4.5+9	C	37°,81*,13,22
327.85		$_2$		$_2$	234 905	539 919	8	9.0−1	1.1+10	D−	37°,81*,13,22
325.22		$_0$		$_1$	218 604	526 089	7	3.0−1	6.3+9	C	37°,81*,13,22
315.98		$_1$		$_2$	223 438	539 919	6	2.9−1	3.9+9	D−	37°,81*,13,22
327.288	$3p3d$	${}^1P^\circ_1$	$3d^2$	${}^1D_2$	1 002 823	1 308 364					39
311.639	$3p3d$	${}^1F^\circ_3$	$3d^2$	${}^1G_4$	991 071	1 311 955	5				39°,38
304.84	$3s^2$	${}^1S_0$	$3s3p$	${}^1P^\circ_1$	0	328 042	10	8.63−1	2.06+10	C+	37°,81*,13,22, 26,36
289.56	$3p^2$	${}^1D_2$	$3p3d$	${}^3F^\circ_2$	521 074	866 417	2				37
285.492	$3p3d$	${}^3P^\circ_1$	$3d^2$	${}^3F_2$	928 282	1 278 547	2				39
276.131		$_2$		$_3$	917 698	1 279 838	3				39°,38
284.752	$3p3d$	${}^3D^\circ_2$	$3d^2$	${}^3F_3$	928 654	1 279 838	3				39°,38
282.444		$_3$		$_4$	927 351	1 281 415	5				39°,38
277.11		$_1$		$_2$	917 685	1 278 547	3				38
275.71	$3p^2$	${}^1D_2$	$3p3d$	${}^1D^\circ_2$	521 074	883 772	5				37
264.71	$3p^2$	${}^3P_2$	$3p3d$	${}^3P^\circ_2$	539 919	917 698	4				37
255.36		$_1$		$_2$	526 089	917 698	5				37
248.87		$_1$		$_0$	526 089	927 907	3				37
248.63		$_1$		$_1$	526 089	928 282	3				37
260.45	$3s3p$	${}^1P^\circ_1$	$3s3d$	${}^1D_2$	328 042	711 986	7	1.9	3.8+10	D−	37°,81*,21, 31,40
258.10	$3p^2$	${}^3P_2$	$3p3d$	${}^3D^\circ_3$	539 919	927 351	6				37
257.24		$_2$		$_2$	539 919	928 654	7*bl*				37
250.33		$_0$		$_1$	518 209	917 685	3				37
248.41		$_1$		$_2$	526 089	928 654	3				37

Mn XIV (Mg sequence) – Continued

λ (Å)	Classification				Energy Levels (cm^{-1})		Int.	*gf*	*A* (s^{-1})	Acc.	References
257.24	$3p^2$	$^1S_0$	$3p3d$	$^1P^\circ_1$	614 024	1 002 823	7*bl*				37
251.361	$3p3d$	$^3F^\circ_4$	$3d^2$	$^3F_4$	883 609	1 281 415	6				39°,38
246.633		3		3	874 367	1 279 838	3				39°,38
242.646		2		2	866 417	1 278 547	1				39
250.45	$3s3p$	$^3P^\circ_2$	$3s3d$	$^3D_2$	234 905	634 185	3	2.4−1		C−	37°,81*
249.66		2		3	234 905	635 446	7	1.34	2.05+10	C−	37°,81*,26
243.93		1		1	223 438	633 381	3	2.4−1	9.1+9	C−	37°,81*,26
243.46		1		2	223 438	634 185	6	7.2−1	1.6+10	C−	37°,81*,26
241.10		0		1	218 604	633 381	6	3.3−1	1.3+10	C−	37°,81*,26
246.14	$3p^2$	$^1D_2$	$3p3d$	$^3D^\circ_3$	521 074	927 351	3				37
235.520	$3p3d$	$^1D^\circ_2$	$3d^2$	$^1D_2$	883 772	1 308 364	4				39
221.65	$3p^2$	$^3P_2$	$3p3d$	$^1F^\circ_3$	539 919	991 071	2				37
212.77	$3p^2$	$^1D_2$	$3p3d$	$^1F^\circ_3$	521 074	991 071	4				37
84.09	$3s3d$	$^1D_2$	$3s4f$	$^1F^\circ_3$	711 986	1 901 300					20
83.78	$3p3d$	$^1F^\circ_3$	$3p4f$	$^1G_4$	991 071	2 184 700					20
81.05	$3p3d$	$^3D^\circ_3$	$3p4f$	$^3F_4$	927 351	2 161 200					20
81.05		1		2	917 685	2 151 500					20
80.46	$3p3d$	$^3D^\circ_3$	$3p4f$	$^3D_3$	927 351	2 170 200					20
80.27		2		2	928 654	2 174 400					20
80.06	$3p3d$	$^3P^\circ_0$	$3p4f$	$^3D_1$	927 907	2 177 200					20
80.06		1		1	928 282	2 177 200					20
79.826	$3s3d$	$^3D_3$	$3s4f$	$^3F^\circ_4$	635 446	1 888 200	3				35
79.761		2		3	634 185	1 887 900	2				35
79.720		1		2	633 381	1 887 800	1				35
79.10	$3p3d$	$^1D^\circ_2$	$3p4f$	$^3F_3$	883 772	2 148 000					20
78.54	$3p3d$	$^3F^\circ_3$	$3p4f$	$^3G_4$	874 367	2 147 600					20
78.42		2		3	866 417	2 141 600					20
78.35		4		5	883 609	2 159 900					20
75.94	$3p^2$	$^3P_2$	$3p4s$	$^3P^\circ_2$	539 919	1 856 700					40
74.961	$3s3p$	$^3P^\circ_2$	$3s4s$	$^3S_1$	234 905	1 568 900					35
74.327		1		1	223 438	1 568 900					35
74.063		0		1	218 604	1 568 900					35
72.45	$3p^2$	$^1D_2$	$3s4f$	$^1F^\circ_3$	521 074	1 901 300					31°,40
67.02	$3s3p$	$^1P^\circ_1$	$3s4d$	$^1D_2$	328 042	1 820 100					31°,40,20
64.23	$3p^2$	$^3P_2$	$3p4d$	$^3D^\circ_3$	539 919	2 096 800					40
64.03		1		2	526 089	2 087 900					40
63.46	$3p^2$	$^1D_2$	$3p4d$	$^3F^\circ_3$	521 074	2 096 900					40
63.45	$3p^2$	$^1D_2$	$3p4d$	$^1F^\circ_3$	521 074	2 097 100					40
63.23	$3p^2$	$^3P_2$	$3p4d$	$^3P^\circ_2$	539 919	2 121 400					40
63.146	$3s3p$	$^3P^\circ_2$	$3s4d$	$^3D_2$	234 905	1 818 500					35
63.109		2		3	234 905	1 819 500					35
62.713		1		1	223 438	1 818 000					35
62.694		1		2	223 438	1 818 500					35
62.526		0		1	218 604	1 818 000					35

Mn xiv (Mg sequence) – Continued

λ (Å)	Classification				Energy Levels (cm^{-1})		Int.	*gf*	*A* (s^{-1})	Acc.	References
59.325	$3s^2$	$^1S_0$	$3s4p$	$^1P^{\circ}_1$	0	1 685 600		3.55 − 1	2.24 + 11	C	35°,81*
58.19	$3s3p$	$^3P^{\circ}_2$	$3p4p$	$^3P_1$	234 905	1 953 400					40
57.81		$_2$		$_2$	234 905	1 964 700					40
57.97	$3s3p$	$^3P^{\circ}_2$	$3p4p$	$^3D_3$	234 905	1 959 900					40
57.71	$3s3p$	$^3P^{\circ}_2$	$3p4p$	$^3S_1$	234 905	1 967 700					40
57.224	$3s3d$	$^3D_3$	$3s5f$	$^3F^{\circ}_4$	635 446	2 383 000					35°,40
50.03	$3s3p$	$^3P^{\circ}_2$	$3s5s$	$^3S_1$	234 905	2 233 700					40
49.63	$3s3d$	$^3D_3$	$3s6f$	$^3F^{\circ}_4$	635 446	2 650 400					40
49.42	$3s3p$	$^1P^{\circ}_1$	$3s5d$	$^1D_2$	328 042	2 351 500					40
47.93	$3s3p$	$^3P^{\circ}_2$	$3s5d$	$^3D_3$	234 905	2 321 300					40
47.67		$_1$		$_2$	223 438	2 321 200					40
47.38		$_0$		$_1$	218 604	2 329 200					40
43.74	$3s^2$	$^1S_0$	$3s5p$	$^1P^{\circ}_1$	0	2 286 200		1.12 − 1	1.3 + 11	C	40°,81*
43.00	$3s3p$	$^3P^{\circ}_2$	$3s6s$	$^3S_1$	234 905	2 560 500					40
41.72	$3s3p$	$^3P^{\circ}_2$	$3s6d$	$^3D_3$	234 905	2 631 800					40
41.51		$_1$		$_2$	223 438	2 632 500					40
38.54	$3s^2$	$^1S_0$	$3s6p$	$^1P^{\circ}_1$	0	2 594 700					40

Mn xv (Na sequence)

λ (Å)	Classification				Energy Levels (cm^{-1})		Int.	*gf*	*A* (s^{-1})	Acc.	References
971.8^{C}	$2p^64s$	$^2S_{1/2}$	$2p^64p$	$^2P^{\circ}_{1/2}$	1 667 500	1 770 400		3.8 − 1	1.3 + 9	C	81*
912.4^{C}		$_{1/2}$		$_{3/2}$	1 667 500	1 777 100		7.6 − 1	1.5 + 9	C	81*
771.0^{C}	$2p^64p$	$^2P^{\circ}_{3/2}$	$2p^64d$	$^2D_{3/2}$	1 777 100	1 906 800		1.8 − 1	4.9 + 8	C	81*
765.1^{C}		$_{3/2}$		$_{5/2}$	1 777 100	1 907 800		1.6	3.0 + 9	C	81*
733.1^{C}		$_{1/2}$		$_{3/2}$	1 770 400	1 906 800		9.2 − 1	2.9 + 9	C	81*
384.743^{P}	$2p^63s$	$^2S_{1/2}$	$2p^63p$	$^2P^{\circ}_{1/2}$	0	259 914		2.60 − 1	5.87 + 9	B	42°,81*,13,36,41
360.987^{P}		$_{1/2}$		$_{3/2}$	0	277 018		5.62 − 1	7.19 + 9	B	42°,81*,13,26
360.4^{C}	$2p^65d$	$^2D_{3/2}$	$2p^66p$	$^2P^{\circ}_{1/2}$	2 491 100	2 768 600		4.8 − 1	1.3 + 10	C	81*
359.1^{C}		$_{5/2}$		$_{3/2}$	2 491 700	2 770 200		9.00 − 1	1.16 + 10	C	81*
358.3^{C}		$_{3/2}$		$_{3/2}$	2 491 100	2 770 200		1.0 − 1	1.3 + 9	D	81*
349.3^{C}	$2p^65f$	$^2F^{\circ}_{5/2}$	$2p^66d$	$^2D_{3/2}$	2 519 000	2 805 300		2.7 − 1	3.7 + 9	C	81*
349.2^{C}		$_{7/2}$		$_{5/2}$	2 519 300	2 805 700		3.8 − 1	3.5 + 9	C	81*
348.8^{C}		$_{5/2}$		$_{5/2}$	2 519 000	2 805 700		1.9 − 2	1.7 + 8	D	81*
318.6^{C}	$2p^65p$	$^2P^{\circ}_{3/2}$	$2p^66s$	$^2S_{1/2}$	2 428 100	2 742 000		6.4 − 1	2.0 + 10	C	81*
315.1^{C}		$_{1/2}$		$_{1/2}$	2 424 600	2 742 000		3.2 − 1	1.1 + 10	C	81*
303.2^{C}	$2p^65d$	$^2D_{5/2}$	$2p^66f$	$^2F^{\circ}_{5/2}$	2 491 700	2 821 500		1.8 − 1	2.2 + 9	D	81*
302.9^{C}		$_{5/2}$		$_{7/2}$	2 491 700	2 821 800		3.7	3.4 + 10	C	81*
302.7^{C}		$_{3/2}$		$_{5/2}$	2 491 100	2 821 500		2.6	3.2 + 10	C	81*
282.184^{P}	$2p^63p$	$^2P^{\circ}_{3/2}$	$2p^63d$	$^2D_{3/2}$	277 018	631 398		1.17 − 1	2.46 + 9	B	42°,81*,13,26
280.411^{P}		$_{3/2}$		$_{5/2}$	277 018	633 637		1.07	1.51 + 10	B	42°,81*,13,26
269.189^{P}		$_{1/2}$		$_{3/2}$	259 914	631 398		6.20 − 1	1.43 + 10	B	42°,81*,13,26

Mn XV (Na sequence) – Continued

λ (Å)	Classification		Energy Levels (cm^{-1})		Int.	*gf*	*A* (s^{-1})	Acc.	References
265.1^{C}	$2p^{6}5p$ $^{2}P^{o}_{3/2}$	$2p^{6}6d$ $^{2}D_{3/2}$	2 428 100	2 805 300		9.6−2	2.3+9	D	81*
264.8^{C}	$_{3/2}$	$_{5/2}$	2 428 100	2 805 700		8.4−1	1.3+10	C	81*
262.7^{C}	$_{1/2}$	$_{3/2}$	2 424 600	2 805 300		4.78−1	1.15+10	C	81*
254.2^{C}	$2p^{6}5s$ $^{2}S_{1/2}$	$2p^{6}6p$ $^{2}P^{o}_{1/2}$	2 375 200	2 768 600		1.6−1	8.5+9	C	81*
253.2^{C}	$_{1/2}$	$_{3/2}$	2 375 200	2 770 200		3.30−1	8.6+9	C	81*
210.6^{C}	$2p^{6}5f$ $^{2}F^{o}_{7/2}$	$2p^{6}7d$ $^{2}D_{5/2}$	2 519 300	2 994 200		6.8−2	1.7+9	D	81*
210.6^{C}	$_{5/2}$	$_{3/2}$	2 519 000	2 993 900		4.7−2	1.8+9	D	81*
210.4^{C}	$_{5/2}$	$_{5/2}$	2 519 000	2 994 200		3.5−3	8.7+7	E	81*
207.7^{C}	$2p^{6}5d$ $^{2}D_{5/2}$	$2p^{6}7p$ $^{2}P^{o}_{3/2}$	2 491 700	2 973 100		1.55−1	6.0+9	C	81*
207.5^{C}	$_{3/2}$	$_{1/2}$	2 491 100	2 973 100		8.8−2	6.7+9	C	81*
207.5^{C}	$_{3/2}$	$_{3/2}$	2 491 100	2 973 100		1.8−2	6.8+8	D	81*
195.3^{C}	$2p^{6}5d$ $^{2}D_{5/2}$	$2p^{6}7f$ $^{2}F^{o}_{5/2}$	2 491 700	3 003 800		5.0−2	1.5+9	D	81*
195.2^{C}	$_{5/2}$	$_{7/2}$	2 491 700	3 004 100		1.0	2.2+10	C	81*
195.0^{C}	$_{3/2}$	$_{5/2}$	2 491 100	3 003 800		6.96−1	2.04+10	C	81*
193.1^{C}	$2p^{6}4d$ $^{2}D_{3/2}$	$2p^{6}5p$ $^{2}P^{o}_{1/2}$	1 906 800	2 424 600		3.2−1	2.8+10	C	81*
192.2^{C}	$_{5/2}$	$_{3/2}$	1 907 800	2 428 100		5.5−1	2.5+10	C	81*
191.8^{C}	$_{3/2}$	$_{3/2}$	1 906 800	2 428 100		6.0−2	2.8+9	D	81*
190^{C}	$2p^{6}5p$ $^{2}P^{o}_{3/2}$	$2p^{6}7s$ $^{2}S_{1/2}$	2 428 100	2 953 000		1.2−1	1.1+10	C	81*
189^{C}	$_{1/2}$	$_{1/2}$	2 424 600	2 953 000		6.16−2	5.7+9	C	81*
188.9^{C}	$2p^{6}4f$ $^{2}F^{o}_{5/2}$	$2p^{6}5d$ $^{2}D_{3/2}$	1 961 600	2 491 100		1.1−1	5.1+9	C	81*
188.8^{C}	$_{7/2}$	$_{5/2}$	1 962 000	2 491 700		1.6−1	4.9+9	C	81*
188.6^{C}	$_{5/2}$	$_{5/2}$	1 961 600	2 491 700		7.8−3	2.5+8	D	81*
178.69	$2p^{6}4f$ $^{2}F^{o}_{7/2}$	$2p^{6}5g$ $^{2}G_{9/2}$	1 962 000	2 521 630					45
178.61	$_{5/2}$	$_{7/2}$	1 961 600	2 521 480					45
176.7^{C}	$2p^{6}5p$ $^{2}P^{o}_{3/2}$	$2p^{6}7d$ $^{2}D_{3/2}$	2 428 100	2 993 900		3.3−2	1.7+9	D	81*
176.6^{C}	$_{3/2}$	$_{5/2}$	2 428 100	2 994 200		2.9−1	1.0+10	C	81*
175.7^{C}	$_{1/2}$	$_{3/2}$	2 424 600	2 993 900		1.7−1	9.1+9	C	81*
167.2^{C}	$2p^{6}4p$ $^{2}P^{o}_{3/2}$	$2p^{6}5s$ $^{2}S_{1/2}$	1 777 100	2 375 200		4.40−1	5.20+10	C	81*
165.3^{C}	$_{1/2}$	$_{1/2}$	1 770 400	2 375 200		2.22−1	2.71+10	C	81*
163.7^{C}	$2p^{6}5d$ $^{2}D_{5/2}$	$2p^{6}8p$ $^{2}P^{o}_{3/2}$	2 491 700	3 102 700		5.8−2	3.6+9	D	81*
163.5^{C}	$_{3/2}$	$_{1/2}$	2 491 100	3 102 700		3.2−2	3.9+9	D	81*
163.5^{C}	$_{3/2}$	$_{3/2}$	2 491 100	3 102 700		6.4−3	4.1+8	E	81*
163.63^{C}	$2p^{6}4d$ $^{2}D_{5/2}$	$2p^{6}5f$ $^{2}F^{o}_{7/2}$	1 907 800	2 519 300		4.1	1.3+11	C	45°,81*
163.6^{C}	$_{5/2}$	$_{5/2}$	1 907 800	2 519 000		2.0−1	8.5+9	D	81*
163.41	$_{3/2}$	$_{5/2}$	1 906 800	2 519 000		3.0	1.2+11	C	45°,81*
158.38^{C}	$2p^{6}3s$ $^{2}S_{1/2}$	$2p^{6}3d$ $^{2}D_{3/2}$	0	631 398		E2	6.1+5	C	81*
157.82^{C}	$_{1/2}$	$_{5/2}$	0	633 637		E2	6.2+5	C	81*
146^{C}	$2p^{6}5p$ $^{2}P^{o}_{3/2}$	$2p^{6}8d$ $^{2}D_{3/2}$	2 428 100	3 114 000		1.6−2	1.3+9	D	81*
145^{C}	$_{3/2}$	$_{5/2}$	2 428 100	3 115 600		1.5−1	7.7+9	C	81*
145^{C}	$_{1/2}$	$_{3/2}$	2 424 600	3 114 000		8.24−2	6.5+9	C	81*
140.1^{C}	$2p^{6}4p$ $^{2}P^{o}_{3/2}$	$2p^{6}5d$ $^{2}D_{3/2}$	1 777 100	2 491 100		1.0−1	8.7+9	D	81*
139.9^{C}	$_{3/2}$	$_{5/2}$	1 777 100	2 491 700		9.2−1	5.2+10	C	81*
138.8^{C}	$_{1/2}$	$_{3/2}$	1 770 400	2 491 100		5.0−1	4.4+10	C	81*
132.1^{C}	$2p^{6}4s$ $^{2}S_{1/2}$	$2p^{6}5p$ $^{2}P^{o}_{1/2}$	1 667 500	2 424 600		1.5−1	2.9+10	C	81*
131.5^{C}	$_{1/2}$	$_{3/2}$	1 667 500	2 428 100		3.08−1	2.96+10	C	81*
116.0^{C}	$2p^{6}4d$ $^{2}D_{5/2}$	$2p^{6}6p$ $^{2}P^{o}_{3/2}$	1 907 800	2 770 200		9.6−2	1.2+10	C	81*
116.0^{C}	$_{3/2}$	$_{1/2}$	1 906 800	2 768 600		5.2−2	1.3+10	C	81*
115.8^{C}	$_{3/2}$	$_{3/2}$	1 906 800	2 770 200		1.0−2	1.3+9	D	81*

Mn xv (Na sequence) – Continued

λ (Å)	Classification				Energy Levels (cm^{-1})		Int.	gf	A (s^{-1})	Acc.	References
109.4^{C}	$2p^64d$	$^2D_{5/2}$	$2p^66f$	$^2F^\circ_{7/2}$	1 907 800	2 821 800		1.0	7.2+10	C	81*
109.4^{C}		$_{5/2}$		$_{5/2}$	1 907 800	2 821 500		5.0−2	4.6+9	D	81*
109.3^{C}		$_{3/2}$		$_{5/2}$	1 906 800	2 821 500		7.2−1	6.7+10	C	81*
103.6^{C}	$2p^64p$	$^2P^\circ_{3/2}$	$2p^66s$	$^2S_{1/2}$	1 777 100	2 742 000		8.64−2	2.68+10	C	81*
102.9^{C}		$_{1/2}$		$_{1/2}$	1 770 400	2 742 000		4.34−2	1.37+10	C	81*
97.257^{C}	$2p^64p$	$^2P^\circ_{3/2}$	$2p^66d$	$^2D_{3/2}$	1 777 100	2 805 300		3.4−2	6.1+9	D	81*
97.220^{C}		$_{3/2}$		$_{5/2}$	1 777 100	2 805 700		3.1−1	3.7+10	C	81*
96.628^{C}		$_{1/2}$		$_{3/2}$	1 770 400	2 805 300		1.8−1	3.2+10	C	81*
96.880^{C}	$2p^64f$	$^2F^\circ_{7/2}$	$2p^67d$	$^2D_{5/2}$	1 962 000	2 994 200		9.6−3	1.2+9	D	81*
96.871^{C}		$_{5/2}$		$_{3/2}$	1 961 600	2 993 900		6.6−3	1.2+9	D	81*
96.843^{C}		$_{5/2}$		$_{5/2}$	1 961 600	2 994 200		4.7−4	5.6+7	E	81*
93.870^{C}	$2p^64d$	$^2D_{5/2}$	$2p^67p$	$^2P^\circ_{3/2}$	1 907 800	2 973 100		3.5−2	6.7+9	D	81*
93.782^{C}		$_{3/2}$		$_{1/2}$	1 906 800	2 973 100		2.0−2	7.4+9	D	81*
93.782^{C}		$_{3/2}$		$_{3/2}$	1 906 800	2 973 100		3.9−3	7.4+8	E	81*
91.241^{C}	$2p^64d$	$^2D_{5/2}$	$2p^67f$	$^2F^\circ_{5/2}$	1 907 800	3 003 800		2.1−2	2.8+9	D	81*
91.216^{C}		$_{5/2}$		$_{7/2}$	1 907 800	3 004 100		4.3−1	4.3+10	C	81*
91.158^{C}		$_{3/2}$		$_{5/2}$	1 906 800	3 003 800		2.9−1	3.9+10	C	81*
90.818^{C}	$2p^64s$	$^2S_{1/2}$	$2p^66p$	$^2P^\circ_{1/2}$	1 667 500	2 768 600		5.0−2	2.0+10	C	81*
90.686^{C}		$_{1/2}$		$_{3/2}$	1 667 500	2 770 200		9.8−2	2.0+10	C	81*
87.80	$2p^63d$	$^2D_{3/2}$	$2p^64p$	$^2P^\circ_{1/2}$	631 398	1 770 400		1.38−1	6.0+10	C	20°,81*
87.47		$_{5/2}$		$_{3/2}$	633 637	1 777 100		2.5−1	5.4+10	C	20°,81*
87.283^{C}		$_{3/2}$		$_{3/2}$	631 398	1 777 100		2.8−2	6.1+9	D	81*
86.78^{C}	$2p^64f$	$^2F^\circ_{5/2}$	$2p^68d$	$^2D_{3/2}$	1 961 600	3 114 000		3.1−3	6.8+8	E	81*
86.69^{C}		$_{7/2}$		$_{5/2}$	1 962 000	3 115 600		4.6−3	6.7+8	E	81*
86.66^{C}		$_{5/2}$		$_{5/2}$	1 961 600	3 115 600		2.2−4	3.3+7	E	81*
85.04^{C}	$2p^64p$	$^2P^\circ_{3/2}$	$2p^67s$	$^2S_{1/2}$	1 777 100	2 953 000		3.3−2	1.5+10	D	81*
84.56^{C}		$_{1/2}$		$_{1/2}$	1 770 400	2 953 000		1.7−2	7.9+9	D	81*
83.689^{C}	$2p^64d$	$^2D_{5/2}$	$2p^68p$	$^2P^\circ_{3/2}$	1 907 800	3 102 700		1.7−2	4.1+9	D	81*
83.619^{C}		$_{3/2}$		$_{1/2}$	1 906 800	3 102 700		1.0−2	4.7+9	D	81*
83.619^{C}		$_{3/2}$		$_{3/2}$	1 906 800	3 102 700		1.9−3	4.6+8	E	81*
82.183^{C}	$2p^64p$	$^2P^\circ_{3/2}$	$2p^67d$	$^2D_{3/2}$	1 777 100	2 993 900		1.7−2	4.1+9	D	81*
82.163^{C}		$_{3/2}$		$_{5/2}$	1 777 100	2 994 200		1.5−1	2.5+10	C	81*
81.733^{C}		$_{1/2}$		$_{3/2}$	1 770 400	2 993 900		8.6−2	2.1+10	C	81*
75.303^{C}	$2p^63d$	$^2D_{5/2}$	$2p^64f$	$^2F^\circ_{5/2}$	633 637	1 961 600		2.6−1	5.2+10	D	81*
75.280^{P}		$_{5/2}$		$_{7/2}$	633 637	1 962 000		5.2	7.7+11	C	42°,81*,43
75.174^{P}		$_{3/2}$		$_{5/2}$	631 398	1 961 600		3.7	7.3+11	C	42°,81*,43
74.80^{C}	$2p^64p$	$^2P^\circ_{3/2}$	$2p^68d$	$^2D_{3/2}$	1 777 100	3 114 000		9.2−3	2.8+9	D	81*
74.71^{C}		$_{3/2}$		$_{5/2}$	1 777 100	3 115 600		8.56−2	1.71+10	C	81*
74.43^{C}		$_{1/2}$		$_{3/2}$	1 770 400	3 114 000		4.78−2	1.44+10	C	81*
71.927	$2p^63p$	$^2P^\circ_{3/2}$	$2p^64s$	$^2S_{1/2}$	277 018	1 667 500					43
71.038		$_{1/2}$		$_{1/2}$	259 914	1 667 500					43
61.361	$2p^63p$	$^2P^\circ_{3/2}$	$2p^64d$	$^2D_{3/2}$	277 018	1 906 800		1.2−1	5.3+10	D	43°,81*
61.319		$_{3/2}$		$_{5/2}$	277 018	1 907 800		1.06	3.13+11	C	43°,81*
60.720		$_{1/2}$		$_{3/2}$	259 914	1 906 800		5.96−1	2.69+11	C	43°,81*
56.484	$2p^63s$	$^2S_{1/2}$	$2p^64p$	$^2P^\circ_{1/2}$	0	1 770 400		1.44−1	1.51+11	C+	43°,81*,40
56.270		$_{1/2}$		$_{3/2}$	0	1 777 100		2.70−1	1.42+11	C+	43°,81*,40

Mn xv (Na sequence) – Continued

λ (Å)	Classification		Energy Levels (cm⁻¹)		Int.	*gf*	*A* (s⁻¹)	Acc.	References
55.72	5/2	3/2	633 637	2 428 100		3.9−2	2.1+10	D	31°,81*,40,44
55.658^{C}	3/2	3/2	631 398	2 428 100		4.4−3	2.3+9	E	81*
53.040^{C}	$2p^63d$ ${}^2D_{5/2}$	$2p^65f$ ${}^2F^{\circ}_{5/2}$	633 637	2 519 000		4.9−2	1.9+10	D	81*
53.032	5/2	7/2	633 637	2 519 300		9.72−1	2.89+11	C	43°,81*,40
52.977	3/2	5/2	631 398	2 519 000		6.84−1	2.7+11	C	43°,81*
47.666	$2p^63p$ ${}^2P^{\circ}_{3/2}$	$2p^65s$ ${}^2S_{1/2}$	277 018	2 375 200		5.2−2	7.4+10	C	44°,81*,40
47.270	1/2	1/2	259 914	2 375 200		2.52−2	3.77+10	C	44°,81*,40
46.804^{C}	$2p^63d$ ${}^2D_{5/2}$	$2p^66p$ ${}^2P^{\circ}_{3/2}$	633 637	2 770 200		1.4−2	1.1+10	D	81*
46.790^{C}	3/2	1/2	631 398	2 768 600		7.6−3	1.2+10	D	81*
46.755^{C}	3/2	3/2	631 398	2 770 200		1.6−3	1.2+9	E	81*
45.707^{C}	$2p^63d$ ${}^2D_{5/2}$	$2p^66f$ ${}^2F^{\circ}_{5/2}$	633 637	2 821 500		1.8−2	9.5+9	D	81*
45.700	5/2	7/2	633 637	2 821 800		3.6−1	1.4+11	C	44°,81*,40
45.659	3/2	5/2	631 398	2 821 500		2.5−1	1.3+11	C	44°,81*,40
45.165^{C}	$2p^63p$ ${}^2P^{\circ}_{3/2}$	$2p^65d$ ${}^2D_{3/2}$	277 018	2 491 100		3.8−2	3.1+10	D	81*
45.154	3/2	5/2	277 018	2 491 700		3.4−1	1.9+11	C	44°,81*,40,43
44.820	1/2	3/2	259 914	2 491 100		1.9−1	1.6+11	C	44°,81*,40
42.745^{C}	$2p^63d$ ${}^2D_{5/2}$	$2p^67p$ ${}^2P^{\circ}_{3/2}$	633 637	2 973 100		7.2−3	6.5+9	D	81*
42.704^{C}	3/2	1/2	631 398	2 973 100		4.0−3	7.4+9	D	81*
42.704^{C}	3/2	3/2	631 398	2 973 100		8.0−4	7.2+8	E	81*
42.191^{C}	$2p^63d$ ${}^2D_{5/2}$	$2p^67f$ ${}^2F^{\circ}_{5/2}$	633 637	3 003 800		8.4−3	5.4+9	D	81*
42.185	5/2	7/2	633 637	3 004 100		1.77−1	8.3+10	C	44°,81*,40
42.152	3/2	5/2	631 398	3 003 800		1.24−1	7.8+10	C	44°,81*
41.243	$2p^63s$ ${}^2S_{1/2}$	$2p^65p$ ${}^2P^{\circ}_{1/2}$	0	2 424 600		4.4−2	8.7+10	C	44°,81*,40
41.185	1/2	3/2	0	2 428 100		8.8−2	8.7+10	C	44°,81*,40
40.572	$2p^63p$ ${}^2P^{\circ}_{3/2}$	$2p^66s$ ${}^2S_{1/2}$	277 018	2 742 000		2.0−2	3.9+10	D	44°,81*,40
40.285	1/2	1/2	259 914	2 742 000		9.8−3	2.0+10	D	44°,81*,40
40.501^{C}	$2p^63d$ ${}^2D_{5/2}$	$2p^68p$ ${}^2P^{\circ}_{3/2}$	633 637	3 102 700		4.0−3	4.0+9	E	81*
40.465^{C}	3/2	1/2	631 398	3 102 700		2.2−3	4.6+9	E	81*
40.465^{C}	3/2	3/2	631 398	3 102 700		4.4−4	4.5+8	E	81*
40.151	$2p^63d$ ${}^2D_{5/2}$	$2p^68f$ ${}^2F^{\circ}_{7/2}$	633 637	3 124 200					44°,40
39.553^{C}	$2p^63p$ ${}^2P^{\circ}_{3/2}$	$2p^66d$ ${}^2D_{3/2}$	277 018	2 805 300		1.8−2	1.9+10	D	81*
39.547	3/2	5/2	277 018	2 805 700		1.56−1	1.11+11	C	44°,81*,40
39.287	1/2	3/2	259 914	2 805 300		8.74−2	9.4+10	C	44°,81*,40
38.89	$2p^63d$ ${}^2D_{5/2}$	$2p^69f$ ${}^2F^{\circ}_{7/2}$	633 637	3 205 000					40
38.02	$2p^63d$ ${}^2D_{5/2}$	$2p^610f$ ${}^2F^{\circ}_{7/2}$	633 637	3 264 000					40
37.42	$2p^63d$ ${}^2D_{5/2}$	$2p^611f$ ${}^2F^{\circ}_{7/2}$	633 637	3 306 000					40
37.4	$2p^63p$ ${}^2P^{\circ}_{3/2}$	$2p^67s$ ${}^2S_{1/2}$	277 018	2 953 000		9.6−3	2.3+10	D	40°,81*
37.12	1/2	1/2	259 914	2 953 000		5.0−3	1.2+10	D	40°,81*
36.807^{C}	$2p^63p$ ${}^2P^{\circ}_{3/2}$	$2p^67d$ ${}^2D_{3/2}$	277 018	2 993 900		1.0−2	1.2+10	D	81*
36.803	3/2	5/2	277 018	2 994 200		8.60−2	7.0+10	C	44°,81*,40
36.577	1/2	3/2	259 914	2 993 900		4.8−2	6.0+10	C	44°,81*,40
36.119	$2p^63s$ ${}^2S_{1/2}$	$2p^66p$ ${}^2P^{\circ}_{1/2}$	0	2 768 600		2.0−2	5.2+10	C	44°,81*
36.099	1/2	3/2	0	2 770 200		4.0−2	5.2+10	C	44°,81*,40
35.25^{C}	$2p^63p$ ${}^2P^{\circ}_{3/2}$	$2p^68d$ ${}^2D_{3/2}$	277 018	3 114 000		6.0−3	7.9+9	D	81*
35.229	3/2	5/2	277 018	3 115 600		5.2−2	4.7+10	C	44°,81*,40
35.04	1/2	3/2	259 914	3 114 000		2.94−2	4.0+10	C	40°,81*

Mn XV (Na sequence) – Continued

λ (Å)	Classification				Energy Levels (cm^{-1})		Int.	gf	A (s^{-1})	Acc.	References
34.22	$2p^63p$	$^2P^\circ_{3/2}$	$2p^69d$	$^2D_{5/2}$	277 018	3 199 000					40
34.02		$_{1/2}$		$_{3/2}$	259 914	3 199 000					40
33.635	$2p^63s$	$^2S_{1/2}$	$2p^67p$	$^2P^\circ_{1/2}$	0	2 973 100					44
33.635		$_{1/2}$		$_{3/2}$	0	2 973 100					44°,40
33.55	$2p^63p$	$^2P^\circ_{3/2}$	$2p^610d$	$^2D_{5/2}$	277 018	3 258 000					40
32.230	$2p^63s$	$^2S_{1/2}$	$2p^68p$	$^2P^\circ_{1/2}$	0	3 102 700					44
32.230		$_{1/2}$		$_{3/2}$	0	3 102 700					44°,40
31.37	$2p^63s$	$^2S_{1/2}$	$2p^69p$	$^2P^\circ_{3/2}$	0	3 188 000					40
30.81	$2p^63s$	$^2S_{1/2}$	$2p^610p$	$^2P^\circ_{3/2}$	0	3 246 000					40

Mn XVI (Ne sequence)

λ (Å)	Classification				Energy Levels (cm^{-1})		Int.	gf	A (s^{-1})	Acc.	References
697.088^C	$2s^22p^5(^2P^\circ_{1/2})3s$	$(^1/_2,^1/_2)^\circ_0$	$2s^22p^5(^2P^\circ_{3/2})3p$	$^2[^1/_2]_1$	5 351 520	5 494 974		3.3−3	1.5+7	E	81*
438.577	$2s^22p^5(^2P^\circ_{3/2})3s$	$(^3/_2,^1/_2)^\circ_2$	$2s^22p^5(^2P^\circ_{3/2})3p$	$^2[^1/_2]_1$	5 266 964	5 494 974	2	2.5−1	2.9+9	D	50°,81*
413.382	$2s^22p^5(^2P^\circ_{3/2})3s$	$(^3/_2,^1/_2)^\circ_1$	$2s^22p^5(^2P^\circ_{3/2})3p$	$^2[^5/_2]_2$	5 281 200	5 523 101	3				50
376.202		$_2$		$_3$	5 266 964	5 532 778	4	7.5−1	5.1+9	D	50°,81*
396.402	$2s^22p^5(^2P^\circ_{1/2})3s$	$(^1/_2,^1/_2)^\circ_0$	$2s^22p^5(^2P^\circ_{1/2})3p$	$^2[^3/_2]_1$	5 351 520	5 603 789	4*bl*				50
373.525		$_1$		$_2$	5 360 800	5 628 520	2				50
377.414	$2s^22p^5(^2P^\circ_{1/2})3s$	$(^1/_2,^1/_2)^\circ_1$	$2s^22p^5(^2P^\circ_{1/2})3p$	$^2[^1/_2]_1$	5 360 800	5 626 306	2				50
363.918		$_0$		$_1$	5 351 520	5 626 306	1				50
365.169	$2s^22p^5(^2P^\circ_{3/2})3s$	$(^3/_2,^1/_2)^\circ_1$	$2s^22p^5(^2P^\circ_{3/2})3p$	$^2[^3/_2]_2$	5 281 200	5 555 050	2				50
347.12		$_2$		$_2$	5 266 964	5 555 050	1				50
302.509^C	$2s^22p^5(^2P^\circ_{3/2})3p$	$^2[^5/_2]_3$	$2s^22p^5(^2P^\circ_{3/2})3d$	$^2[^3/_2]^\circ_2$	5 532 778	5 863 347		2.7−2	3.9+8	E	81*
301.513	$2s^22p^5(^2P^\circ_{3/2})3p$	$^2[^5/_2]_3$	$2s^22p^5(^2P^\circ_{3/2})3d$	$^2[^7/_2]^\circ_4$	5 532 778	5 864 439	5*bl*	1.0	8.5+9	D	50°,81*
288.003		$_2$		$_3$	5 523 101	5 870 337	2				50
298.648	$2s^22p^5(^2P^\circ_{1/2})3p$	$^2[^1/_2]_1$	$2s^22p^5(^2P^\circ_{1/2})3d$	$^2[^3/_2]^\circ_2$	5 626 306	5 961 148	1				50
297.698	$2s^22p^5(^2P^\circ_{3/2})3p$	$^2[^3/_2]_2$	$2s^22p^5(^2P^\circ_{3/2})3d$	$^2[^5/_2]^\circ_3$	5 555 050	5 890 952	3*bl*				50
293.270		$_1$		$_2$	5 542 158	5 883 137	3*bl*				50
297.698	$2s^22p^5(^2P^\circ_{1/2})3p$	$^2[^3/_2]_2$	$2s^22p^5(^2P^\circ_{1/2})3d$	$^2[^5/_2]^\circ_3$	5 628 520	5 964 431	3*bl*				50
286.998^C	$2s^22p^5(^2P^\circ_{3/2})3p$	$^2[^1/_2]_1$	$2s^22p^5(^2P^\circ_{3/2})3d$	$^2[^1/_2]^\circ_0$	5 494 974	5 843 409		1.1−1	8.9+9	D	81*
281.472^C		$_1$		$_1$	5 494 974	5 850 249		2.7−1	7.4+9	D	81*
271.464	$2s^22p^5(^2P^\circ_{3/2})3p$	$^2[^1/_2]_1$	$2s^22p^5(^2P^\circ_{3/2})3d$	$^2[^3/_2]^\circ_2$	5 494 974	5 863 347		2.5−1	4.5+9	E	81*
69.124	$2s^22p^5(^2P^\circ_{1/2})3d$	$^2[^3/_2]^\circ_1$	$2s^22p^5(^2P^\circ_{1/2})4f$	$^2[^5/_2]_2$	6 018 300	7 465 000	5				49
66.503		$_2$		$_3$	5 961 148	7 464 838	30				49°,52
68.662	$2s^22p^5(^2P^\circ_{3/2})3d$	$^2[^3/_2]^\circ_1$	$2s^22p^5(^2P^\circ_{3/2})4f$	$^2[^5/_2]_2$	5 923 500	7 379 900	7				49
65.927		$_2$		$_3$	5 863 347	7 380 185	30*bl*				49°,52
67.314	$2s^22p^5(^2P^\circ_{3/2})3d$	$^2[^5/_2]^\circ_3$	$2s^22p^5(^2P^\circ_{3/2})4f$	$^2[^9/_2]_4$	5 890 952	7 376 520	2				49
67.149	$2s^22p^5(^2P^\circ_{3/2})3d$	$^2[^5/_2]^\circ_3$	$2s^22p^5(^2P^\circ_{3/2})4f$	$^2[^5/_2]_3$	5 890 952	7 380 185	3				49

Mn XVI (Ne sequence) – Continued

λ (Å)	Classification				Energy Levels (cm^{-1})		Int.	*gf*	*A* (s^{-1})	Acc.	References
67.099	$2s^22p^5(^2P^\circ_{3/2})3d$	$^2[^5/_2]^\circ_3$	$2s^22p^5(^2P^\circ_{3/2})4f$	$^2[^7/_2]_4$	5 890 952	7 381 282	60				49°,52
66.773		$_2$		$_3$	5 883 137	7 380 720	50				49°,52
66.706	$2s^22p^5(^2P^\circ_{1/2})3d$	$^2[^5/_2]^\circ_3$	$2s^22p^5(^2P^\circ_{1/2})4f$	$^2[^7/_2]_4$	5 964 431	7 463 551	60				49°,52
66.320		$_2$		$_3$	5 955 038	7 462 863	20				49°,52
66.393	$2s^22p^5(^2P^\circ_{3/2})3d$	$^2[^7/_2]^\circ_3$	$2s^22p^5(^2P^\circ_{3/2})4f$	$^2[^9/_2]_4$	5 870 337	7 376 520	40				49°,52
66.129		$_4$		$_5$	5 864 439	7 376 639	50				49°,52
66.209	$2s^22p^5(^2P^\circ_{3/2})3d$	$^2[^7/_2]^\circ_3$	$2s^22p^5(^2P^\circ_{3/2})4f$	$^2[^7/_2]_3$	5 870 337	7 380 720	3				49
65.927		$_4$		$_4$	5 864 439	7 381 282	30*bl*				49°,52
66.036	$2s^22p^5(^2P^\circ_{3/2})3d$	$^2[^3/_2]^\circ_2$	$2s^22p^5(^2P^\circ_{3/2})4f$	$^2[^3/_2]_2$	5 863 347	7 377 669	4				49°,52
65.508	$2s^22p^5(^2P^\circ_{3/2})3d$	$^2[^1/_2]^\circ_1$	$2s^22p^5(^2P^\circ_{3/2})4f$	$^2[^3/_2]_1$	5 850 249	7 376 779	4				49
65.470		$_1$		$_2$	5 850 249	7 377 669	8				49
65.216		$_0$		$_1$	5 843 409	7 376 779	6				49
65.153	$2s^22p^5(^2P^\circ_{3/2})3p$	$^2[^3/_2]_2$	$2s^22p^5(^2P^\circ_{3/2})4s$	$(^3/_2,^1/_2)^\circ_2$	5 555 050	7 089 864	2				49
64.224	$2s^22p^5(^2P^\circ_{3/2})3p$	$^2[^5/_2]_3$	$2s^22p^5(^2P^\circ_{3/2})4s$	$(^3/_2,^1/_2)^\circ_2$	5 532 778	7 089 864	5				49
56.700	$2s^22p^5(^2P^\circ_{3/2})3p$	$^2[^3/_2]_2$	$2s^22p^5(^2P^\circ_{3/2})4d$	$^2[^3/_2]^\circ_2$	5 555 050	7 318 722	2				49
55.472		$_1$		$_1$	5 542 158	7 344 868	1				49
56.432	$2s^22p^5(^2P^\circ_{3/2})3p$	$^2[^3/_2]_2$	$2s^22p^5(^2P^\circ_{3/2})4d$	$^2[^5/_2]^\circ_3$	5 555 050	7 327 149	5				49
56.110		$_1$		$_2$	5 542 158	7 324 359	3				49°,51
56.207	$2s^22p^5(^2P^\circ_{1/2})3p$	$^2[^1/_2]_1$	$2s^22p^5(^2P^\circ_{1/2})4d$	$^2[^3/_2]^\circ_2$	5 626 306	7 405 446	5*bl*				49°,51
56.207	$2s^22p^5(^2P^\circ_{1/2})3p$	$^2[^3/_2]_2$	$2s^22p^5(^2P^\circ_{1/2})4d$	$^2[^5/_2]^\circ_3$	5 628 520	7 407 660	5*bl*				49°,51
55.560		$_1$		$_2$	5 603 789	7 403 649	5				49°,51,52
56.032	$2s^22p^5(^2P^\circ_{3/2})3p$	$^2[^5/_2]_3$	$2s^22p^5(^2P^\circ_{3/2})4d$	$^2[^7/_2]^\circ_4$	5 532 778	7 317 468	15				49°,51
55.962		$_3$		$_3$	5 532 778	7 319 729	1				49
55.659		$_2$		$_3$	5 523 101	7 319 729	10				49°,52
55.728	$2s^22p^5(^2P^\circ_{3/2})3p$	$^2[^5/_2]_3$	$2s^22p^5(^2P^\circ_{3/2})4d$	$^2[^5/_2]^\circ_3$	5 532 778	7 327 149	2				49
55.517		$_2$		$_2$	5 523 101	7 324 359	1				49°,52
55.09	$2s^22p^5(^2P^\circ_{3/2})3p$	$^2[^1/_2]_1$	$2s^22p^5(^2P^\circ_{3/2})4d$	$^2[^1/_2]^\circ_0$	5 494 974	7 310 174	1				49
54.988		$_1$		$_1$	5 494 974	7 313 554	1				49
54.832	$2s^22p^5(^2P^\circ_{3/2})3p$	$^2[^1/_2]_1$	$2s^22p^5(^2P^\circ_{3/2})4d$	$^2[^3/_2]^\circ_2$	5 494 974	7 318 722	2				49
52.344	$2s^22p^5(^2P^\circ_{3/2})3s$	$(^3/_2,^1/_2)^\circ_1$	$2s^22p^5(^2P^\circ_{3/2})4p$	$^2[^5/_2]_2$	5 281 200	7 191 600	1				49
51.847		$_2$		$_3$	5 266 964	7 195 714	3				49
52.147	$2s^22p^5(^2P^\circ_{3/2})3s$	$(^3/_2,^1/_2)^\circ_2$	$2s^22p^5(^2P^\circ_{3/2})4p$	$^2[^1/_2]_1$	5 266 964	7 184 624	2*bl*				49
52.147	$2s^22p^5(^2P^\circ_{3/2})3s$	$(^3/_2,^1/_2)^\circ_1$	$2s^22p^5(^2P^\circ_{3/2})4p$	$^2[^3/_2]_1$	5 281 200	7 198 860	2*bl*				49
51.999	$2s^22p^5(^2P^\circ_{1/2})3s$	$(^1/_2,^1/_2)^\circ_1$	$2s^22p^5(^2P^\circ_{1/2})4p$	$^2[^3/_2]_2$	5 360 800	7 283 910	2				49
18.935	$2s^22p^6$	$^1S_0$	$2s^22p^5(^2P^\circ_{3/2})3s$	$(^3/_2,^1/_2)^\circ_1$	0	5 281 200		1.2−1	7.3+11	C−	46°,81*
18.654	$2s^22p^6$	$^1S_0$	$2s^22p^5(^2P^\circ_{1/2})3s$	$(^1/_2,^1/_2)^\circ_1$	0	5 360 800		1.1−1	7.2+11	C−	46°,81*
17.095	$2s^22p^6$	$^1S_0$	$2s^22p^5(^2P^\circ_{3/2})3d$	$^2[^1/_2]^\circ_1$	0	5 850 249		1.1−2	8.3+10	E	46°,81*
16.882	$2s^22p^6$	$^1S_0$	$2s^22p^5(^2P^\circ_{3/2})3d$	$^2[^3/_2]^\circ_1$	0	5 923 500		5.3−1	4.1+12	D	46°,81*
16.616	$2s^22p^6$	$^1S_0$	$2s^22p^5(^2P^\circ_{1/2})3d$	$^2[^3/_2]^\circ_1$	0	6 018 300		2.48	2.00+13	C−	46°,81*
15.312	$2s^22p^6$	$^1S_0$	$2s2p^63p$	$^3P^\circ_1$	0	6 530 800					46
15.238	$2s^22p^6$	$^1S_0$	$2s2p^63p$	$^1P^\circ_1$	0	6 562 500					46

Mn XVI (Ne sequence) – Continued

λ (Å)	Classification				Energy Levels (cm^{-1})		Int.	gf	A (s^{-1})	Acc.	References
14.098	$2s^22p^6$	$^1S_0$	$2s^22p^5(^2P^\circ_{3/2})4s$	$(^3/_2,^1/_2)^\circ_1$	0	7 092 000	3				47
13.61	$2s^22p^6$	$^1S_0$	$2s^22p^5(^2P^\circ_{3/2})4d$	$^2[^3/_2]^\circ_1$	0	7 344 868					46
13.46	$2s^22p^6$	$^1S_0$	$2s^22p^5(^2P^\circ_{1/2})4d$	$^2[^3/_2]^\circ_1$	0	7 429 000					46
12.510	$2s^22p^6$	$^1S_0$	$2s^22p^5(^2P^\circ_{3/2})5d$	$^2[^3/_2]^\circ_1$	0	7 994 000	5				47
12.373	$2s^22p^6$	$^1S_0$	$2s^22p^5(^2P^\circ_{1/2})5d$	$^2[^3/_2]^\circ_1$	0	8 084 000	2				47
11.971	$2s^22p^6$	$^1S_0$	$2s^22p^5(^2P^\circ_{3/2})6d$	$^2[^3/_2]^\circ_1$	0	8 354 000	1				47
11.853	$2s^22p^6$	$^1S_0$	$2s^22p^5(^2P^\circ_{1/2})6d$	$^2[^3/_2]^\circ_1$	0	8 439 000	2				47

Mn XVII (F sequence)

λ (Å)	Classification				Energy Levels (cm^{-1})		Int.	gf	A (s^{-1})	Acc.	References
1170^C	$2s^22p^5$	$^2P^\circ_{3/2}$	$2s^22p^5$	$^2P^\circ_{1/2}$	0	85 500		M1	1.12+4	C+	81*
109.35	$2s^22p^5$	$^2P^\circ_{1/2}$	$2s2p^6$	$^2S_{1/2}$	85 500	1 000 000	10	1.12−1	3.14+10	C+	45°,81*,53,54,55
100.00		$3/2$		$1/2$	0	1 000 000	10	2.49−1	8.31+10	C+	45°,81*,53,54,55
17.987	$2s^22p^5$	$^2P^\circ_{1/2}$	$2s^22p^4(^3P)3s$	$^4P_{3/2}$	85 500	5 644 800	0				56
17.794		$3/2$		$5/2$	0	5 619 900	3	1.8−2	6.3+10	E	56°,81*
17.716		$3/2$		$3/2$	0	5 644 800	5				56°,26,83
17.807	$2s^22p^5$	$^2P^\circ_{1/2}$	$2s^22p^4(^3P)3s$	$^2P_{3/2}$	85 500	5 701 100	0				56
17.729		$1/2$		$1/2$	85 500	5 725 800	2	1.2−1	1.3+12	D	56°,81*
17.541		$3/2$		$3/2$	0	5 701 100	5				56°,26
17.465		$3/2$		$1/2$	0	5 725 800	3	1.1−1	1.2+12	D	56°,81*
17.550	$2s^22p^5$	$^2P^\circ_{1/2}$	$2s^22p^4(^1D)3s$	$^2D_{3/2}$	85 500	5 783 500	5	2.0−1	1.1+12	D	56°,81*
17.301		$3/2$		$5/2$	0	5 780 000	5	2.5−1	9.4+11	D	56°,81*,26,83
17.131	$2s^22p^5$	$^2P^\circ_{1/2}$	$2s^22p^4(^1S)3s$	$^2S_{1/2}$	85 500	5 922 900	2	7.4−2	8.4+11	D	56°,81*
16.880		$3/2$		$1/2$	0	5 922 900	20*bl*	2.3−2	2.7+11	E	56°,81*
16.278	$2s^22p^5$	$^2P^\circ_{1/2}$	$2s^22p^4(^3P)3d$	$^4P_{3/2}$	85 500	6 228 900	2				56
16.090		$3/2$		$1/2$	0	6 215 000	5				56
16.054		$3/2$		$3/2$	0	6 228 900	5				56
15.987		$3/2$		$5/2$	0	6 255 100	1				56
16.041	$2s^22p^5$	$^2P^\circ_{3/2}$	$2s^22p^4(^3P)3d$	$^4F_{5/2}$	0	6 234 000	6				56
15.958	$2s^22p^5$	$^2P^\circ_{3/2}$	$2s^22p^4(^3P)3d$	$^2D_{3/2}$	0	6 266 400	1				56
15.871		$3/2$		$5/2$	0	6 300 800	7				56°,26,47,83
15.946	$2s^22p^5$	$^2P^\circ_{1/2}$	$2s^22p^4(^1D)3d$	$^2S_{1/2}$	85 500	6 356 600	1	1.8−1	2.3+12	D	56°,81*
15.732		$3/2$		$1/2$	0	6 356 600	5	9.6−1	1.3+13	D	56°,81*
15.926	$2s^22p^5$	$^2P^\circ_{3/2}$	$2s^22p^4(^3P)3d$	$^2F_{5/2}$	0	6 279 000	2				56
15.889	$2s^22p^5$	$^2P^\circ_{1/2}$	$2s^22p^4(^1D)3d$	$^2P_{3/2}$	85 500	6 379 200	2	3.8−1	2.5+12	E	56°,81*
15.676^C		$3/2$		$3/2$	0	6 379 200		2.4	1.6+13	E	81*
15.826	$2s^22p^5$	$^2P^\circ_{1/2}$	$2s^22p^4(^1D)3d$	$^2D_{3/2}$	85 500	6 404 200	6	1.9	1.3+13	E	56°,81*
15.670		$3/2$		$5/2$	0	6 381 600	10				56°,26,83
15.615		$3/2$		$3/2$	0	6 404 200	3	4.8−1	3.3+12	E	56°,81*
15.570	$2s^22p^5$	$^2P^\circ_{1/2}$	$2s^22p^4(^1S)3d$	$^2D_{3/2}$	85 500	6 508 100	5	1.7	1.1+13	D	56°,81*,47,83
15.404		$3/2$		$5/2$	0	6 491 800	4	2.5−1	1.2+12	D	56°,81*,47,83
15.365^C		$3/2$		$3/2$	0	6 508 100		1.4−2	9.9+10	E	81*

Mn XVIII (O sequence)

λ (Å)	Classification				Energy Levels (cm^{-1})		Int.	gf	A (s^{-1})	Acc.	References
2720^{C}	$2s2p^5$	$^3P^o_1$	$2s2p^5$	$^3P^o_0$	919 450	956 200		M1	2.61+3	C	81*
1895^{C}		2		1	866 690	919 450		M1	3.22+3	C	81*
1117^{C}		2		0	866 690	956 200		E2	1.2	E	81*
1502^{C}	$2s^22p^4$	$^3P_2$	$2s^22p^4$	$^3P_0$	0	66 560		E2	3.1−1	E	81*
1359^{C}		2		1	0	73 590		M1	8.17+3	C+	81*
1298^{C}	$2s^22p^4$	$^3P_1$	$2s^22p^4$	$^1D_2$	73 590	150 610		M1	5.4+2	D	81*
663.97^{C}		2		2	0	150 610		M1	1.1+4	D	81*
707.16^{C}	$2s^22p^4$	$^1D_2$	$2s^22p^4$	$^1S_0$	150 610	292 020		E2	3.7+1	D	81*
457.81^{C}	$2s^22p^4$	$^3P_1$	$2s^22p^4$	$^1S_0$	73 590	292 020		M1	9.8+4	E	81*
428.14^{C}	$2s2p^5$	$^3P^o_0$	$2s2p^5$	$^1P^o_1$	956 200	1 189 770		M1	5.2+3	D−	81*
369.93^{C}		1		1	919 450	1 189 770		M1	5.9+3	D−	81*
309.52^{C}		2		1	866 690	1 189 770		M1	1.7+4	D−	81*
159.38^{C}	$2s^22p^4$	$^1S_0$	$2s2p^5$	$^3P^o_1$	292 020	919 450		7.4−3	6.5+8	E	81*
139.65	$2s^22p^4$	$^1D_2$	$2s2p^5$	$^3P^o_2$	150 610	866 690	3	2.7−2	1.8+9	E	45°,81*
126.09	$2s^22p^4$	$^3P_1$	$2s2p^5$	$^3P^o_2$	73 590	866 690	8	1.17−1	9.8+9	C	45°,81*,54,55
118.22		1		1	73 590	919 450	6	7.38−2	1.17+10	C	45°,81*,54,55
117.25		0		1	66 560	919 450	7	9.1−2	1.5+10	C	45°,81*,54,55
115.38		2		2	0	866 690	11	3.5−1	3.6+10	C	45°,81*,54,55,53
113.30		1		0	73 590	956 200	8	1.06−1	5.50+10	C	45°,81*,54,55
108.76		2		1	0	919 450	8	1.47−1	2.77+10	C	45°,81*,54,55,53
122.29	$2s2p^5$	$^1P^o_1$	$2p^6$	$^1S_0$	1 189 770	2 007 500	7	3.36−1	1.5+11	C	45°,81*,57
111.39	$2s^22p^4$	$^1S_0$	$2s2p^5$	$^1P^o_1$	292 020	1 189 770	5	5.6−2	1.0+10	C	45°,81*,54
96.23	$2s^22p^4$	$^1D_2$	$2s2p^5$	$^1P^o_1$	150 610	1 189 770	10*bl*	5.85−1	1.4+11	C	45°,81*,53,54,55
91.90	$2s2p^5$	$^3P^o_1$	$2p^6$	$^1S_0$	919 450	2 007 500	2	1.0−2	8.3+9	E	45°,81*
89.59	$2s^22p^4$	$^3P_1$	$2s2p^5$	$^1P^o_1$	73 590	1 189 770	1	2.5−3	6.9+8	E	45°,81*
89.03		0		1	66 560	1 189 770	1	4.4−3	1.2+9	E	45°,81*
84.05		2		1	0	1 189 770	6	3.4−2	1.1+10	E	45°,81*
16.724	$2s^22p^4$	$^3P_1$	$2s^22p^3(^4S^o)3s$	$^3S^o_1$	73 590	6 052 900	1	7.8−2	6.2+11	C−	58°,81*
16.705^{C}		0		1	66 560	6 052 900		5.2−2	4.1+11	C−	81*
16.521		2		1	0	6 052 900	4	2.6−1	1.7+12	C−	58°,81*
16.663^{C}	$2s^22p^4$	$^1D_2$	$2s^22p^3(^2D^o)3s$	$^3D^o_2$	150 610	6 152 100		2.2−2	1.1+11	E	81*
16.589^{C}		2		3	150 610	6 178 600		2.2−2	7.6+10	E	81*
16.577	$2s^22p^4$	$^1S_0$	$2s^22p^3(^2P^o)3s$	$^1P^o_1$	292 020	6 324 500	3	1.4−1	1.1+12	D	58°,81*
16.540	$2s^22p^4$	$^1D_2$	$2s^22p^3(^2D^o)3s$	$^1D^o_2$	150 610	6 196 600	5	3.9−1	1.9+12	D	58°,81*
16.451	$2s^22p^4$	$^3P_1$	$2s^22p^3(^2D^o)3s$	$^3D^o_2$	73 590	6 152 100	4	4.5−2	2.2+11	D	58°,81*
16.444^{C}		1		1	73 590	6 154 800		1.1−1	9.4+11	D	81*
16.425		0		1	66 560	6 154 800	3	2.2−2	1.8+11	D	58°,81*
16.255		2		2	0	6 152 100	5	1.6−1	8.1+11	D	58°,81*
16.185		2		3	0	6 178 600	6*bl*	2.6−1	9.5+11	C	58°,81*
16.332^{C}	$2s^22p^4$	$^3P_1$	$2s^22p^3(^2D^o)3s$	$^1D^o_2$	73 590	6 196 600		4.5−2	2.3+11	E	81*
16.138^{C}		2		2	0	6 196 600		2.3−2	1.2+11	E	81*
16.197^{C}	$2s^22p^4$	$^1D_2$	$2s^22p^3(^2P^o)3s$	$^1P^o_1$	150 610	6 324 500		1.1−1	9.7+11	D	81*
15.403^{T}	$2s^22p^4$	$^3P_1$	$2s^22p^3(^4S^o)3d$	$^3D^o_2$	73 590	6 565 800	2				59°,47
15.238^{T}		2		3	0	6 562 500	2	1.3	5.6+12	D	59°,81*,47

Mn XVIII (O sequence) – Continued

λ (Å)	Classification				Energy Levels (cm^{-1})		Int.	*gf*	*A* (s^{-1})	Acc.	References
14.877^{T}	$2s^22p^4$	$^3P_2$	$2s^22p^3(^2D^o)3d$	$^3D^o_3$	0	6 721 800	7	3.8	1.6+13	D	59°,81*,47
14.752^{T}	$2s^22p^4$	$^3P_2$	$2s^22p^3(^2P^o)3d$	$^3P^o_2$	0	6 778 700	4				59°,47
14.698^{T}	$2s^22p^4$	$^3P_2$	$2s^22p^3(^2P^o)3d$	$^3D^o_3$	0	6 803 600	2				59°,47

Mn XIX (N sequence)

λ (Å)	Classification				Energy Levels (cm^{-1})		Int.	*gf*	*A* (s^{-1})	Acc.	References
8739^{C}	$2s2p^4$	$^2D_{3/2}$	$2s2p^4$	$^2D_{5/2}$	981 160	992 600		M1	1.6+1	D	81*
5021^{C}	$2s2p^4$	$^4P_{3/2}$	$2s2p^4$	$^4P_{1/2}$	765 760	785 670		M1	3.39+2	C	81*
1764^{C}		5/2		3/2	709 070	765 760		M1	4.36+3	C	81*
1305^{C}		5/2		1/2	709 070	785 670		E2	4.7−1	E	81*
3259^{C}	$2s^22p^3$	$^2D^o_{3/2}$	$2s^22p^3$	$^2D^o_{5/2}$	131 770	162 450		M1	2.36+2	C	81*
2268^{C}	$2s2p^4$	$^2S_{1/2}$	$2s2p^4$	$^2P_{3/2}$	1 126 740	1 170 820		M1	1.4+2	D	81*
797.77^{C}		1/2		1/2	1 126 740	1 252 090		M1	1.2+4	D	81*
2015^{C}	$2s^22p^3$	$^2P^o_{1/2}$	$2s^22p^3$	$^2P^o_{3/2}$	242 110	291 730		M1	8.0+2	C	81*
1255^{C}	$2s^22p^3$	$^2D^o_{5/2}$	$2s^22p^3$	$^2P^o_{1/2}$	162 450	242 110		E2	6.7−1	E	81*
906.29^{C}		3/2		1/2	131 770	242 110		M1	4.5+3	D	81*
773.51^{C}		5/2		3/2	162 450	291 730		M1	8.2+3	D	81*
625.16^{C}		3/2		3/2	131 770	291 730		M1	2.7+4	D	81*
1230^{C}	$2s2p^4$	$^2P_{3/2}$	$2s2p^4$	$^2P_{1/2}$	1 170 820	1 252 090		M1	7.2+3	C	81*
1111^{C}	$2p^5$	$^2P^o_{3/2}$	$2p^5$	$^2P^o_{1/2}$	1 844 360	1 934 390		M1	1.31+4	C	81*
758.90^{C}	$2s^22p^3$	$^4S^o_{3/2}$	$2s^22p^3$	$^2D^o_{3/2}$	0	131 770		M1	1.0+4	D	81*
615.57^{C}		3/2		5/2	0	162 450		M1	6.6+2	D	81*
745.49^{C}	$2s2p^4$	$^2D_{5/2}$	$2s2p^4$	$^2S_{1/2}$	992 600	1 126 740		E2	1.5+1	E	81*
561.10^{C}	$2s2p^4$	$^2D_{5/2}$	$2s2p^4$	$^2P_{3/2}$	992 600	1 170 820		M1	3.3+3	D−	81*
527.26^{C}		3/2		3/2	981 160	1 170 820		M1	7.8+3	D	81*
385.37^{C}		5/2		1/2	992 600	1 252 090		E2	9.9+1	E	81*
369.10^{C}		3/2		1/2	981 160	1 252 090		M1	1.3+4	D−	81*
511.54^{C}	$2s2p^4$	$^4P_{1/2}$	$2s2p^4$	$^2D_{3/2}$	785 670	981 160		M1	1.5+3	D−	81*
464.25^{C}		3/2		3/2	765 760	981 160		M1	7.4+3	D	81*
440.84^{C}		3/2		5/2	765 760	992 600		M1	1.2+3	D−	81*
352.70^{C}		5/2		5/2	709 070	992 600		M1	1.8+4	D	81*
413.04^{C}	$2s^22p^3$	$^4S^o_{3/2}$	$2s^22p^3$	$^2P^o_{1/2}$	0	242 110		M1	2.1+4	D	81*
342.78^{C}		3/2		3/2	0	291 730		M1	2.2+4	D	81*
277.02^{C}	$2s2p^4$	$^4P_{3/2}$	$2s2p^4$	$^2S_{1/2}$	765 760	1 126 740		M1	7.0+4	D	81*
239.61^{C}	$2s^22p^3$	$^2P^o_{3/2}$	$2s2p^4$	$^4P_{5/2}$	291 730	709 070		1.3−3	2.6+7	E	81*
210.96^{C}		3/2		3/2	291 730	765 760		3.9−3	1.5+8	E	81*
183.97^{C}		1/2		1/2	242 110	785 670		1.6−3	1.6+8	E	81*
216.57^{C}	$2s2p^4$	$^4P_{5/2}$	$2s2p^4$	$^2P_{3/2}$	709 070	1 170 820		M1	1.1+4	D−	81*
205.62^{C}		3/2		1/2	765 760	1 252 090		M1	1.7+4	D−	81*
182.94^{C}	$2s^22p^3$	$^2D^o_{5/2}$	$2s2p^4$	$^4P_{5/2}$	162 450	709 070		5.8−3	1.9+8	E	81*
173.22^{C}		3/2		5/2	131 770	709 070		1.1−2	4.1+8	E	81*
157.73^{C}		3/2		3/2	131 770	765 760		1.2−3	7.8+7	E	81*
152.93^{C}		3/2		1/2	131 770	785 670		1.5−3	2.1+8	E	81*

Mn XIX (N sequence) – Continued

λ (Å)	Classification		Energy Levels (cm^{-1})		Int.	*gf*	*A* (s^{-1})	Acc.	References
168.84^C	$2s2p^4$ $^2P_{1/2}$	$2p^5$ $^2P^o_{3/2}$	1 252 090	1 844 360		3.30−2	1.93+9	C	81*
148.48	3/2	3/2	1 170 820	1 844 360		3.9−1	3.0+10	C	45°,81*
146.57	1/2	1/2	1 252 090	1 934 390		2.0−1	3.0+10	C	45°,81*
130.97	3/2	1/2	1 170 820	1 934 390		1.62−1	3.14+10	C	45°,81*
145.05^C	$2s^22p^3$ $^2P^o_{3/2}$	$2s2p^4$ $^2D_{3/2}$	291 730	981 160		8.4−3	6.7+8	D	81*
142.68	3/2	5/2	291 730	992 600		1.04−1	5.7+9	C	45°,81*,54
135.33	1/2	3/2	242 110	981 160		3.22−2	2.93+9	C	45°,81*
141.03	$2s^22p^3$ $^4S^o_{3/2}$	$2s2p^4$ $^4P_{5/2}$	0	709 070		2.2−1	1.3+10	C	45°,81*,54,55
130.59	3/2	3/2	0	765 760		1.70−1	1.66+10	C	45°,81*,54,55
127.28	3/2	1/2	0	785 670		9.04−2	1.86+10	C	45°,81*,54,55
139.36	$2s2p^4$ $^2S_{1/2}$	$2p^5$ $^2P^o_{3/2}$	1 126 740	1 844 360		9.40−2	8.1+9	C	45°,81*
123.82^C	1/2	1/2	1 126 740	1 934 390		6.8−3	1.5+9	D	81*
122.14^C	$2s^22p^3$ $^2D^o_{5/2}$	$2s2p^4$ $^2D_{3/2}$	162 450	981 160		1.3−3	1.5+8	E	81*
120.46	5/2	5/2	162 450	992 600		3.9−1	3.0+10	C	45°,81*,54,55
117.74	3/2	3/2	131 770	981 160		3.2−1	3.8+10	C	45°,81*,54,55
116.17^C	3/2	5/2	131 770	992 600		7.6−5	6.3+6	E	81*
119.76	$2s^22p^3$ $^2P^o_{3/2}$	$2s2p^4$ $^2S_{1/2}$	291 730	1 126 740		1.8−2	4.1+9	D	45°,81*
113.04	1/2	1/2	242 110	1 126 740		1.3−1	3.4+10	C	45°,81*,60
117.41	$2s2p^4$ $^2D_{5/2}$	$2p^5$ $^2P^o_{3/2}$	992 600	1 844 360		3.4−1	4.1+10	C	45°,81*,57
115.84	3/2	3/2	981 160	1 844 360		1.19−1	1.48+10	C	45°,81*,57
104.90	3/2	1/2	981 160	1 934 390		1.46−1	4.44+10	C	45°,81*,57
113.75	$2s^22p^3$ $^2P^o_{3/2}$	$2s2p^4$ $^2P_{3/2}$	291 730	1 170 820		7.12−2	9.2+9	C	45°,81*,54
107.68	1/2	3/2	242 110	1 170 820		5.56−2	8.0+9	C	45°,81*,54
104.13	3/2	1/2	291 730	1 252 090		2.8−1	8.7+10	C	45°,81*,54
99.01	1/2	1/2	242 110	1 252 090		1.4−2	4.7+9	D	45°,81*,54
101.92	$2s^22p^3$ $^4S^o_{3/2}$	$2s2p^4$ $^2D_{3/2}$	0	981 160		6.8−3	1.1+9	E	45°,81*
100.50	$2s^22p^3$ $^2D^o_{3/2}$	$2s2p^4$ $^2S_{1/2}$	131 770	1 126 740		1.2−1	4.0+10	E	45°,81*,60
99.17	$2s^22p^3$ $^2D^o_{5/2}$	$2s2p^4$ $^2P_{3/2}$	162 450	1 170 820		5.6−1	9.5+10	C	45°,81*,54,55
96.24	3/2	3/2	131 770	1 170 820		8.48−2	1.53+10	C	45°,81*,54,55
89.26	3/2	1/2	131 770	1 252 090		7.12−2	2.98+10	C	45°,81*,54
94.456^C	$2s2p^4$ $^4P_{1/2}$	$2p^5$ $^2P^o_{3/2}$	785 670	1 844 360		2.0−3	3.7+8	E	81*
92.71	3/2	3/2	765 760	1 844 360		5.6−3	1.1+9	E	45°,81*
88.08	5/2	3/2	709 070	1 844 360		1.1−2	2.3+9	E	45°,81*
87.053^C	1/2	1/2	785 670	1 934 390		1.7−3	7.4+8	E	81*
85.570^C	3/2	1/2	765 760	1 934 390		4.0−4	1.8+8	E	81*
88.75	$2s^22p^3$ $^4S^o_{3/2}$	$2s2p^4$ $^2S_{1/2}$	0	1 126 740		3.2−3	1.4+9	E	45°,81*
85.41	$2s^22p^3$ $^4S^o_{3/2}$	$2s2p^4$ $^2P_{3/2}$	0	1 170 820		1.5−2	3.4+9	E	45°,81*
14.098^T	$2s^22p^3$ $^4S^o_{3/2}$	$2s^22p^2(^3P)3d$ $^4P_{3/2}$	0	7 093 200					59°,47
14.098^T	3/2	5/2	0	7 093 200					59°,47

Mn xx (C sequence)

λ (Å)	Classification				Energy Levels (cm^{-1})		Int.	gf	A (s^{-1})	Acc.	References
7308^{C}	$2s2p^3$	$^3P^\circ_1$	$2s2p^3$	$^3P^\circ_2$	856 900	870 580		M1	3.4+1	D	81*
4942^{C}	$2s2p^3$	$^3D^\circ_2$	$2s2p^3$	$^3D^\circ_3$	722 710	742 940		M1	1.2+2	D	81*
2559^{C}	$2s^22p^2$	$^3P_1$	$2s^22p^2$	$^3P_2$	59 580	98 650		M1	6.4+2	C+	81*
1678^{C}		0		1	0	59 580		M1	3.46+3	C+	81*
1014^{C}		0		2	0	98 650		E2	3.8−1	E	81*
1340^{C}	$2p^4$	$^3P_1$	$2p^4$	$^1D_2$	1 623 650	1 698 290		M1	4.7+2	D	81*
655.78^{C}		2		2	1 545 800	1 698 290		M1	1.1+4	D	81*
1285^{C}	$2p^4$	$^3P_2$	$2p^4$	$^3P_1$	1 545 800	1 623 650		M1	9.7+3	C	81*
1280^{C}		2		0	1 545 800	1 623 890		E2	5.9−1	E	81*
880.20^{C}	$2s^22p^2$	$^3P_2$	$2s^22p^2$	$^1D_2$	98 650	212 260		M1	9.5+3	D	81*
654.96^{C}		1		2	59 580	212 260		M1	9.6+3	D	81*
877.50^{C}	$2s2p^3$	$^3D^\circ_3$	$2s2p^3$	$^3P^\circ_1$	742 940	856 900		E2	4.0	E	81*
785.85^{C}		1		0	723 090	850 340		M1	1.2+4	D	81*
783.51^{C}		2		0	722 710	850 340		E2	1.5+1	E	81*
783.45^{C}		3		2	742 940	870 580		M1	8.1+3	D	81*
747.33^{C}		1		1	723 090	856 900		M1	1.3+4	D	81*
678.01^{C}		1		2	723 090	870 580		M1	1.7+3	D−	81*
676.27^{C}		2		2	722 710	870 580		M1	7.5+3	D	81*
827.68^{C}	$2s^22p^2$	$^1D_2$	$2s^22p^2$	$^1S_0$	212 260	333 080		E2	1.4+1	E	81*
679.99^{C}	$2s2p^3$	$^3S^\circ_1$	$2s2p^3$	$^1P^\circ_1$	1 025 510	1 172 570		M1	2.1+4	D	81*
645.45^{C}	$2s2p^3$	$^3P^\circ_2$	$2s2p^3$	$^3S^\circ_1$	870 580	1 025 510		M1	1.2+3	D−	81*
593.08^{C}		1		1	856 900	1 025 510		M1	1.1+3	D−	81*
570.87^{C}		0		1	850 340	1 025 510		M1	2.7+3	D−	81*
560.85^{C}	$2s2p^3$	$^3P^\circ_2$	$2s2p^3$	$^1D^\circ_2$	870 580	1 048 880		M1	1.0+4	D	81*
520.89^{C}		1		2	856 900	1 048 880		M1	5.0+3	D	81*
465.79^{C}	$2p^4$	$^1D_2$	$2p^4$	$^1S_0$	1 698 290	1 912 980		E2	2.8+2	E	81*
365.63^{C}	$2s^22p^2$	$^3P_1$	$2s^22p^2$	$^1S_0$	59 580	333 080		M1	9.4+4	D	81*
357.59^{C}	$2s2p^3$	$^5S^\circ_2$	$2s2p^3$	$^3D^\circ_2$	[443 060]	722 710		M1	9.5+3	E	81*
357.10^{C}		2		1	[443 060]	723 090		M1	3.7+3	E	81*
345.63^{C}	$2p^4$	$^3P_1$	$2p^4$	$^1S_0$	1 623 650	1 912 980		M1	1.4+5	D	81*
331.14^{C}	$2s2p^3$	$^3P^\circ_2$	$2s2p^3$	$^1P^\circ_1$	870 580	1 172 570		M1	8.7+3	D−	81*
316.79^{C}		1		1	856 900	1 172 570		M1	5.7+3	D−	81*
330.67^{C}	$2s2p^3$	$^3D^\circ_1$	$2s2p^3$	$^3S^\circ_1$	723 090	1 025 510		M1	3.7+3	E	81*
330.25^{C}		2		1	722 710	1 025 510		M1	1.0+4	E	81*
306.59^{C}	$2s2p^3$	$^3D^\circ_2$	$2s2p^3$	$^1D^\circ_2$	722 710	1 048 880		M1	8.6+3	D−	81*
290.36^{P}	$2s^22p^2$	$^3P_2$	$2s2p^3$	$^5S^\circ_2$	98 650	[443 060]		1.6−3	2.5+7	E	61°,81*
260.77^{P}		1		2	59 580	[443 060]		1.2−3	2.4+7	E	61°,81*
267.93^{C}	$2s2p^3$	$^1P^\circ_1$	$2p^4$	$^3P_2$	1 172 570	1 545 800		5.4−3	1.0+8	E	81*
221.69^{C}		1		1	1 172 570	1 623 650		1.3−2	6.0+8	E	81*
256.40^{C}	$2s^22p^2$	$^1S_0$	$2s2p^3$	$^3D^\circ_1$	333 080	723 090		1.3−3	4.4+7	E	81*
241.64^{C}	$2s2p^3$	$^5S^\circ_2$	$2s2p^3$	$^3P^\circ_1$	[443 060]	856 900		M1	2.8+4	D−	81*
233.91^{C}		2		2	[443 060]	870 580		M1	5.0+4	D	81*
222.48^{C}	$2s2p^3$	$^3D^\circ_1$	$2s2p^3$	$^1P^\circ_1$	723 090	1 172 570		M1	1.1+4	D−	81*
222.29^{C}		2		1	722 710	1 172 570		M1	3.8+4	D−	81*

Mn xx (C sequence) – Continued

λ (Å)	Classification				Energy Levels (cm^{-1})		Int.	*gf*	*A* (s^{-1})	Acc.	References
201.24^C	$2s2p^3$	$^1D^o_2$	$2p^4$	$^3P_2$	1 048 880	1 545 800		2.3−2	7.4+8	E	81*
173.98^C		2		1	1 048 880	1 623 650		3.1−3	2.3+8	E	81*
195.91^C	$2s^22p^2$	$^1D_2$	$2s2p^3$	$^3D^o_2$	212 260	722 710		1.0−3	3.6+7	E	81*
195.76^C		2		1	212 260	723 090		2.8−3	1.6+8	E	81*
188.44^C		2		3	212 260	742 940		3.0−2	8.2+8	E	81*
192.20	$2s2p^3$	$^3S^o_1$	$2p^4$	$^3P_2$	1 025 510	1 545 800		1.8−1	6.5+9	C	45°,81*
167.19		1		1	1 025 510	1 623 650		1.6−1	1.3+10	C	45°,81*
167.12		1		0	1 025 510	1 623 890		6.99−2	1.67+10	C	45°,81*
190.91^C	$2s^22p^2$	$^1S_0$	$2s2p^3$	$^3P^o_1$	333 080	856 900		2.2−3	1.3+8	E	81*
190.23	$2s2p^3$	$^1P^o_1$	$2p^4$	$^1D_2$	1 172 570	1 698 290		1.24−1	4.56+9	C	45°,81*
160.14^C	$2s^22p^2$	$^3P_2$	$2s2p^3$	$^3D^o_1$	98 650	723 090		4.8−4	4.2+7	E	81*
155.21		2		3	98 650	742 940		1.58−1	6.2+9	C	45°,81*,55
150.80		1		2	59 580	722 710		1.6−1	9.2+9	C	45°,81*,55
150.71		1		1	59 580	723 090		9.6−3	9.4+8	D	45°,81*
138.30		0		1	0	723 090		9.1−2	1.1+10	C	45°,81*,55
155.13^C	$2s^22p^2$	$^1D_2$	$2s2p^3$	$^3P^o_1$	212 260	856 900		3.2−3	3.0+8	E	81*
151.90^C		2		2	212 260	870 580		3.9−3	2.3+8	E	81*
153.98	$2s2p^3$	$^1D^o_2$	$2p^4$	$^1D_2$	1 048 880	1 698 290		5.95−1	3.35+10	C	45°,81*
148.10	$2s2p^3$	$^3P^o_2$	$2p^4$	$^3P_2$	870 580	1 545 800		5.90−2	3.59+9	C	45°,81*
145.16		1		2	856 900	1 545 800		5.61−2	3.55+9	C	45°,81*
132.79		2		1	870 580	1 623 650		1.25−1	1.58+10	C	45°,81*
130.42^C		1		1	856 900	1 623 650		2.0−4	2.6+7	E	81*
130.38		1		0	856 900	1 623 890		4.86−2	1.91+10	C	45°,81*
129.31		0		1	850 340	1 623 650		3.48−2	4.63+9	C	45°,81*
144.42^C	$2s^22p^2$	$^1S_0$	$2s2p^3$	$^3S^o_1$	333 080	1 025 510		5.1−3	5.4+8	E	81*
135.06	$2s2p^3$	$^1P^o_1$	$2p^4$	$^1S_0$	1 172 570	1 912 980		2.1−1	7.8+10	C	45°,81*
131.88^C	$2s^22p^2$	$^3P_2$	$2s2p^3$	$^3P^o_1$	98 650	856 900		2.7−2	3.4+9	D	81*
129.55		2		2	98 650	870 580		2.41−1	1.92+10	C	45°,81*,55,60
126.46		1		0	59 580	850 340		5.25−2	2.19+10	C	45°,81*
125.42		1		1	59 580	856 900		1.02−1	1.44+10	C	45°,81*
123.30		1		2	59 580	870 580		6.0−3	5.3+8	D	45°,81*
116.70		0		1	0	856 900		2.55−2	4.16+9	C	45°,81*
124.56	$2s2p^3$	$^3D^o_3$	$2p^4$	$^3P_2$	742 940	1 545 800		3.46−1	2.98+10	C	45°,81*
121.55		1		2	723 090	1 545 800		3.30−2	2.98+9	C	45°,81*
121.49		2		2	722 710	1 545 800		1.47−1	1.33+10	C	45°,81*
111.04		1		1	723 090	1 623 650		8.07−2	1.46+10	C	45°,81*
111.01		1		0	723 090	1 623 890		6.45−2	3.49+10	C	45°,81*
111.00		2		1	722 710	1 623 650		1.20−1	2.17+10	C	45°,81*
122.96^C	$2s^22p^2$	$^1D_2$	$2s2p^3$	$^3S^o_1$	212 260	1 025 510		1.1−3	1.6+8	E	81*
120.82	$2s2p^3$	$^3P^o_2$	$2p^4$	$^1D_2$	870 580	1 698 290		1.7−2	1.6+9	E	45°,81*
118.85^C		1		2	856 900	1 698 290		1.0−2	9.6+8	E	81*
119.54	$2s^22p^2$	$^1D_2$	$2s2p^3$	$^1D^o_2$	212 260	1 048 880		4.9−1	4.6+10	C	45°,81*,55,60
119.12	$2s^22p^2$	$^1S_0$	$2s2p^3$	$^1P^o_1$	333 080	1 172 570		1.08−1	1.69+10	C	45°,81*
112.68^C	$2s2p^3$	$^3S^o_1$	$2p^4$	$^1S_0$	1 025 510	1 912 980		9.9−3	5.2+9	E	81*
107.89	$2s^22p^2$	$^3P_2$	$2s2p^3$	$^3S^o_1$	98 650	1 025 510		3.1−1	5.9+10	C	45°,81*,55,60
103.53		1		1	59 580	1 025 510		1.23−1	2.55+10	C	45°,81*,55,60
97.51		0		1	0	1 025 510		4.03−2	9.4+9	C	45°,81*,60

Mn xx (C sequence) – Continued

λ (Å)	Classification				Energy Levels (cm^{-1})		Int.	*gf*	*A* (s^{-1})	Acc.	References
105.24	$2s^22p^2$	$^3P_2$	$2s2p^3$	$^1D^\circ_2$	98 650	1 048 880		6.0−2	7.2+9	E	45°,81*
101.08^{C}		$_1$		$_2$	59 580	1 048 880		2.5−3	3.3+8	E	81*
104.67	$2s2p^3$	$^3D^\circ_3$	$2p^4$	$^1D_2$	742 940	1 698 290		3.9−2	4.8+9	E	45°,81*
102.50^{C}		$_2$		$_2$	722 710	1 698 290		5.0−3	6.3+8	E	81*
104.13	$2s^22p^2$	$^1D_2$	$2s2p^3$	$^1P^\circ_1$	212 260	1 172 570		3.2−1	6.6+10	C	45°,81*,55,60
94.690^{C}	$2s2p^3$	$^3P^\circ_1$	$2p^4$	$^1S_0$	856 900	1 912 980		4.5−3	3.3+9	E	81*
93.117^{C}	$2s^22p^2$	$^3P_2$	$2s2p^3$	$^1P^\circ_1$	98 650	1 172 570		5.5−4	1.4+8	E	81*
89.85		$_1$		$_1$	59 580	1 172 570		1.6−2	4.4+9	E	45°,81*
90.683^{C}	$2s2p^3$	$^5S^\circ_2$	$2p^4$	$^3P_2$	[443 060]	1 545 800		6.5−3	1.1+9	E	81*
84.703^{C}		$_2$		$_1$	[443 060]	1 623 650		7.5−4	2.3+8	E	81*
13.46^{T}	$2s^22p^2$	$^1D_2$	$2s^22p3d$	$^1F^\circ_3$	212 260	7 642 000					59°,47

Mn xxi (B sequence)

λ (Å)	Classification				Energy Levels (cm^{-1})		Int.	*gf*	*A* (s^{-1})	Acc.	References
7228.7^{C}	$2s2p^2$	$^2S_{1/2}$	$2s2p^2$	$^2P_{3/2}$	910 880	924 710		M1	1.03+1	C−	81*
6004.3^{C}	$2s2p^2$	$^2D_{3/2}$	$2s2p^2$	$^2D_{5/2}$	687 540	704 190		M1	4.73+1	C	81*
4134.5^{C}	$2p^3$	$^2D^\circ_{3/2}$	$2p^3$	$^2D^\circ_{5/2}$	1 310 890	1 335 070		M1	1.3+2	C	81*
2236.4^{C}	$2p^3$	$^2P^\circ_{1/2}$	$2p^3$	$^2P^\circ_{3/2}$	1 472 710	1 517 410		M1	6.7+2	C	81*
2205.8^{C}	$2s2p^2$	$^4P_{1/2}$	$2s2p^2$	$^4P_{3/2}$	379 660	424 980		M1	2.03+3	C	81*
2188.0^{C}		$_{3/2}$		$_{5/2}$	424 980	470 670		M1	1.5+3	C	81*
1006.4^{C}	$2s^22p$	$^2P^\circ_{1/2}$	$2s^22p$	$^2P^\circ_{3/2}$	0	99 360		M1	8.8+3	B	81*
952.8^{C}	$2s2p^2$	$^2P_{1/2}$	$2s2p^2$	$^2S_{1/2}$	805 930	910 880		M1	1.1+4	C−	81*
841.9^{C}	$2s2p^2$	$^2P_{1/2}$	$2s2p^2$	$^2P_{3/2}$	805 930	924 710		M1	8.0+3	C	81*
618.0^{C}	$2p^3$	$^2D^\circ_{3/2}$	$2p^3$	$^2P^\circ_{1/2}$	1 310 890	1 472 710		M1	8.6+3	D	81*
548.4^{C}		$_{5/2}$		$_{3/2}$	1 335 070	1 517 410		M1	1.3+4	D	81*
484.2^{C}		$_{3/2}$		$_{3/2}$	1 310 890	1 517 410		M1	3.7+4	D	81*
395.69^{C}	$2s2p^2$	$^2P_{3/2}$	$2p^3$	$^4S^\circ_{3/2}$	924 710	1 177 430		2.4−3	2.5+7	E	81*
356.76^{C}	$2s^22p$	$^2P^\circ_{3/2}$	$2s2p^2$	$^4P_{1/2}$	99 360	379 660		4.8−4	1.3+7	E	81*
269.32^{C}		$_{3/2}$		$_{5/2}$	99 360	470 670		3.2−3	4.8+7	E	81*
263.39^{C}		$_{1/2}$		$_{1/2}$	0	379 660		1.3−3	6.1+7	E	81*
258.95^{T}	$2s2p^2$	$^2P_{3/2}$	$2p^3$	$^2D^\circ_{3/2}$	924 710	1 310 890		1.9−3	4.7+7	E	45°,81*
243.69		$_{3/2}$		$_{5/2}$	924 710	1 335 070		1.70−1	3.17+9	C	45°,81*
198.04		$_{1/2}$		$_{3/2}$	805 930	1 310 890					45
204.13^{C}	$2s2p^2$	$^2D_{3/2}$	$2p^3$	$^4S^\circ_{3/2}$	687 540	1 177 430		1.9−3	7.7+7	E	81*
182.48	$2s2p^2$	$^2P_{3/2}$	$2p^3$	$^2P^\circ_{1/2}$	924 710	1 472 710		2.3−2	2.3+9	D	45°,81*
168.72		$_{3/2}$		$_{3/2}$	924 710	1 517 410		3.0−1	1.8+10	C	45°,81*
140.55		$_{1/2}$		$_{3/2}$	805 930	1 517 410					45
177.99	$2s2p^2$	$^2S_{1/2}$	$2p^3$	$^2P^\circ_{1/2}$	910 880	1 472 710					45
164.87		$_{1/2}$		$_{3/2}$	910 880	1 517 410					45

Mn xxi (B sequence) — Continued

λ (Å)	Classification		Energy Levels (cm^{-1})		Int.	*gf*	*A* (s^{-1})	Acc.	References
170.02^{C}	$2s^22p\ ^2P^o_{3/2}$	$2s2p^2\ ^2D_{3/2}$	99 360	687 540		1.2−3	7.2+7	E	81*
165.34	$_{3/2}$	$_{5/2}$	99 360	704 190		1.41−1	5.7+9	C	45°,81*,55
145.45	$_{1/2}$	$_{3/2}$	0	687 540		1.2−1	9.6+9	C	45°,81*,55
164.83	$2s2p^2\ ^2D_{5/2}$	$2p^3\ ^2D^o_{3/2}$	704 190	1 310 890		7.38−2	4.53+9	C	45°,81*
160.42	$_{3/2}$	$_{3/2}$	687 540	1 310 890		1.13−1	7.3+9	C	45°,81*
158.51	$_{5/2}$	$_{5/2}$	704 190	1 335 070		2.72−1	1.2+10	C	45°,81*
154.43	$_{3/2}$	$_{5/2}$	687 540	1 335 070		6.24−2	2.91+9	C	45°,81*
141.49	$2s2p^2\ ^4P_{5/2}$	$2p^3\ ^4S^o_{3/2}$	470 670	1 177 430		2.23−1	1.85+10	C	45°,81*
132.90	$_{3/2}$	$_{3/2}$	424 980	1 177 430		1.52−1	1.44+10	C	45°,81*
125.35	$_{1/2}$	$_{3/2}$	379 660	1 177 430		8.72−2	9.3+9	C	45°,81*
127.36	$2s2p^2\ ^2D_{3/2}$	$2p^3\ ^2P^o_{1/2}$	687 540	1 472 710		1.30−1	2.67+10	C	45°,81*
122.97	$_{5/2}$	$_{3/2}$	704 190	1 517 410		1.21−1	1.34+10	C	45°,81*
120.50	$_{3/2}$	$_{3/2}$	687 540	1 517 410		4.12−2	4.73+9	C	45°,81*
124.08	$2s^22p\ ^2P^o_{1/2}$	$2s2p^2\ ^2P_{1/2}$	0	805 930					45°,55
121.16	$_{3/2}$	$_{3/2}$	99 360	924 710		3.6−1	4.1+10	C	45°,81*,55,62
108.14	$_{1/2}$	$_{3/2}$	0	924 710		4.18−2	6.0+9	C	45°,81*,62
123.23	$2s^22p\ ^2P^o_{3/2}$	$2s2p^2\ ^2S_{1/2}$	99 360	910 880					45
109.78	$_{1/2}$	$_{1/2}$	0	910 880					45
119.02^{C}	$2s2p^2\ ^4P_{5/2}$	$2p^3\ ^2D^o_{3/2}$	470 670	1 310 890		9.6−4	1.1+8	E	81*
115.69^{T}	$_{5/2}$	$_{5/2}$	470 670	1 335 070		1.7−2	1.4+9	E	45°,81*
112.88^{C}	$_{3/2}$	$_{3/2}$	424 980	1 310 890		1.2−2	1.5+9	E	81*
95.535^{C}	$2s2p^2\ ^4P_{5/2}$	$2p^3\ ^2P^o_{3/2}$	470 670	1 517 410		7.2−4	1.3+8	E	81*
91.539^{C}	$_{3/2}$	$_{3/2}$	424 980	1 517 410		1.2−3	2.5+8	E	81*
91.487^{C}	$_{1/2}$	$_{1/2}$	379 660	1 472 710		4.6−4	1.8+8	E	81*

Mn xxii (Be sequence)

λ (Å)	Classification		Energy Levels (cm^{-1})		Int.	*gf*	*A* (s^{-1})	Acc.	References
3755.5^{C}	$1s^22s2p\ ^3P^o_0$	$1s^22s2p\ ^3P^o_1$	333 350	359 970		M1	3.33+2	C+	81*
1293.2^{C}	$_{1}$	$_{2}$	359 970	437 300		M1	6.11+3	C+	81*
2487.4^{C}	$1s^22p^2\ ^3P_1$	$1s^22p^2\ ^3P_2$	967 950	1 008 140		M1	7.0+2	C	81*
1736.4^{C}	$_{0}$	$_{1}$	910 360	967 950		M1	3.26+3	C	81*
850.92^{C}	$1s^22p^2\ ^3P_2$	$1s^22p^2\ ^1D_2$	1 008 140	1 125 660		M1	1.08+4	C	81*
634.08^{C}	$_{1}$	$_{2}$	967 950	1 125 660		M1	1.1+4	D+	81*
496.06^{C}	$1s^22s2p\ ^1P^o_1$	$1s^22p^2\ ^3P_0$	708 770	910 360		8.1−4	2.2+7	E	81*
385.83^{C}	$_{1}$	$_{1}$	708 770	967 950		3.9−4	5.8+6	E	81*
334.03^{C}	$_{1}$	$_{2}$	708 770	1 008 140		2.3−2	2.8+8	D	81*
368.36^{C}	$1s^22s2p\ ^3P^o_2$	$1s^22s2p\ ^1P^o_1$	437 300	708 770		M1	8.6+3	D	81*
286.70^{C}	$_{1}$	$_{1}$	359 970	708 770		M1	1.1+4	D−	81*
266.37^{C}	$_{0}$	$_{1}$	333 350	708 770		M1	1.8+4	D	81*
277.80	$1s^22s^2\ ^1S_0$	$1s^22s2p\ ^3P^o_1$	0	359 970		1.3−3	3.7+7	D	65°,81*,36
271.41^{C}	$1s^22p^2\ ^3P_1$	$1s^22p^2\ ^1S_0$	967 950	1 336 400		M1	1.3+5	D	81*
239.87	$1s^22s2p\ ^1P^o_1$	$1s^22p^2\ ^1D_2$	708 770	1 125 660		1.77−1	4.10+9	B	45°,81*

Mn XXII (Be sequence) – Continued

λ (Å)	Classification				Energy Levels (cm^{-1})		Int.	*gf*	A (s^{-1})	Acc.	References
175.18		$_2$		$_2$	437 300	1 008 140		1.72-1	7.5+9	B	45°,81*
164.48		$_1$		$_1$	359 970	967 950		4.59-2	3.77+9	B	45°,81*
157.58		$_0$		$_1$	333 350	967 950		6.56-2	5.87+9	B	45°,81*
154.28		$_1$		$_2$	359 970	1 008 140		8.58-2	4.81+9	B	45°,81*
159.33	$1s^22s2p$	$^1P^\circ_1$	$1s^22p^2$	$^1S_0$	708 770	1 336 400		1.13-1	2.98+10	B	45°,81*
145.27	$1s^22s2p$	$^3P^\circ_2$	$1s^22p^2$	$^1D_2$	437 300	1 125 660		5.90-2	3.73+9	C	45°,81*
130.60^C		$_1$		$_2$	359 970	1 125 660		4.2-3	3.3+8	D	81*
141.10	$1s^22s^2$	$^1S_0$	$1s^22s2p$	$^1P^\circ_1$	0	708 770		1.59-1	1.78+10	B	66°,81*,45,55
103.31	$1s^22s^2$	$^1S_0$	$1s^22p^2$	$^3P_1$	0	967 950		M1	7.8+3	E	81*
99.193^C		$_0$		$_2$	0	1 008 140		E2	1.3+3	E	81*
13.58^C	$1s^22p^2$	$^1S_0$	$1s^22p3s$	$^1P^\circ_1$	1 336 400	8 702 000		5.6-2	6.8+11	D	81*
13.199	$1s^22p^2$	$^1D_2$	$1s^22p3s$	$^1P^\circ_1$	1 125 660	8 702 000		1.4-1	1.8+12	D	68°,81*,67
13.199	$1s^22p^2$	$^3P_1$	$1s^22p3s$	$^3P^\circ_0$	967 950	8 544 300		5.1-2	2.0+12	D	68°,81*,67
13.00^C	$1s^22p^2$	$^1S_0$	$1s^22p3d$	$^1P^\circ_1$	1 336 400	9 027 000		1.29	1.70+13	C-	81*
12.935	$1s^22s2p$	$^3P^\circ_2$	$1s^22s3s$	$^3S_1$	437 300	8 168 000		1.3-1	1.7+12	D	68°,81*,67
12.816		$_1$		$_1$	359 970	8 168 000		8.1-2	1.1+12	D	68°,81*,67
12.76^C		$_0$		$_1$	333 350	8 168 000		2.7-2	3.7+11	D	81*
12.816	$1s^22s2p$	$^1P^\circ_1$	$1s^22s3d$	$^1D_2$	708 770	8 512 000		1.8	1.5+13	C-	68°,81*
12.816	$1s^22p^2$	$^1D_2$	$1s^22p3d$	$^1D^\circ_2$	1 125 660	8 928 000		2.5-1	2.0+12	C-	68°,81*,67
12.738	$1s^22p^2$	$^1D_2$	$1s^22p3d$	$^3P^\circ_2$	1 125 660	8 976 000		6.5-1	5.4+12	C-	68°,81*,67
12.738	$1s^22p^2$	$^3P_2$	$1s^22p3d$	$^3D^\circ_2$	1 008 140	8 860 000		1.4-1	1.2+12	D	68°,81*,67
12.706		$_2$		$_1$	1 008 140	8 878 000		1.1-2	1.5+11	D	68°,81*,67
12.670		$_1$		$_2$	967 950	8 860 000		1.31	1.09+13	C-	68°,81*,67
12.656		$_1$		$_1$	967 950	8 878 000		2.8-1	3.9+12	C-	68°,81*,67
12.580		$_2$		$_3$	1 008 140	8 957 000		3.3	2.0+13	C-	68°,81*,47,,59,67
12.553		$_0$		$_1$	910 360	8 878 000		1.29	1.82+13	C-	68°,81*,67
12.656	$1s^22p^2$	$^1D_2$	$1s^22p3d$	$^1P^\circ_1$	1 125 660	9 027 000		7.5-2	1.0+12	D	68°,81*
12.656	$1s^22p^2$	$^1D_2$	$1s^22p3d$	$^1F^\circ_3$	1 125 660	9 027 000		5.10	3.03+13	C-	68°,81*,47,59
12.63^C	$1s^22p^2$	$^3P_2$	$1s^22p3d$	$^1D^\circ_2$	1 008 140	8 928 000		2.0-1	1.7+12	C-	81*
12.56^C		$_1$		$_2$	967 950	8 928 000		1.1	9.4+12	D	81*
12.553	$1s^22p^2$	$^3P_2$	$1s^22p3d$	$^3P^\circ_1$	1 008 140	8 975 000		3.7-1	5.2+12	C-	68°,81*,67
12.553		$_2$		$_2$	1 008 140	8 976 000		1.25	1.06+13	C-	68°,81*,67
12.488		$_1$		$_0$	967 950	8 975 600		3.3-1	1.4+13	C-	68°,81*,67
12.488		$_1$		$_2$	967 950	8 976 000		1.8-1	1.5+12	D	68°,81*,67
12.488		$_1$		$_1$	967 950	8 975 000		6.9-1	9.8+12	C-	68°,81*,67
12.40^C		$_0$		$_1$	910 360	8 975 000		3.3-3	4.8+10	D	81*
12.521^C	$1s^22s2p$	$^1P^\circ_1$	$1s^22p3p$	$^3D_1$	708 770	8 695 400		9.6-2	1.4+12	D	81*
12.507	$1s^22s2p$	$^3P^\circ_2$	$1s^22s3d$	$^3D_1$	437 300	8 433 000		3.6-2	5.1+11	C-	68°,81*,67
12.488		$_2$		$_3$	437 300	8 445 000		3.0	1.8+13	C-	68°,81*,47,59,67
12.488		$_2$		$_2$	437 300	8 445 000		5.5-1	4.7+12	C-	68°,81*,67
12.39^C		$_1$		$_1$	359 970	8 433 000		5.4-1	7.8+12	C-	81*
12.368		$_1$		$_2$	359 970	8 445 000		1.6	1.4+13	C-	68°,81*,47,59,67
12.336		$_0$		$_1$	333 350	8 433 000		7.4-1	1.1+13	C-	68°,81*,67
12.447	$1s^22p^2$	$^3P_2$	$1s^22p3d$	$^1F^\circ_3$	1 008 140	9 027 000					68°,67
12.427	$1s^22s2p$	$^1P^\circ_1$	$1s^22p3p$	$^1P_1$	708 770	8 756 000		1.2-1	1.7+12	D	68°,81*,67

Mn XXII (Be sequence) – Continued

λ (Å)	Classification				Energy Levels (cm^{-1})		Int.	*gf*	*A* (s^{-1})	Acc.	References
12.271^C	$1s^22s2p$	$^1P^o_1$	$1s^22p3p$	$^3P_2$	708 770	8 858 000		1.8−1	1.6+12	D	81*
12.172	$1s^22s2p$	$^1P^o_1$	$1s^22p3p$	$^1D_2$	708 770	8 924 000		6.6−1	5.9+12	C−	68°,81*,67
12.079	$1s^22s2p$	$^1P^o_1$	$1s^22s3s$	$^1S_0$	708 770	8 987 600		3.0−2	1.1+12	D	68°,81*,67
12.017^C	$1s^22s2p$	$^3P^o_2$	$1s^22p3p$	$^3D_2$	437 300	8 759 100		2.1−2	1.9+11	D	81*
11.997		$_1$		$_1$	359 970	8 695 400		1.4−1	2.2+12	D	68°,81*,67
11.959^C		$_0$		$_1$	333 350	8 695 400		8.3−2	1.3+12	D	81*
11.906		$_2$		$_3$	437 300	8 836 400		7.0−1	4.7+12	C−	68°,81*,67
11.906		$_1$		$_2$	359 970	8 759 100		4.8−1	4.5+12	C−	68°,81*,67
11.997	$1s^22s^2$	$^1S_0$	$1s^22s3p$	$^3P^o_1$	0	8 335 000		2.8−1	4.3+12	C−	68°,81*,67
11.971	$1s^22s^2$	$^1S_0$	$1s^22s3p$	$^1P^o_1$	0	8 354 000		4.2−1	6.5+12	C−	68°,81*,67
11.906	$1s^22s2p$	$^3P^o_1$	$1s^22p3p$	$^1P_1$	359 970	8 756 000					68°,67
11.876		$_0$		$_1$	333 350	8 756 000					68°,67
11.876	$1s^22s2p$	$^3P^o_2$	$1s^22p3p$	$^3S_1$	437 300	8 857 600					68°,67
11.876	$1s^22s2p$	$^3P^o_2$	$1s^22p3p$	$^3P_2$	437 300	8 858 000		4.8−1	4.5+12	C−	68°,81*
11.876		$_1$		$_0$	359 970	8 780 300		1.2−1	5.7+12	D	68°,81*,67
11.793		$_1$		$_2$	359 970	8 858 000		2.5−2	2.4+11	D	68°,81*,67
11.793	$1s^22s2p$	$^3P^o_2$	$1s^22p3p$	$^1D_2$	437 300	8 924 000					68°,67

Mn XXIII (Li sequence)

λ (Å)	Classification				Energy Levels (cm^{-1})		Int.	*gf*	*A* (s^{-1})	Acc.	References
920.801^C	$1s^22p$	$^2P^o_{1/2}$	$1s^22p$	$^2P^o_{3/2}$	374 654	483 255		M1	1.15+4	B	81*,71
266.913^C	$1s^22s$	$^2S_{1/2}$	$1s^22p$	$^2P^o_{1/2}$	0	374 654		3.70−2	1.73+9	B+	71,81*,36,45, 65,70
206.930^C		$_{1/2}$		$_{3/2}$	0	483 255		9.66−2	3.76+9	B+	71,81*,36,45, 65,70
75.3807^C	$1s^24p$	$^2P^o_{3/2}$	$1s^25d$	$^2D_{3/2}$	[11 508 400]	[12 835 000]		2.3−1	6.5+10	D	81*
75.2559^C		$_{3/2}$		$_{5/2}$	[11 508 400]	[12 837 200]		2.10	4.06+11	C+	81*
74.6213^C		$_{1/2}$		$_{3/2}$	[11 494 900]	[12 835 000]		1.17	3.38+11	C+	81*
35.7705^C	$1s^23p$	$^2P^o_{3/2}$	$1s^24s$	$^2S_{1/2}$	[8 655 600]	[11 451 200]					
35.3632^C		$_{1/2}$		$_{1/2}$	[8 623 400]	[11 451 200]					
34.8493^C	$1s^23p$	$^2P^o_{3/2}$	$1s^24d$	$^2D_{3/2}$	[8 655 600]	[11 525 100]		2.4−1	3.2+11	C+	81*
34.7983^C		$_{3/2}$		$_{5/2}$	[8 655 600]	[11 529 300]		2.1	2.0+12	B	81*
34.4626^C		$_{1/2}$		$_{3/2}$	[8 623 400]	[11 525 100]		1.1	1.6+12	B	81*
33.6100^C	$1s^23s$	$^2S_{1/2}$	$1s^24p$	$^2P^o_{1/2}$	[8 519 600]	[11 494 900]		2.8−1	8.5+11	C	81*
33.4582^C		$_{1/2}$		$_{3/2}$	[8 519 600]	[11 508 400]		6.0−1	8.9+11	C	81*
24.1447^C	$1s^23p$	$^2P^o_{3/2}$	$1s^25s$	$^2S_{1/2}$	[8 655 600]	[12 797 300]					
23.9584^C		$_{1/2}$		$_{1/2}$	[8 623 400]	[12 797 300]					
23.9269^C	$1s^23p$	$^2P^o_{3/2}$	$1s^25d$	$^2D_{3/2}$	[8 655 600]	[12 835 000]		5.6−2	1.6+11	D	81*
23.9143^C		$_{3/2}$		$_{5/2}$	[8 655 600]	[12 837 200]		4.96−1	9.67+11	C+	81*
23.7439^C		$_{1/2}$		$_{3/2}$	[8 623 400]	[12 835 000]		2.76−1	8.15+11	C+	81*
12.4436^C	$1s^22p$	$^2P^o_{3/2}$	$1s^23s$	$^2S_{1/2}$	[483 255]	[8 519 600]					68,72,73
12.2773^C		$_{1/2}$		$_{1/2}$	[374 654]	[8 519 600]					68,72,73

Mn XXIII (Li sequence) – Continued

λ (Å)	Classification				Energy Levels (cm^{-1})		Int.	*gf*	*A* (s^{-1})	Acc.	References
12.1775^{C}	$1s^22p$	$^2P^\circ_{3/2}$	$1s^23d$	$^2D_{3/2}$	[483 255]	[8 695 100]		2.7−1	3.1+12	B	68,81*,73
12.1626^{C}		$_{3/2}$		$_{5/2}$	[483 255]	[8 705 200]		2.44	1.83+13	B	68,81*,72,73
12.0186^{C}		$_{1/2}$		$_{3/2}$	[374 654]	[8 695 100]		1.34	1.54+13	B	68,81*,73
11.5964^{C}	$1s^22s$	$^2S_{1/2}$	$1s^23p$	$^2P^\circ_{1/2}$	0	[8 623 400]		2.56−1	6.34+12	B	68,81*,73
11.5532^{C}		$_{1/2}$		$_{3/2}$	0	[8 655 600]		4.92−1	6.14+12	B	68,81*,73
9.1175^{C}	$1s^22p$	$^2P^\circ_{3/2}$	$1s^24s$	$^2S_{1/2}$	[483 255]	[11 451 200]					
9.0280^{C}		$_{1/2}$		$_{1/2}$	[374 654]	[11 451 200]					
9.0565^{C}	$1s^22p$	$^2P^\circ_{3/2}$	$1s^24d$	$^2D_{3/2}$	[483 255]	[11 525 100]		4.8−2	9.7+11	C+	81*,73
9.0530^{C}		$_{3/2}$		$_{5/2}$	[483 255]	[11 529 300]		4.4−1	6.0+12	B	68,81*,73
8.9682^{C}		$_{1/2}$		$_{3/2}$	[374 654]	[11 525 100]		2.4−1	4.9+12	B	68,81*,73
8.6995^{C}	$1s^22s$	$^2S_{1/2}$	$1s^24p$	$^2P^\circ_{1/2}$	0	[11 494 900]		6.6−2	2.9+12	C+	68,81*,73
8.6893^{C}		$_{1/2}$		$_{3/2}$	0	[11 508 400]		1.3−1	2.9+12	C+	68,81*,73
8.0960^{C}	$1s^22p$	$^2P^\circ_{3/2}$	$1s^25d$	$^2D_{3/2}$	[483 255]	[12 835 000]		1.8−2	4.6+11	D	81*,73
8.0946^{C}		$_{3/2}$		$_{5/2}$	[483 255]	[12 837 200]		1.62−1	2.75+12	C+	68,81*,73
8.0255^{C}		$_{1/2}$		$_{3/2}$	[374 654]	[12 835 000]		9.04−2	2.34+12	C+	68,81*,73
8.1208^{C}	$1s^22p$	$^2P^\circ_{3/2}$	$1s^25s$	$^2S_{1/2}$	[483 255]	[12 797 300]					
8.0498^{C}		$_{1/2}$		$_{1/2}$	[374 654]	[12 797 300]					
7.8006^{C}	$1s^22s$	$^2S_{1/2}$	$1s^25p$	$^2P^\circ_{1/2}$	0	[12 819 600]					68,73
7.7964^{C}		$_{1/2}$		$_{3/2}$	0	[12 826 500]					68,73
2.0572^{C}	$1s^22p$	$^2P^\circ_{3/2}$	$1s2s^2$	$^2S_{1/2}$	[483 255]	[49 092 000]					
2.0527^{C}		$_{1/2}$		$_{1/2}$	[374 654]	[49 092 000]					
2.0348^{C}	$1s^22p$	$^2P^\circ_{3/2}$	$1s(^2S)2p^2(^3P)$	$^4P_{1/2}$	[483 255]	[49 627 000]					
2.0326^{C}		$_{3/2}$		$_{3/2}$	[483 255]	[49 680 000]					
2.0308^{C}		$_{3/2}$		$_{5/2}$	[483 255]	[49 723 000]					
2.0304^{C}		$_{1/2}$		$_{1/2}$	[374 654]	[49 627 000]					
2.0282^{C}		$_{1/2}$		$_{3/2}$	[374 654]	[49 680 000]					
2.0331^{C}	$1s^22s$	$^2S_{1/2}$	$1s(^2S)2s2p(^3P^\circ)$	$^4P_{1/2}$	0	[49 186 000]					
2.0318^{C}		$_{1/2}$		$_{3/2}$	0	[49 216 000]					
2.0289^{C}		$_{1/2}$		$_{5/2}$	0	[49 288 000]					
2.0248^{C}	$1s^22p$	$^2P^\circ_{3/2}$	$1s(^2S)2p^2(^1D)$	$^2D_{3/2}$	[483 255]	[49 871 000]					
2.0234^{C}		$_{3/2}$		$_{5/2}$	[483 255]	[49 903 000]					
2.0204^{C}		$_{1/2}$		$_{3/2}$	[374 654]	[49 871 000]					
2.0243^{C}	$1s^22s$	$^2P^\circ_{3/2}$	$1s(^2S)2p^2(^3P)$	$^2P_{1/2}$	[483 255]	[49 883 000]					
2.0199^{C}		$_{1/2}$		$_{1/2}$	[374 654]	[49 883 000]					
2.0194^{C}		$_{3/2}$		$_{3/2}$	[483 255]	[50 002 000]					
2.0150^{C}		$_{1/2}$		$_{3/2}$	[374 654]	[50 002 000]					
2.0205^{C}	$1s^22s$	$^2S_{1/2}$	$1s(^2S)2s2p(^3P^\circ)$	$^2P^\circ_{1/2}$	0	[49 493 000]					
2.0180^{C}		$_{1/2}$		$_{3/2}$	0	[49 554 000]					
2.0136^{C}	$1s^22s$	$^2S_{1/2}$	$1s(^2S)2s2p(^1P^\circ)$	$^2P^\circ_{1/2}$	0	[49 662 000]					
2.0127^{C}		$_{1/2}$		$_{3/2}$	0	[49 684 000]					
2.0131^{C}	$1s^22p$	$^2P^\circ_{3/2}$	$1s(^2S)2p^2(^1S)$	$^2S_{1/2}$	[483 255]	[50 157 000]					
2.0087^{C}		$_{1/2}$		$_{1/2}$	[374 654]	[50 157 000]					

Mn XXIV (He sequence)

λ (Å)	Classification				Energy Levels (cm^{-1})		Int.	*gf*	*A* (s^{-1})	Acc.	References
7090^{C}	1*s*5*s*	$^3S_1$	1*s*5*p*	$^3P^\circ_1$	[63 098 000]	[63 112 100]		9.0−2		E	81*
6664^{C}	1*s*5*s*	$^1S_0$	1*s*5*p*	$^1P^\circ_1$	[63 111 700]	[63 126 700]		1.0−1		E	81*
3609^{C}	1*s*4*s*	$^3S_1$	1*s*4*p*	$^3P^\circ_1$	[61 645 000]	[61 672 700]		7.2−2		E	81*
3411^{C}	1*s*4*s*	$^1S_0$	1*s*4*p*	$^1P^\circ_1$	[61 671 900]	[61 701 200]		7.9−2		E	81*
1522.8^{C}	1*s*3*s*	$^3S_1$	1*s*3*p*	$^3P^\circ_1$	[58 488 820]	[58 554 489]		5.1−2		E	81*
1048.4^{C}		$_1$		$_2$	[58 488 820]	[58 584 202]					
1440.1^{C}	1*s*3*s*	$^1S_0$	1*s*3*p*	$^1P^\circ_1$	[58 553 004]	[58 622 446]		5.7−2		D	81*
449.19^{C}	1*s*2*s*	$^3S_1$	1*s*2*p*	$^3P^\circ_0$	[49 370 128]	[49 592 753]		1.1−2	3.59+8	B	81*
421.18^{C}		$_1$		$_1$	[49 370 128]	[49 607 558]		3.21−2	4.06+8	B	81*
296.91^{C}		$_1$		$_2$	[49 370 128]	[49 706 936]		8.13−2	1.22+9	B	81*
422.70^{C}	1*s*2*s*	$^1S_0$	1*s*2*p*	$^1P^\circ_1$	[49 611 955]	[49 848 527]		3.28−2	4.05+8	B	81*
209.03^{C}	1*s*2*s*	$^3S_1$	1*s*2*p*	$^1P^\circ_1$	[49 370 128]	[49 848 527]		5.13−3	2.60+8	B	81*
70.90^{C}	1*s*4*p*	$^1P^\circ_1$	1*s*5*s*	$^1S_0$	[61 701 200]	[63 111 700]		1.6−1	2.2+11	C	81*
70.16^{C}	1*s*4*p*	$^3P^\circ_1$	1*s*5*s*	$^3S_1$	[61 672 700]	[63 098 000]		1.6−1	7.3+10	D	81*
68.74^{C}	1*s*4*s*	$^1S_0$	1*s*5*p*	$^1P^\circ_1$	[61 671 900]	[63 126 700]		4.5−1	2.1+11	D	81*
68.16^{C}	1*s*4*s*	$^3S_1$	1*s*5*p*	$^3P^\circ_1$	[61 645 000]	[63 112 100]		4.50−1	2.15+11	C	81*
32.793^{C}	1*s*3*p*	$^1P^\circ_1$	1*s*4*s*	$^1S_0$	[58 622 446]	[61 671 900]		1.0−1	6.3+11	C	81*
32.568^{C}	1*s*3*d*	$^1D_2$	1*s*4*p*	$^1P^\circ_1$	[58 630 729]	[61 701 200]		5.5−2		C	81*
32.443^{C}	1*s*3*p*	$^1P^\circ_1$	1*s*4*d*	$^1D_2$	[58 622 446]	[61 704 800]		1.9		C	81*
32.357^{C}	1*s*3*p*	$^3P^\circ_1$	1*s*4*s*	$^3S_1$	[58 554 489]	[61 645 000]		9.6−2	2.1+11	C−	81*
31.764^{C}	1*s*3*s*	$^1S_0$	1*s*4*p*	$^1P^\circ_1$	[58 553 004]	[61 701 200]		4.02−1	8.9+11	C	81*
31.408^{C}	1*s*3*s*	$^3S_1$	1*s*4*p*	$^3P^\circ_1$	[58 488 820]	[61 672 700]		4.05−1	9.1+11	C	81*
22.275^{C}	1*s*3*p*	$^1P^\circ_1$	1*s*5*s*	$^1S_0$	[58 622 446]	[63 111 700]		2.3−2	3.1+11	C	81*
22.009^{C}	1*s*3*p*	$^3P^\circ_1$	1*s*5*s*	$^3S_1$	[58 554 489]	[63 098 000]		2.2−2	1.0+11	D	81*
21.864^{C}	1*s*3*s*	$^1S_0$	1*s*5*p*	$^1P^\circ_1$	[58 553 004]	[63 126 700]		1.04−1	4.84+11	C+	81*
21.630^{C}	1*s*3*s*	$^3S_1$	1*s*5*p*	$^3P^\circ_1$	[58 488 820]	[63 112 100]		1.0−1	4.8+11	C	81*
11.4883^{C}	1*s*2*p*	$^1P^\circ_1$	1*s*3*s*	$^1S_0$	[49 848 527]	[58 553 004]		4.2−2	2.1+12	C+	81*
11.3867^{C}	1*s*2*p*	$^1P^\circ_1$	1*s*3*d*	$^1D_2$	[49 848 527]	[58 630 729]		2.1		C+	81*
11.2597^{C}	1*s*2*p*	$^3P^\circ_1$	1*s*3*s*	$^3S_1$	[49 607 558]	[58 488 820]		4.2−2	7.4+11	C−	81*
11.0982^{C}	1*s*2*s*	$^1S_0$	1*s*3*p*	$^1P^\circ_1$	[49 611 955]	[58 622 446]		3.66−1	6.61+12	C	81*
10.8881^{C}	1*s*2*s*	$^3S_1$	1*s*3*p*	$^3P^\circ_1$	[49 370 128]	[58 554 489]		3.69−1	6.92+12	C	81*
10.8530^{C}		$_1$		$_2$	[49 370 128]	[58 584 202]					
8.4578^{C}	1*s*2*p*	$^1P^\circ_1$	1*s*4*s*	$^1S_0$	[49 848 527]	[61 671 900]		9.3−3	8.7+11	C	81*
8.4344^{C}	1*s*2*p*	$^1P^\circ_1$	1*s*4*d*	$^1D_2$	[49 848 527]	[61 704 800]		3.6−1		C	81*
8.3074^{C}	1*s*2*p*	$^3P^\circ_1$	1*s*4*s*	$^3S_1$	[49 607 558]	[61 645 000]		9.3−3	3.0+11	D	81*

Mn XXIV (He sequence) — Continued

λ (Å)	Classification				Energy Levels (cm^{-1})		Int.	gf	A (s^{-1})	Acc.	References
8.2719^{C}	1s2s	$^1S_0$	1s4p	$^1P^\circ_1$	[49 611 955]	[61 701 200]		8.9−2	2.9+12	C+	81*
8.1284^{C}	1s2s	$^3S_1$	1s4p	$^3P^\circ_1$	[49 370 128]	[61 672 700]		9.0−2	3.0+12	C+	81*
7.5397^{C}	1s2p	$^1P^\circ_1$	1s5s	$^1S_0$	[49 848 527]	[63 111 700]		3.6−3	4.2+11	C	81*
7.4127^{C}	1s2p	$^3P^\circ_1$	1s5s	$^3S_1$	[49 607 558]	[63 098 000]		3.6−3	1.5+11	D	81*
7.3993^{C}	1s2s	$^1S_0$	1s5p	$^1P^\circ_1$	[49 611 955]	[63 126 700]		3.6−2	1.5+12	C+	81*
7.2770^{C}	1s2s	$^3S_1$	1s5p	$^3P^\circ_1$	[49 370 128]	[63 112 100]		3.6−2	1.5+12	C+	81*
2.02552^{C}	1s^2	$^1S_0$	1s2s	$^3S_1$	0	[49 370 128]		M1	1.42+8	B	81*
2.01582^{C}	1s^2	$^1S_0$	1s2p	$^3P^\circ_1$	0	[49 607 558]		5.94−2	3.25+13	B	81*
2.01179^{C}		$_0$		$_2$	0	[49 706 936]		M2	4.82+9	B	81*
2.00608^{C}	1s^2	$^1S_0$	1s2p	$^1P^\circ_1$	0	[49 848 527]		7.12−1	3.93+14	B	81*
1.9607^{C}	1s2p	$^1P^\circ_1$	2s^2	$^1S_0$	[49 848 527]	[100 850 000]					73
1.9515^{C}	1s2p	$^3P^\circ_1$	2s^2	$^1S_0$	[49 607 558]	[100 850 000]					73
1.9504^{C}	1s2s	$^1S_0$	2s2p	$^3P^\circ_0$	[49 611 955]	[100 885 000]					73
1.9491^{C}		$_0$		$_1$	[49 611 955]	[100 917 000]					73
1.9501^{C}	1s2p	$^1P^\circ_1$	2p^2	$^3P_0$	[49 848 527]	[101 126 000]					73
1.9476^{C}		$_1$		$_1$	[49 848 527]	[101 192 000]					73
1.9458^{C}		$_1$		$_2$	[49 848 527]	[101 240 000]					73
1.9423^{C}	1s2p	$^3P^\circ_2$	2p^2	$^3P_1$	[49 706 936]	[101 192 000]					73
1.9411^{C}		$_1$		$_0$	[49 607 558]	[101 126 000]					73
1.9405^{C}		$_2$		$_2$	[49 706 936]	[101 124 000]					73
1.9386^{C}		$_1$		$_1$	[49 607 558]	[101 192 000]					73
1.9381^{C}		$_0$		$_1$	[49 592 753]	[101 192 000]					73
1.9368^{C}		$_1$		$_2$	[49 607 558]	[101 240 000]					73
1.9412^{C}	1s2s	$^3S_1$	2s2p	$^3P^\circ_0$	[49 370 128]	[100 885 000]					73
1.9400^{C}		$_1$		$_1$	[49 370 128]	[100 917 000]					73
1.9361^{C}		$_1$		$_2$	[49 370 128]	[101 020 000]					73
1.9404^{C}	1s2p	$^1P^\circ_1$	2p^2	$^1D_2$	[49 848 527]	[101 384 000]					73
1.9351^{C}	1s2p	$^3P^\circ_2$	2p^2	$^1D_2$	[49 706 936]	[101 384 000]					73
1.9314^{C}		$_1$		$_2$	[49 607 558]	[101 384 000]					73
1.9348^{C}	1s2s	$^1S_0$	2s2p	$^1P^\circ_1$	[49 611 955]	[101 297 000]					73
1.9301^{C}	1s2p	$^1P^\circ_1$	2p^2	$^1S_0$	[49 848 527]	[101 659 000]					73
1.9258^{C}	1s2s	$^3S_1$	2s2p	$^1P^\circ_1$	[49 370 128]	[101 297 000]					73
1.9212^{C}	1s2p	$^3P^\circ_1$	2p^2	$^1S_0$	49 607 558	[101 659 000]					73
1.70781^{C}	1s^2	$^1S_0$	1s3p	$^3P^\circ_1$	0	[58 554 489]		1.5−2	1.1+13	E	81*
1.70583^{C}	1s^2	$^1S_0$	1s3p	$^1P^\circ_1$	0	[58 622 446]		1.39−1	1.06+14	C+	81*
1.62146^{C}	1s^2	$^1S_0$	1s4p	$^3P^\circ_1$	0	[61 672 700]		5.1−3	4.3+12	E	81*
1.62071^{C}	1s^2	$^1S_0$	1s4p	$^1P^\circ_1$	0	[61 701 200]		5.1−2	4.32+13	C+	81*
1.58448^{C}	1s^2	$^1S_0$	1s5p	$^3P^\circ_1$	0	[63 112 100]		2.5−3	2.2+12	E	81*
1.58412^{C}	1s^2	$^1S_0$	1s5p	$^1P^\circ_1$	0	[63 126 700]		2.46−2	2.18+13	C+	81*

Mn xxv (H sequence)

λ (Å)	Classification		Energy Levels (cm^{-1})		Int.	*gf*	*A* (s^{-1})	Acc.	References
2377.5^{C}	$3s\ {}^2\mathrm{S}_{1/2}$	$3p\ {}^2\mathrm{P}^{\circ}_{3/2}$	[61 453 640]	[61 495 689]		4.42−2	1.30+7	A	80*
2313.7^{C}	$3p\ {}^2\mathrm{P}^{\circ}_{1/2}$	$3d\ {}^2\mathrm{D}_{3/2}$	[61 452 404]	[61 495 612]		2.84−2	8.83+6	A	80*
704.047^{C}	$2s\ {}^2\mathrm{S}_{1/2}$	$2p\ {}^2\mathrm{P}^{\circ}_{3/2}$	[51 813 492]	[51 955 528]		2.49−2	8.36+7	A	80*
29.95075^{C}	$3d\ {}^2\mathrm{D}_{5/2}$	$4f\ {}^2\mathrm{F}^{\circ}_{7/2}$	[61 509 817]	[64 848 631]		5.82	5.41+12	A	80*
29.85106^{C}	$3p\ {}^2\mathrm{P}^{\circ}_{3/2}$	$4d\ {}^2\mathrm{D}_{5/2}$	[61 495 689]	[64 845 654]		2.24	2.79+12	A	80*
29.53293^{C}	$3s\ {}^2\mathrm{S}_{1/2}$	$4p\ {}^2\mathrm{P}^{\circ}_{3/2}$	[61 453 640]	[64 839 691]		6.56−1	1.26+12	A	80*
20.48181^{C}	$3d\ {}^2\mathrm{D}_{5/2}$	$5f\ {}^2\mathrm{F}^{\circ}_{7/2}$	[61 509 817]	[66 392 198]		8.96−1	1.78+12	A	80*
20.42907^{C}	$3p\ {}^2\mathrm{P}^{\circ}_{3/2}$	$5d\ {}^2\mathrm{D}_{5/2}$	[61 495 689]	[66 390 674]		5.03−1	1.34+12	A	80*
20.26761^{C}	$3s\ {}^2\mathrm{S}_{1/2}$	$5p\ {}^2\mathrm{P}^{\circ}_{3/2}$	[61 453 640]	[66 387 620]		1.63−1	6.63+11	A	80*
10.466503^{C}	$2p\ {}^2\mathrm{P}^{\circ}_{3/2}$	$3d\ {}^2\mathrm{D}_{5/2}$	[51 955 528]	[61 509 817]		2.51	2.55+13	A	80*
10.328234^{C}	$2s\ {}^2\mathrm{S}_{1/2}$	$3p\ {}^2\mathrm{P}^{\circ}_{3/2}$	[51 813 492]	[61 495 689]		5.90−1	9.22+12	A	80*
7.757876^{C}	$2p\ {}^2\mathrm{P}^{\circ}_{3/2}$	$4d\ {}^2\mathrm{D}_{5/2}$	[51 955 528]	[64 845 654]		4.39−1	8.12+12	A	80*
7.676836^{C}	$2s\ {}^2\mathrm{S}_{1/2}$	$4p\ {}^2\mathrm{P}^{\circ}_{3/2}$	[51 813 492]	[64 839 691]		1.39−1	3.93+12	A	80*
6.927536^{C}	$2p\ {}^2\mathrm{P}^{\circ}_{3/2}$	$5d\ {}^2\mathrm{D}_{5/2}$	[51 955 528]	[66 390 674]		1.60−1	3.71+12	A	80*
6.861474^{C}	$2s\ {}^2\mathrm{S}_{1/2}$	$5p\ {}^2\mathrm{P}^{\circ}_{3/2}$	[51 813 492]	[66 387 620]		5.66−2	2.00+12	A	80*
1.930147^{C}	$1s\ {}^2\mathrm{S}_{1/2}$	$2p\ {}^2\mathrm{P}^{\circ}_{1/2}$	0	[51 809 520]		2.80−1	2.50+14	A	80*
1.924723^{C}	$_{1/2}$	$_{3/2}$	0	[51 955 528]		5.61−1	2.52+14	A	80*
1.627276^{C}	$1s\ {}^2\mathrm{S}_{1/2}$	$3p\ {}^2\mathrm{P}^{\circ}_{1/2}$	0	[61 452 404]		5.32−2	6.70+13	A	80*
1.626130^{C}	$_{1/2}$	$_{3/2}$	0	[61 495 689]		1.06−1	6.71+13	A	80*
1.542265^{C}	$1s\ {}^2\mathrm{S}_{1/2}$	$4p\ {}^2\mathrm{P}^{\circ}_{3/2}$	0	[64 839 691]		3.90−2	2.73+13	A	80*
1.506305^{C}	$1s\ {}^2\mathrm{S}_{1/2}$	$5p\ {}^2\mathrm{P}^{\circ}_{3/2}$	0	[66 387 620]		1.87−2	1.38+13	A	80*

5. Explanation of Grotrian Diagrams

Notations on the Diagrams generally have the same meanings as for the Tables (see Explanation of Tables).

Abscissa

Energies of the levels in cm^{-1}.

Short vertical lines

Energy levels are indicated as the vertical lines. The electronic configuration (with the parentage in parentheses) and the level energy in cm^{-1} are given to the right of the vertical line, and at the top is the J value. Energy levels with the same LS label for the upper term are grouped together. The term designation is given at the right of the diagram; the ordering is by increasing multiplicity and orbital angular momentum. For the lower level, the term is adjacent to the configuration.

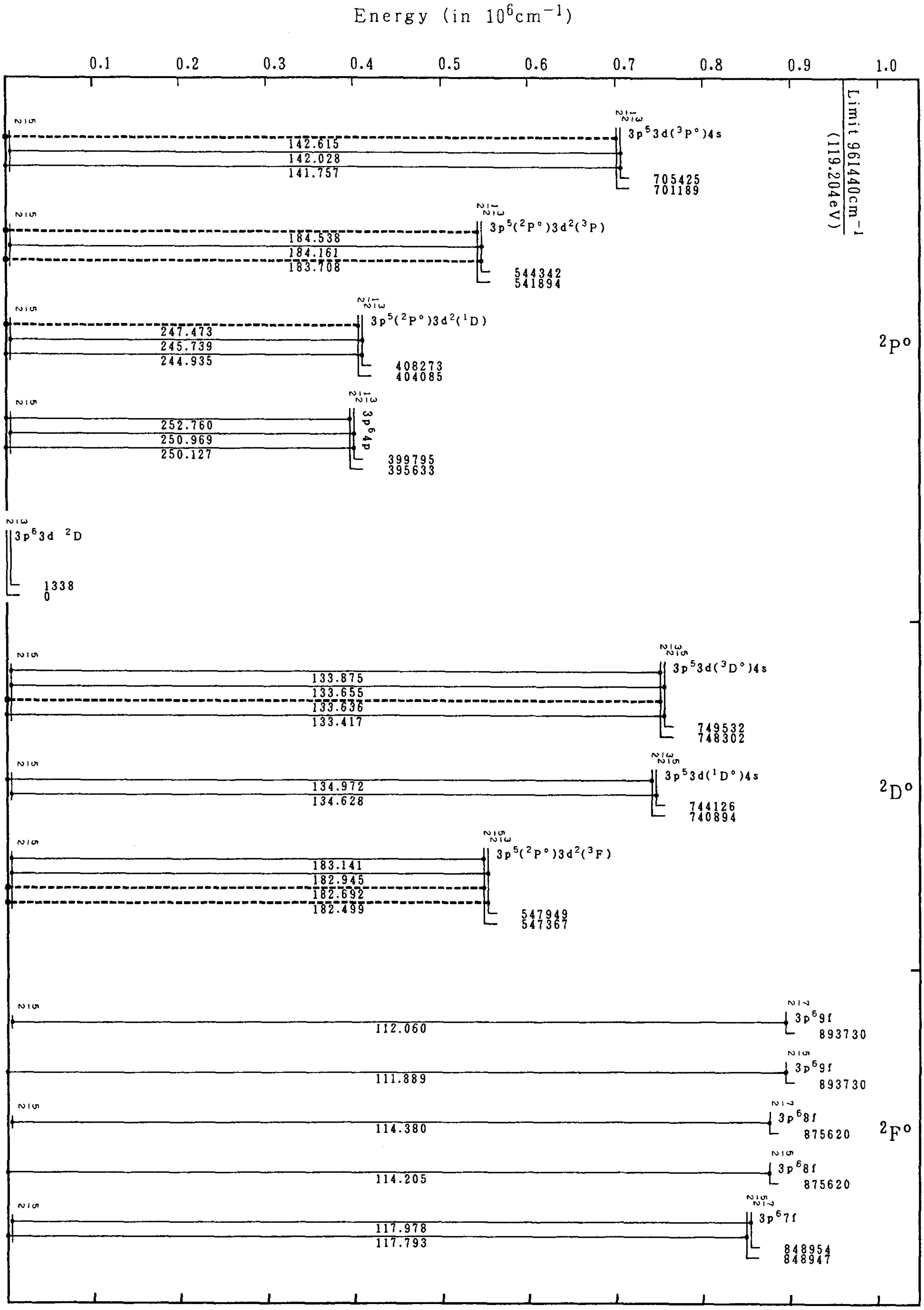
Horizontal lines

Transitions between levels. The number below each line gives the transition wavelength in Angstroms (10^{-8} cm). Heavier dashed lines indicate resonance transitions with absorption oscillator strengths $f \geqslant 0.01$.

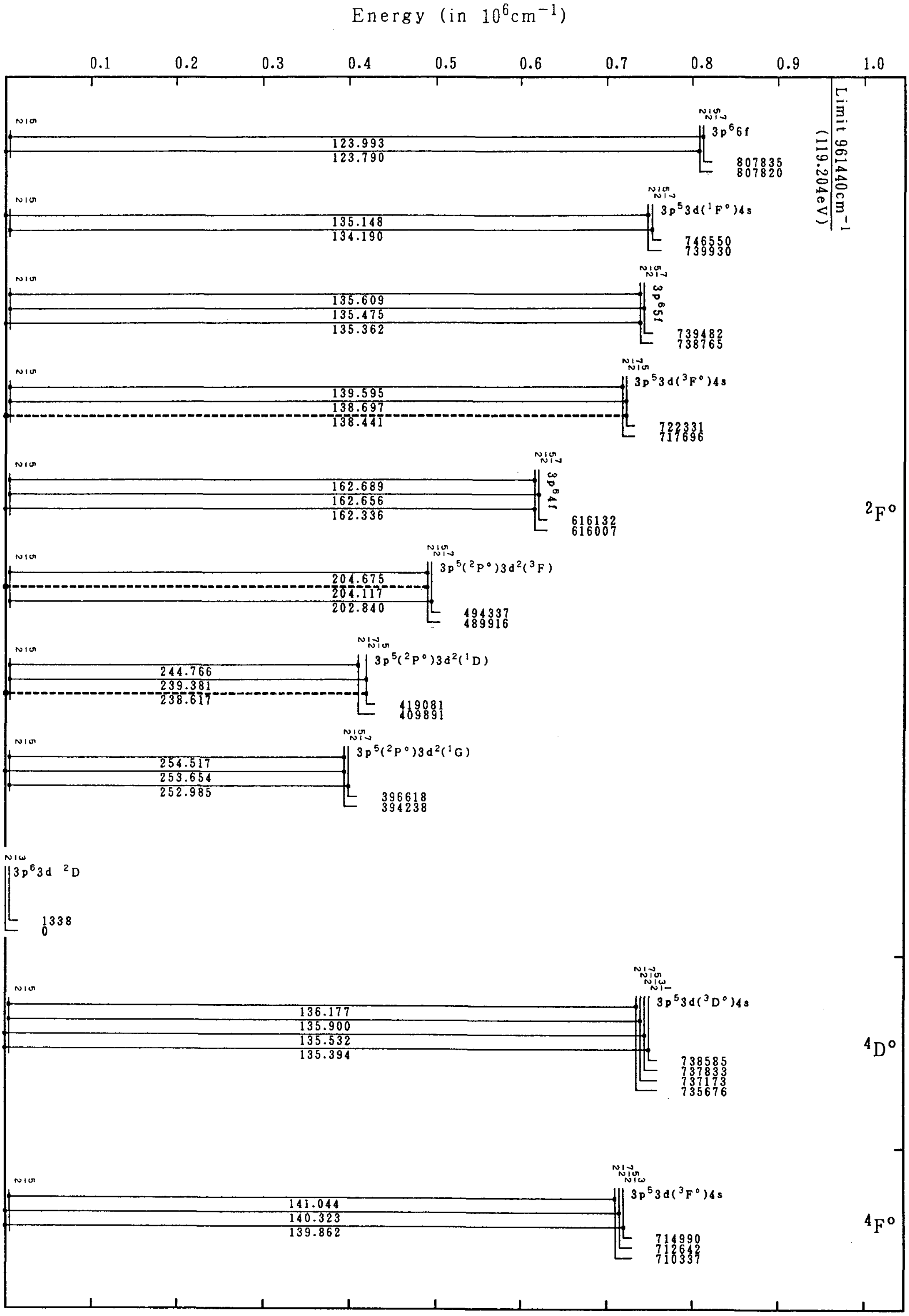
Limit

Principal ionization limit in cm^{-1} and eV.

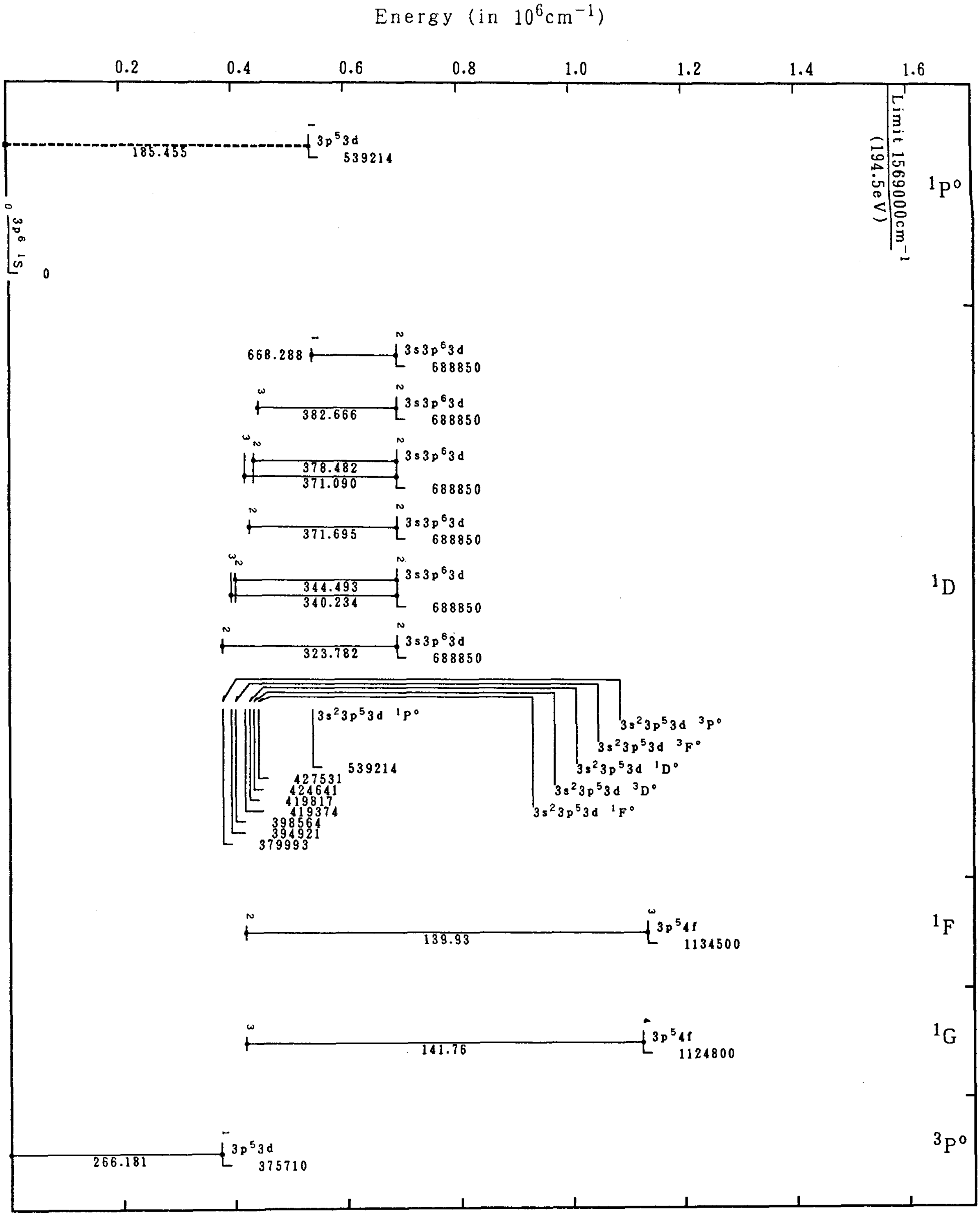
6. Grotrian Diagrams for Mn VII through Mn XXV



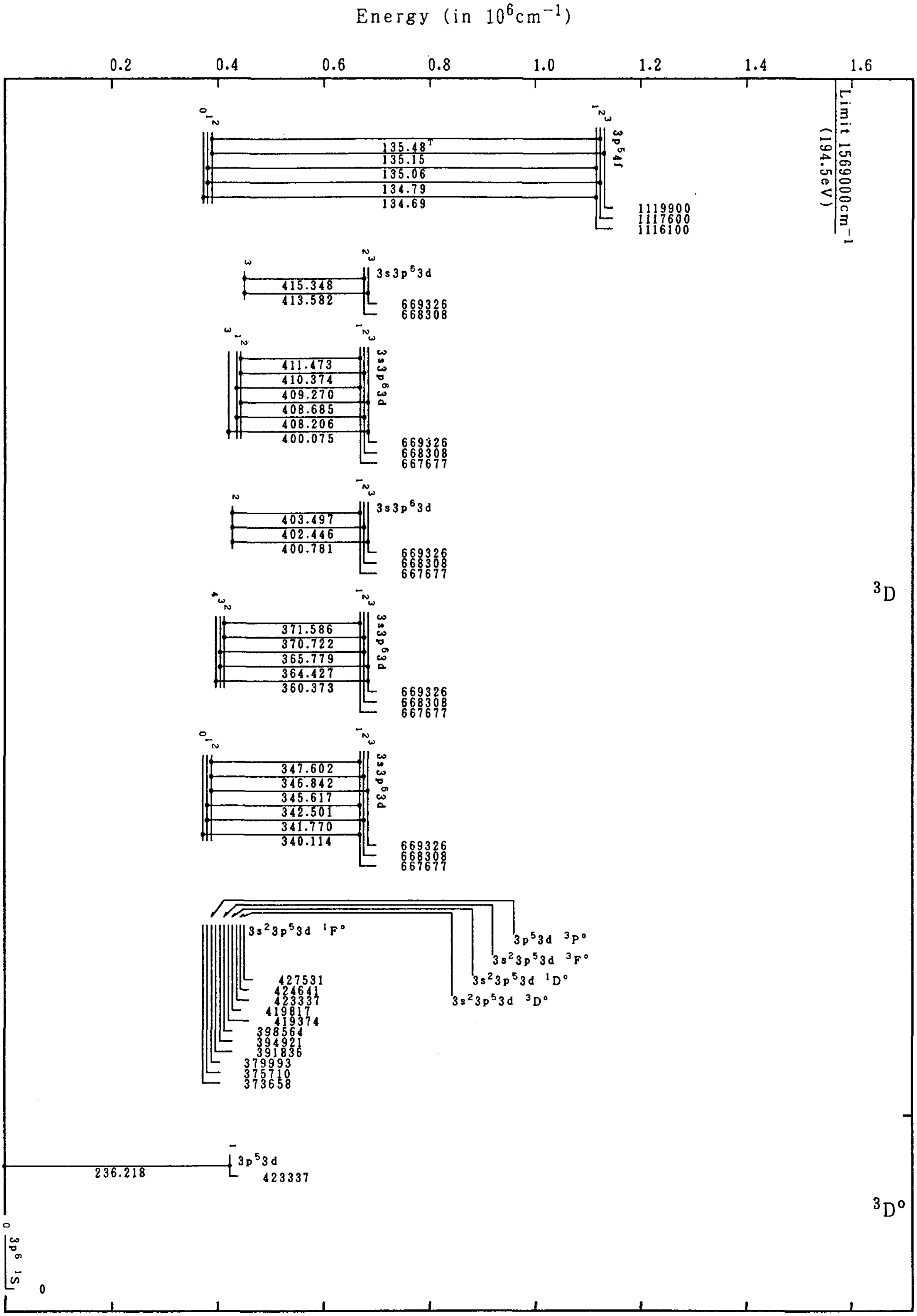
Mn VII(K–Sequence)



Mn VII(K–Sequence)



Mn VIII(Ar–Sequence)



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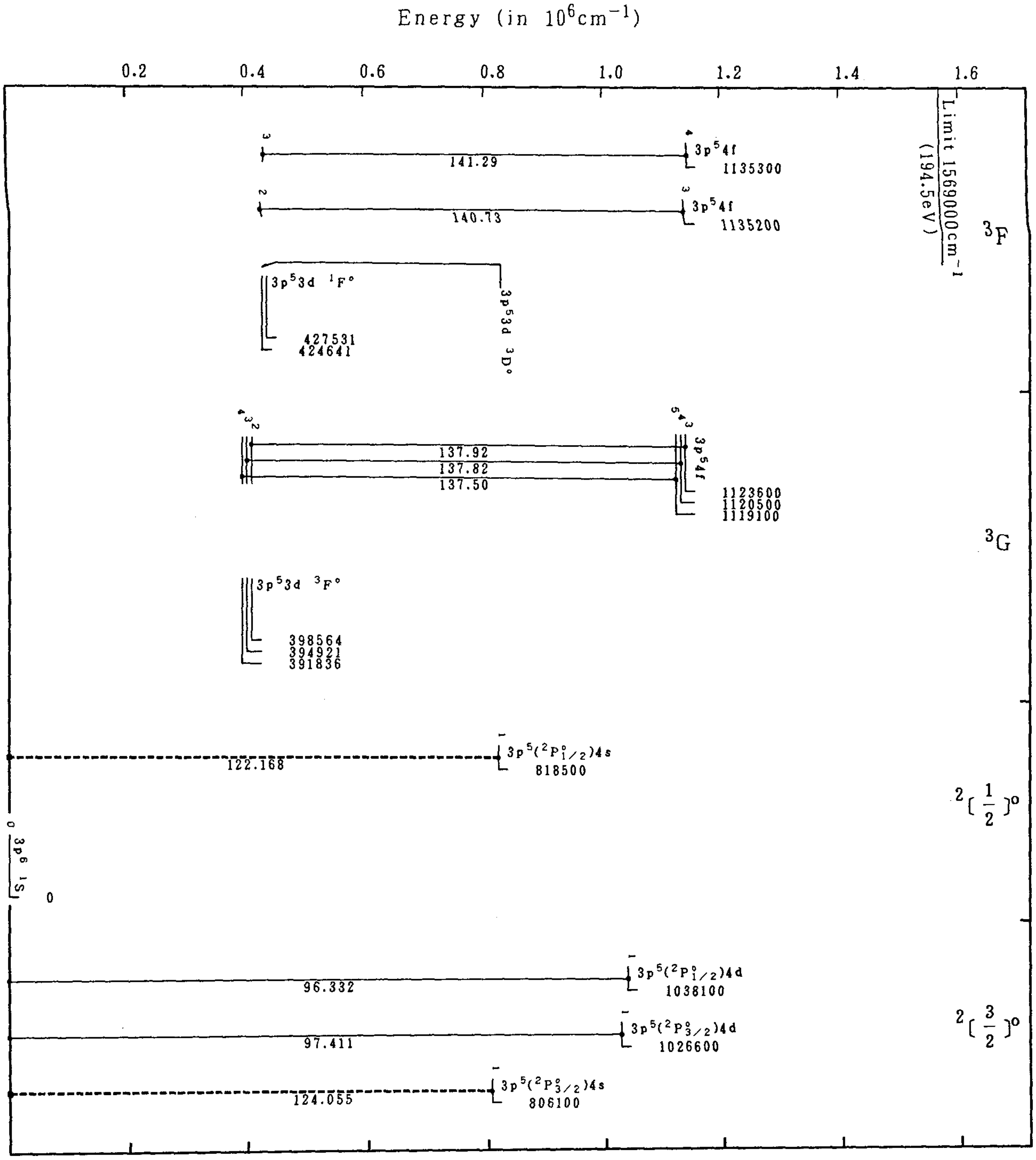

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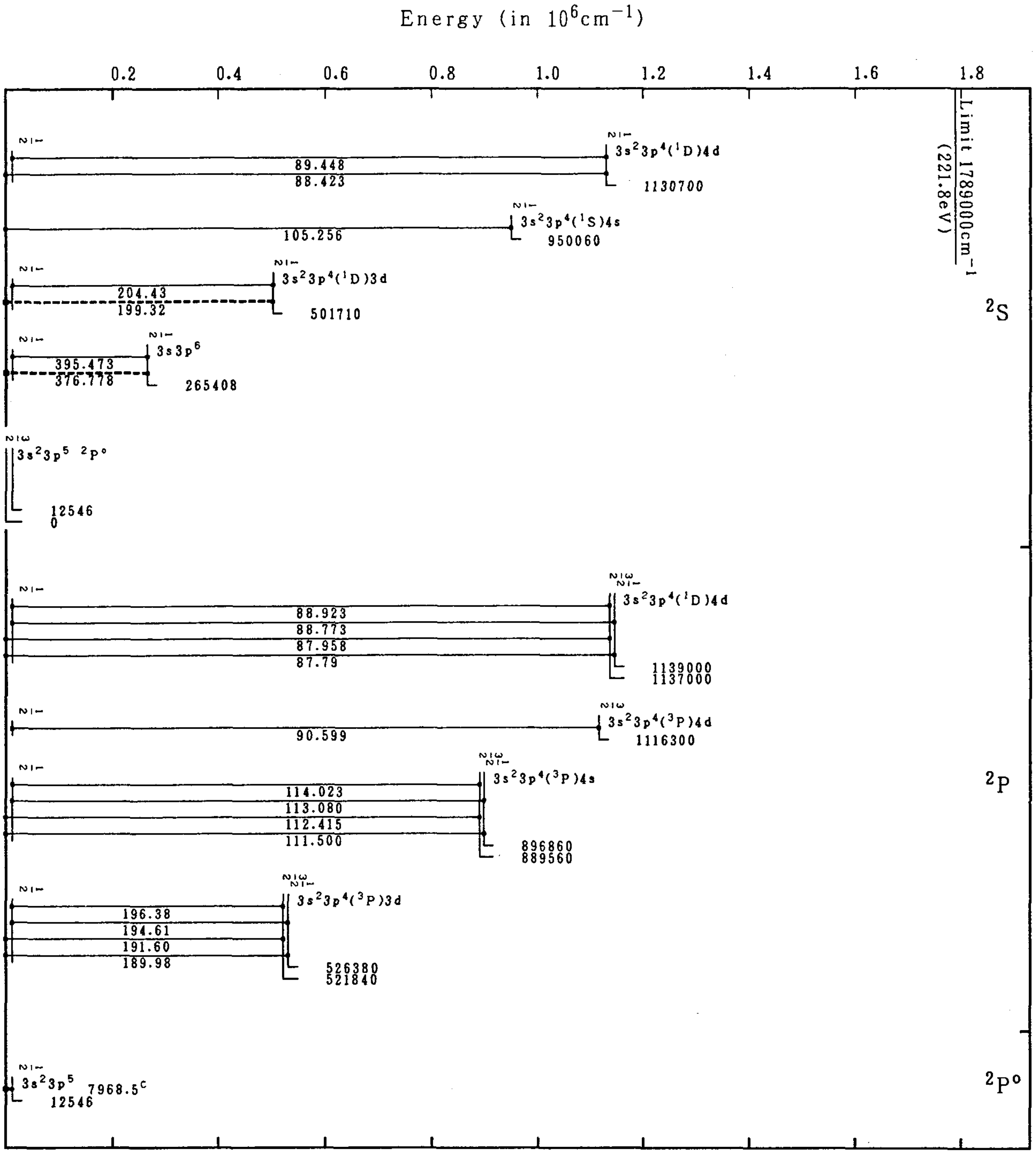
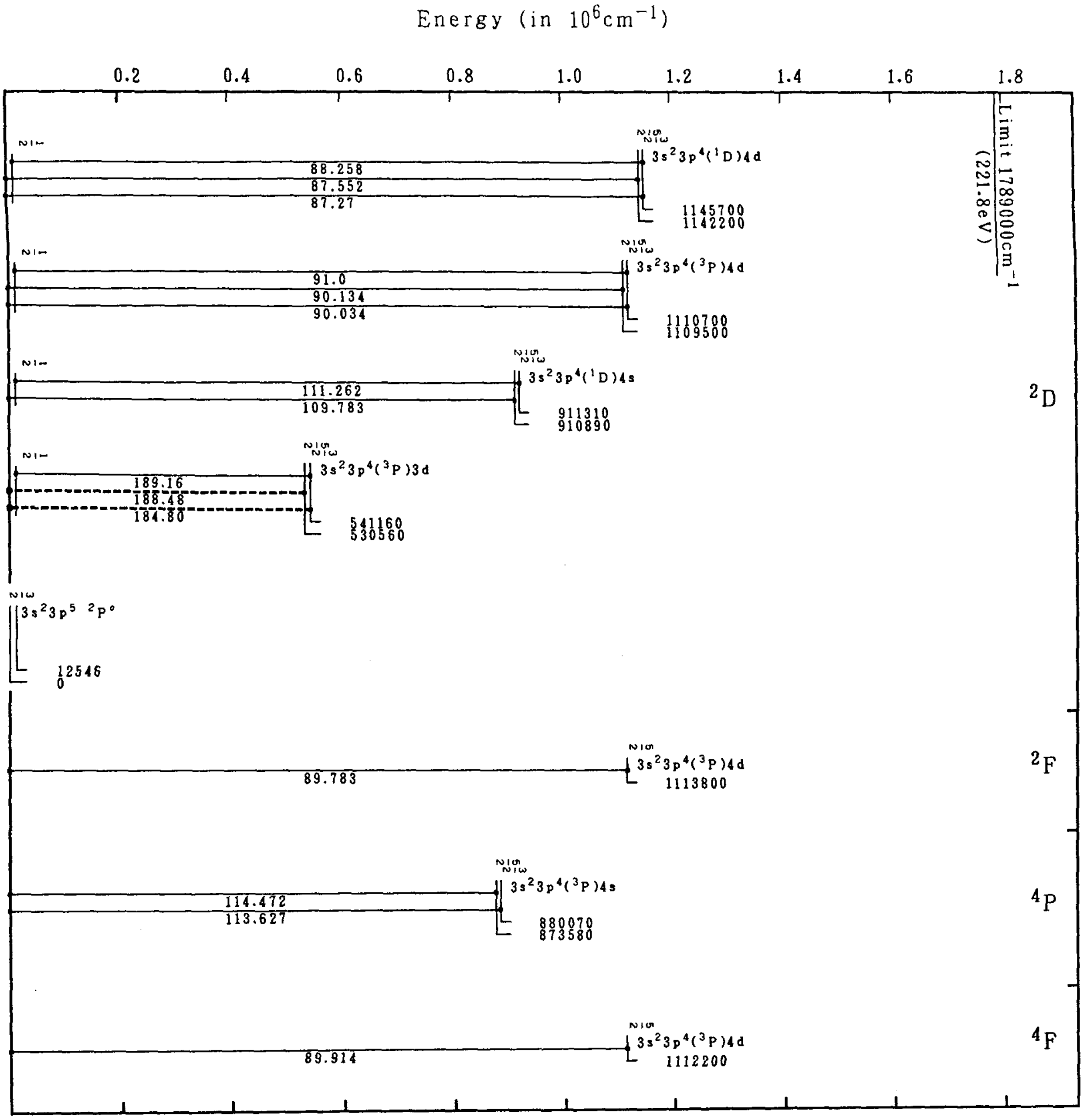
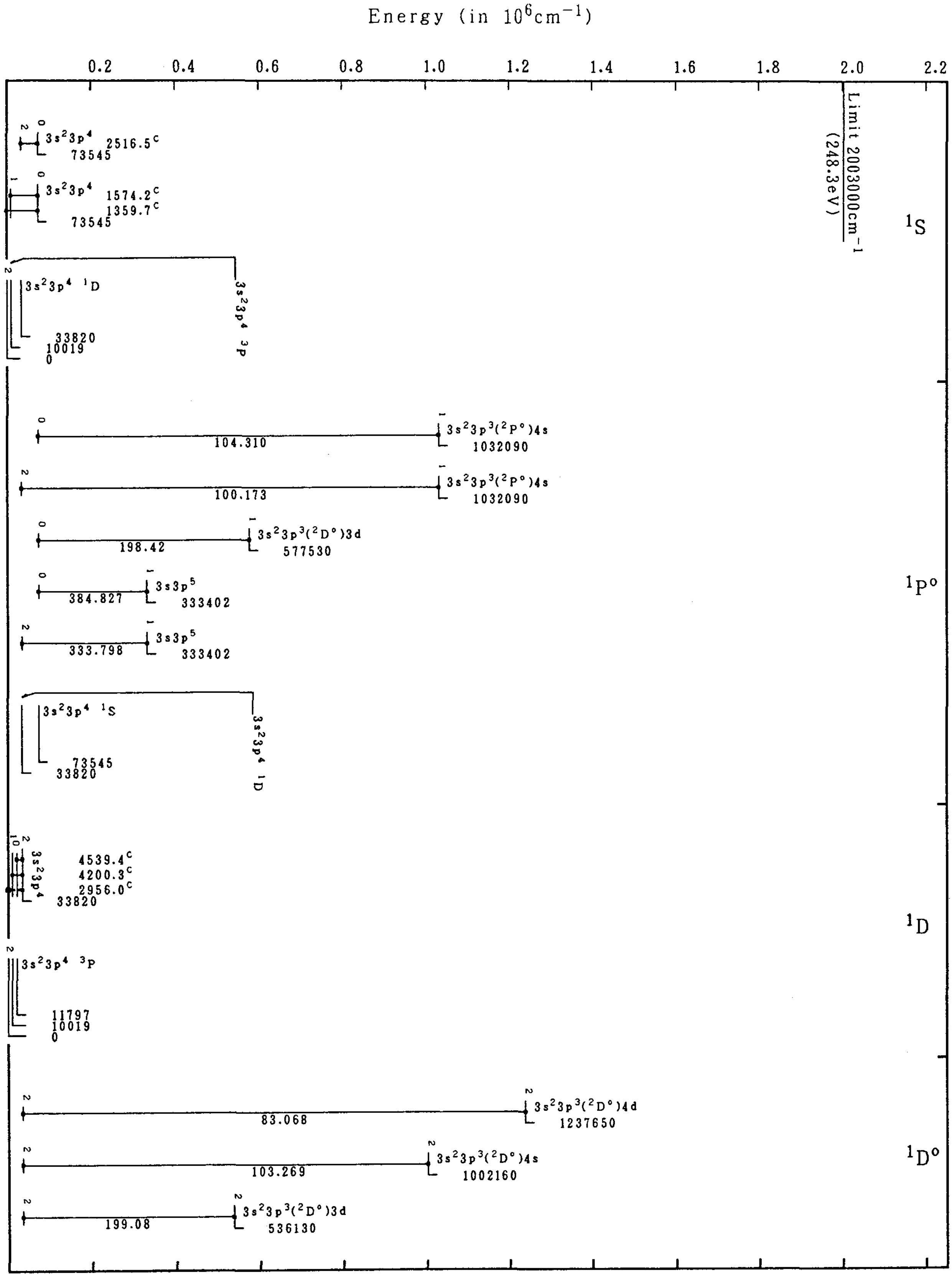


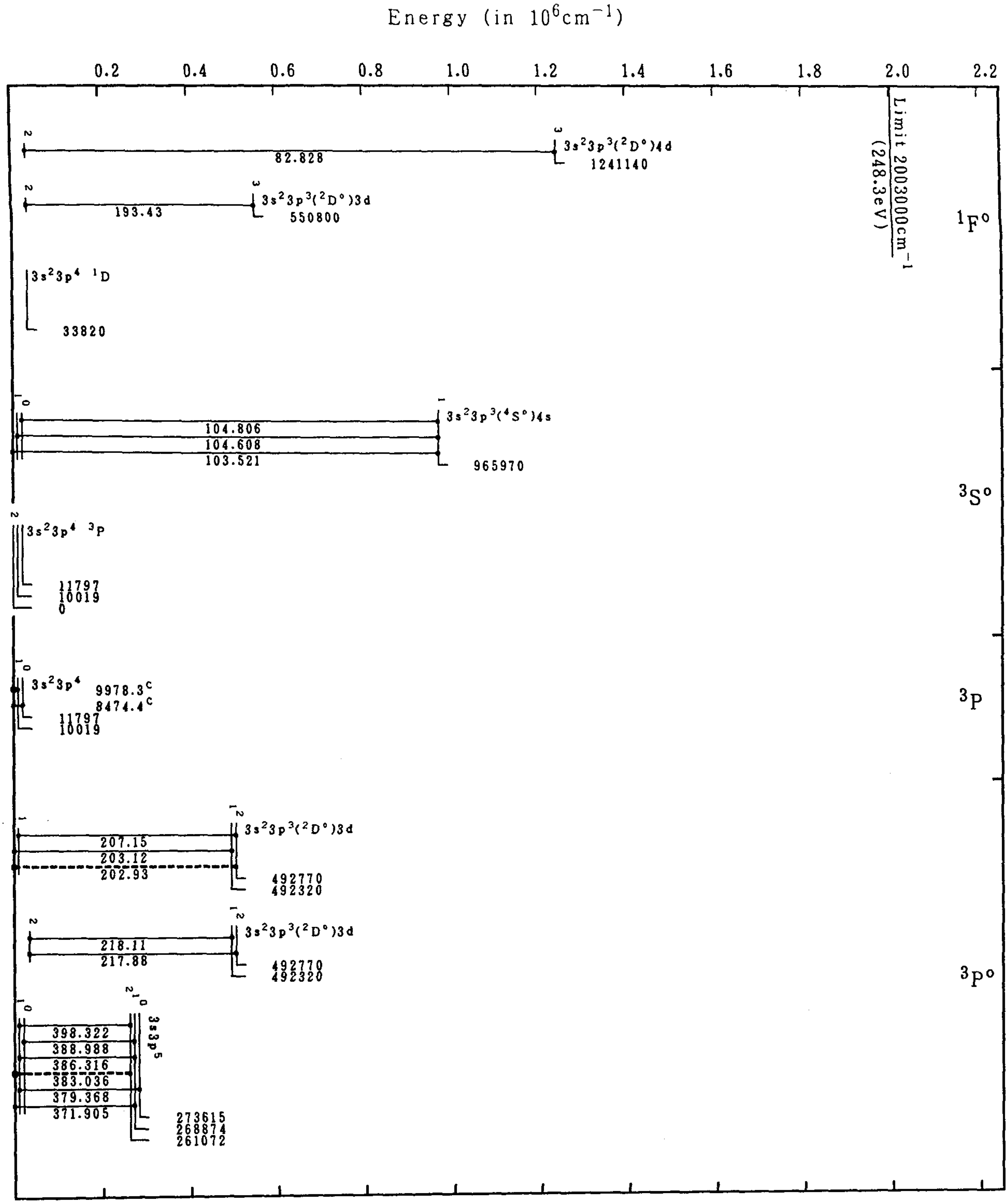
Mn IX(Cl–Sequence)



Mn IX(Cl–Sequence)



Mn X(S–Sequence)



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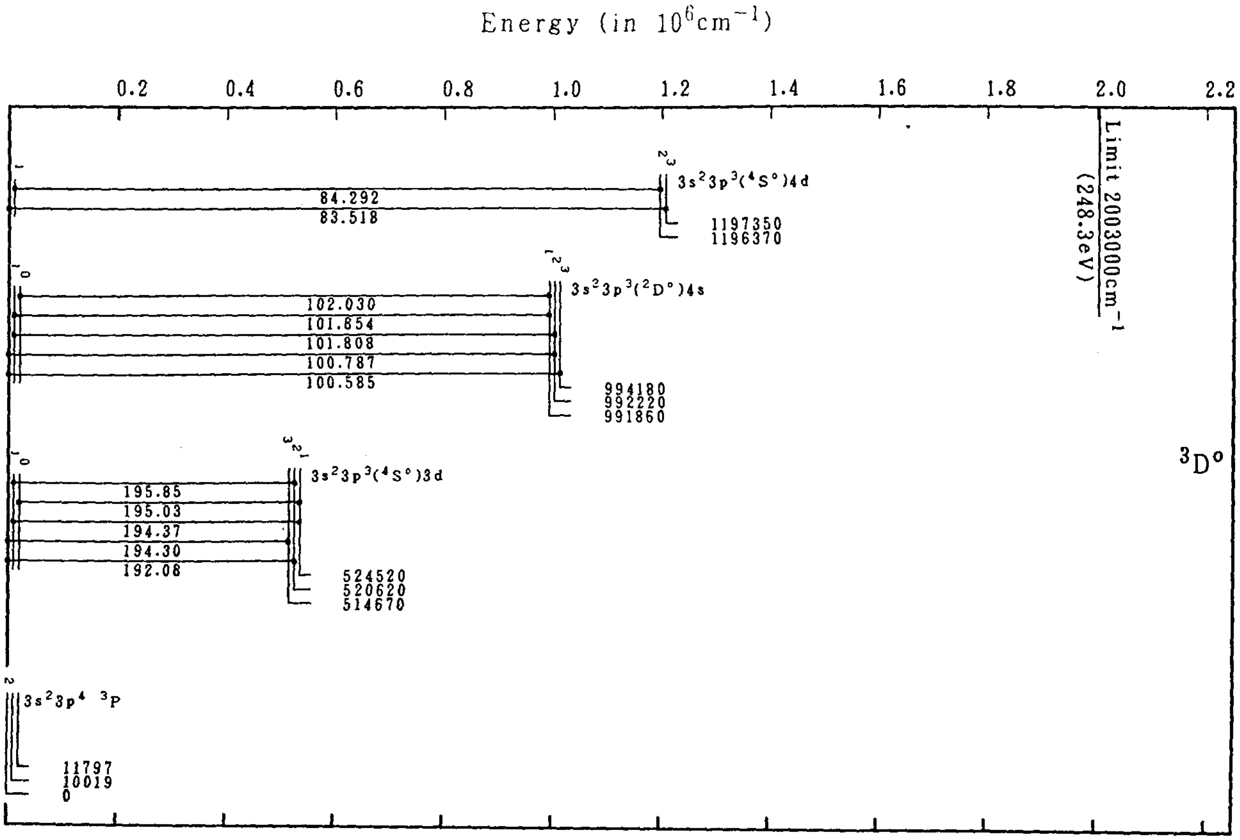

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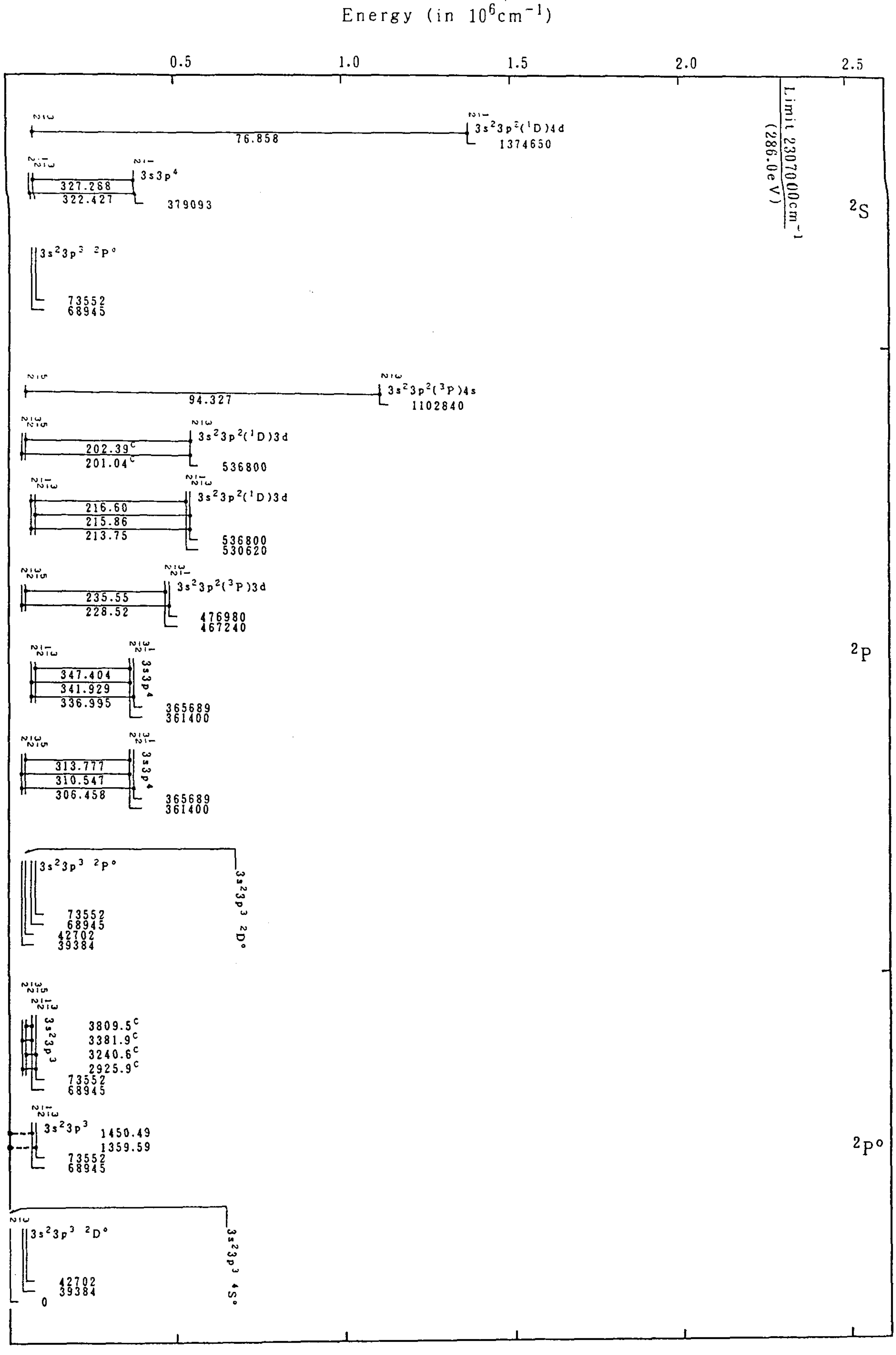
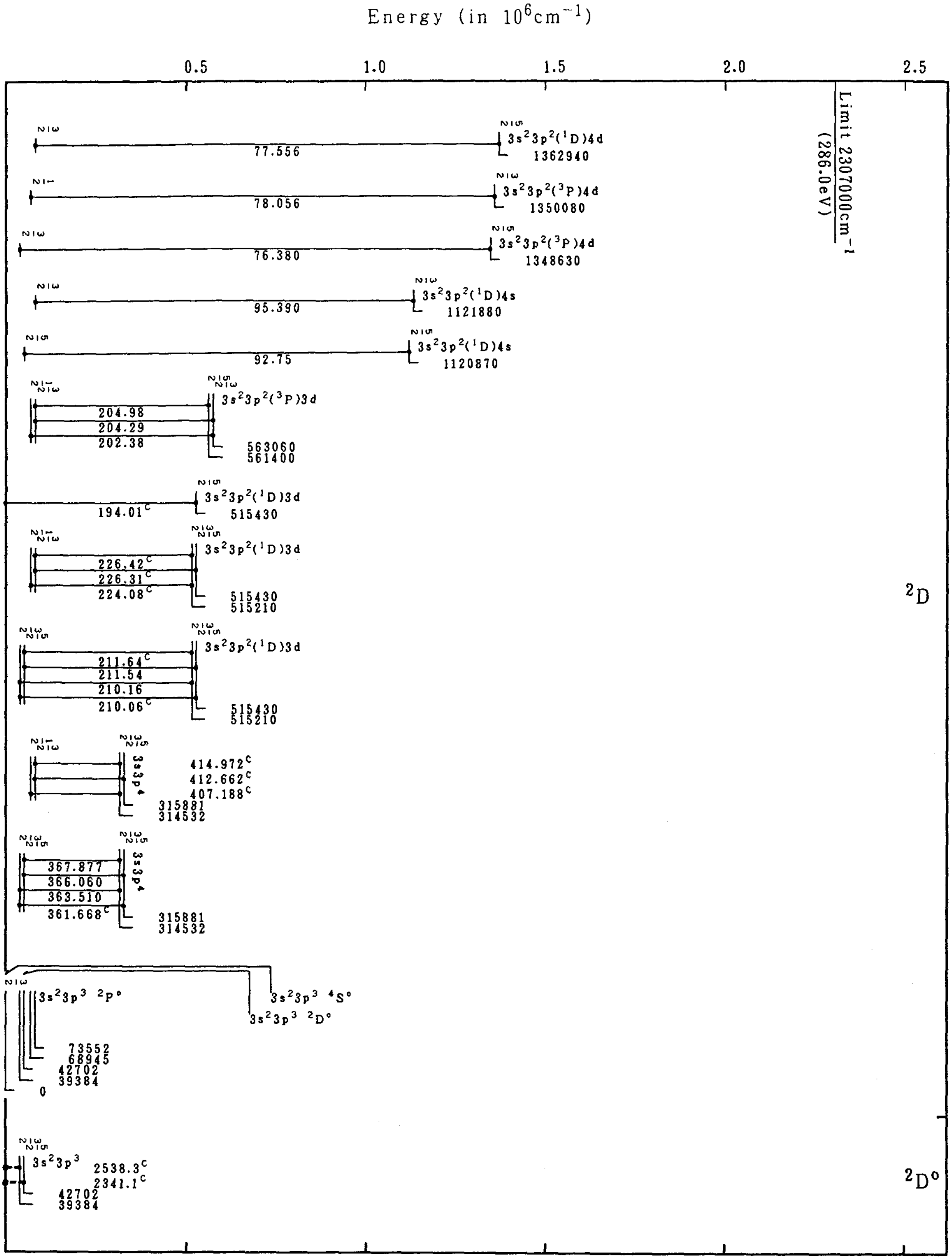
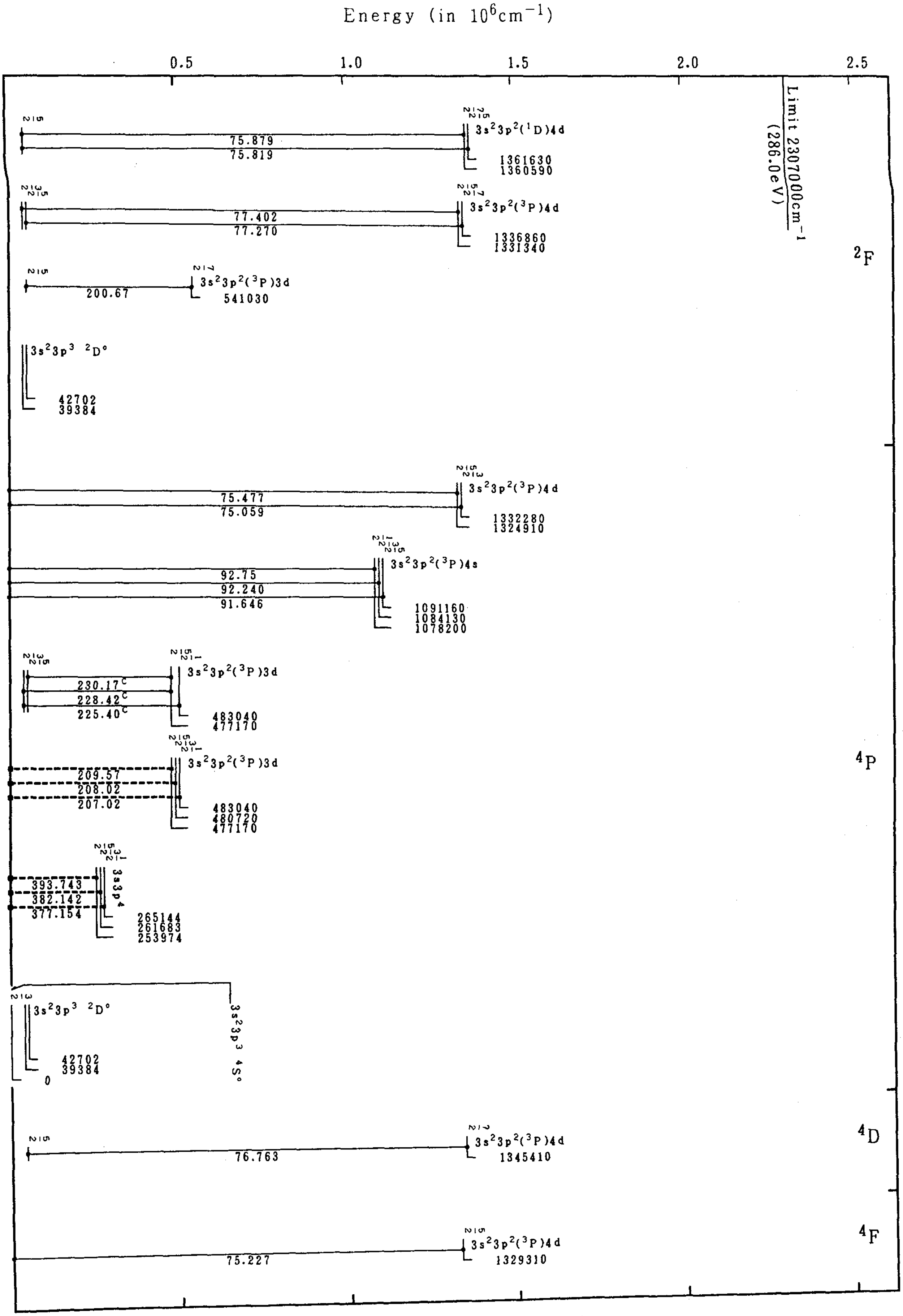


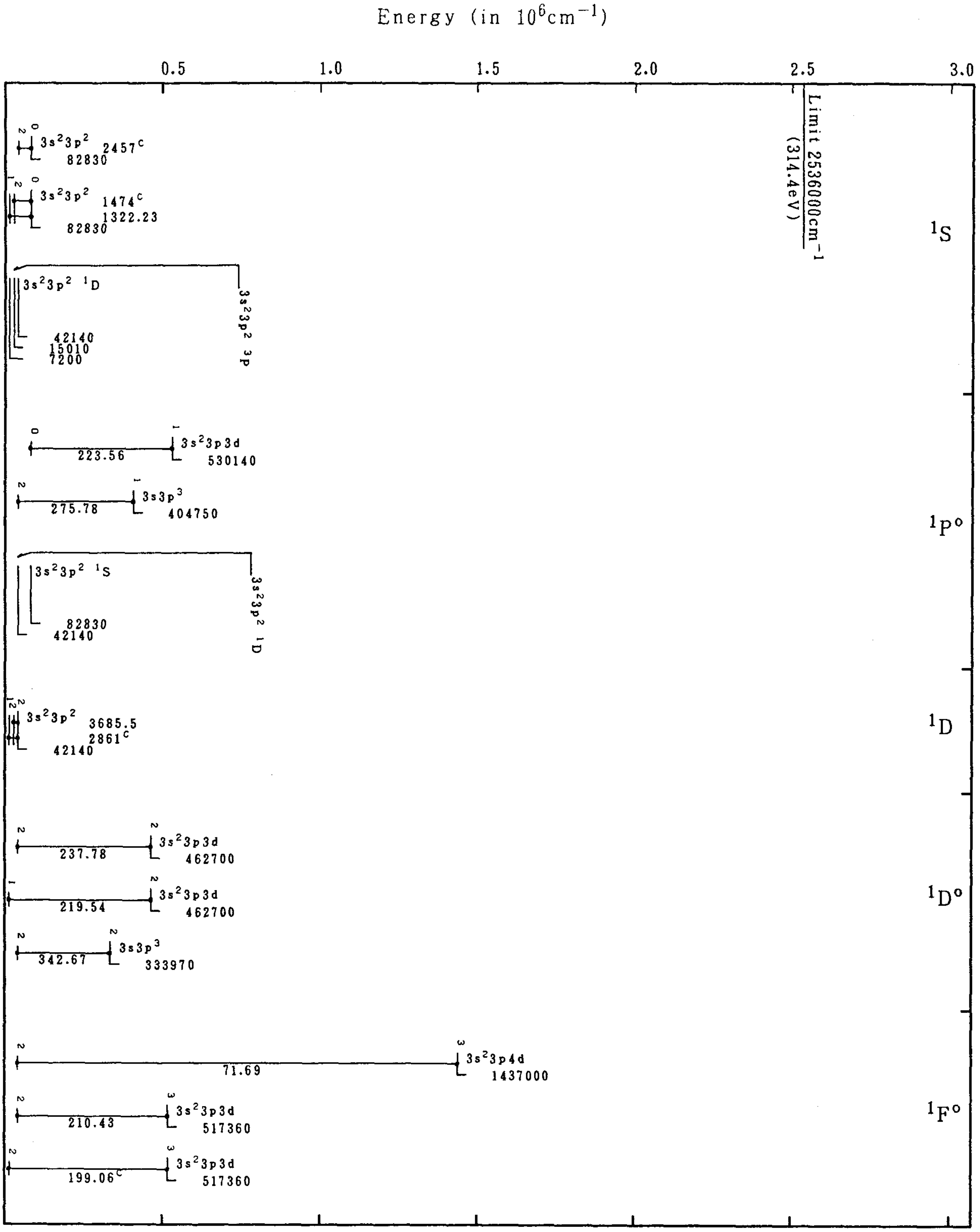
Mn XI(P–Sequence)



Mn XI(P–Sequence)

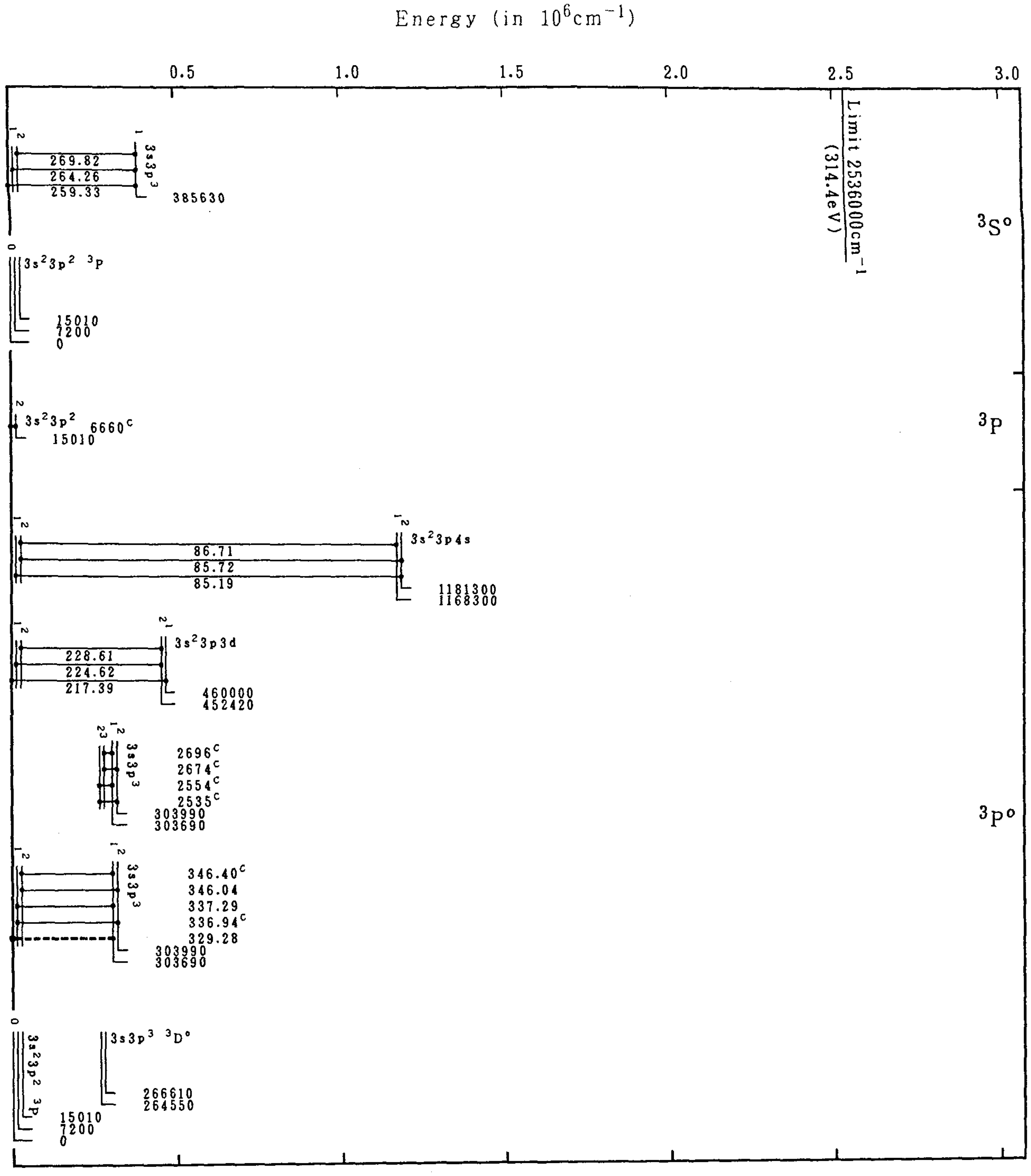


Mn XI(P–Sequence)

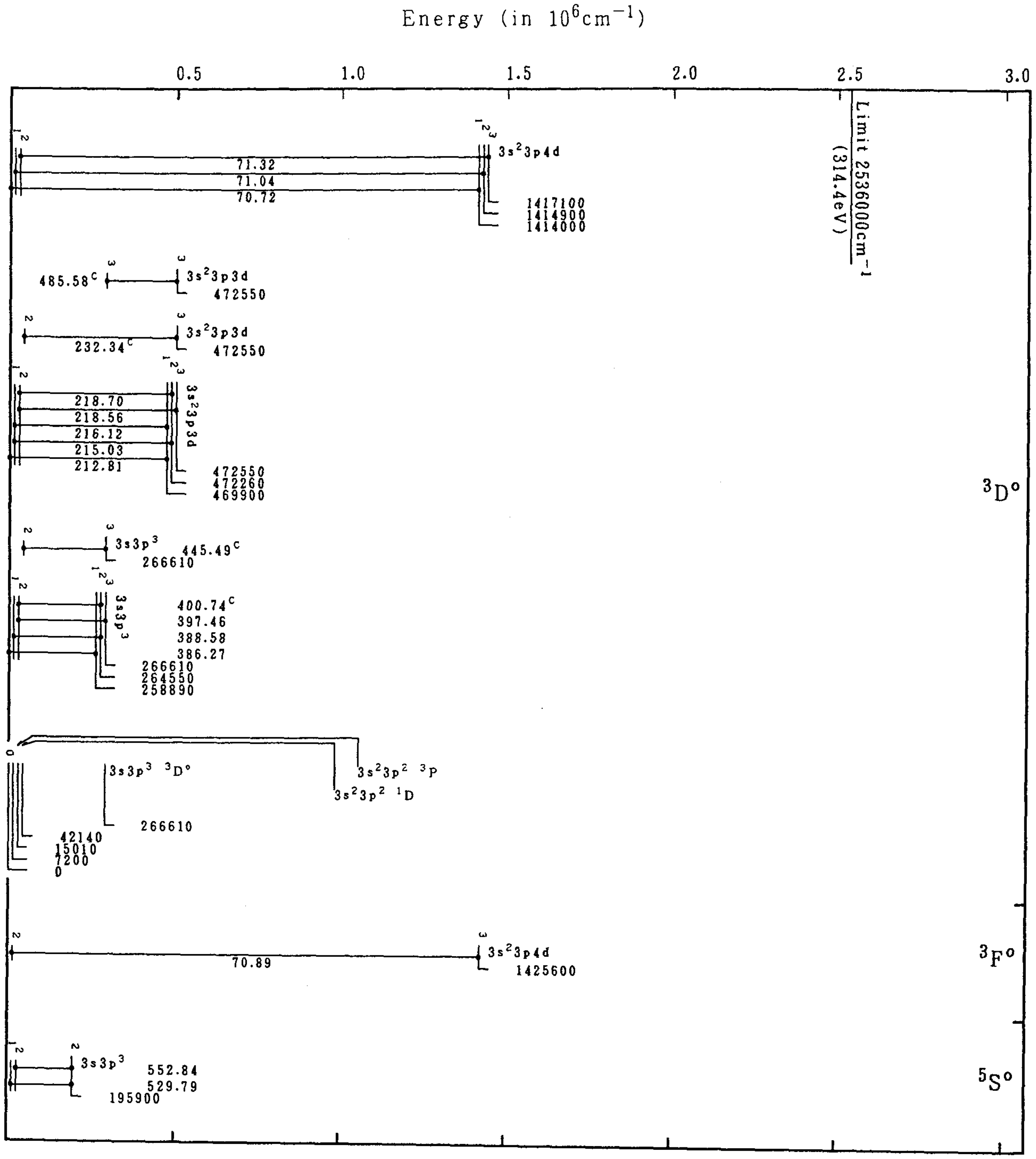


Mn XII(Si–Sequence)

]



Mn XII(Si–Sequence)



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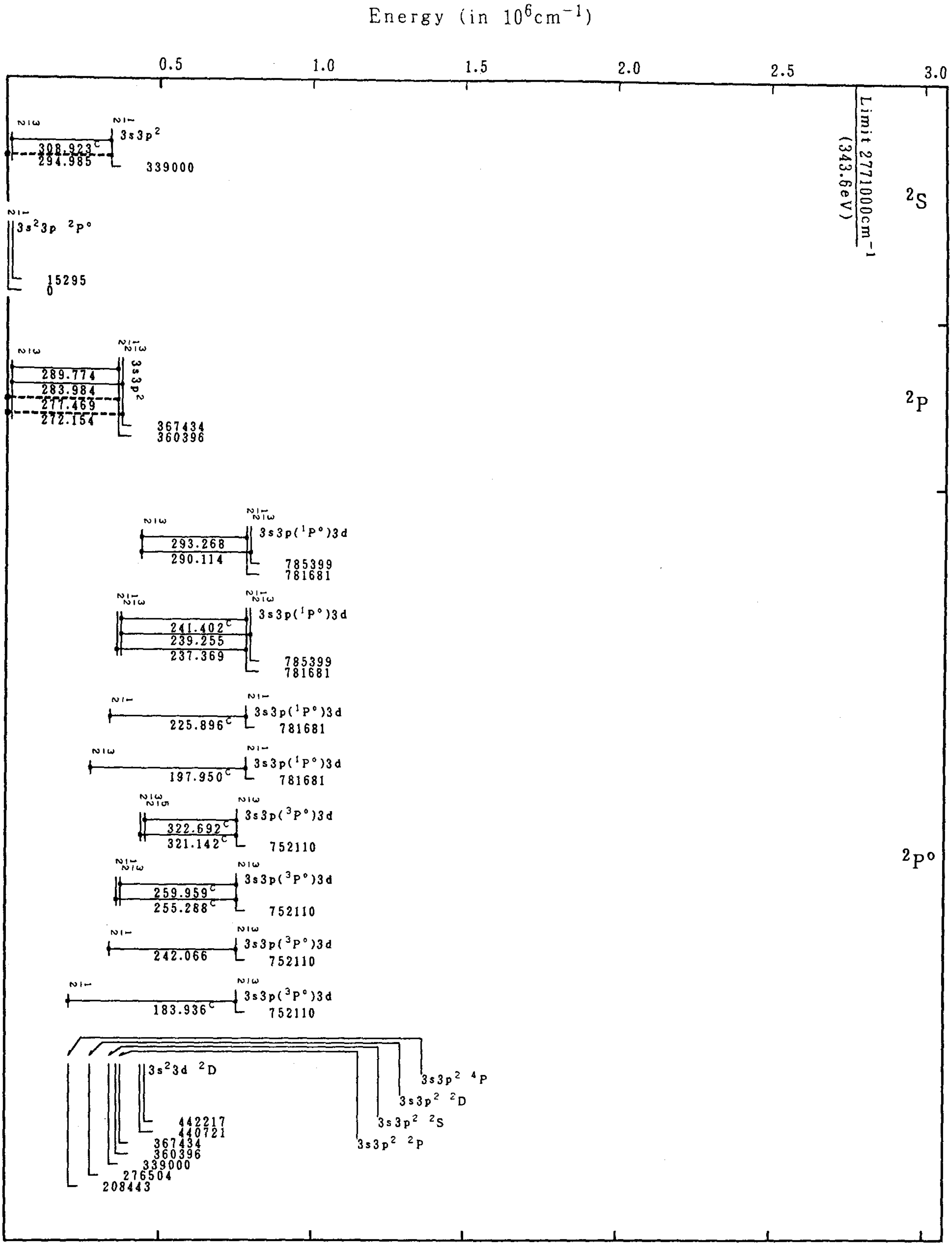
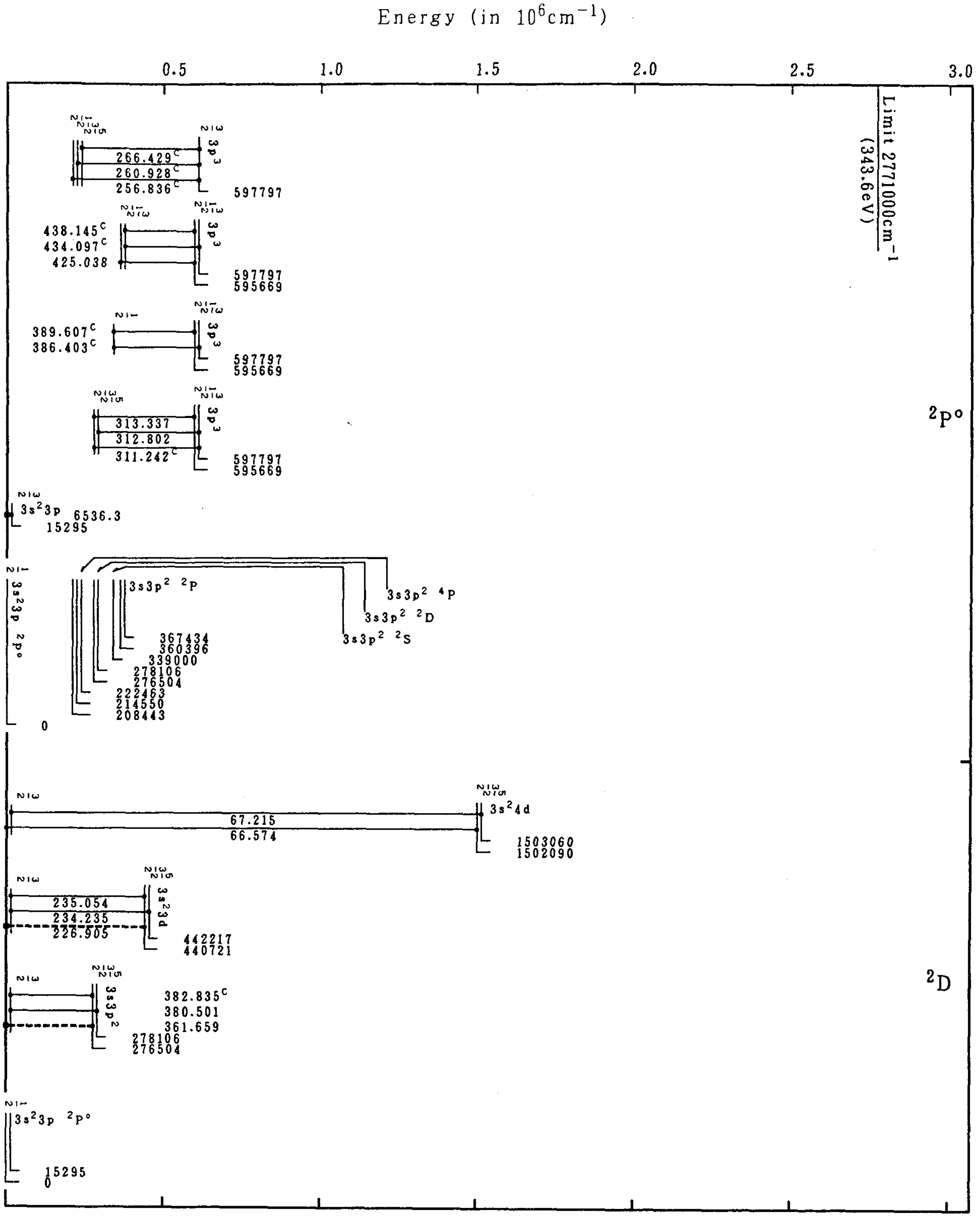


Mn XIII(Al–Sequence)



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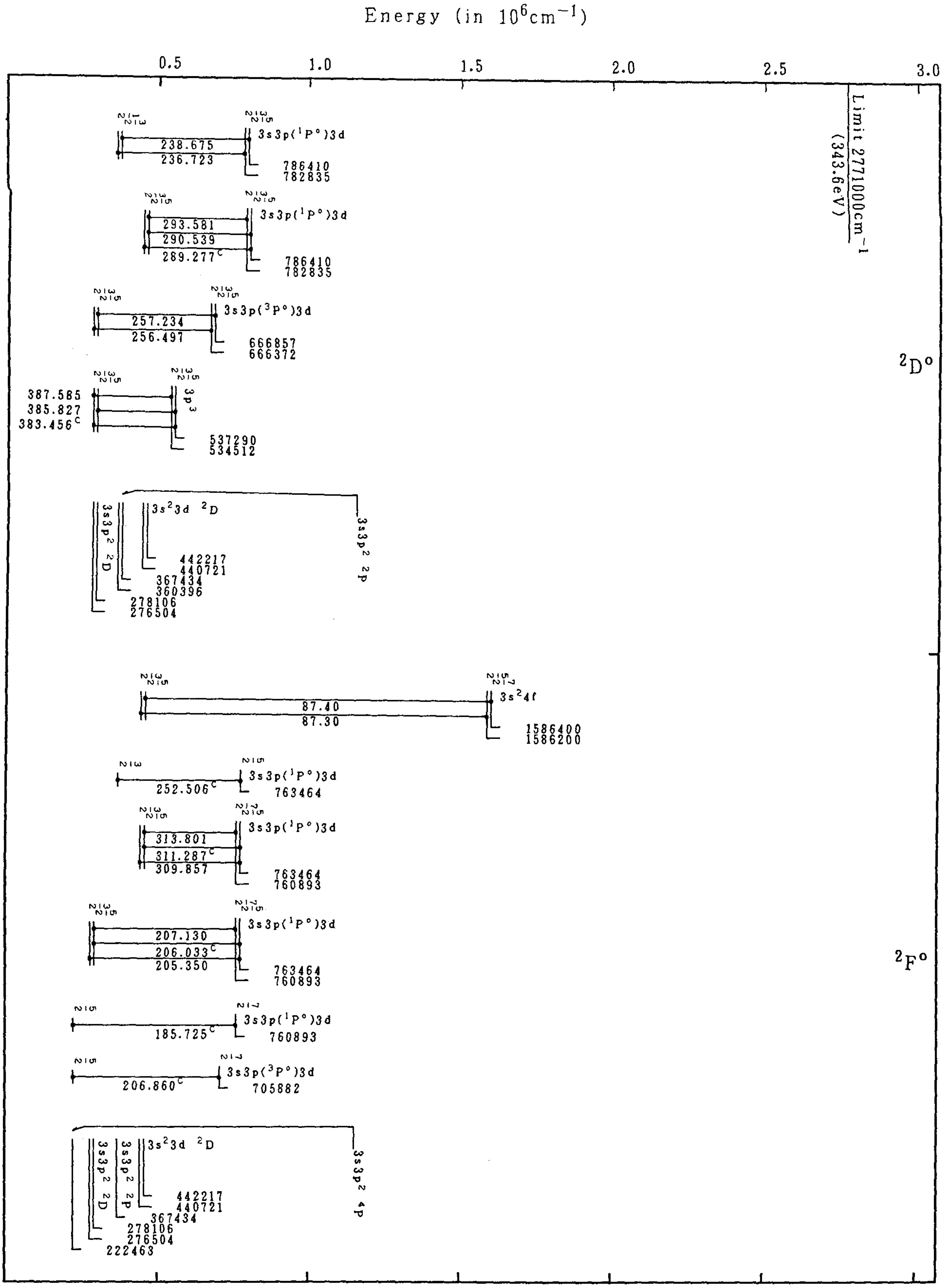

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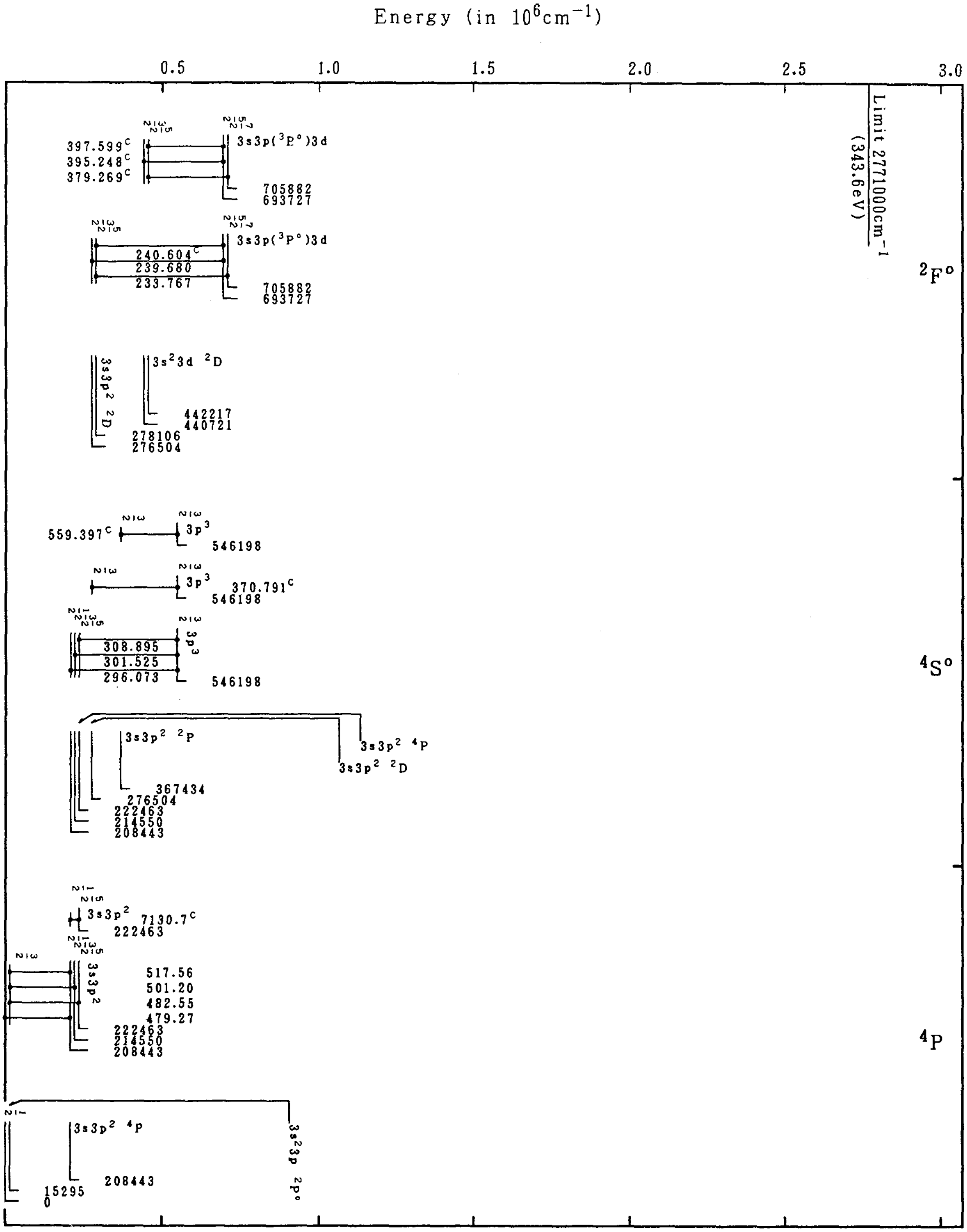

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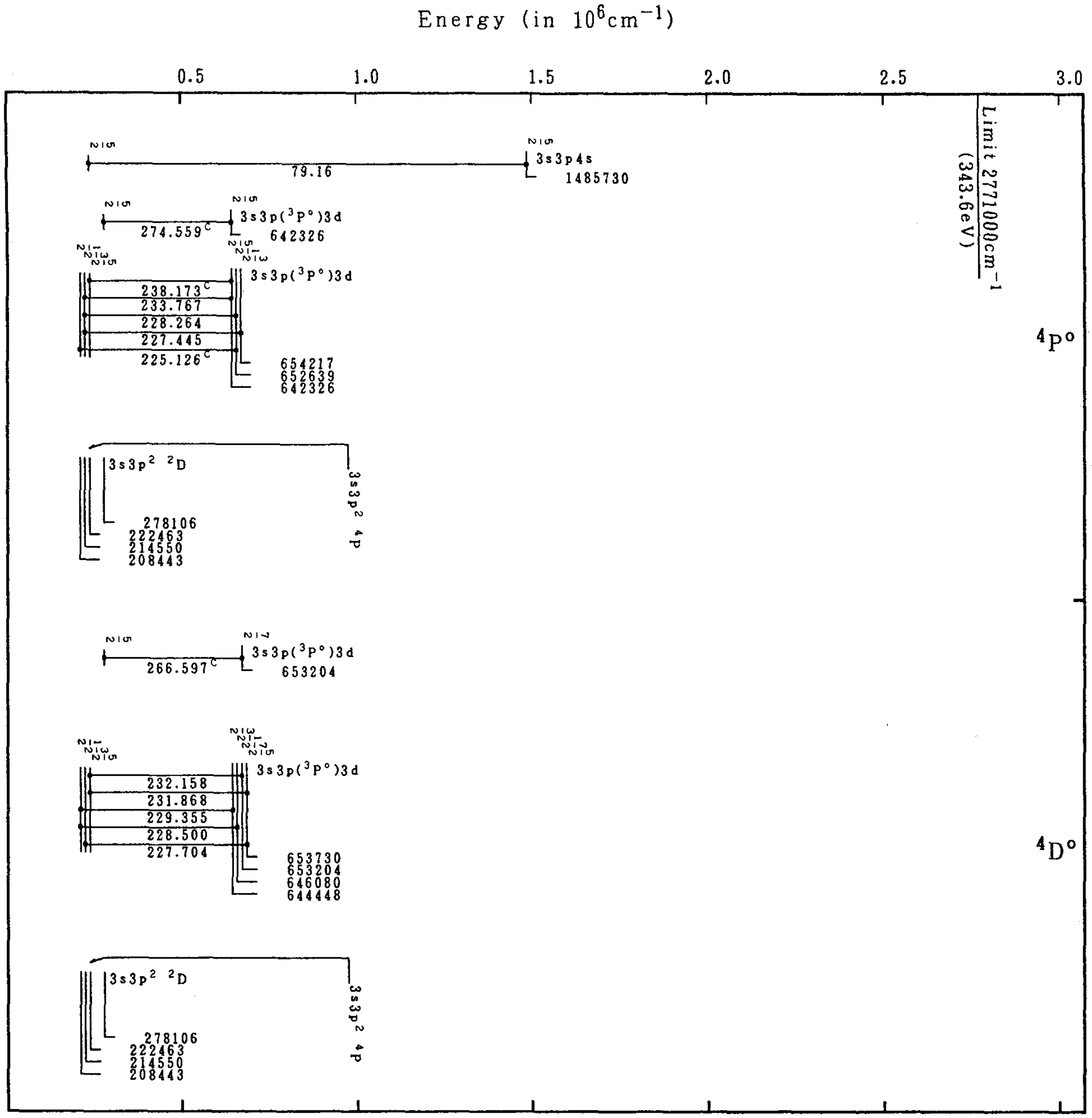
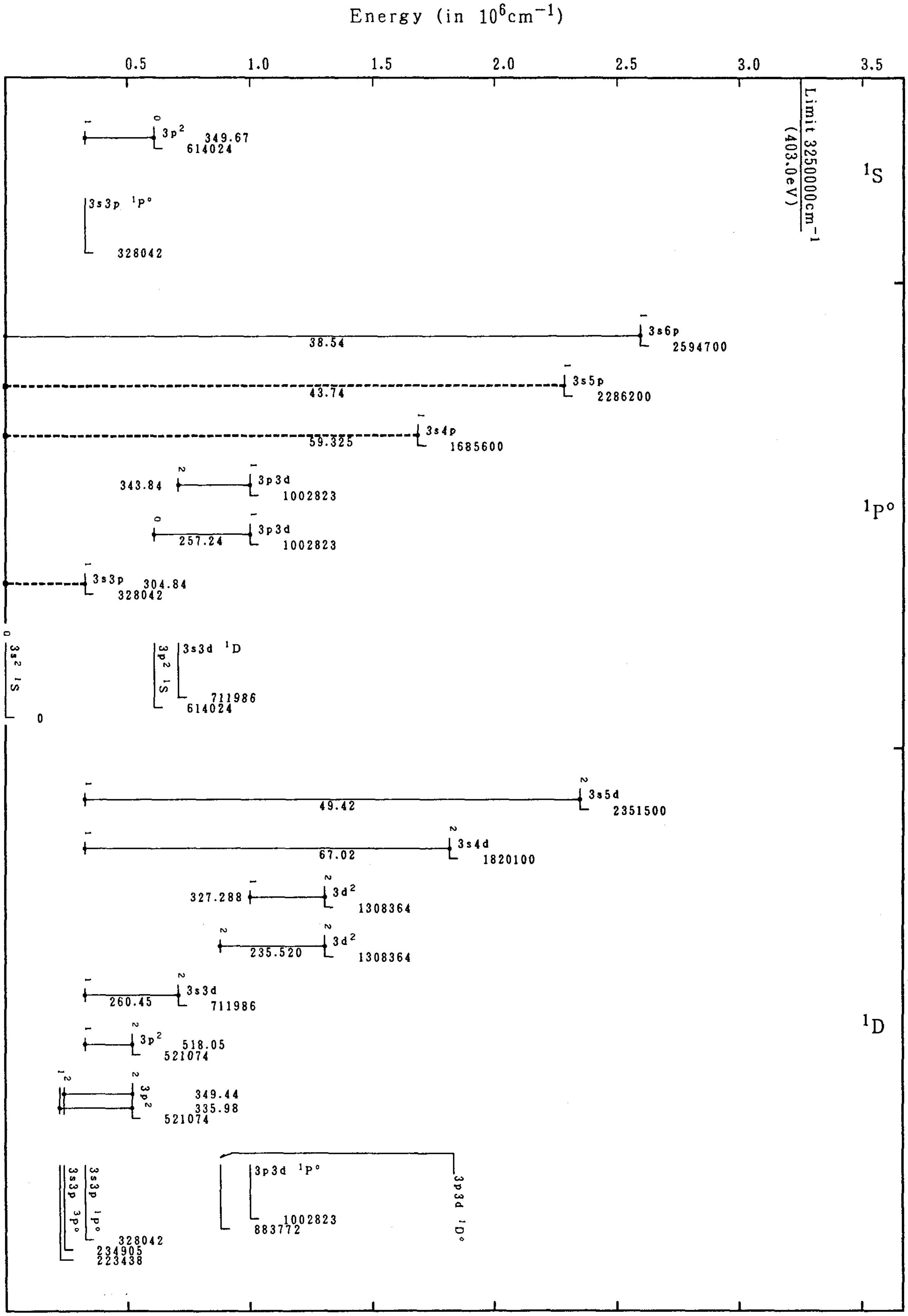
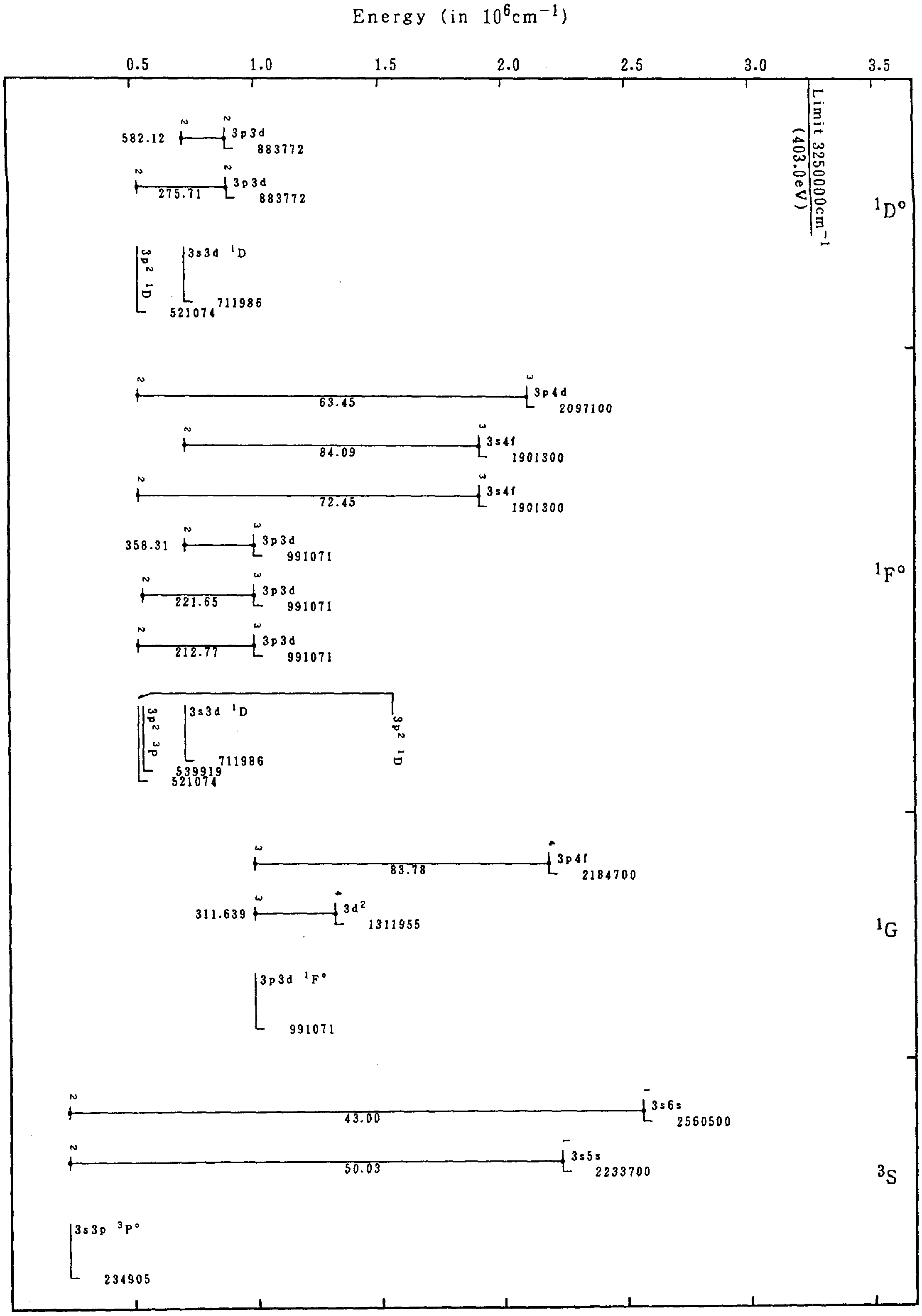


Mn XIII(Al–Sequence)



Mn XIV(Mg–Sequence)



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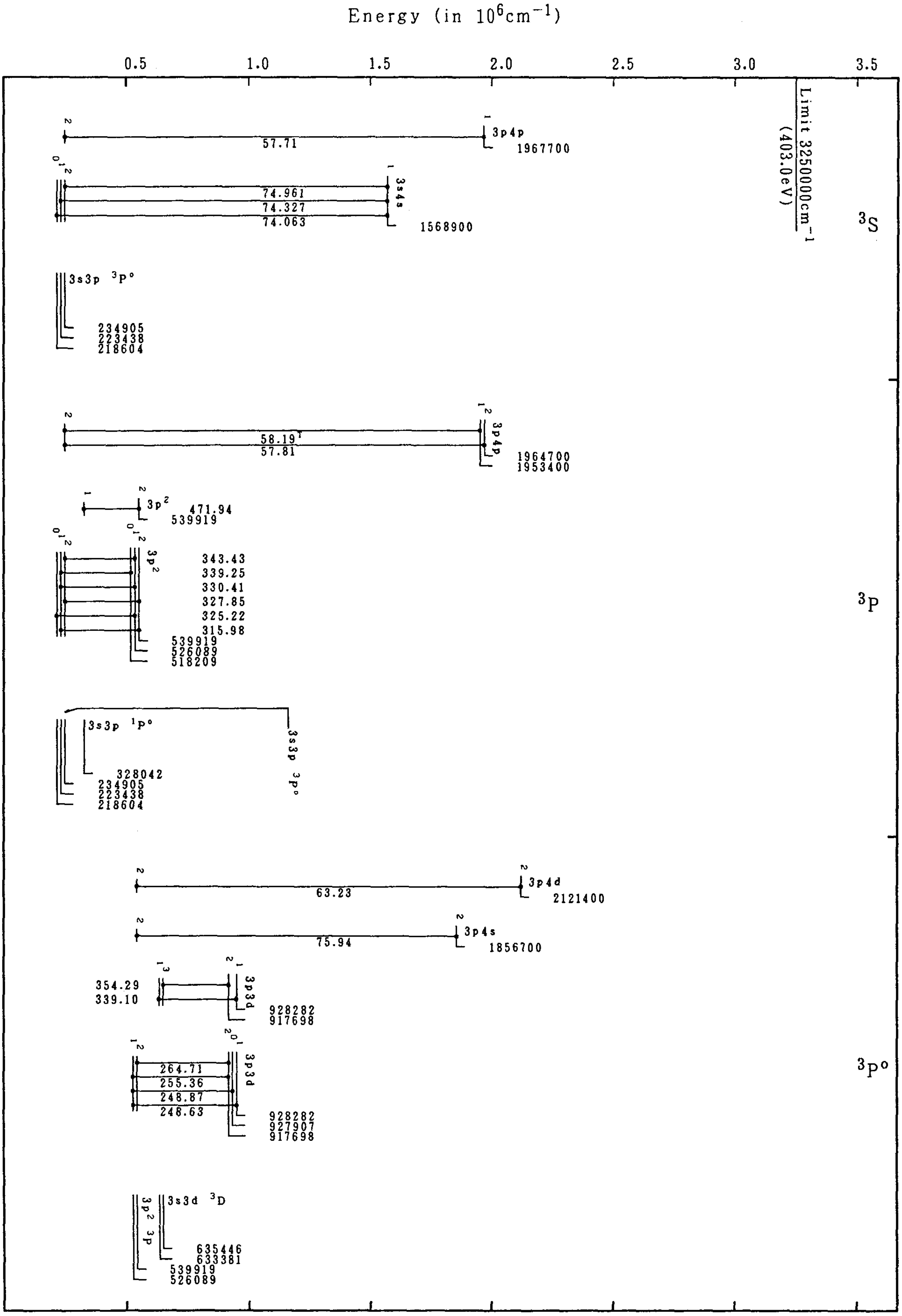

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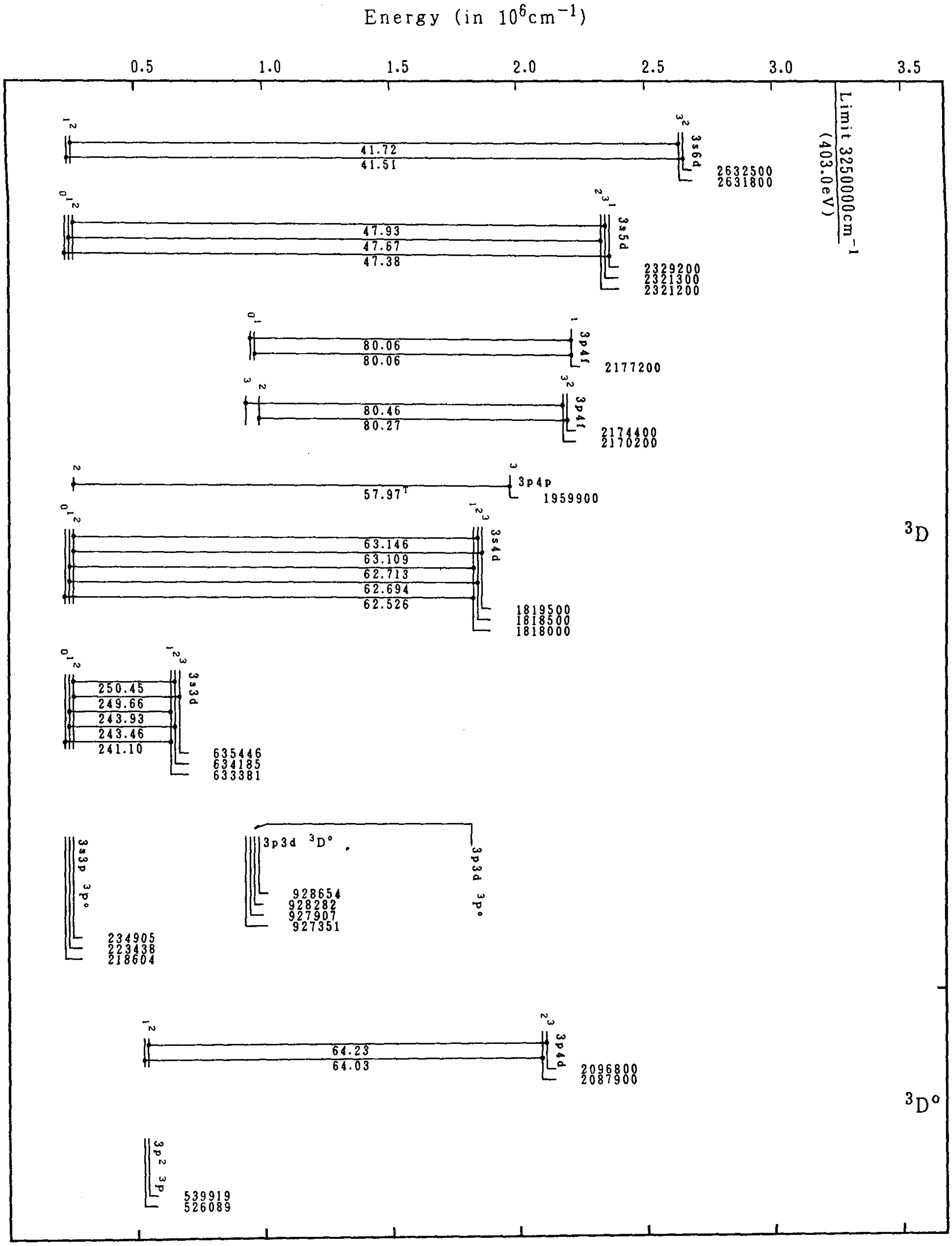

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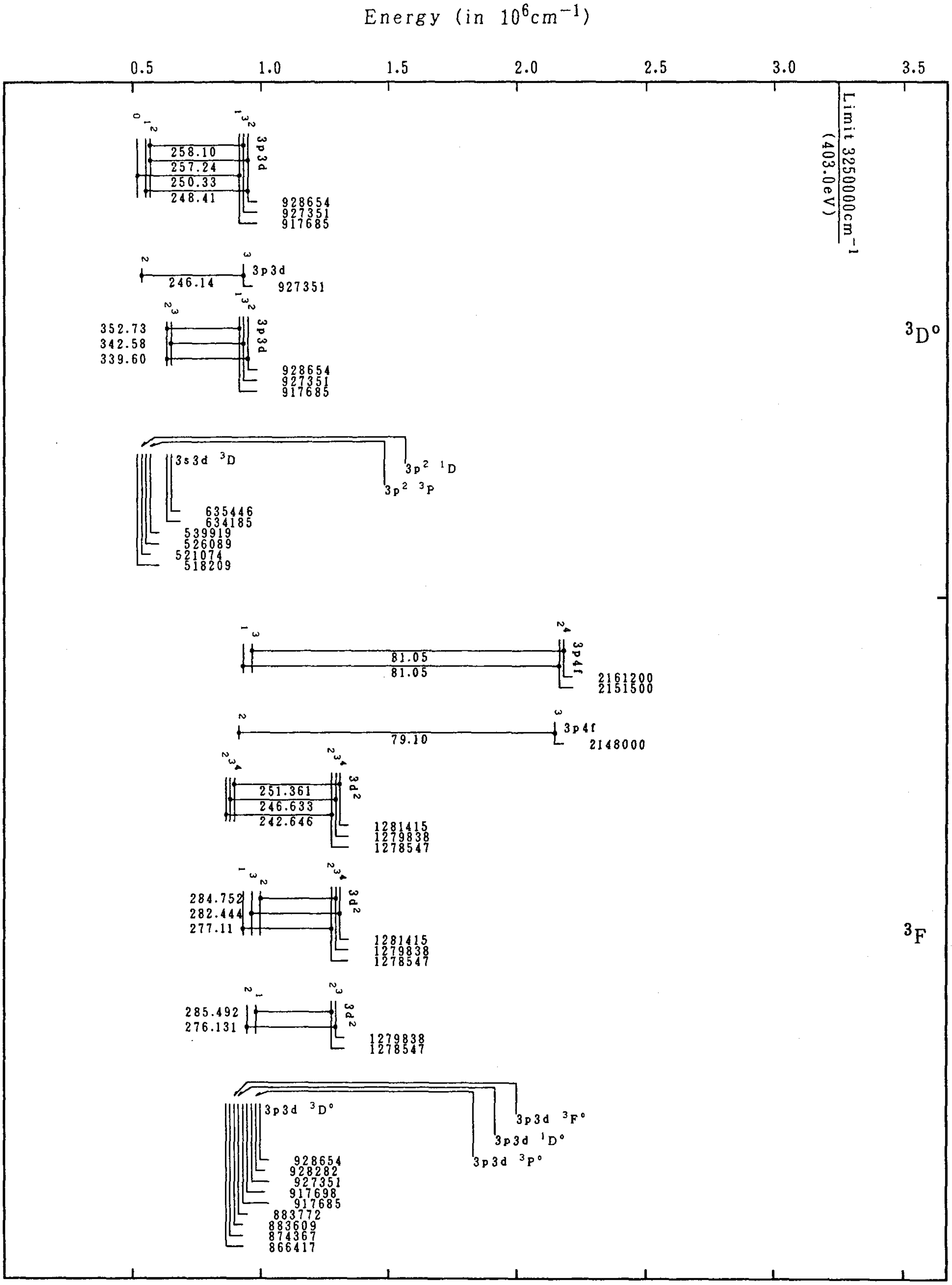

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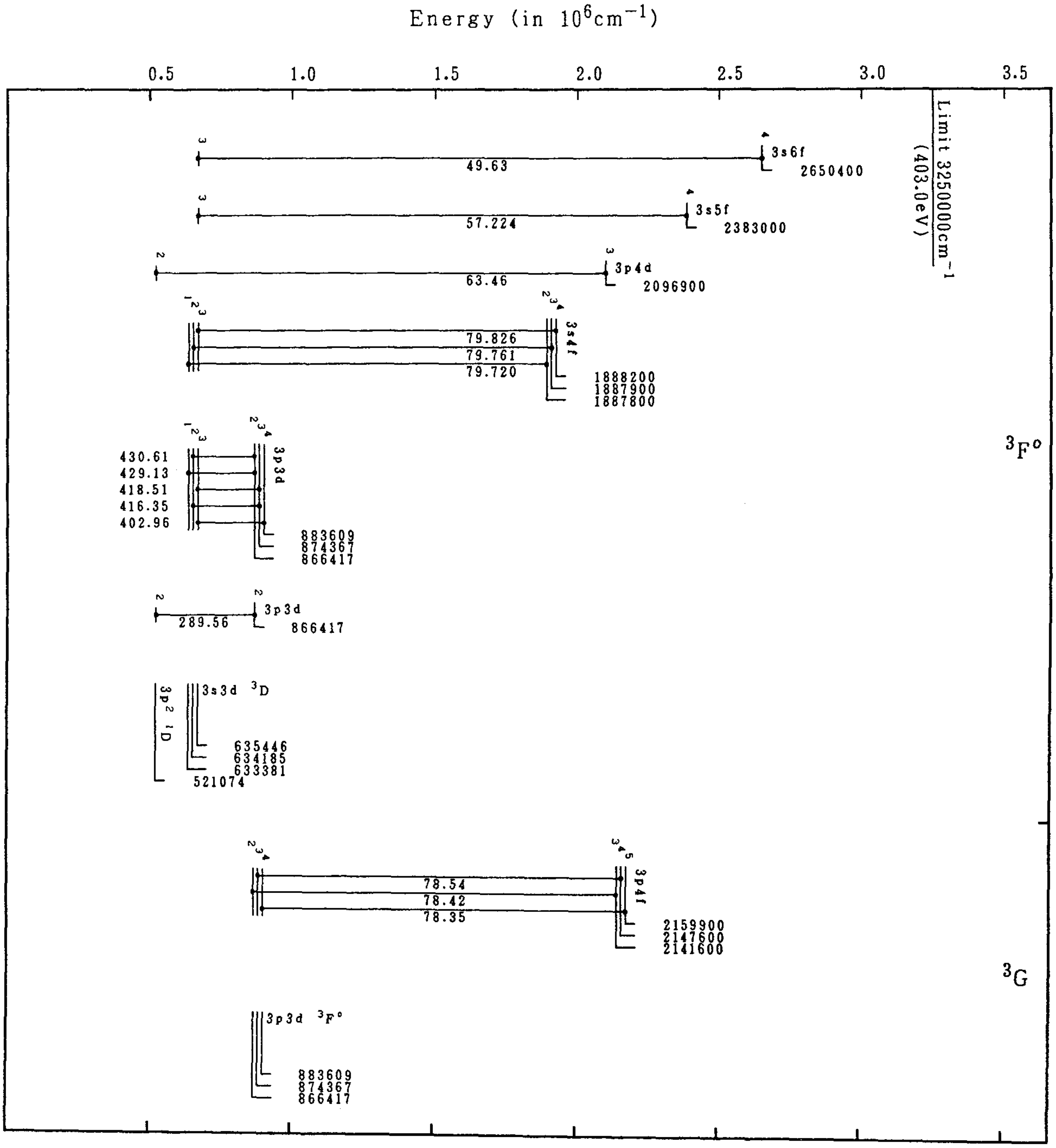

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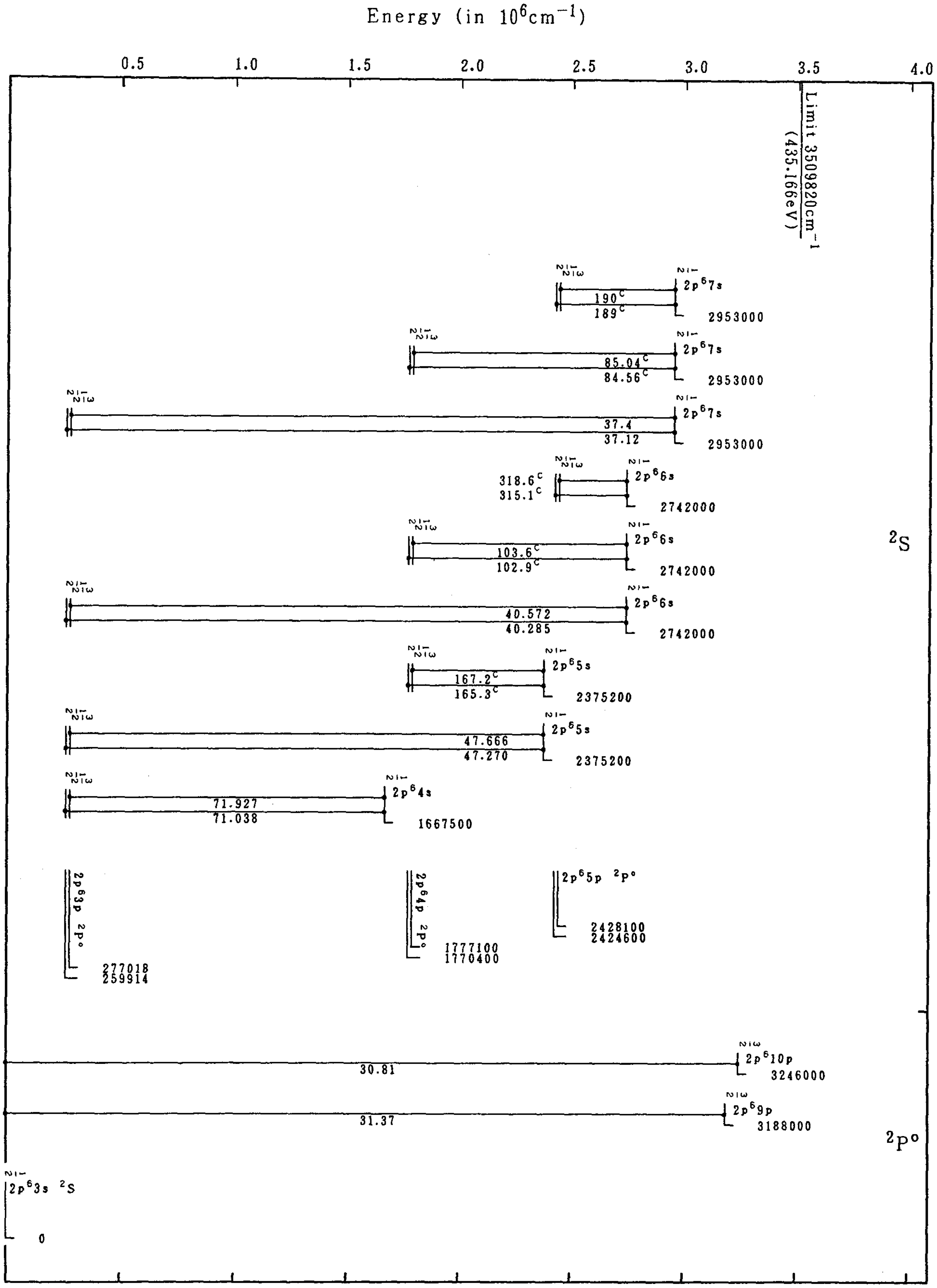

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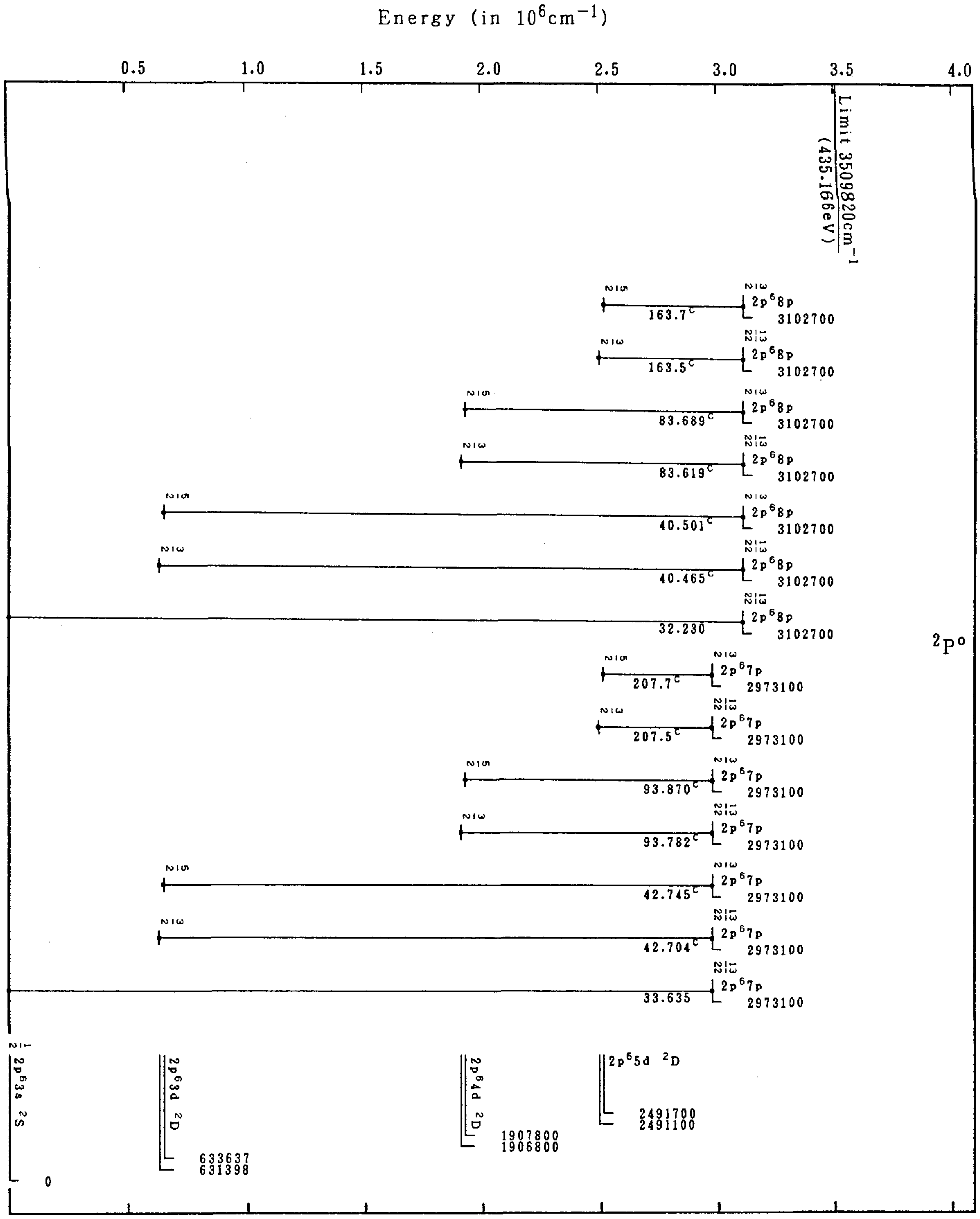

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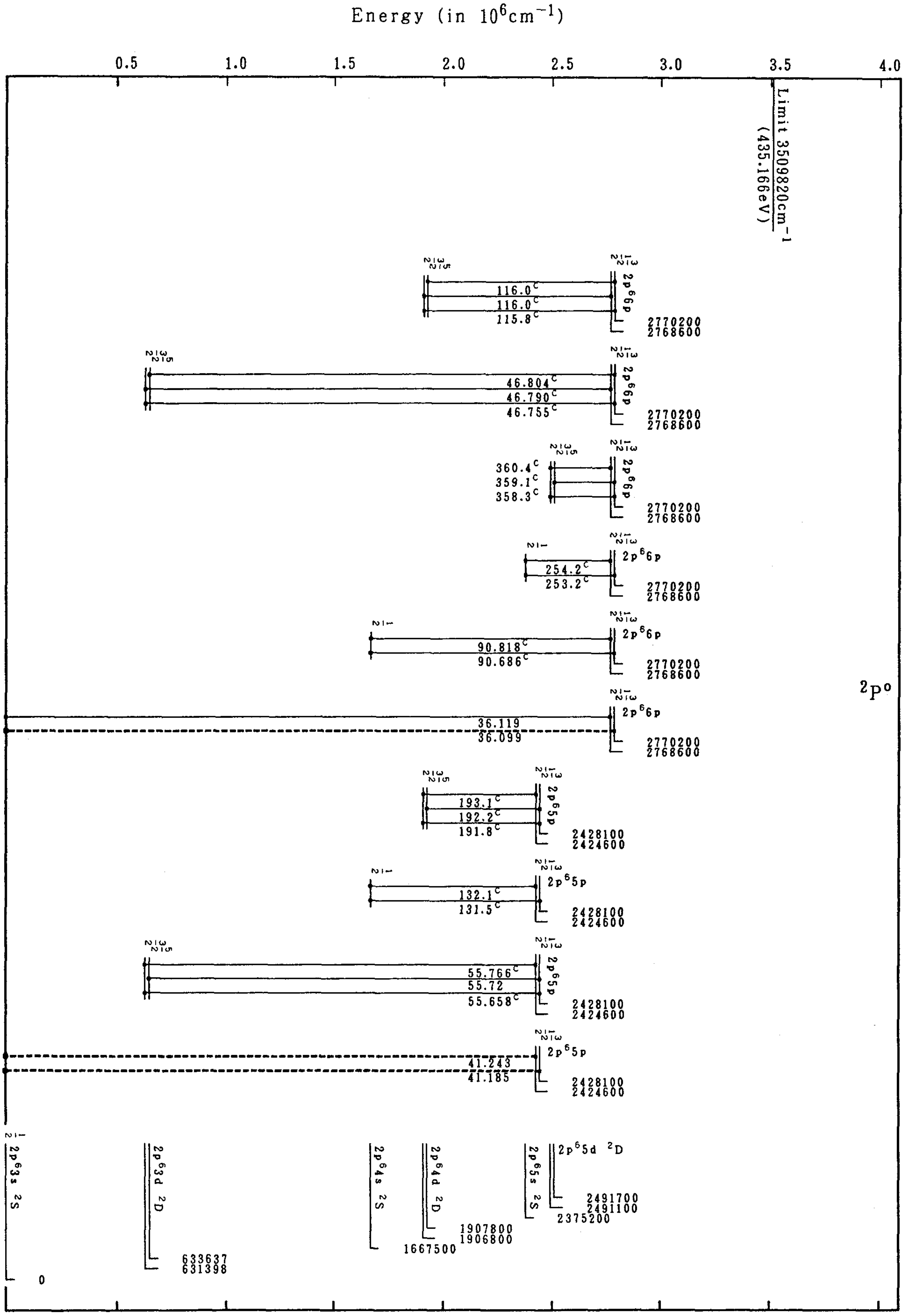

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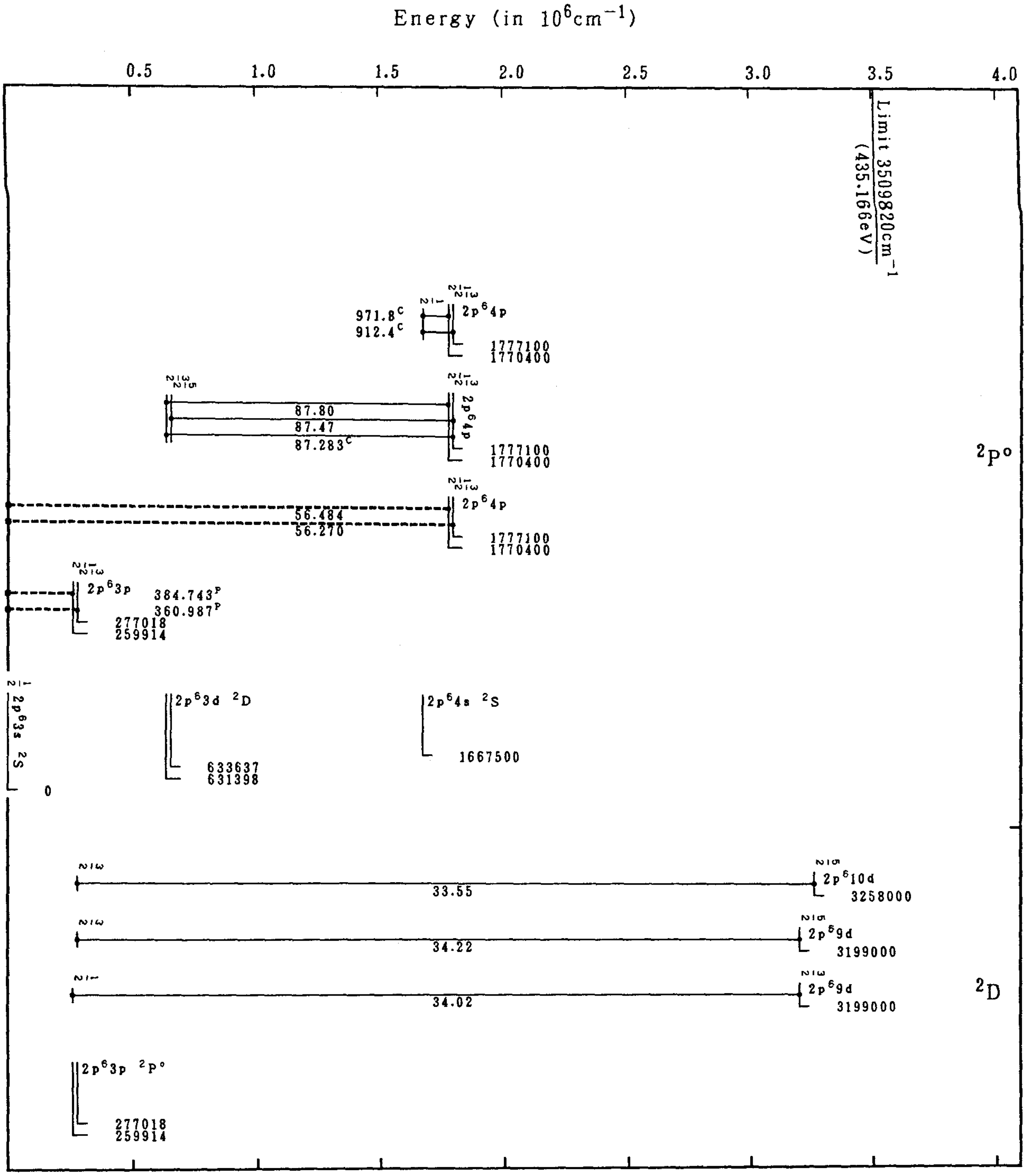

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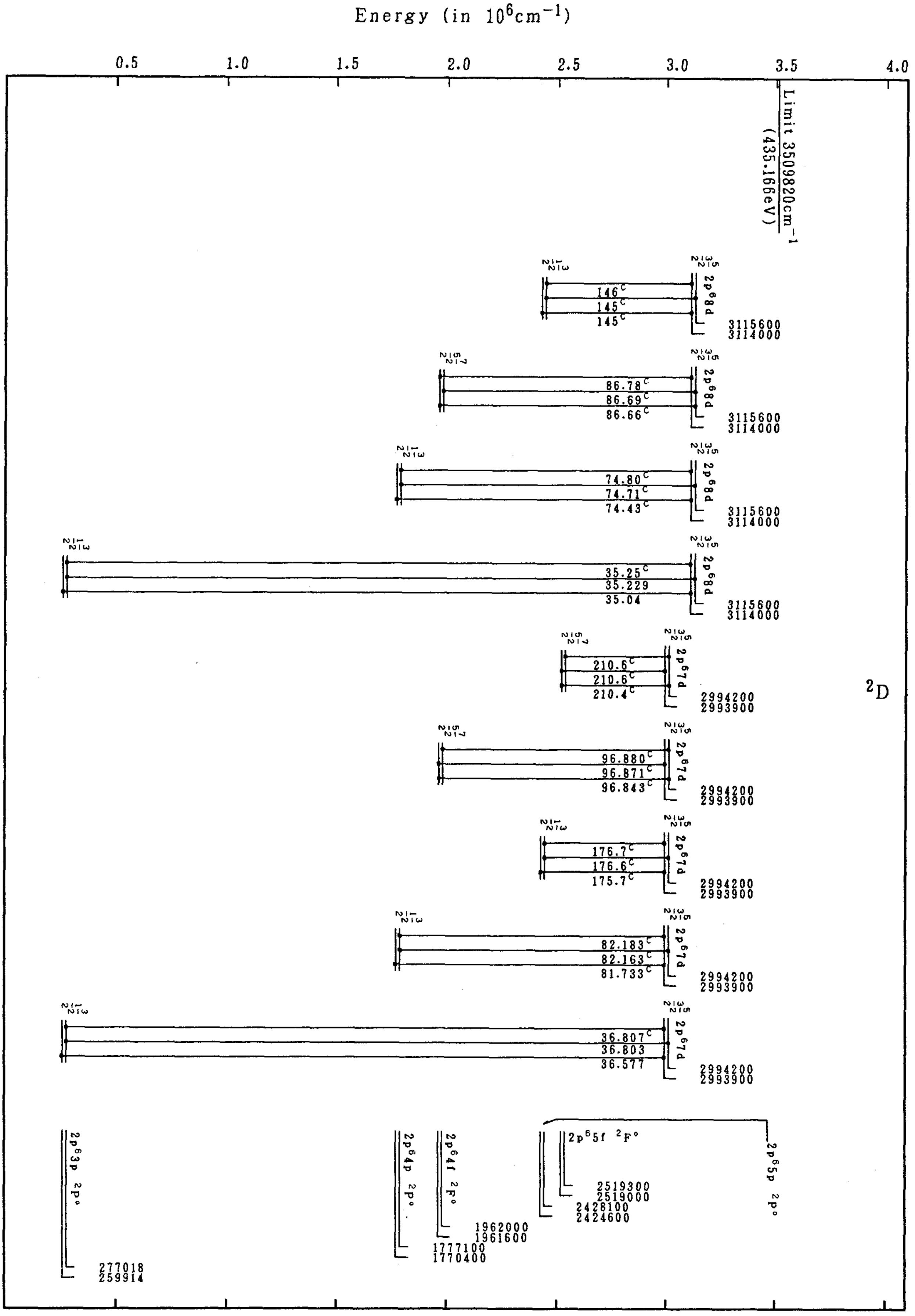

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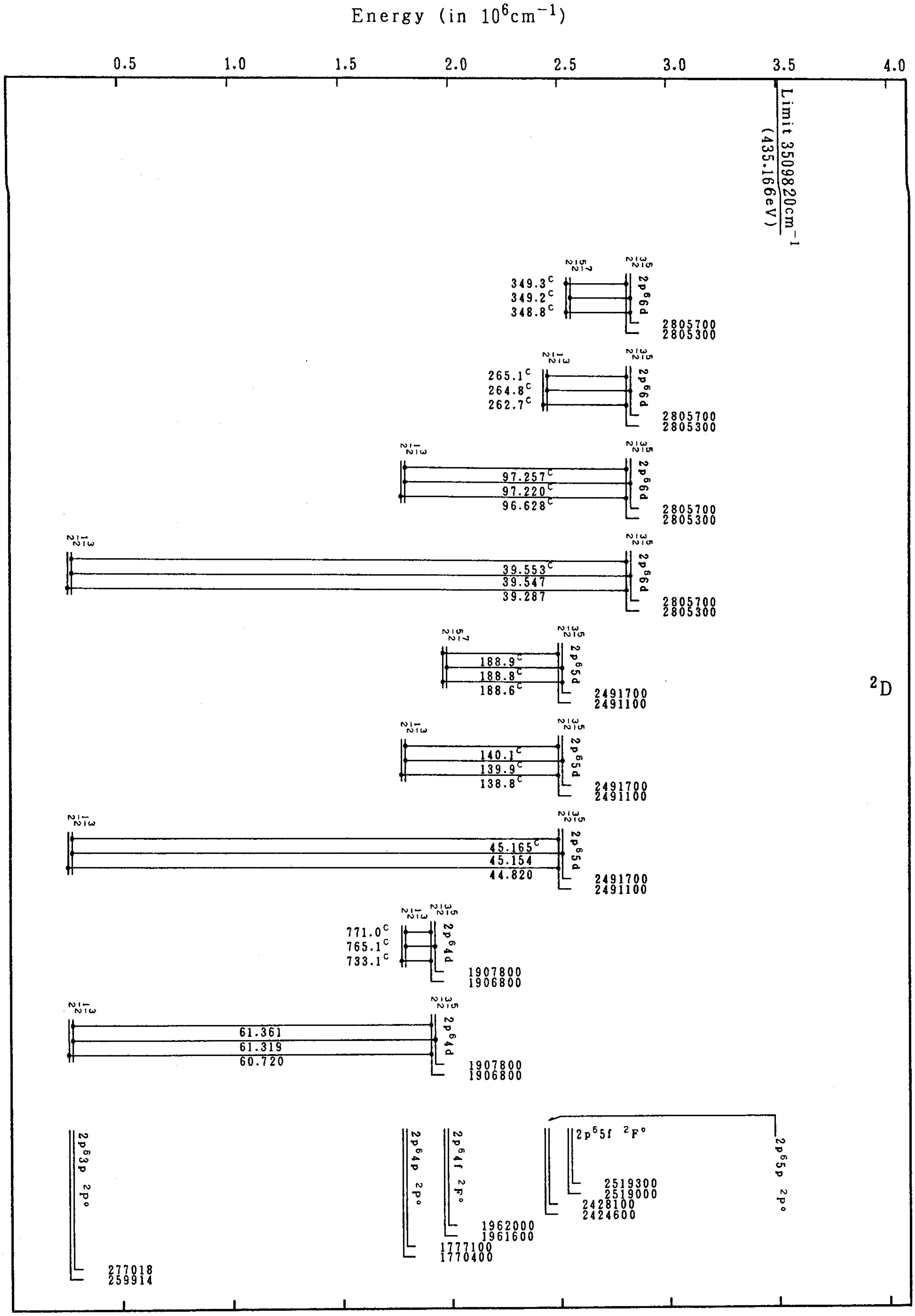

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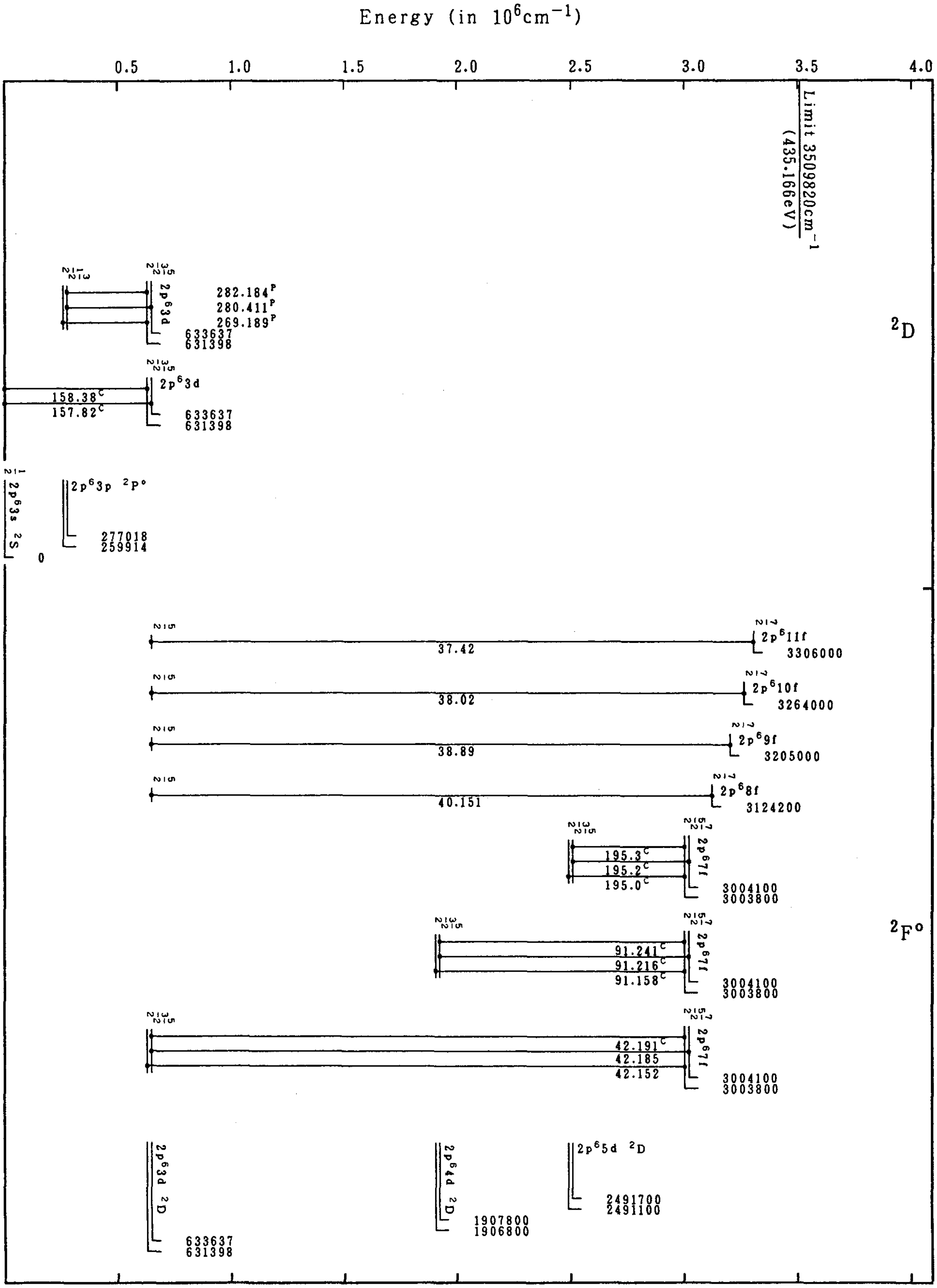

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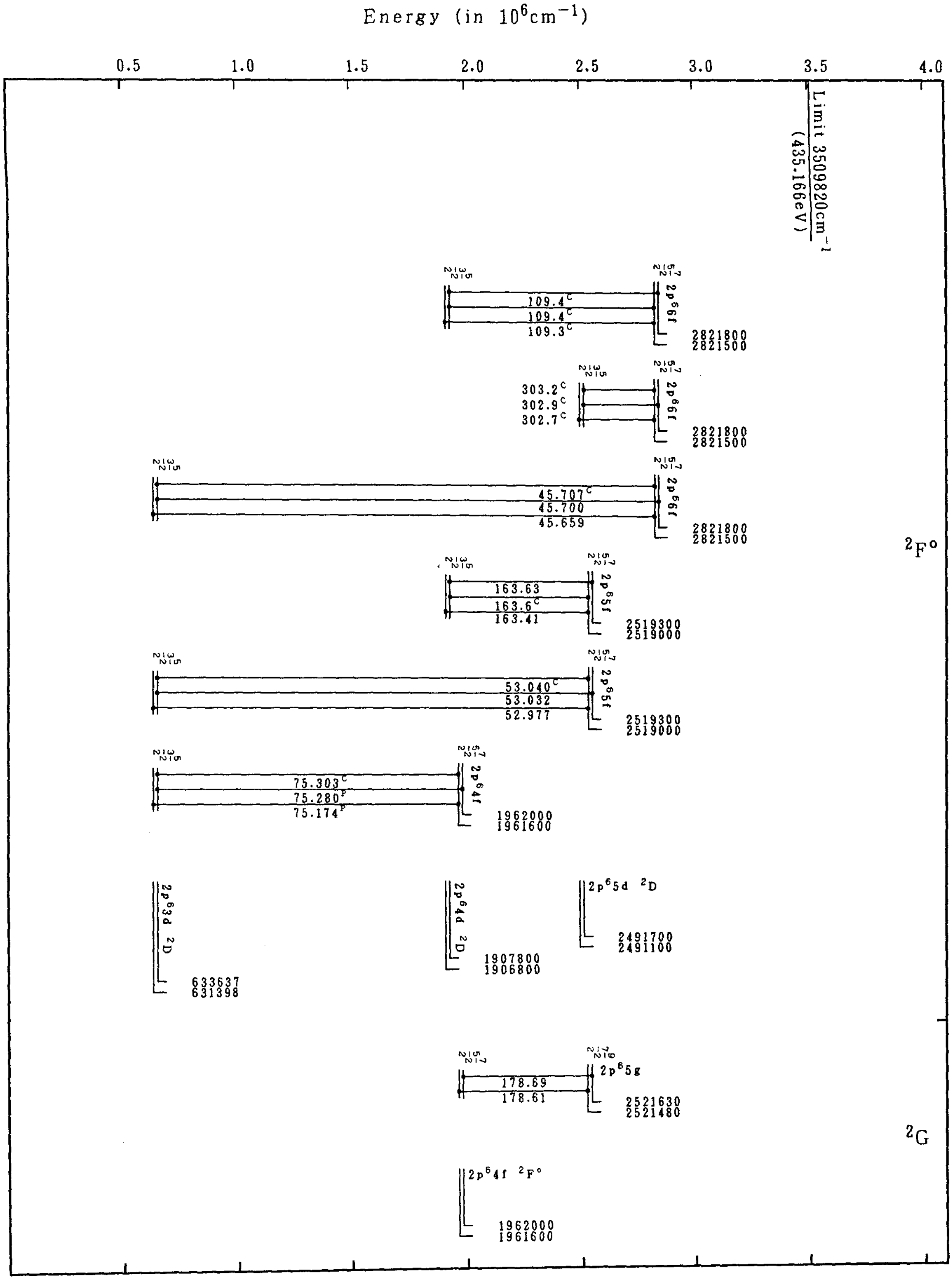

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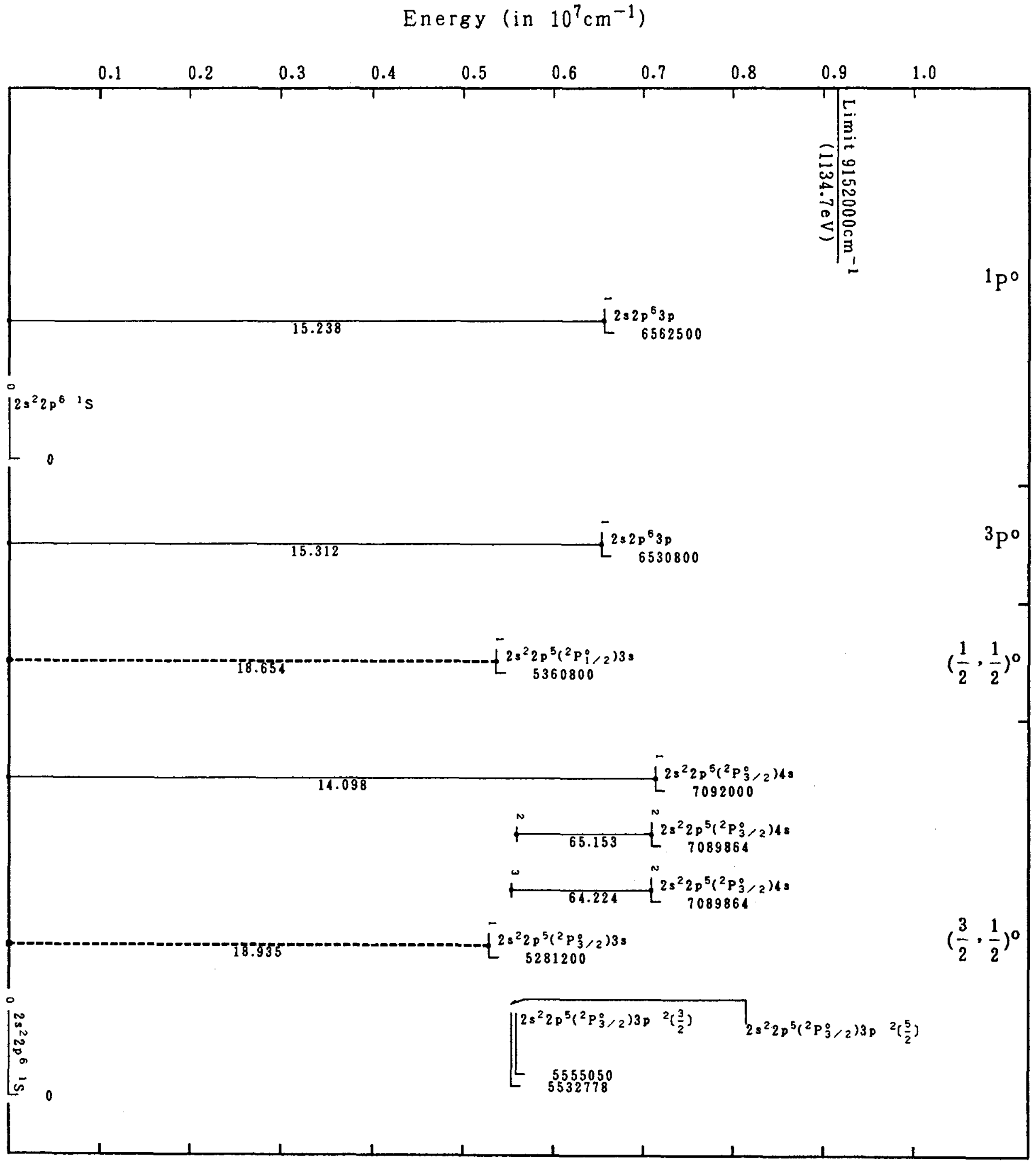

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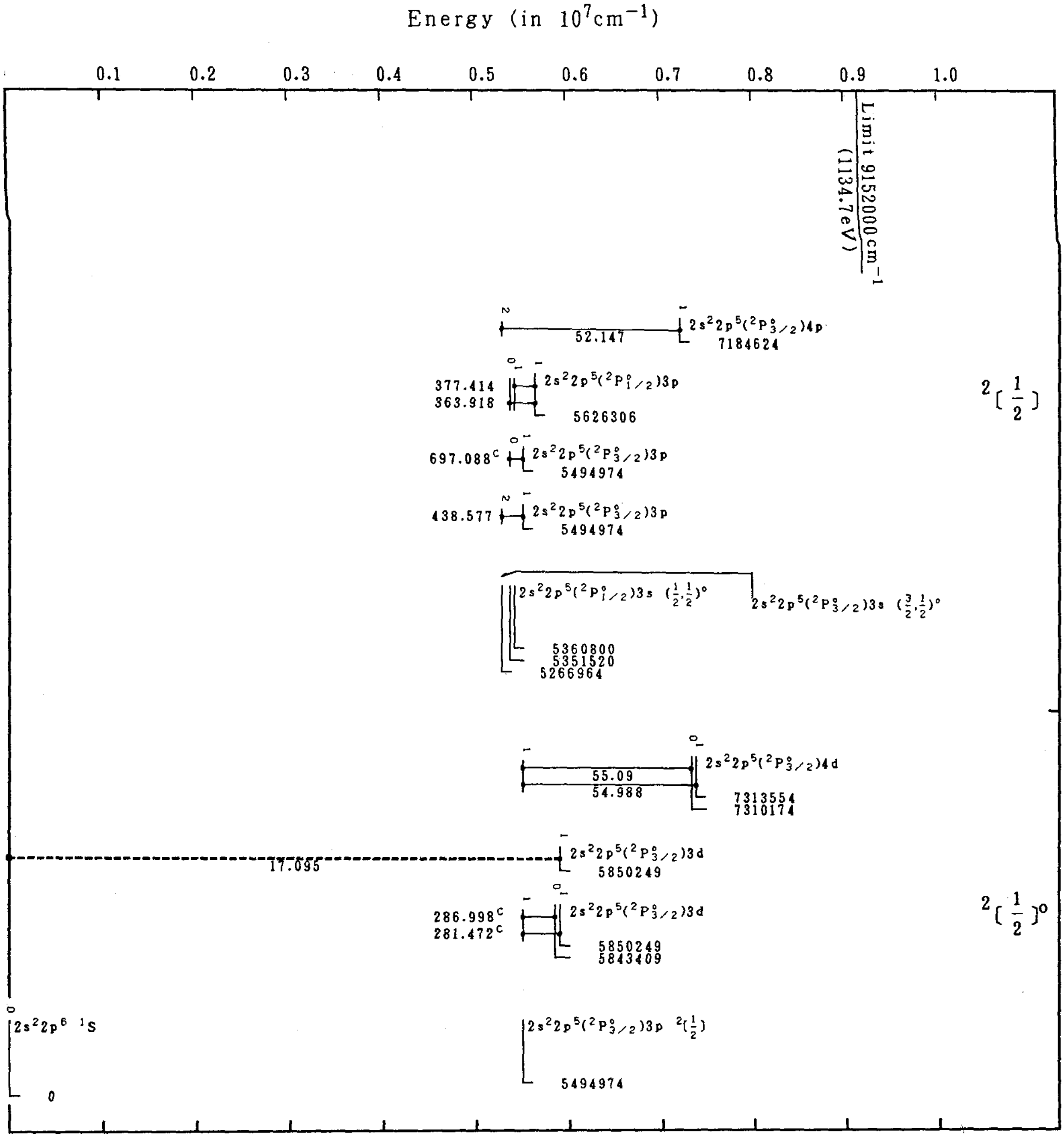

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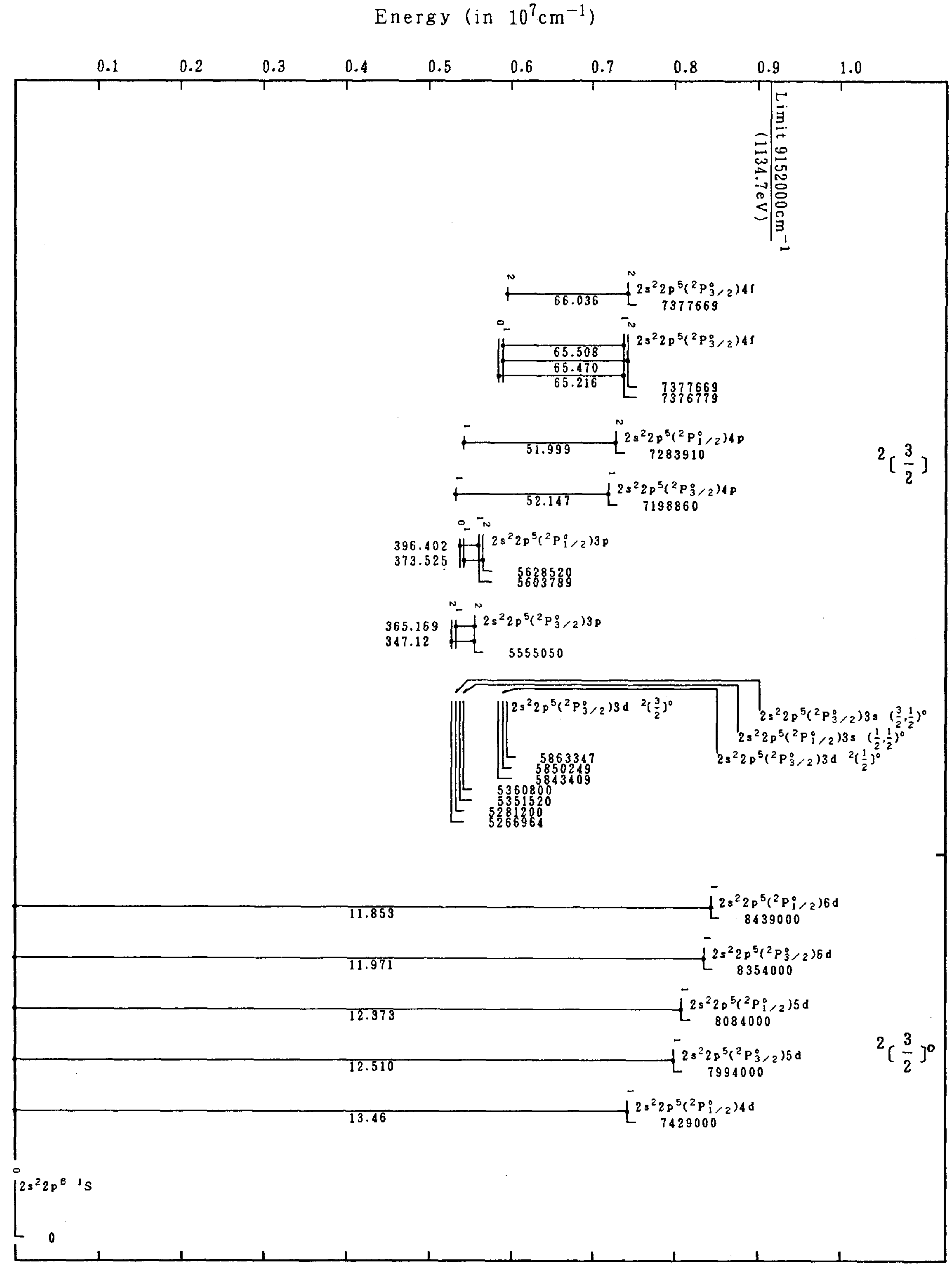

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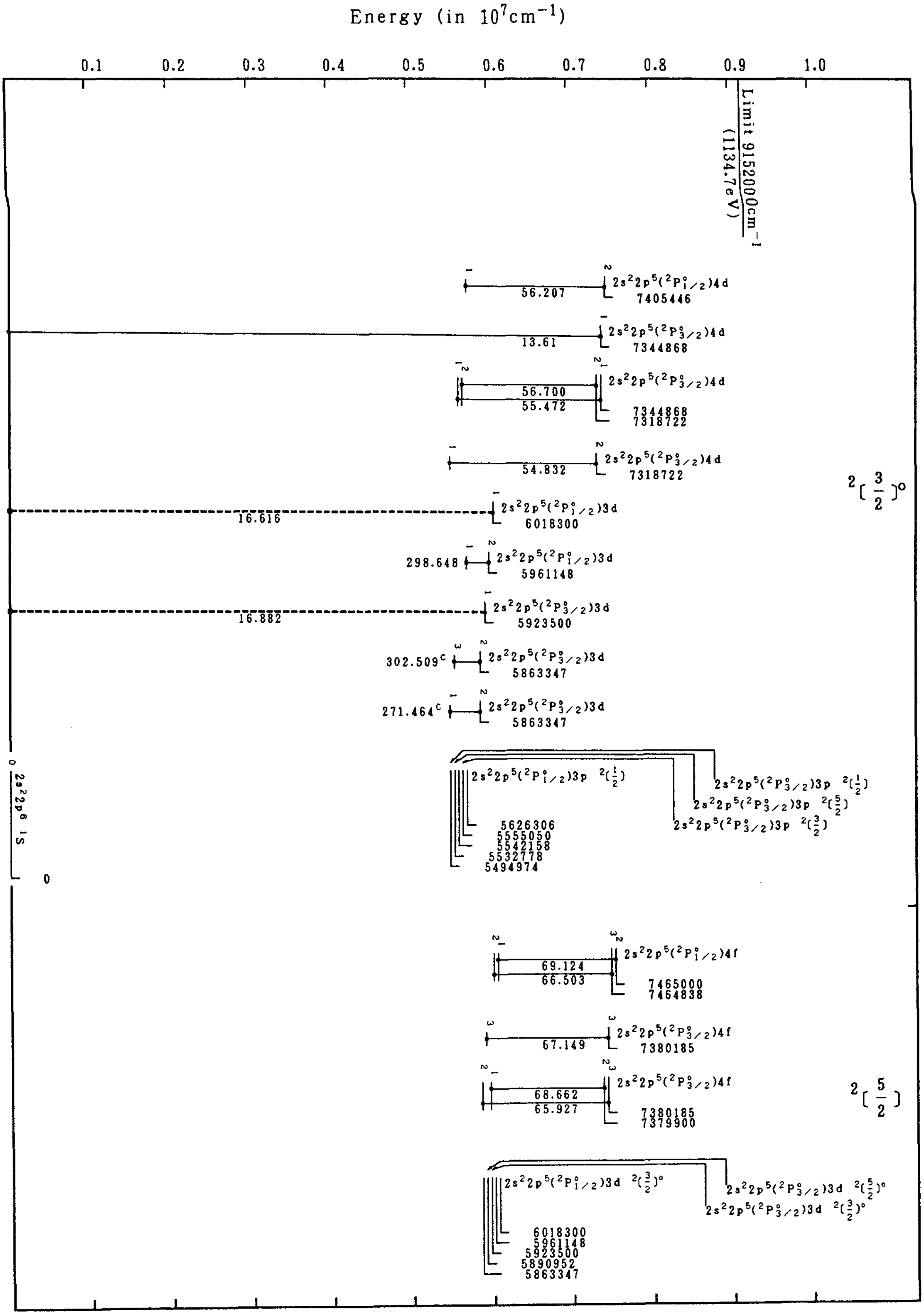

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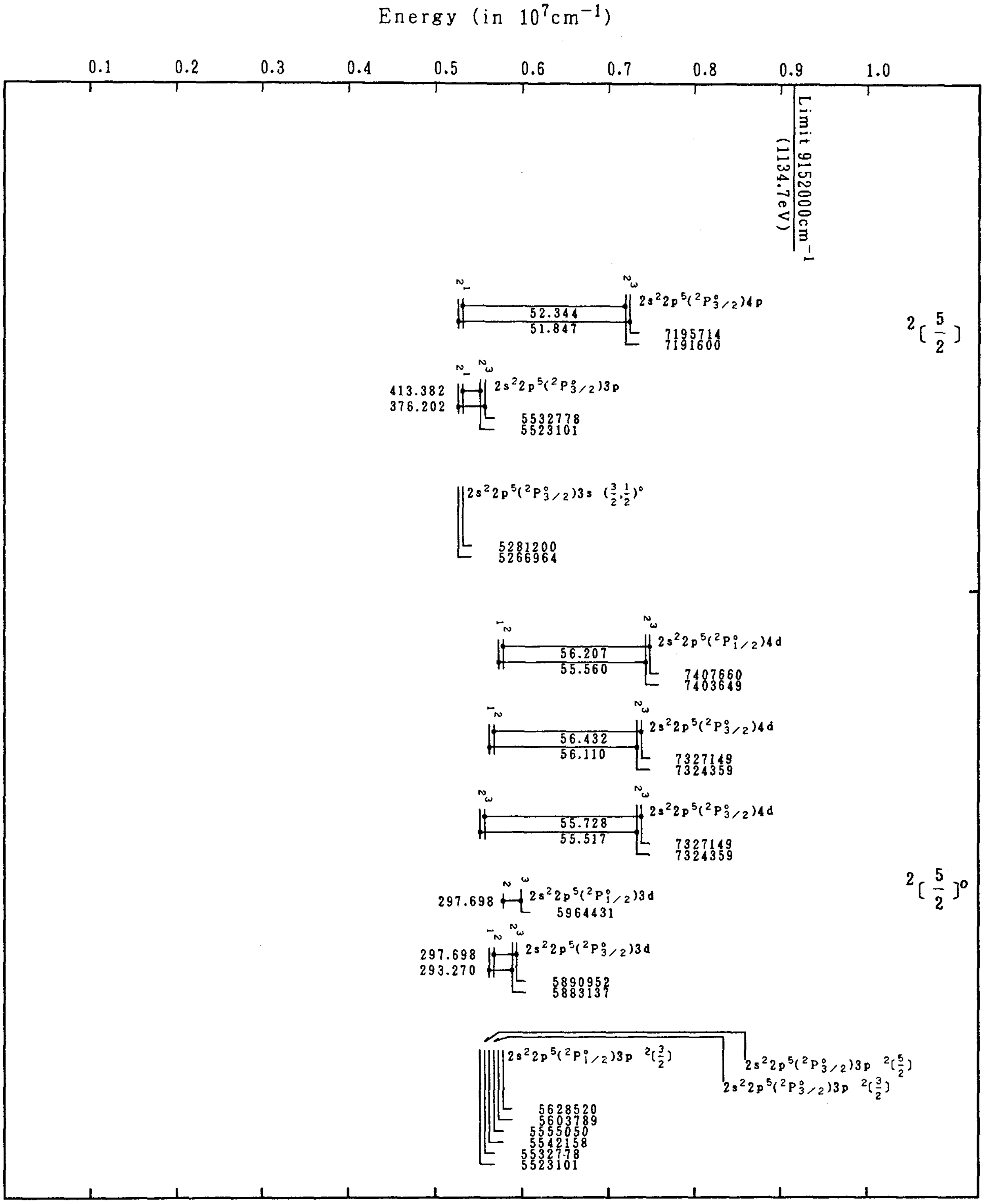

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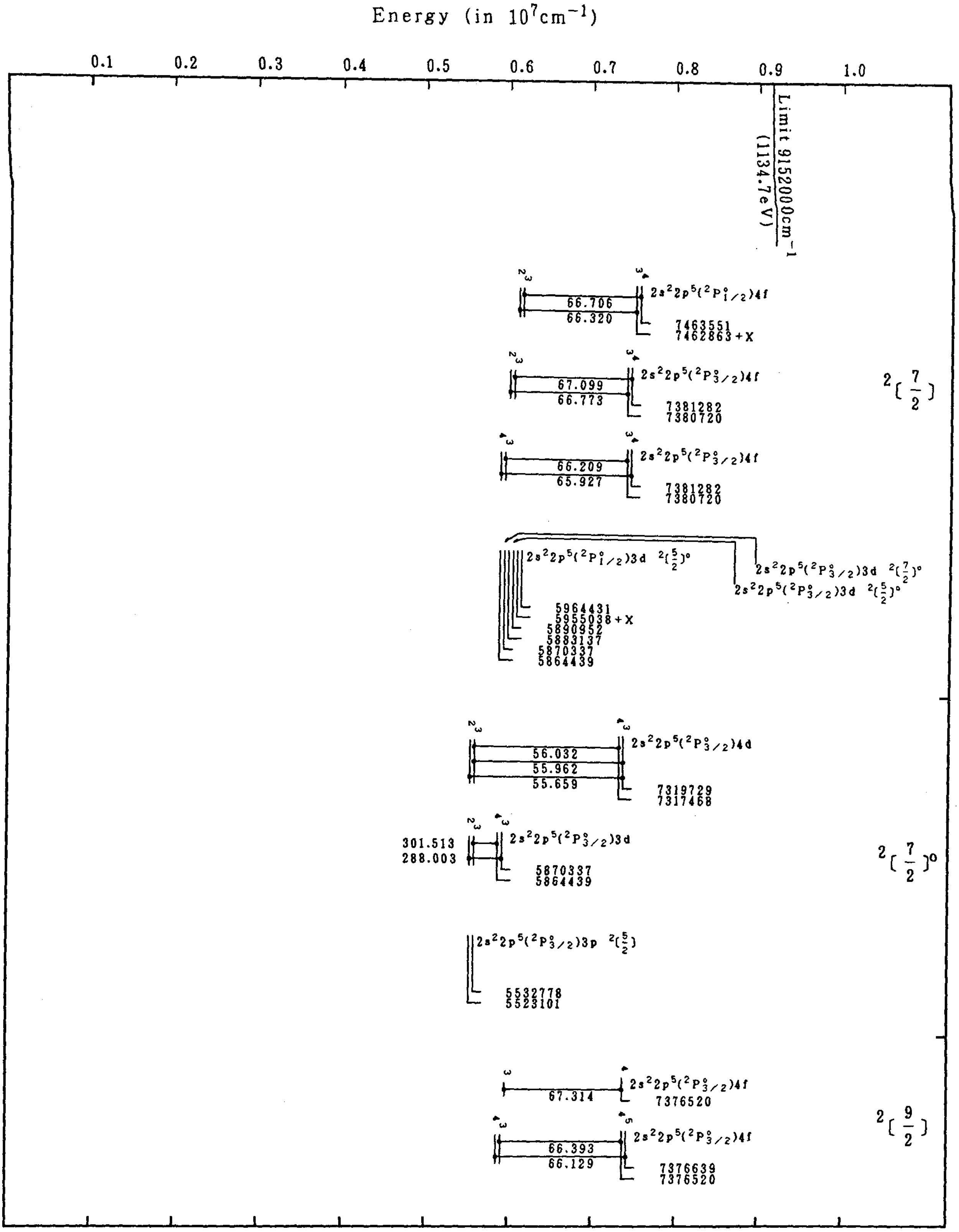

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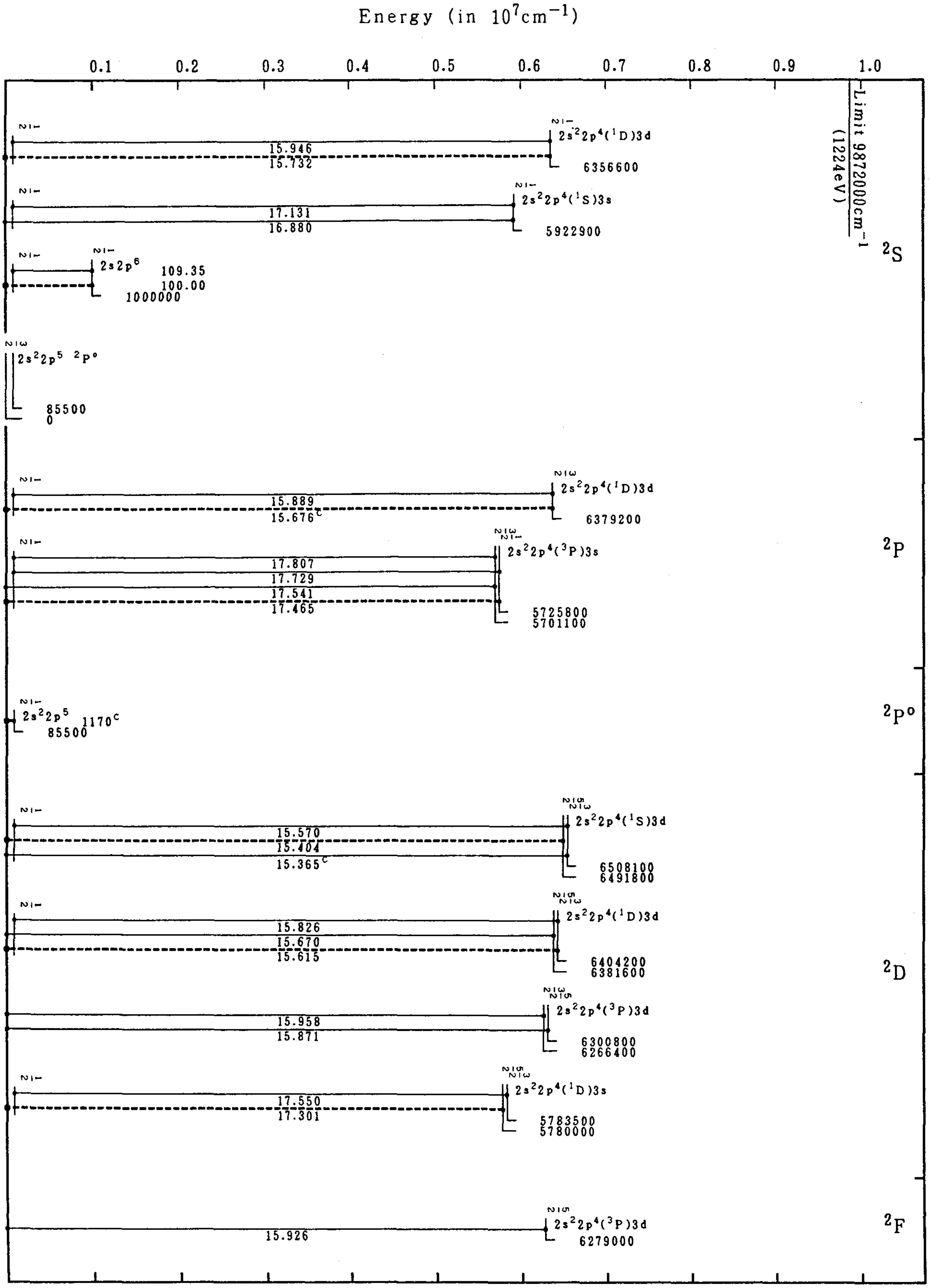

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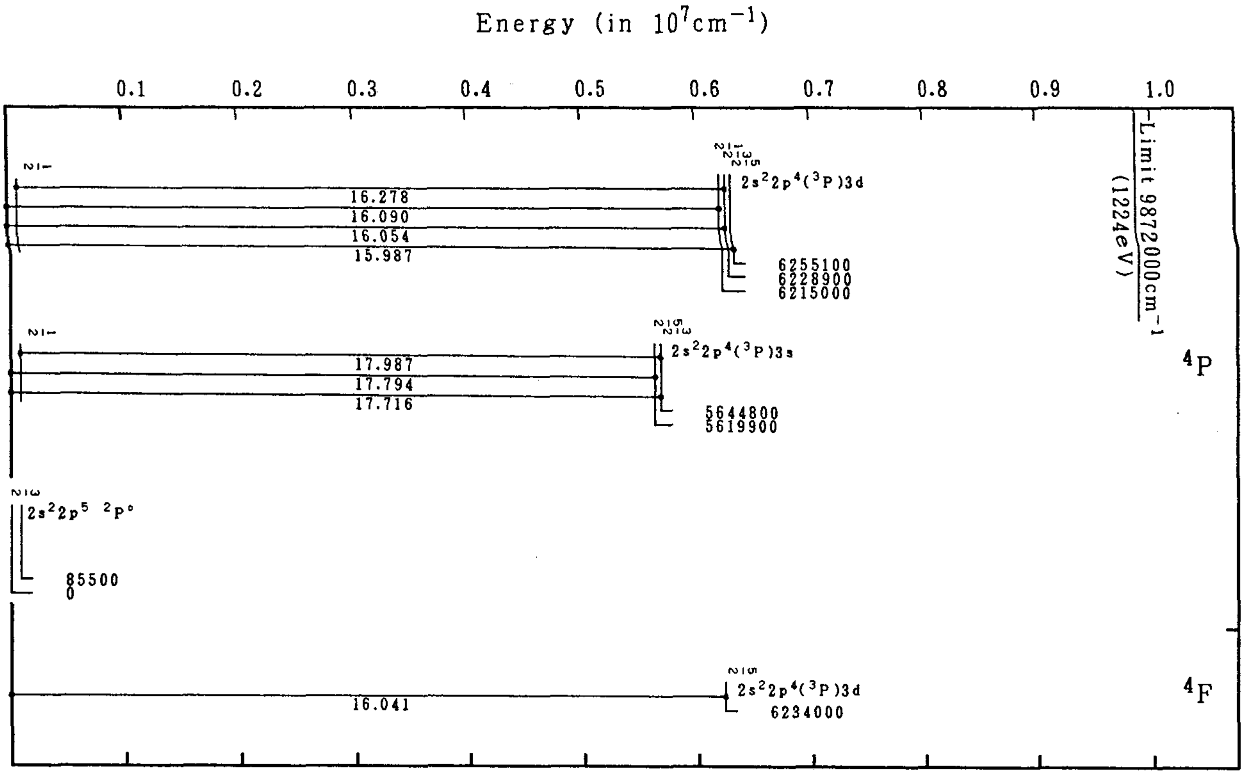

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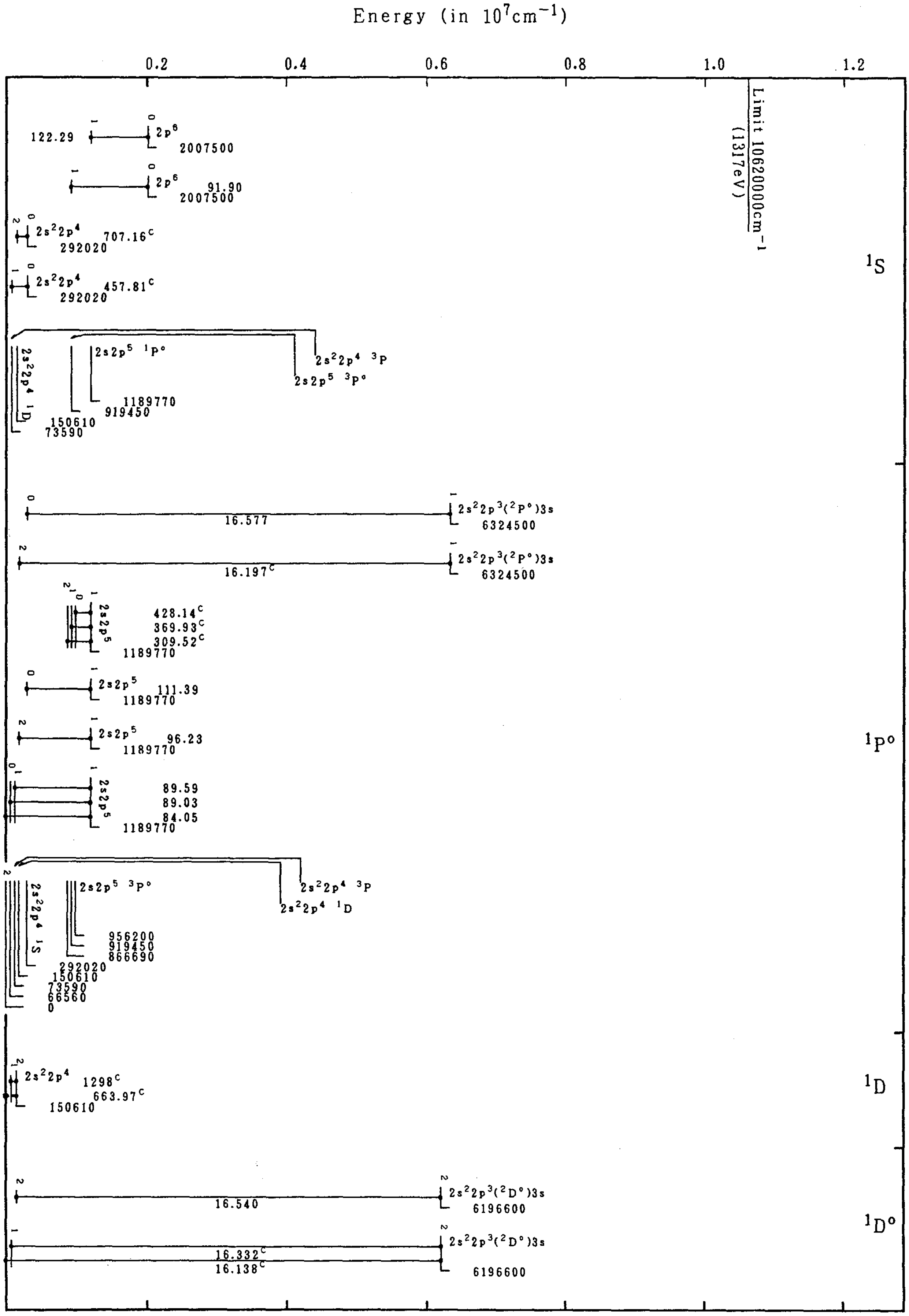

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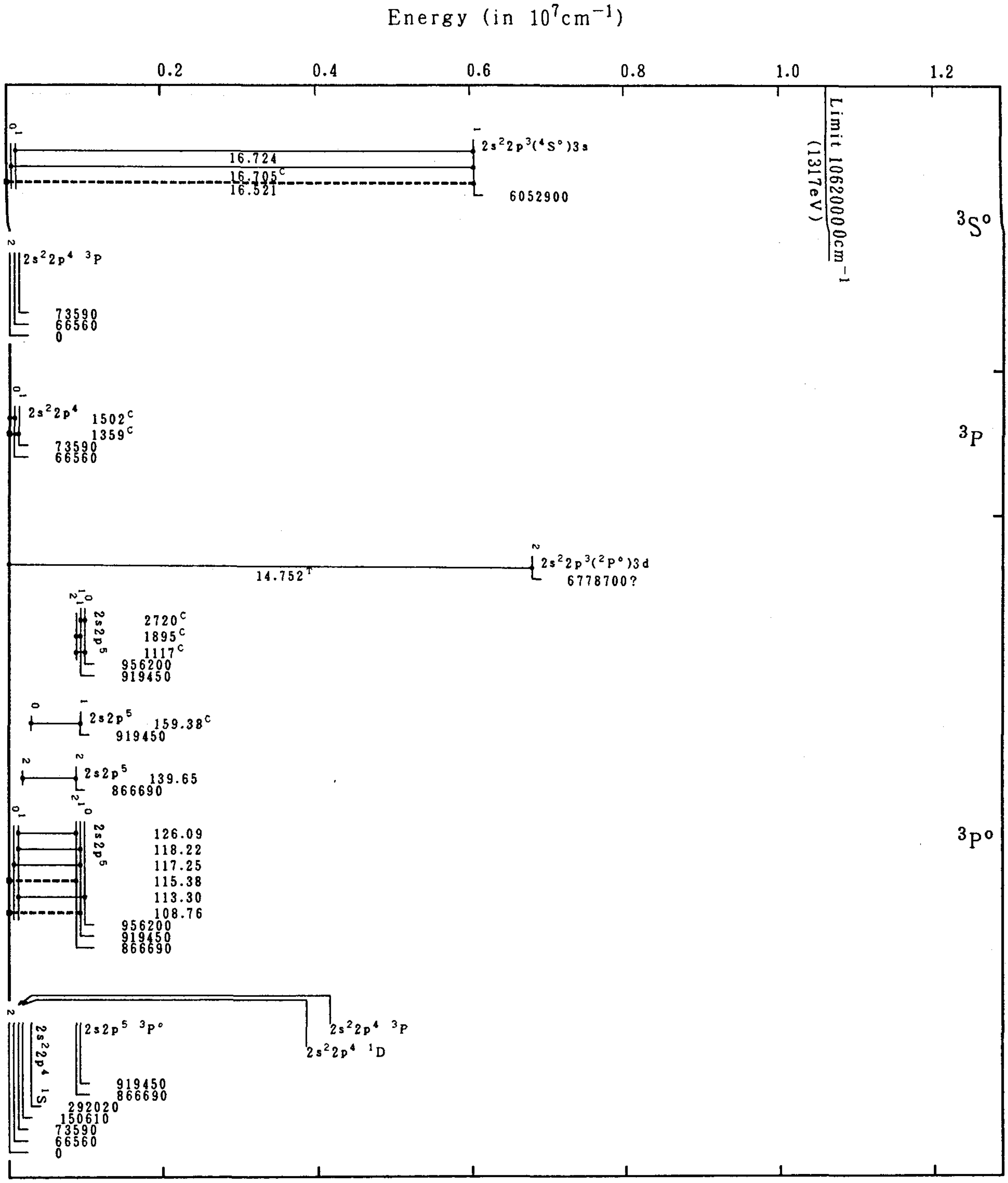

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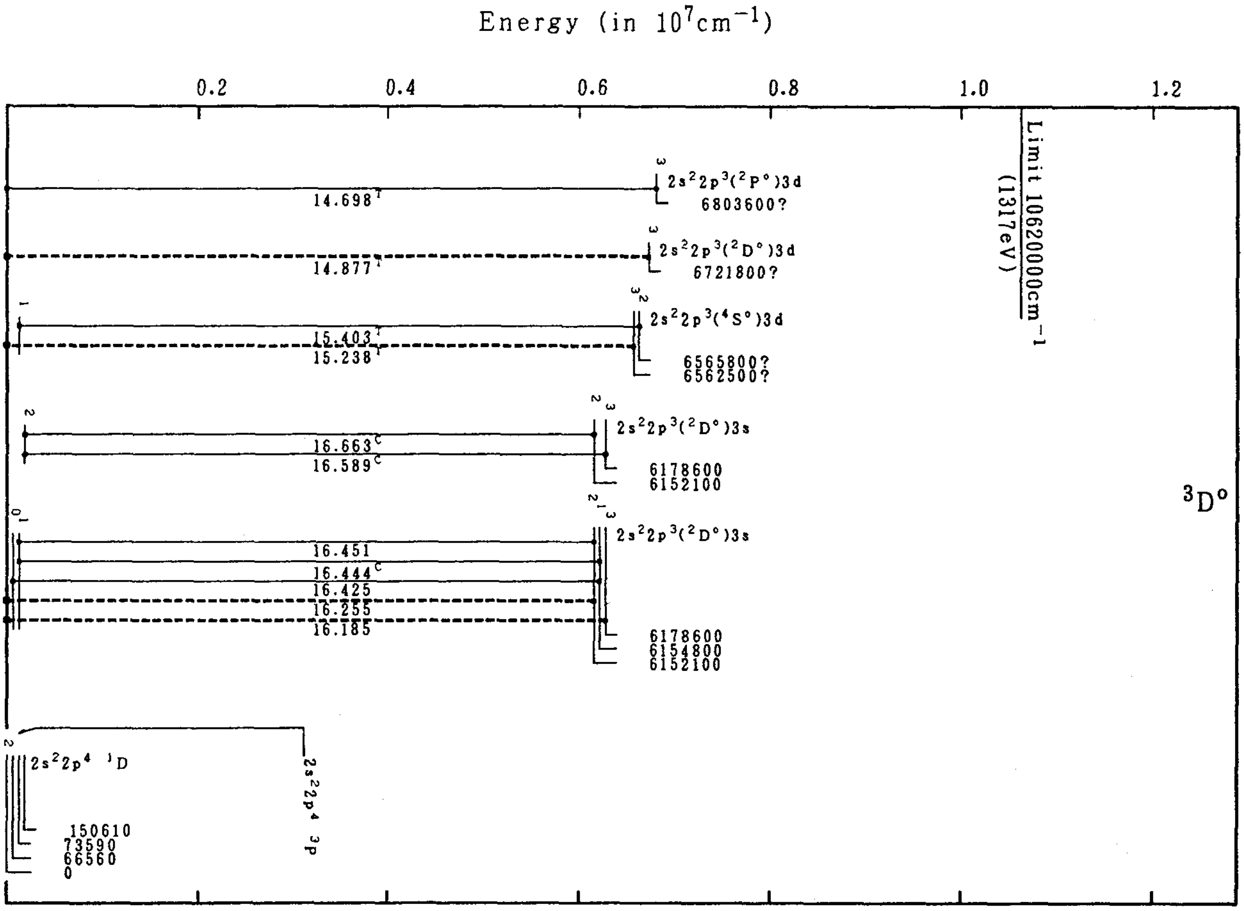

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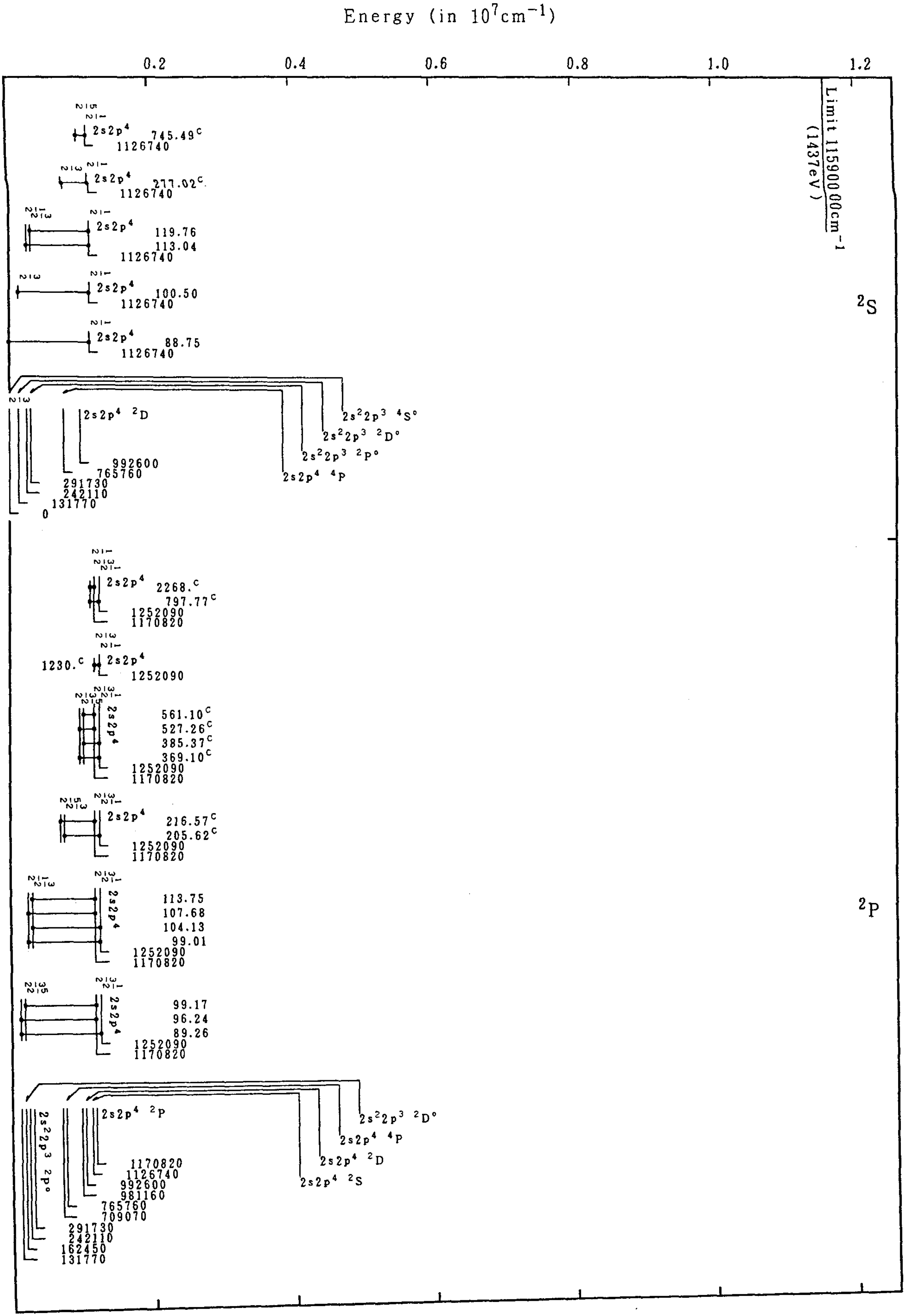

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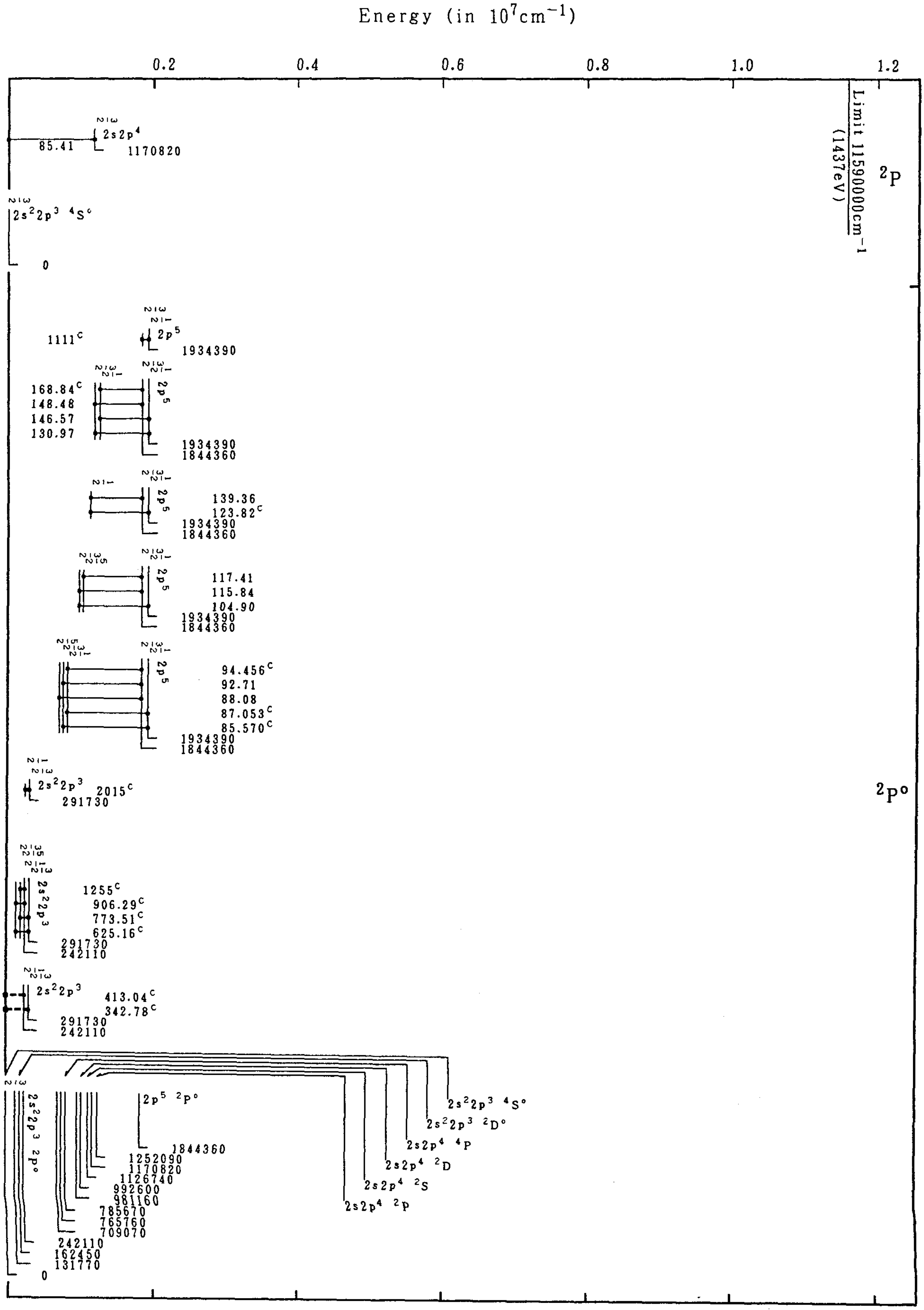

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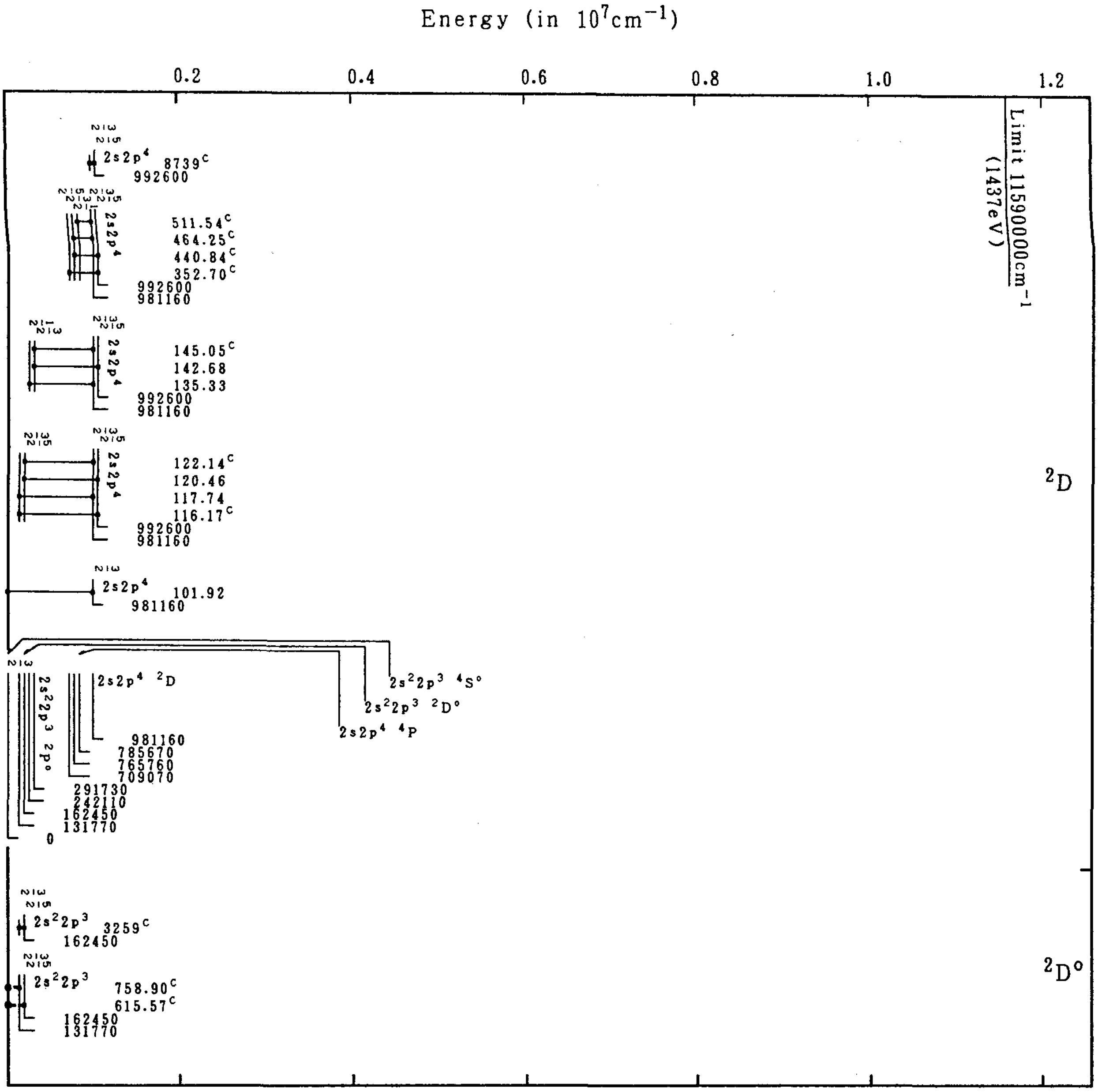

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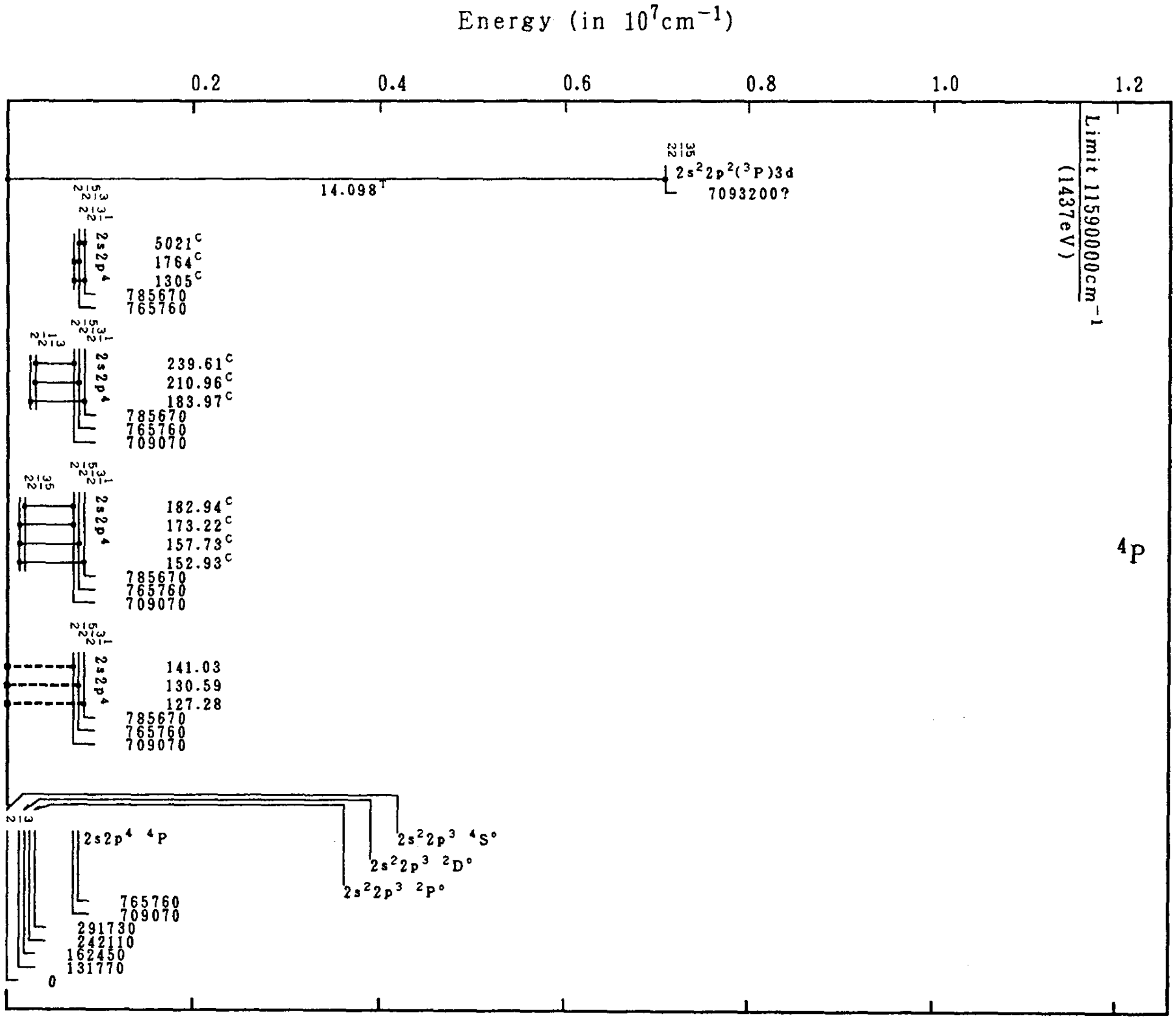

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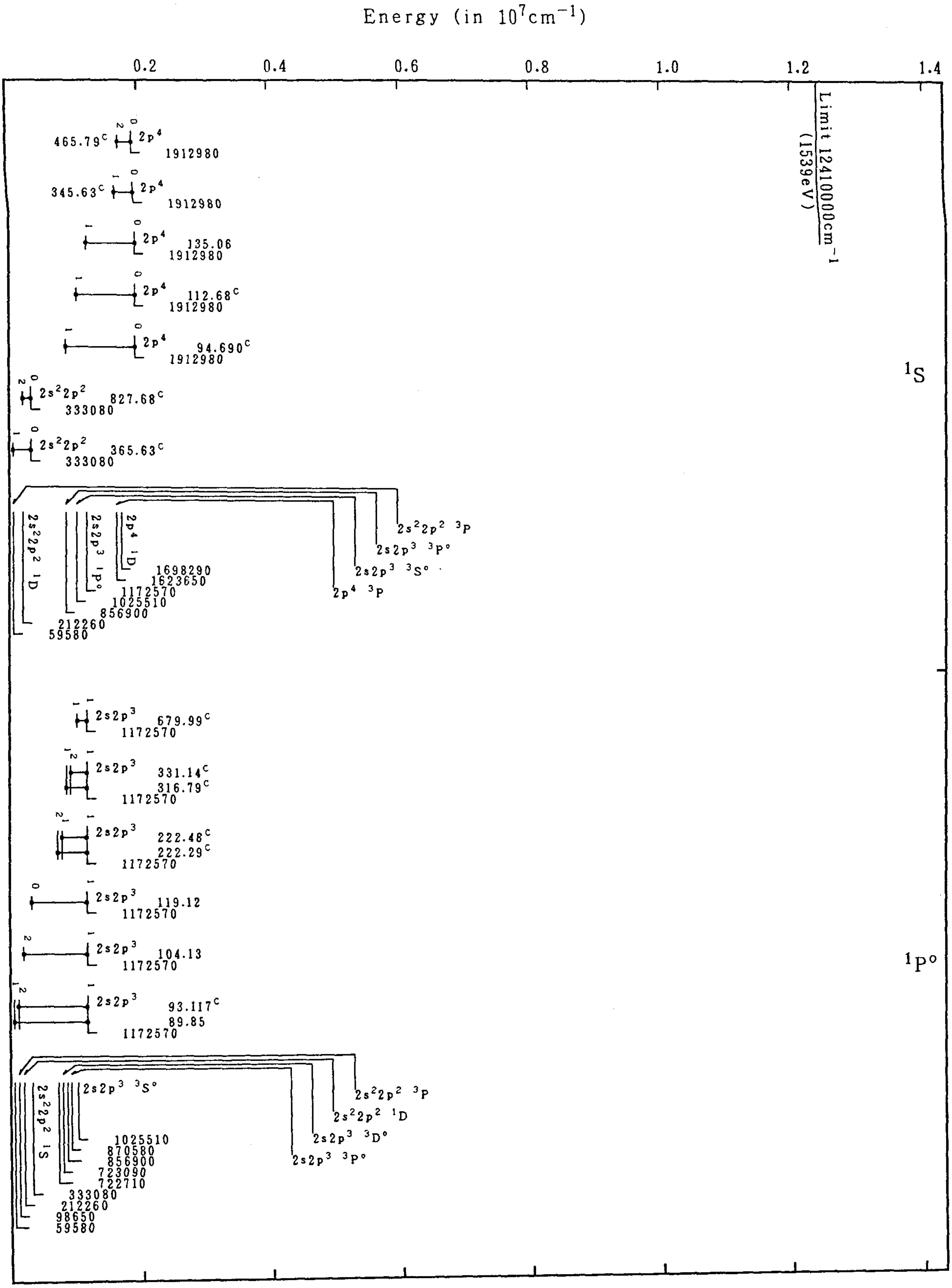

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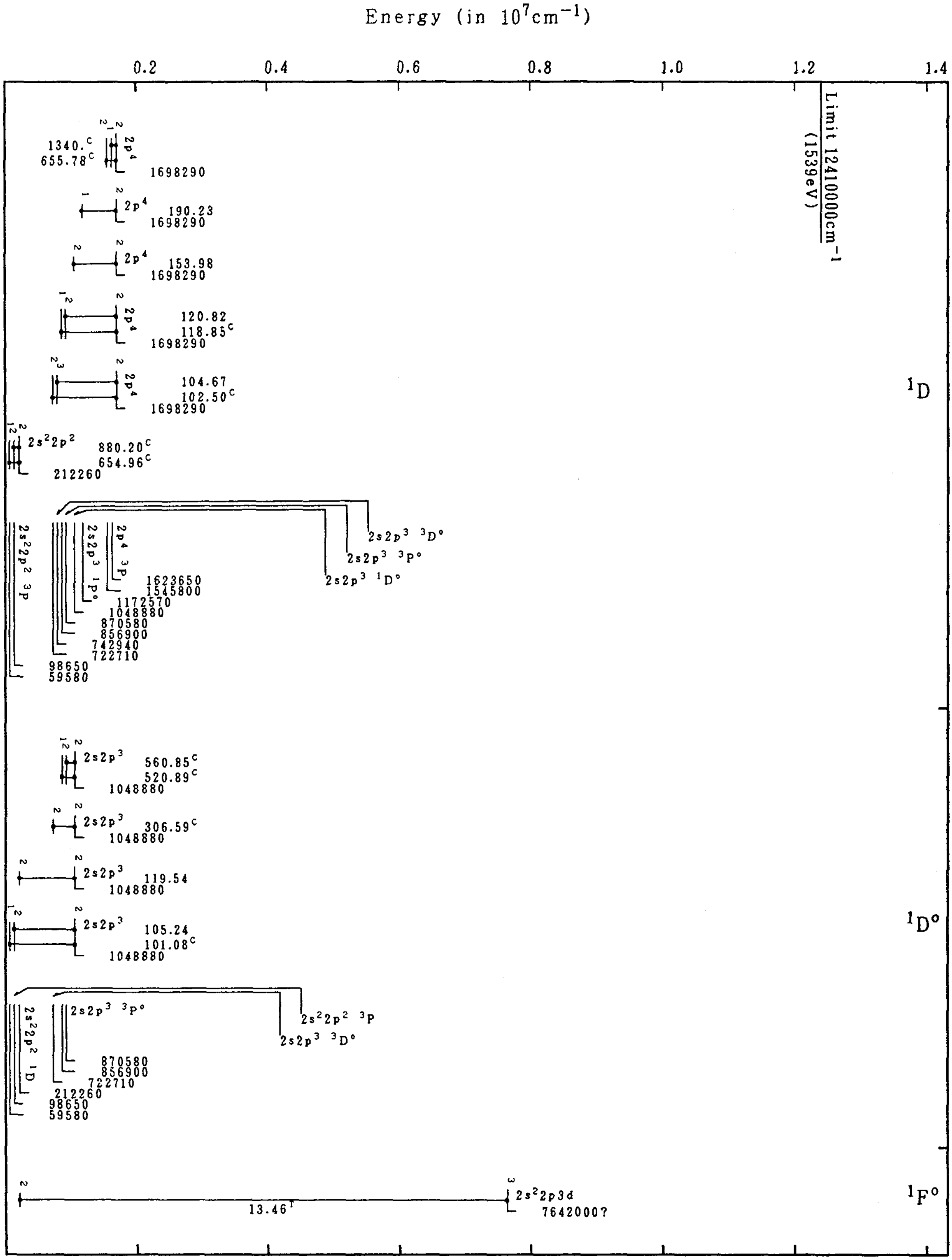

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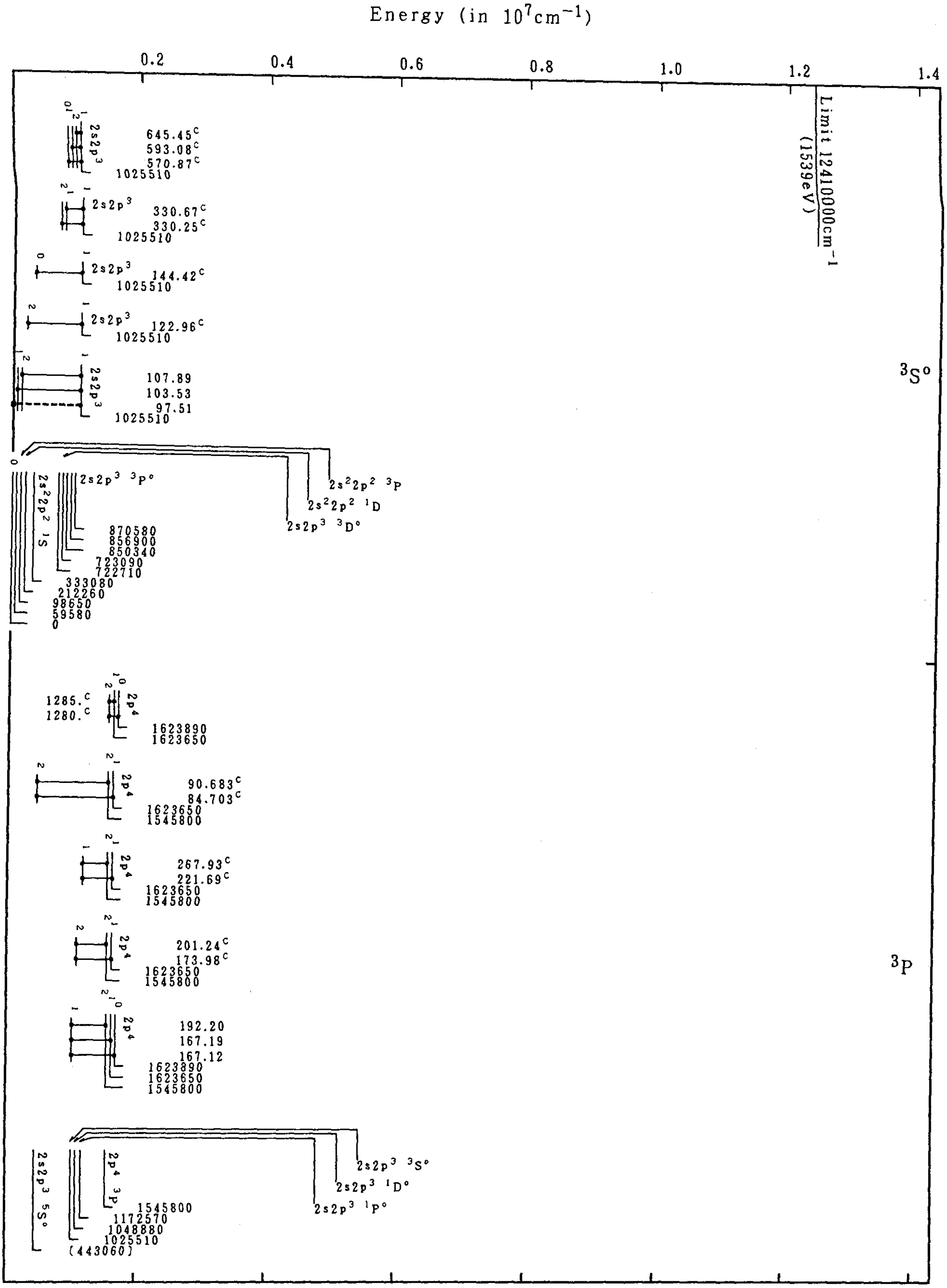

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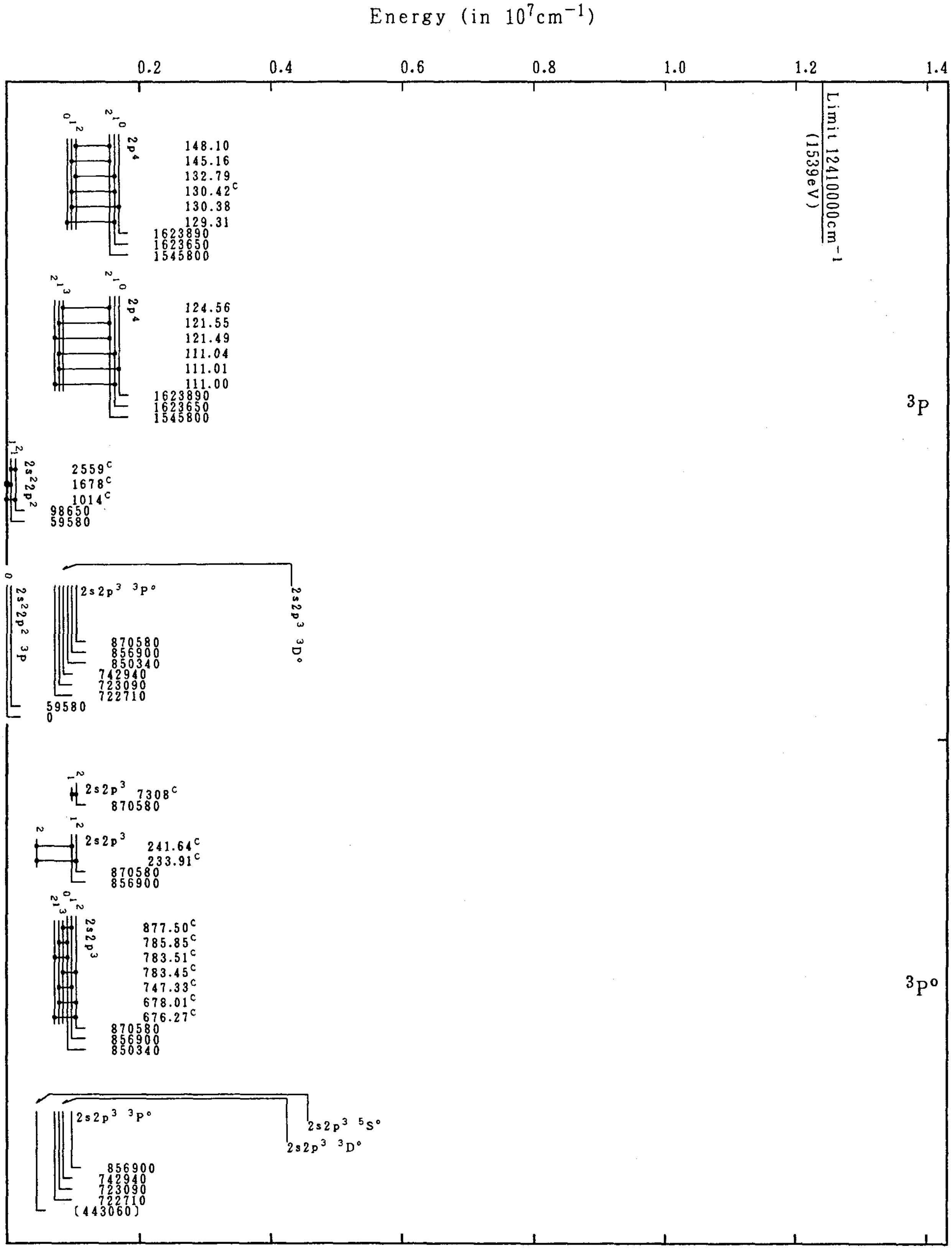

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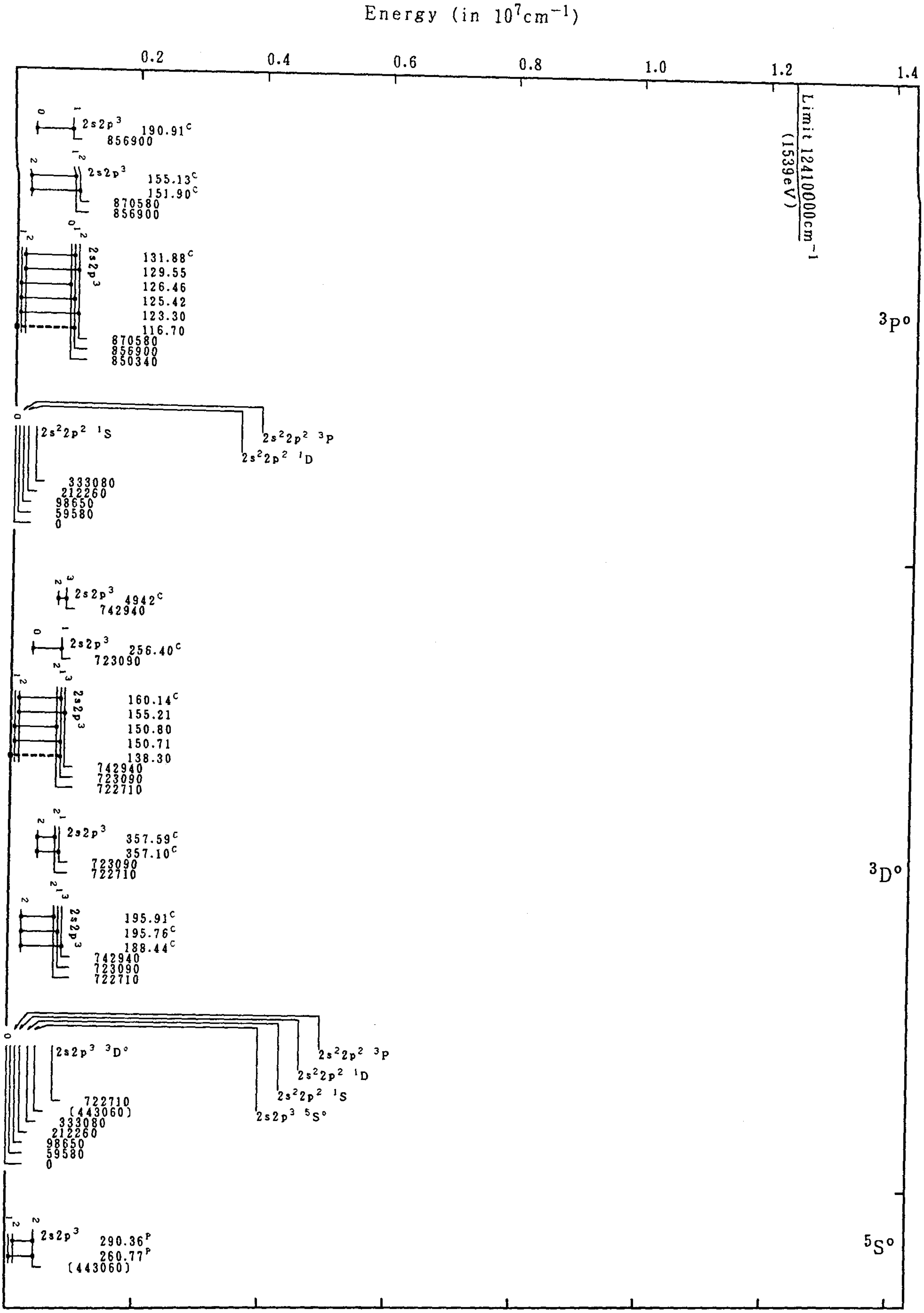

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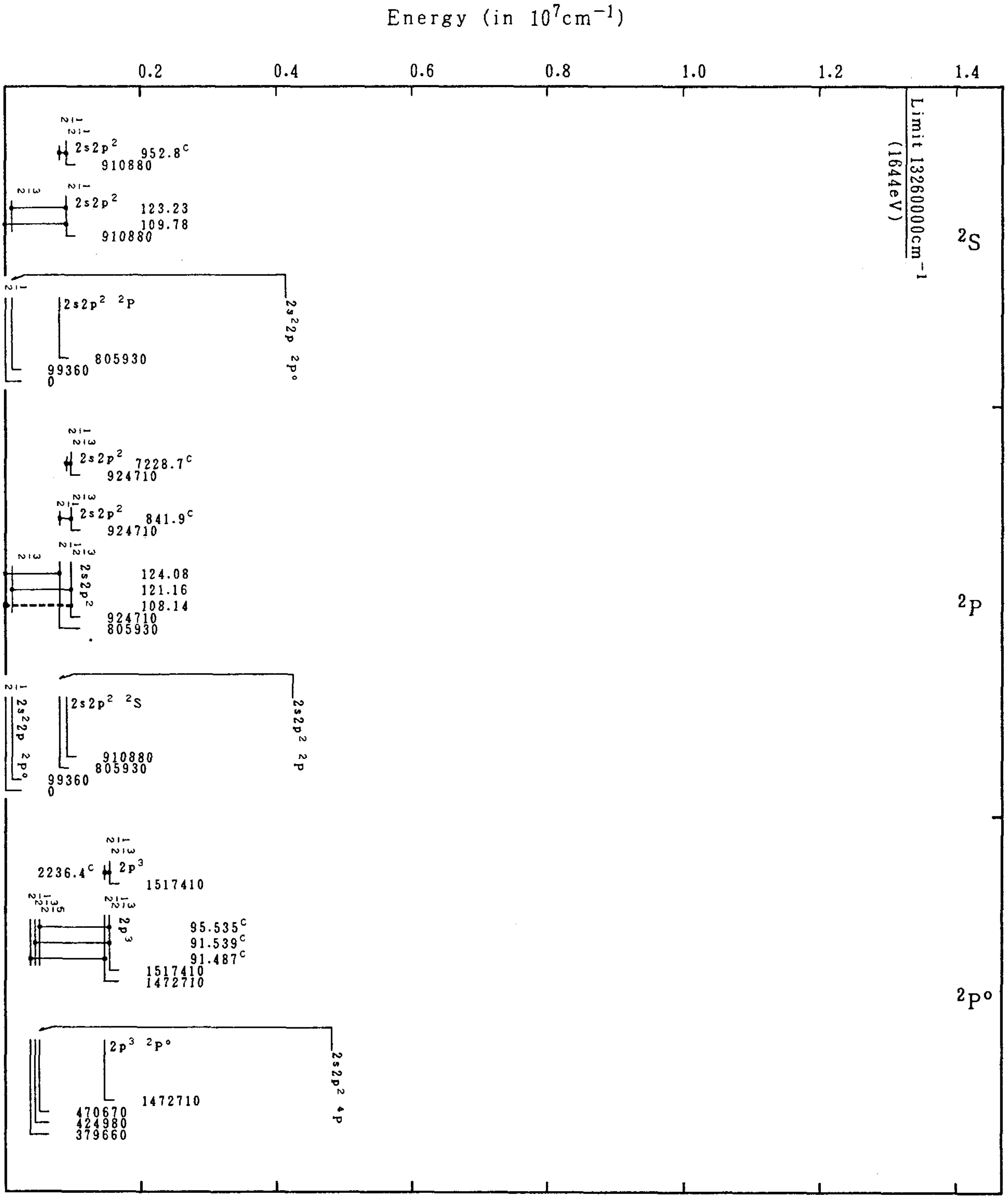

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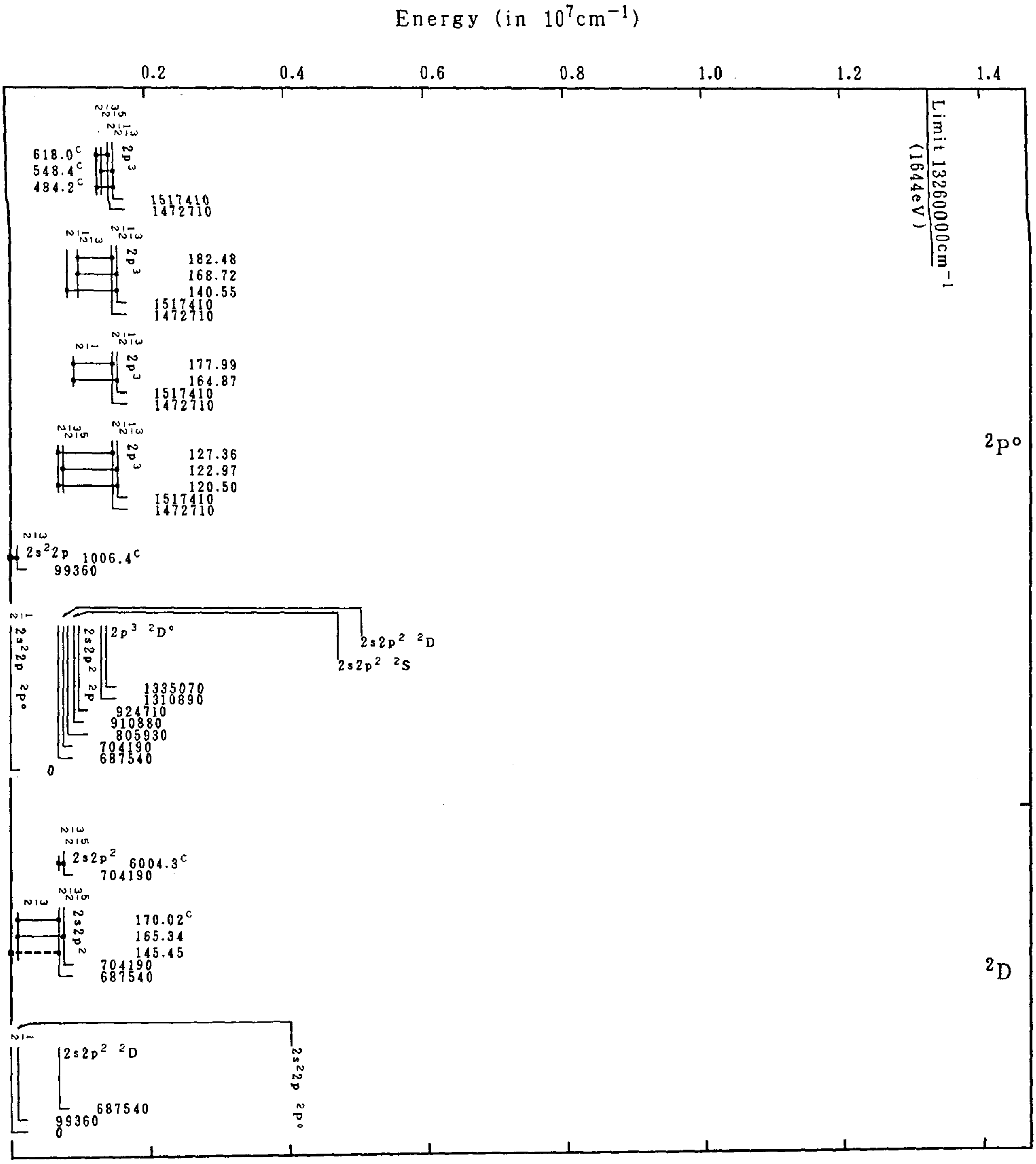

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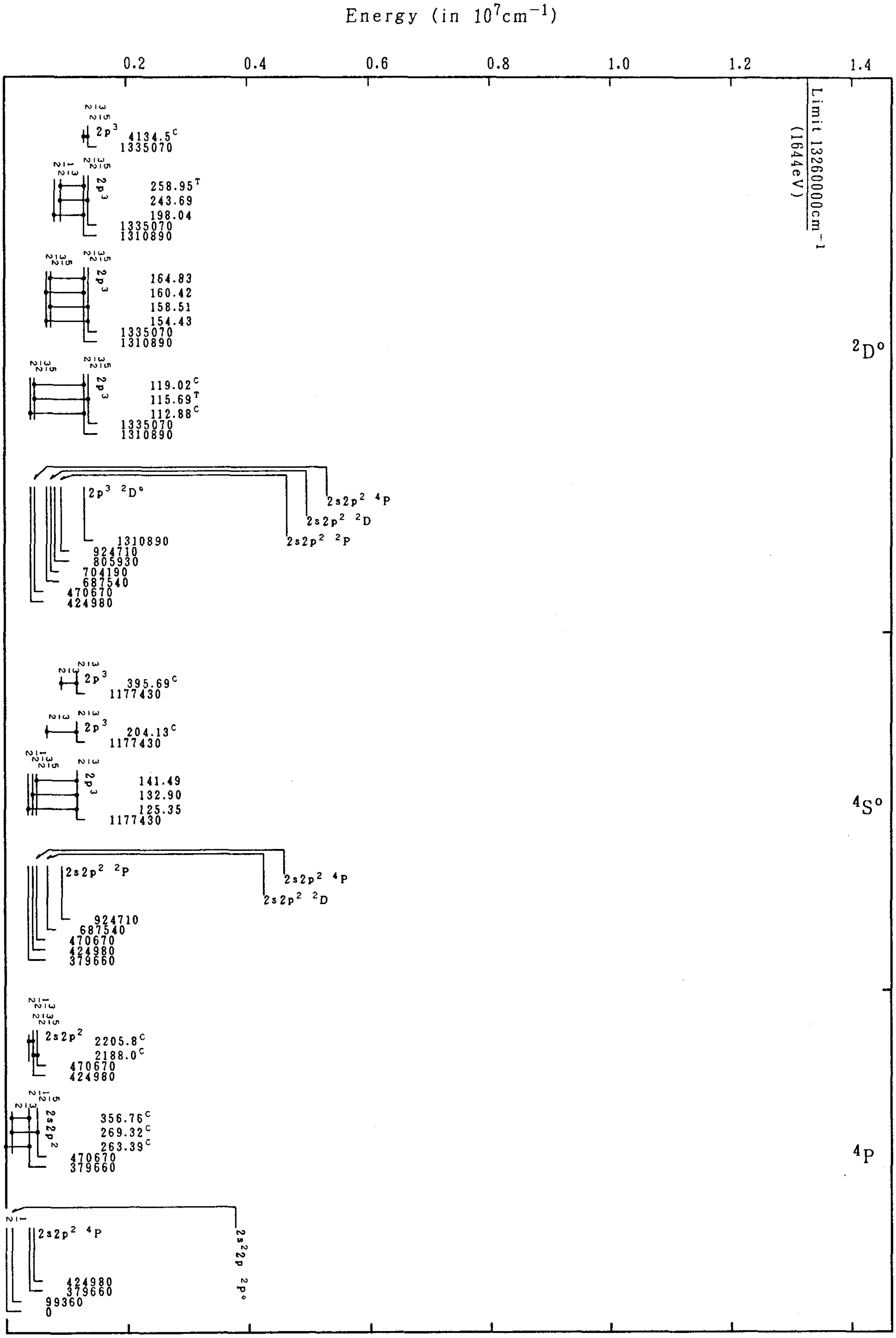

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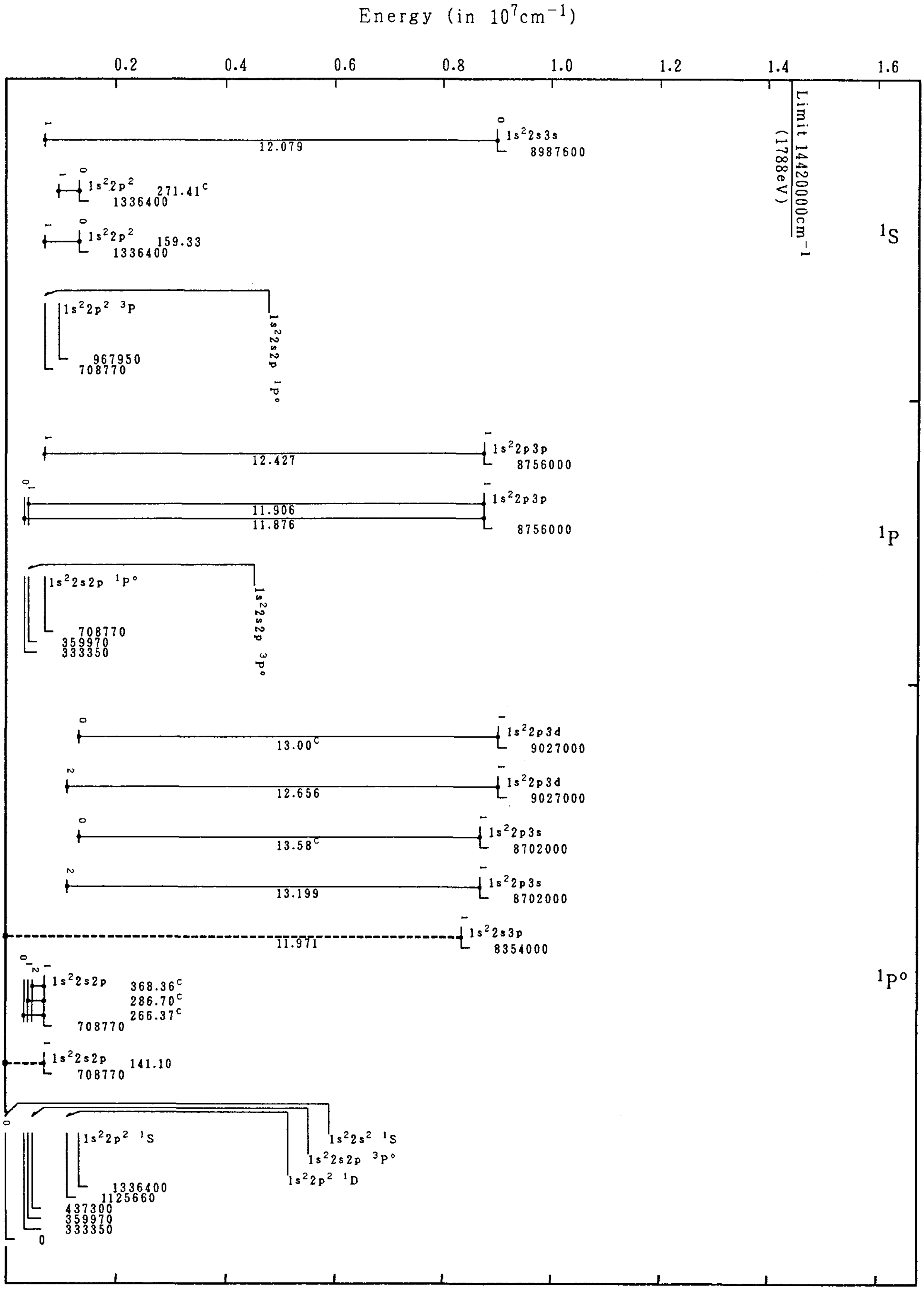
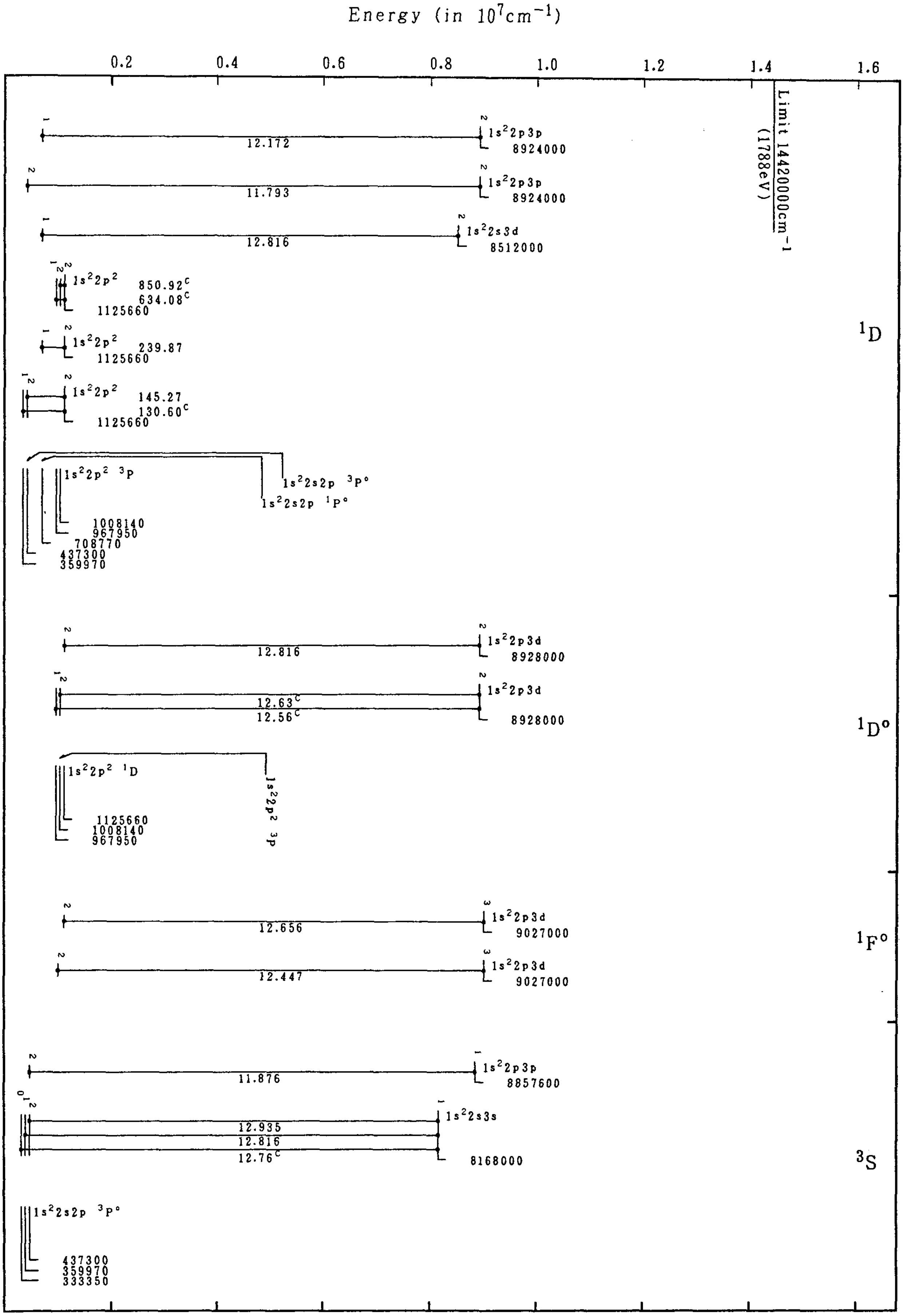


Mn XXII(Be–Sequence)



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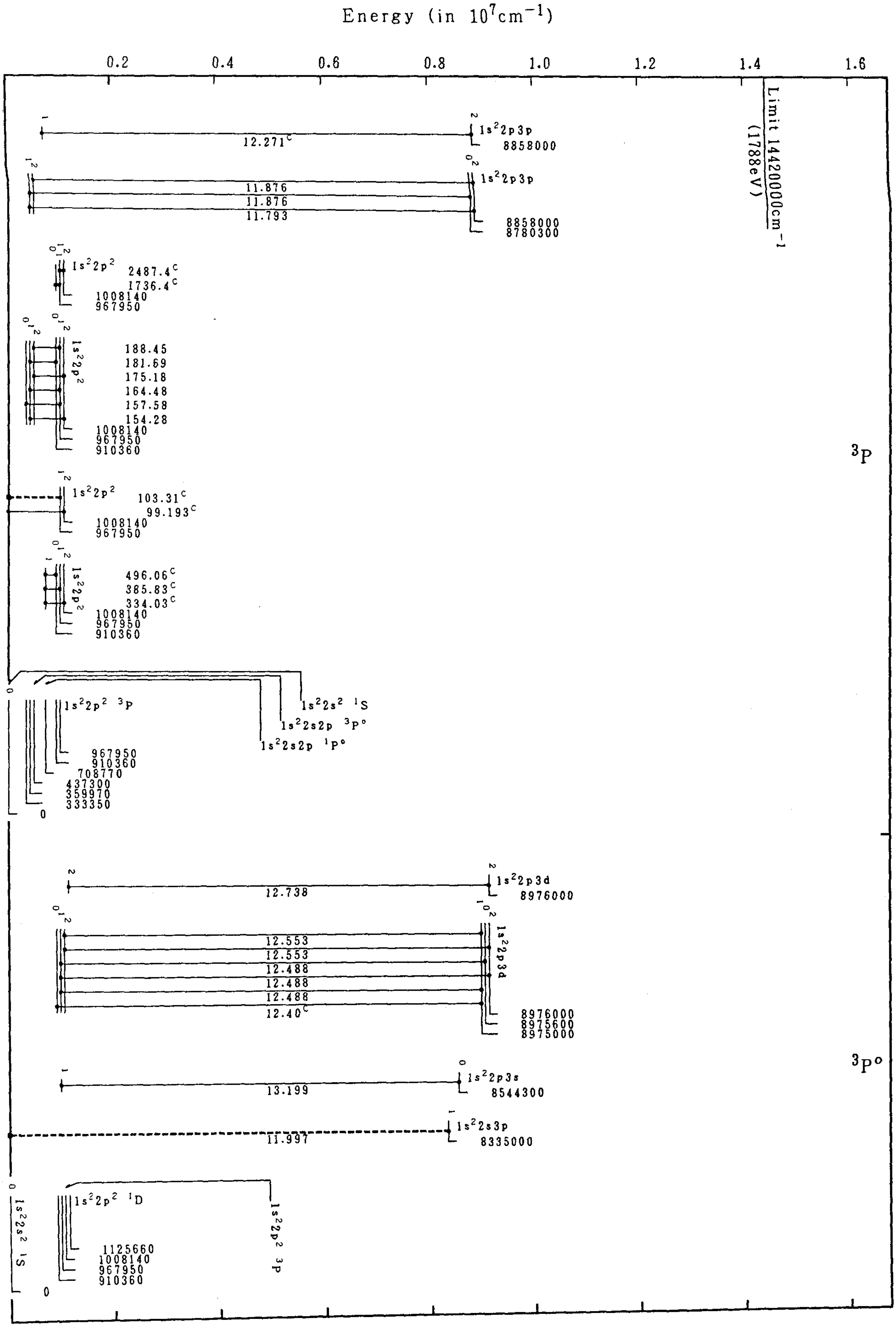

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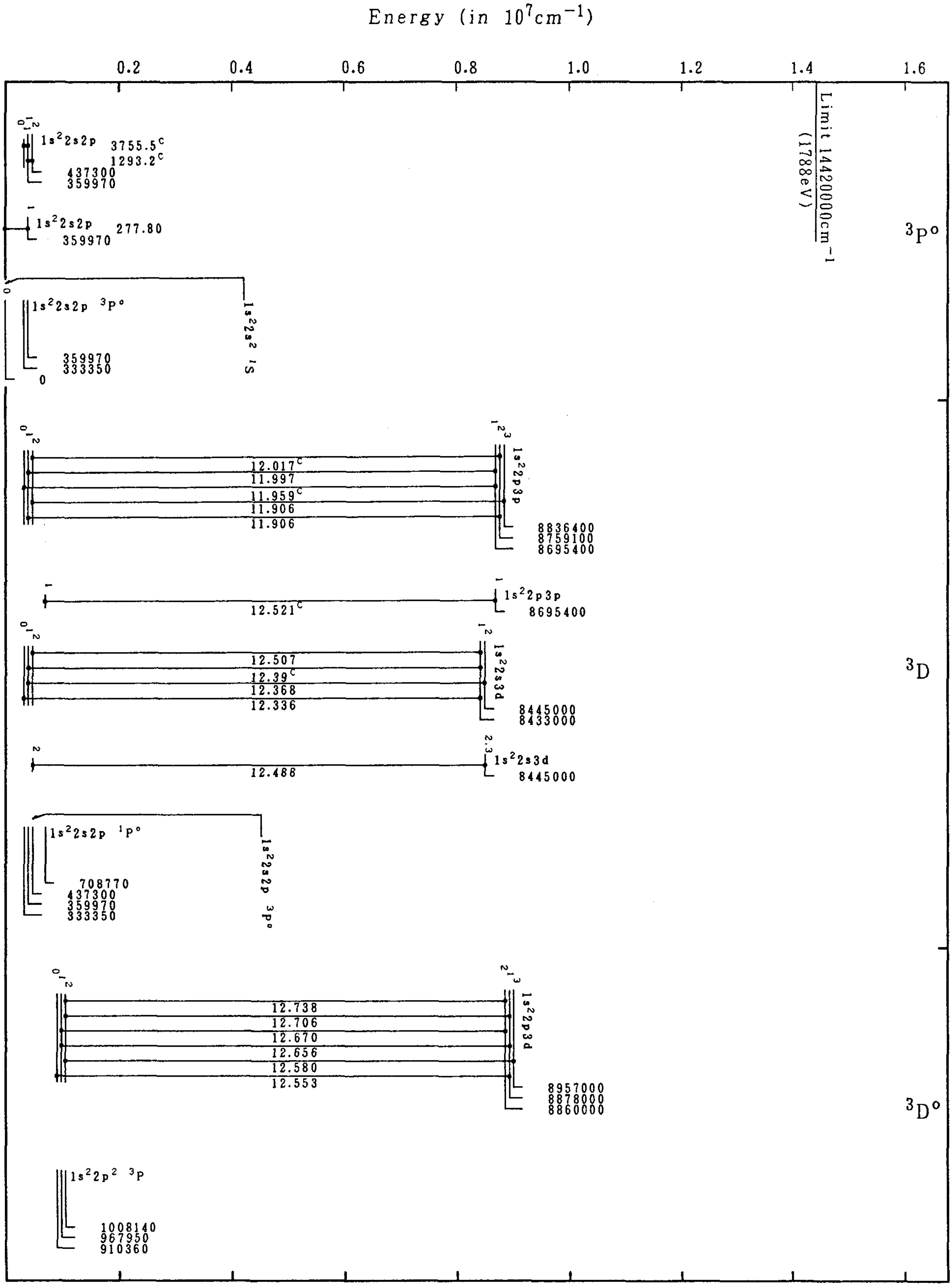

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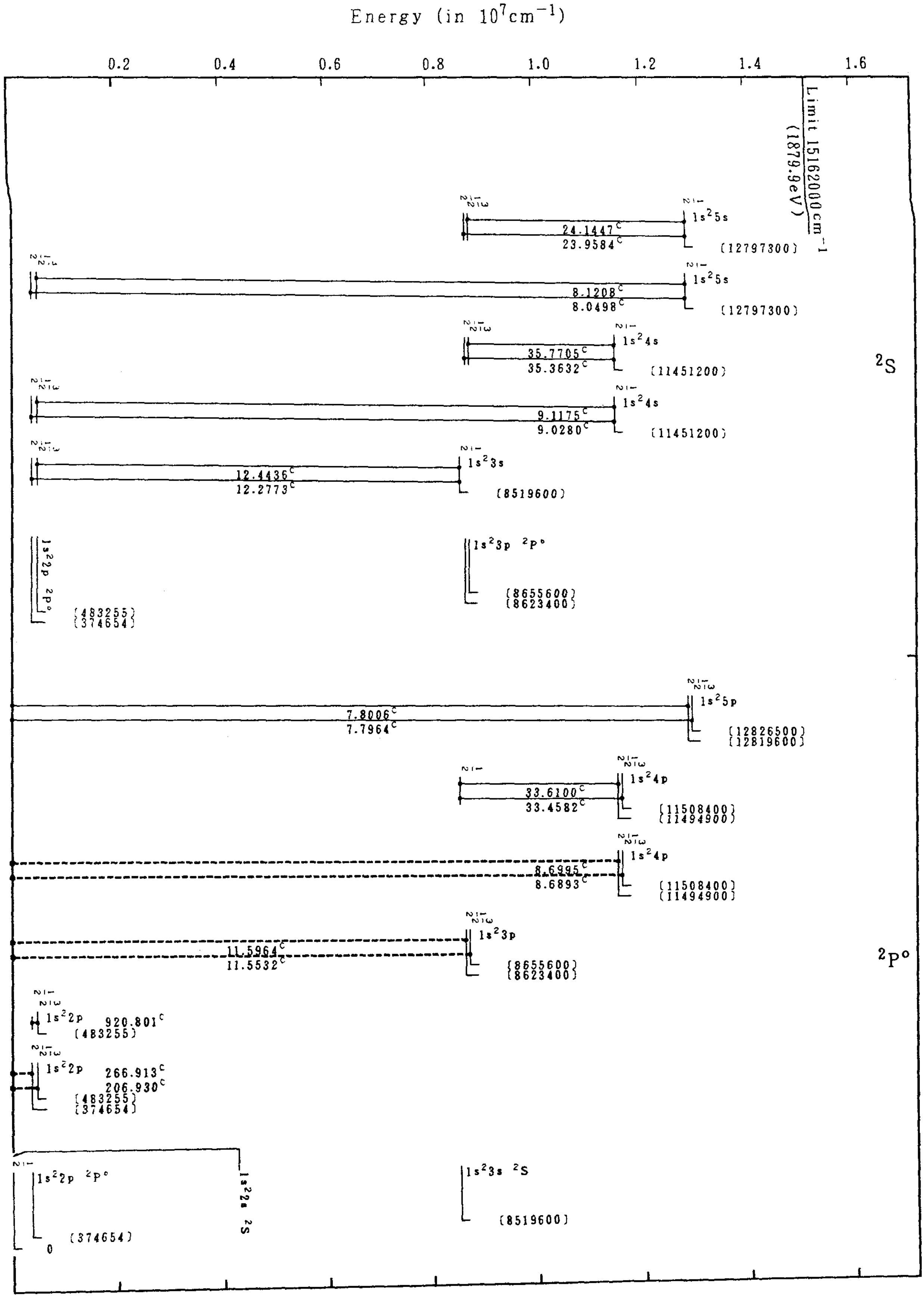

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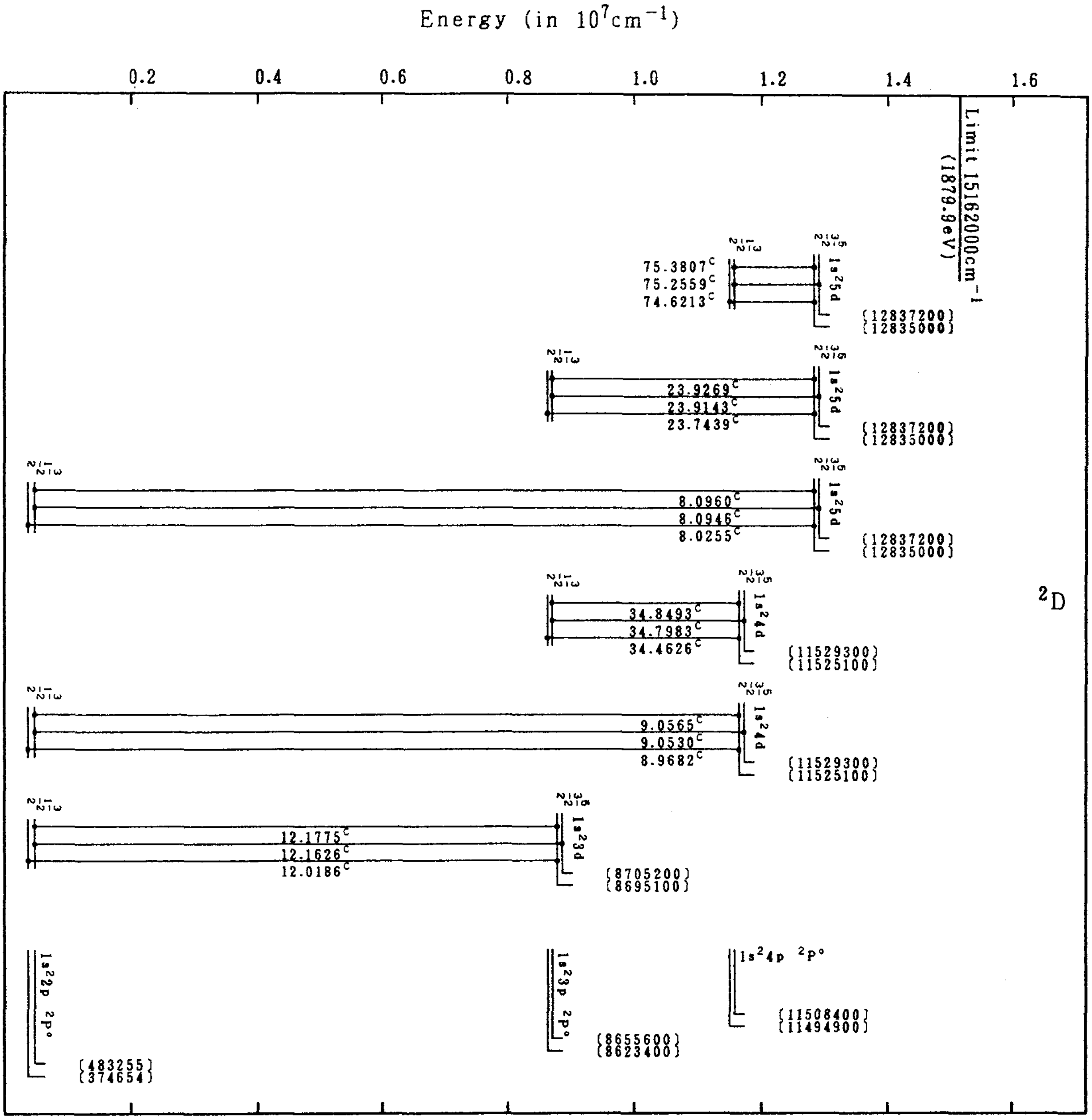

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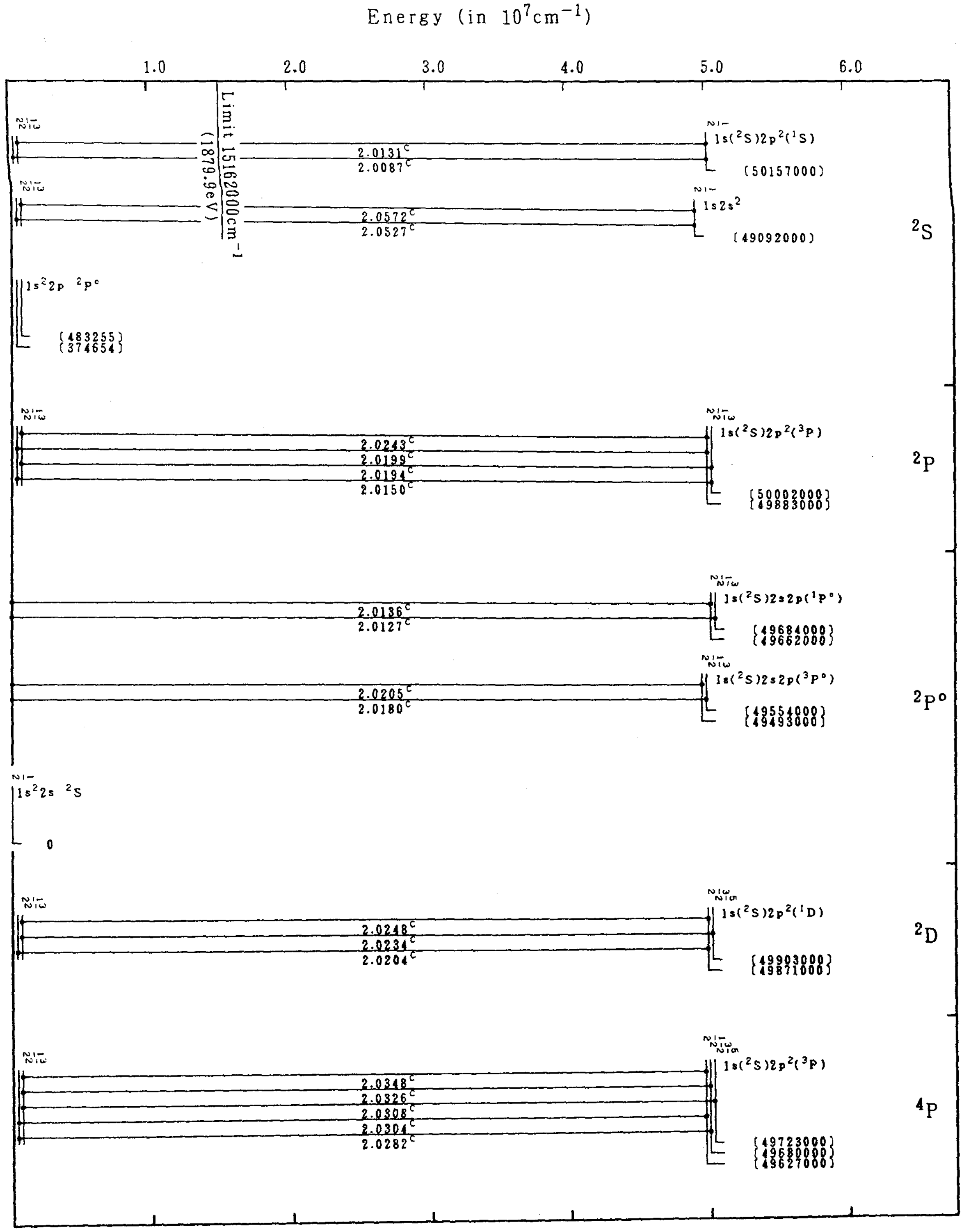

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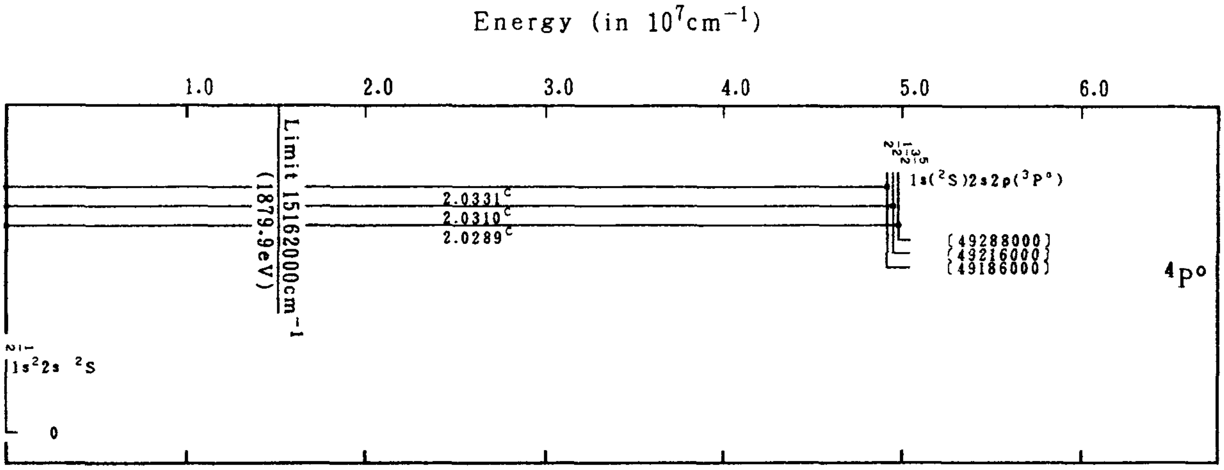

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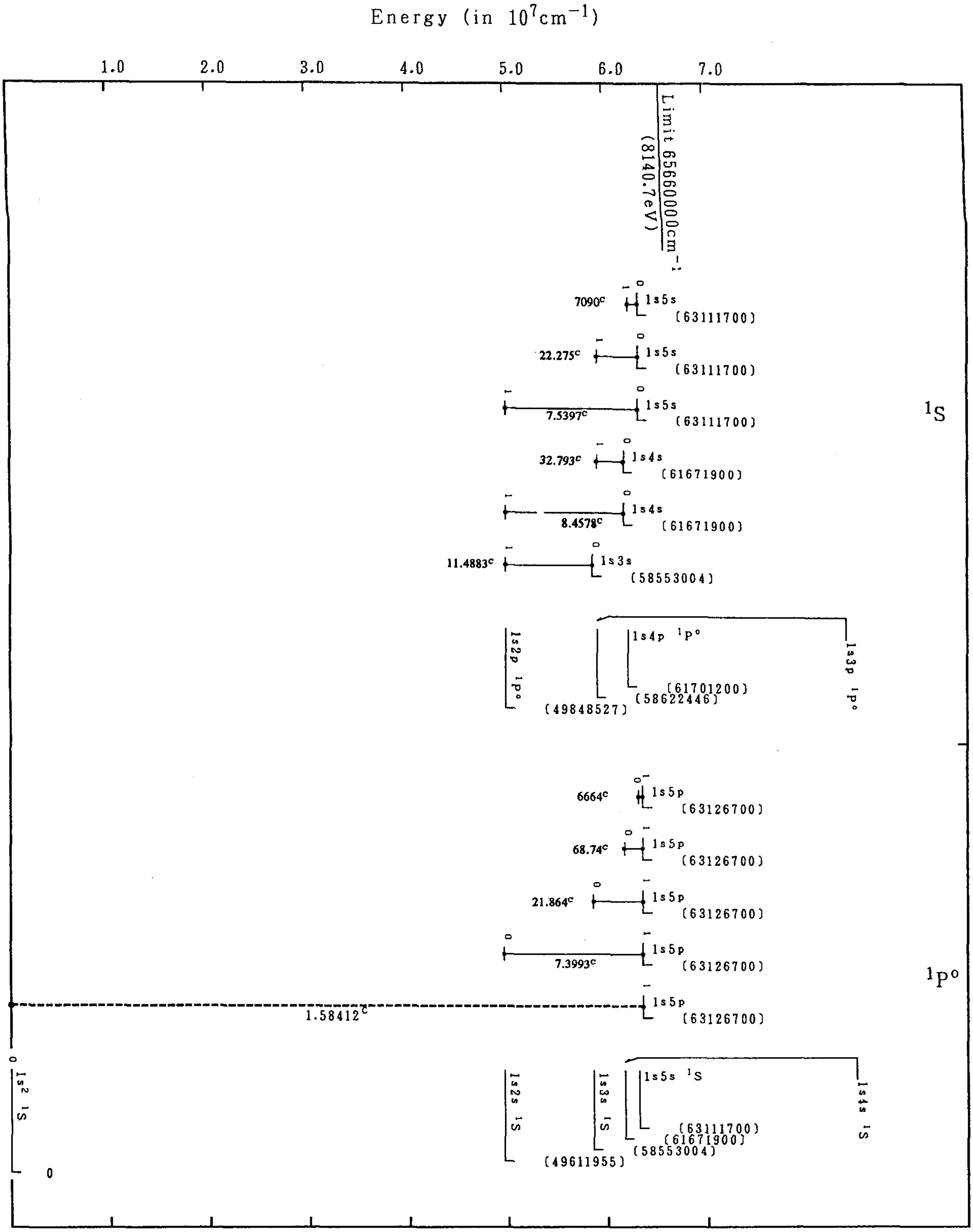

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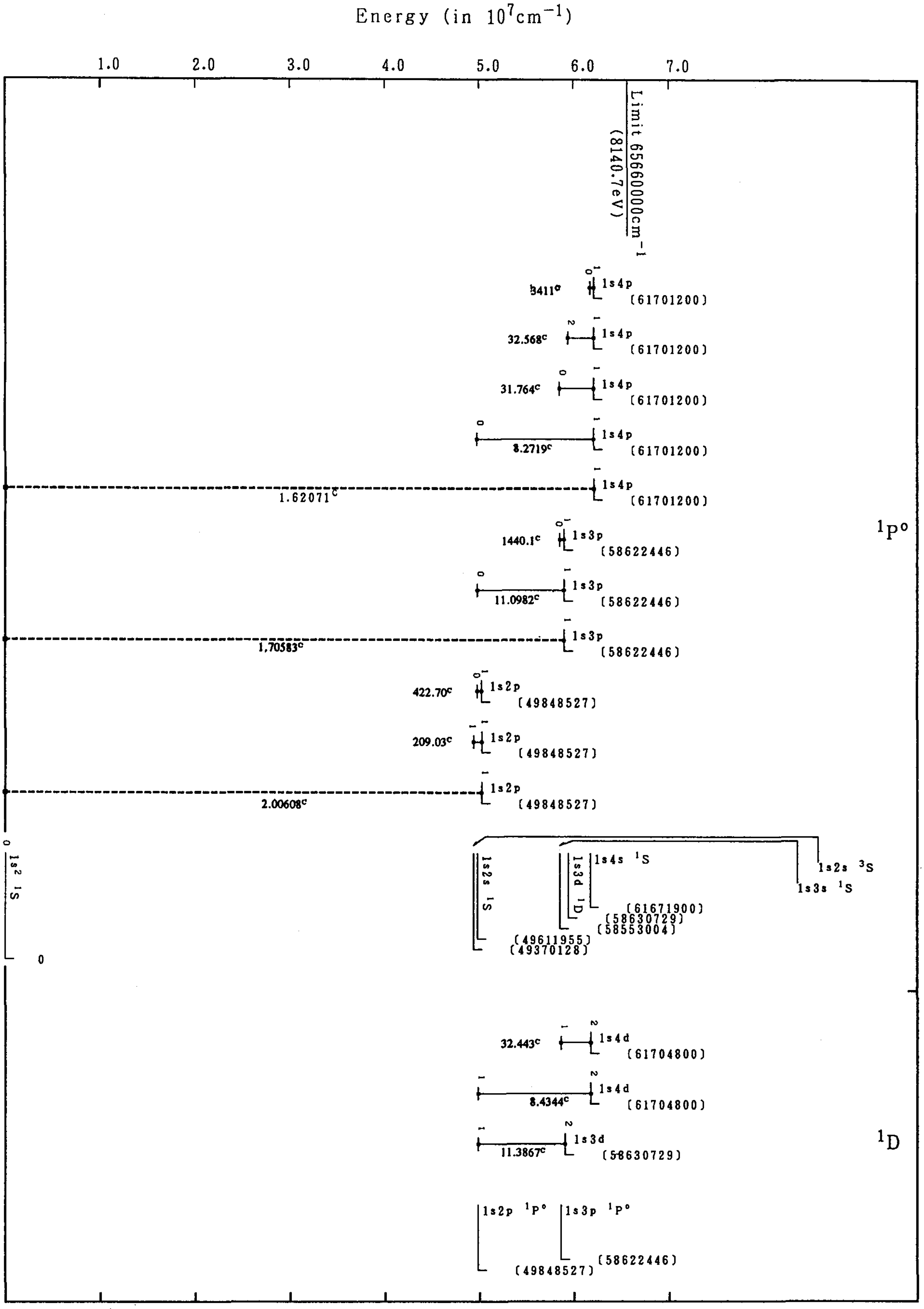

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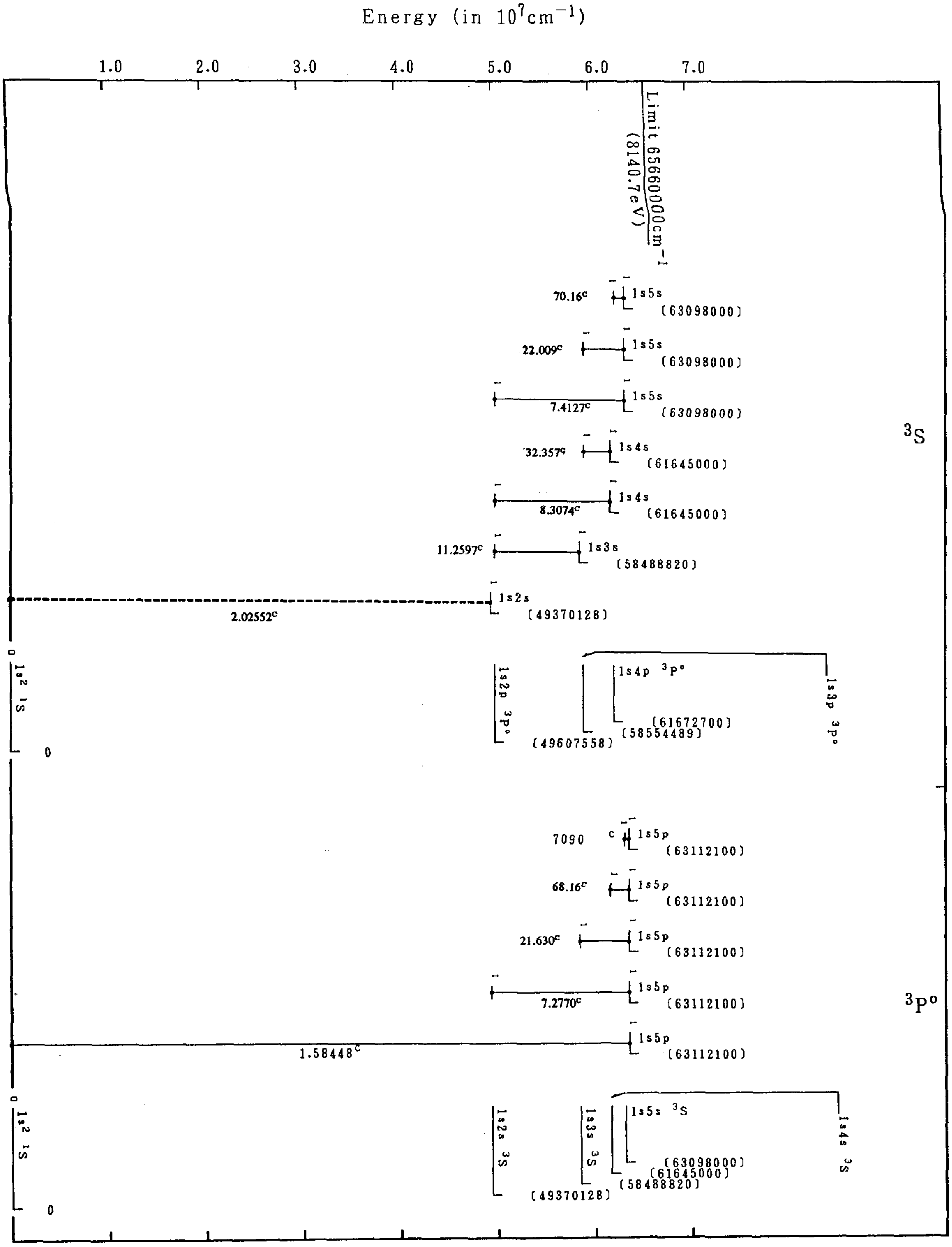

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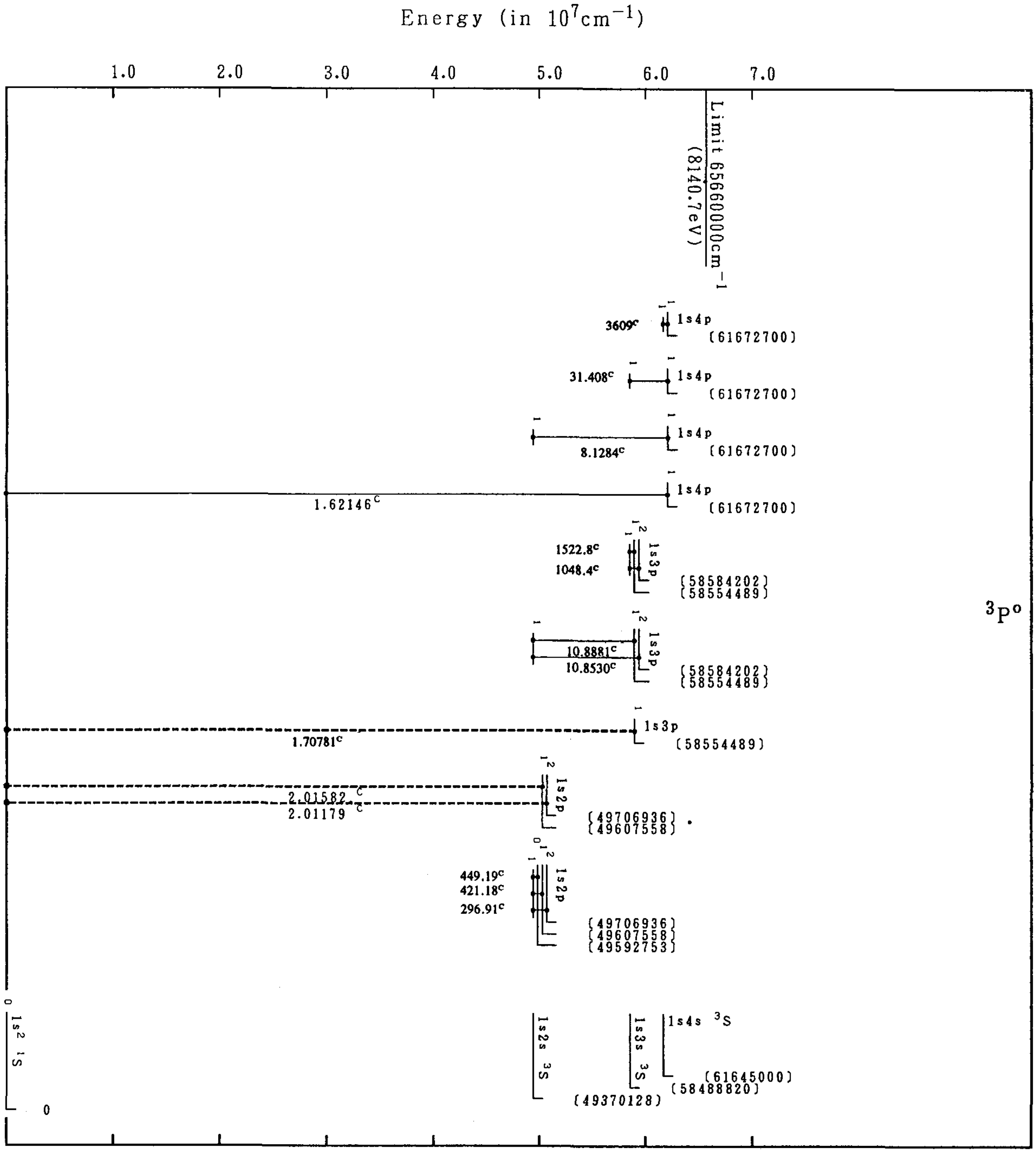

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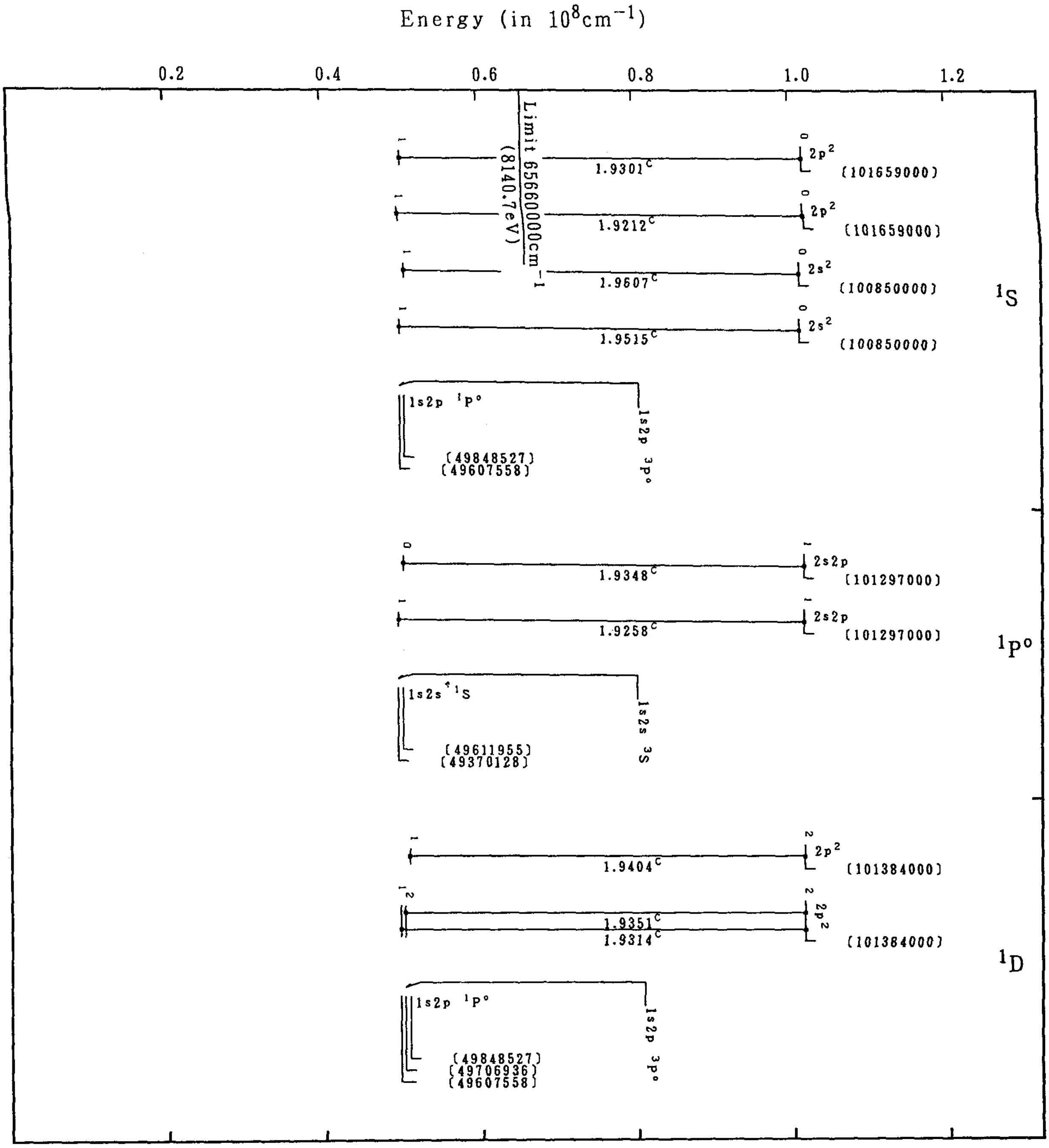

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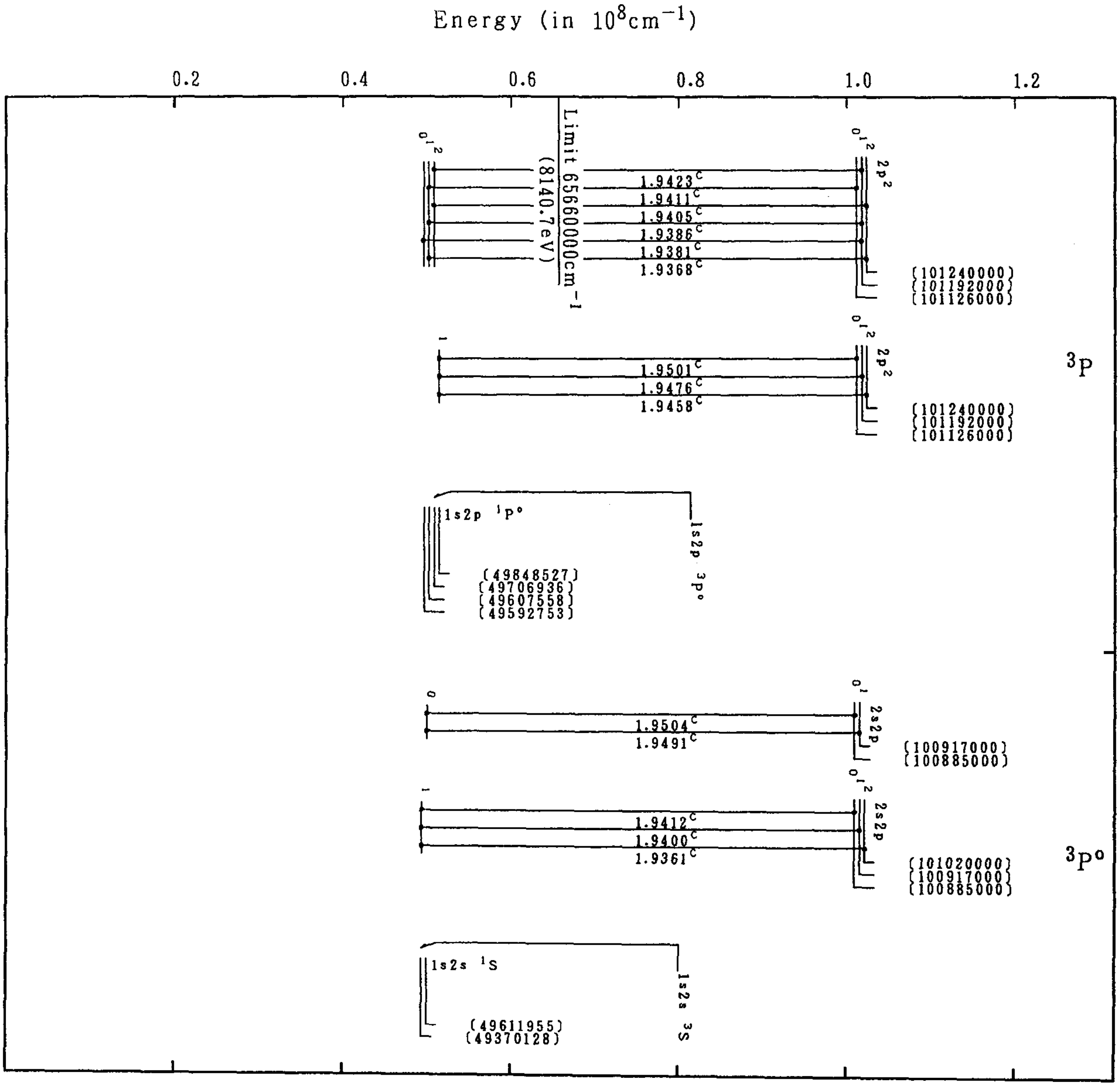
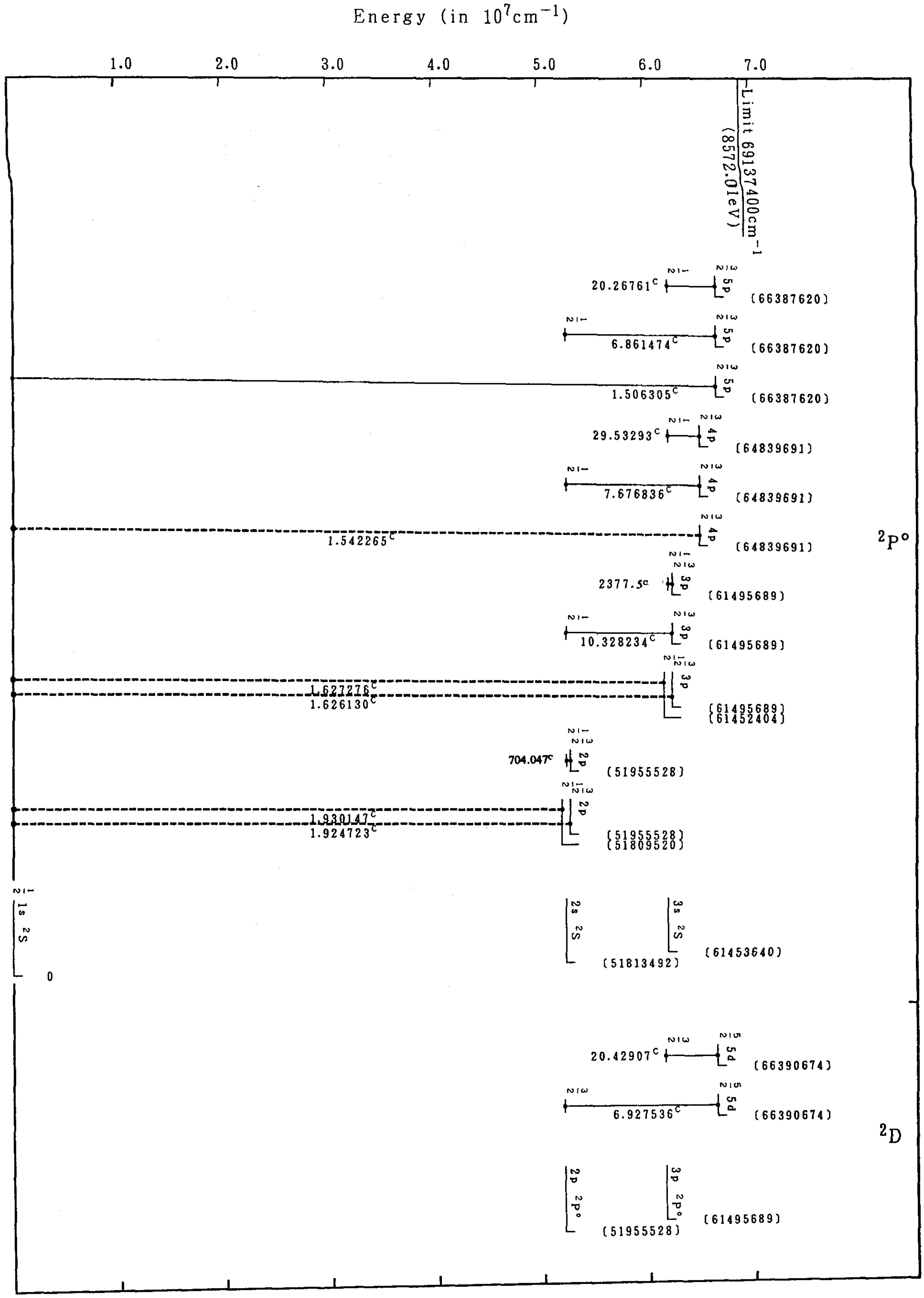


Mn XXIV(He–Sequence)



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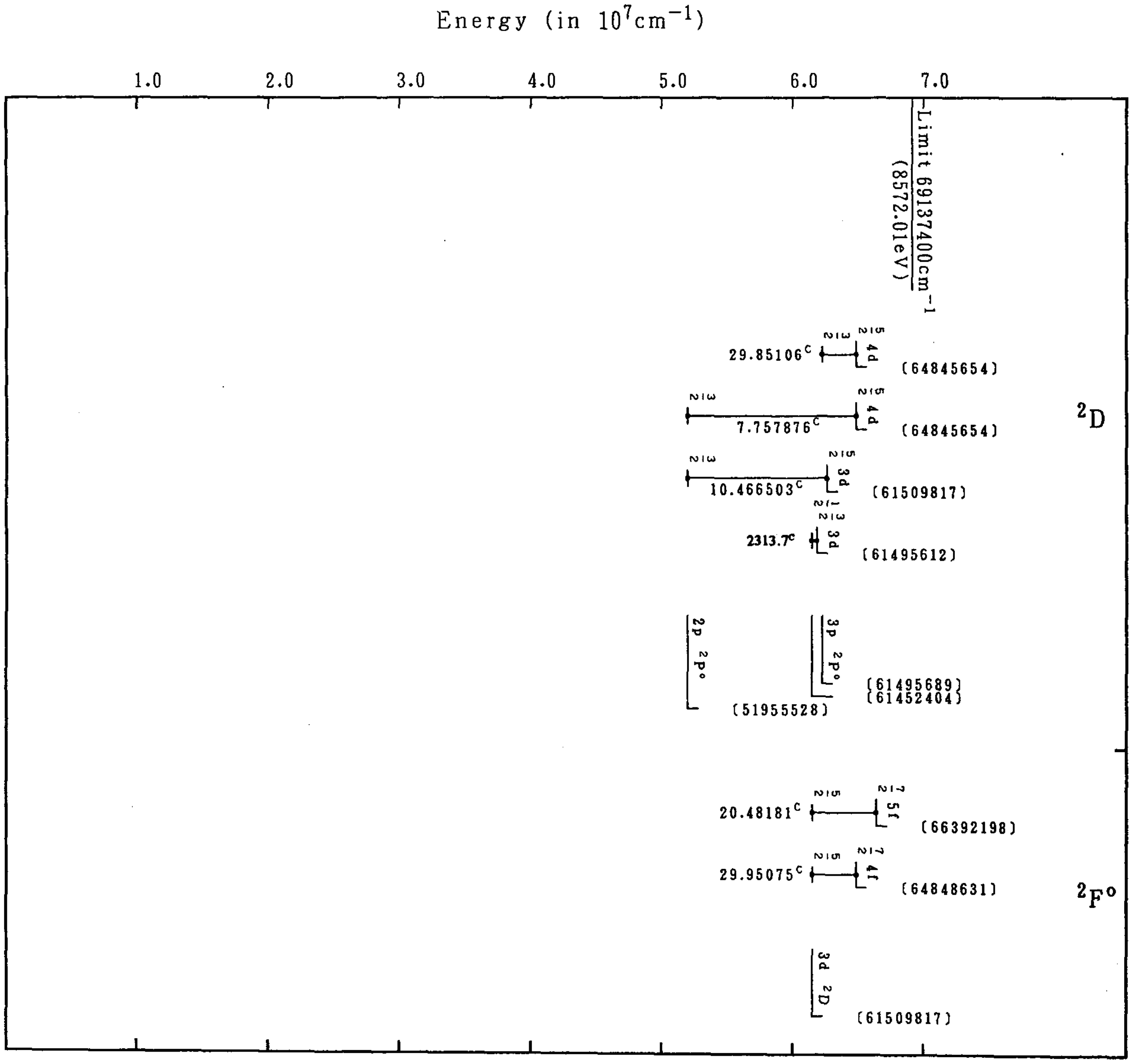

Mn XXV(H–Sequence)

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