

## スペクトル線データベースと新しい吸収係数

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### 1. 最近の遷移確率計算

#### A. OPACITY PROJECT (1984-)

\*Seaton(1987):J.Phys. B20, 6363

\*Seaton et al.(1992) Rev.Mexicana.Astron.Astrof. 23, 19

輻射過程と衝突過程の断面積の総合計算: 0.5GB

元素:  $z = 1 - 20, 26$  (Li, Be, B, F, Cl, K除く)

利用: 本(The Opacity Project vol. 1,...)

データベース TOPBASE

#### A' IRON PROJECT

\*Hummer et al.(1993) A&A 279, 298

上記の補遺: A&Aに投稿

#### B. Kurucz

\*Kurucz(1992) Rev.Mexicana.Astron.Astrof. 23, 45

元素: 原子  $z = 2 - 28$  (Ni)

分子: H<sub>2</sub>, CH, OH, MgH, SiH, CN, C<sub>2</sub>, CO, SiO,  
TiO

計: 5800万本

利用: CD-ROM

#### C. OPAL

\*Iglesius(1992) Rev.Mexicana.Astron.Astrof. 23, 9

opacity table

### 2. ATMLINE

京都での compilation (今月 NASA, CDS へリリースした)

以下に, 概説の一部を載せる.

利用: 京大計算センター (version upは少し遅れる)

個人的にもリリース

## Atomic spectral line list

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Contents: A. General description  
 B. Explanation of columns in each file  
 C. Present status for each ion

## A. General description

This compilation is aimed at providing a general catalog of atomic lines for comparatively low-ionized species, laying emphasis on their transition probabilities, and consists of three files:

file 1: Description and status report for each ion(this file),  
 file 2: Table of references(1,144 references from Kelly(1987,=K003),  
 and about 640 additional references)  
 file 3: Atomic line table

Record sizes and record numbers of these files are as follows.

	record size(byte)	record number
file 1	72	7,123
file 2	152	1,801
file 3	154	629,771

The explanation of columns in each file is given in "B. Explanation of columns in each file" below. The details of the present status for an individual ion are given in Section C.

The main file(file 3) includes wavelength, line classification, laboratory intensities and transition probabilities. We treat mainly permitted lines. Damping constants and collision cross section are out of scope.

We make an effort to be as self-consistent as possible, for examples, between wavelength and energy levels, and in the multiplet-number designation. The former example enables us to find misprints in literatures. The latter example requires that we frequently change the multiplet members or to re-define the multiplet number itself, when energy level or term designation are altered from those of Moore.

Predicted wavelengths are calculated by the dispersion formula given by B.Edlen(1966,Metrologia, 2, p71), except for platinum lines where main source(Reader et al. 1988,=R023) employed Peck & Reeder's(1972,J. Opt.Soc.Americ. 62, p158) three-term formula.

Based on this compilation, the data retrieval system ATMLINE is open to Japanese users through Data Processing Center of Kyoto University, since 1989.

Main features of our list are as follows:

\*wavelength region : 13A to 100,000A( 1.4 to 10,000nm)  
 \*elements : z=1 to 92(with some heavy ions missing)  
 \*ionization stage : all for z<=8, I to VI for z=9-30, I to II or V for z=31-92

\*total number of lines : 629,771 lines.

The main sources are as follows:

1. Starting files are Kurucz(1975,1989,=K000, K002) which give semi-empirical gf-values for many ions.
2. Energy levels are adopted from recent compilations(e.g., Sugar & Corliss(1985,=S001) or individual works.
3. We merged Kelly's(1983,=K001) list into our file(wv<3500A). We make an effort to collect the best wavelength values, especially for the region above 3500A. Thus, this compilation can be regarded as an extension of Kelly's ultraviolet line table towards optical and infrared regions, though still incomplete.
4. The gf-values are first taken from the several compilations( e.g.,Martin et al.(1988,=M005), Fuhr et al.(1988,=F005), Wiese & Martin(1980,=W002), Wiese et al.(1966,1969,=W001) and Morton (1991,=M013)). We also adopted published results of Opacity Project(see Seaton,M.J. 1987, J.Phys. B20, 6363), and the other recent articles(about 360 references).
5. The multiplet numbers are from Moore's Multiplet Tables(refs. 0488 & 1015). We adopt Moore's new compilations for C,N,O, and Si(refs.0504,0507,0510,0511,0521,0522,0523,0628,M012, and M058). Adelman's compilation for Mn I and Co II are also adopted.
6. Laboratory intensities are taken from various sources, though incomplete at present. The most important source is Meggers et al.(1975,=M003). Kelly's(1983,=K001) intensities are kept in principle(wv<3500A).

(Present status)

Some statistics are given below:

line	: classified	605965
	unclassified	23806
lambda:	experimental	205889
	predicted	423882
gf1:	Kurucz	458562
	NBS compilation	6847
	Corliss & Bozman	13576
	others	48146
	none	102640
int1:	M003	34592
	others	51960
	none	543219
int2:	M003	4176
	Kelly	66949
	others	76568
	none	482078
multiplet number:	yes	80289
	no	549482

Table. Total number of lines for each ion

	I	II	III	IV	V	VI	VII	VIII	>=IX	?	sum
1 H	318	0	0	0	0	0	0	0	0	0	318
1 H	318	0	0	0	0	0	0	0	0	0	318
2 He	386	203	0	0	0	0	0	0	0	0	589

3	Li	314	126	65	0	0	0	0	0	0	0	505
4	Be	120	565	79	77	0	0	0	0	0	0	841
5	B	241	292	602	90	80	0	0	0	0	0	1305
6	C	5604	1189	495	600	104	222	0	0	0	0	8214
7	N	7038	2300	728	562	865	78	220	0	0	0	11791
8	O	1951	2685	2036	727	360	552	.95	219	0	0	8625
9	F	1875	2029	4059	905	362	348	573	74	0	0	10225
10	Ne	3860	5678	487	642	330	171	0	0	0	0	11168
11	Na	482	388	728	252	306	544	0	0	0	0	2700
12	Mg	1984	646	869	1153	258	366	0	0	0	0	5276
13	Al	619	3509	371	407	582	238	0	0	0	0	5726
14	Si	5598	963	1694	358	239	530	0	0	0	0	9382
15	P	2770	1454	736	664	252	122	0	0	0	0	5998
16	S	1000	1440	285	134	715	313	0	0	0	0	3887
17	Cl	4067	2168	751	159	79	198	0	0	0	0	7422
18	Ar	3833	7323	1034	195	74	56	0	0	0	0	12515
19	K	765	85	256	118	220	119	0	0	0	0	1563
20	Ca	11435	908	2230	701	155	168	127	189	725	0	16638
21	Sc	7782	3236	217	1201	460	127	0	0	0	0	13023
22	Ti	13191	4552	2937	150	451	525	0	0	0	0	21806
23	V	16851	10104	8462	1256	394	477	0	0	0	0	37544
24	Cr	17209	35904	5686	2484	249	315	539	0	0	0	62386
25	Mn	11746	19948	12862	1592	908	1351	0	0	0	0	48407
26	Fe	22250	45774	23073	7950	3768	1135	0	0	0	0	103950
27	Co	9769	6763	4673	8405	7763	3636	0	0	0	0	41009
28	Ni	3905	28231	12148	5674	9902	7213	0	0	0	0	67073
29	Cu	1090	4713	1818	1622	1186	1110	0	0	0	0	11539
30	Zn	251	629	3515	688	322	307	0	0	0	0	5712
31	Ga	377	168	124	120	146	0	0	0	0	0	935
32	Ge	636	329	89	95	141	129	0	0	0	0	1419
33	As	236	1035	0	0	0	0	0	0	0	0	1271
34	Se	65	40	0	0	0	0	0	0	0	0	105
35	Br	33	36	0	0	0	0	0	0	0	0	69
36	Kr	41	50	0	0	0	0	0	0	0	0	91
37	Rb	210	4	0	0	0	0	0	0	0	0	214
38	Sr	103	138	0	0	0	0	0	0	0	0	241
39	Y	439	1530	643	0	0	0	0	0	0	0	2612
40	Zr	796	758	455	102	0	0	0	0	0	4	2115
41	Nb	1254	380	0	0	0	0	0	0	0	0	1634
42	Mo	3256	621	35	1327	412	0	0	0	0	0	5651
43	Tc	14	45	0	0	0	0	0	0	0	0	59
44	Ru	3435	708	37	0	0	0	0	0	0	0	4180
45	Rh	488	281	0	0	0	0	0	0	0	18	787
46	Pd	101	62	1458	0	0	0	0	0	0	0	1621
47	Ag	35	83	123	0	0	0	0	0	0	0	241
48	Cd	192	58	273	373	0	0	0	0	0	0	896
49	In	146	19	32	0	0	0	0	0	0	0	197
50	Sn	76	42	46	28	181	0	0	0	0	0	373
51	Sb	79	32	12	0	0	0	0	0	0	0	123
52	Te	563	15	0	0	0	0	0	0	0	0	578
53	I	1302	2388	0	0	0	0	0	0	0	0	3690
54	Xe	24	1355	22	0	0	0	0	0	0	0	1401
55	Cs	261	20	0	0	0	0	0	0	0	0	281
56	Ba	109	166	0	0	0	0	0	0	0	0	275
57	La	304	447	128	0	0	0	0	0	0	0	879
58	Ce	1023	1723	35	0	0	0	0	0	0	0	2781
59	Pr	268	1221	0	0	0	0	0	0	0	4	1493
60	Nd	362	1229	0	0	0	0	0	0	0	52	1643
61	Pm	0	0	0	0	0	0	0	0	0	0	0
62	Sm	458	1135	0	0	0	0	0	0	0	44	1637
63	Eu	316	229	0	0	0	0	0	0	0	1	546
64	Gd	630	937	0	0	0	0	0	0	0	0	1567
65	Tb	574	1047	0	0	0	0	0	0	0	67	1688
66	Dy	2129	1594	0	0	0	0	0	0	0	2	3725
67	Ho	396	624	0	0	0	0	0	0	0	15	1035
68	Er	775	1087	136	0	0	0	0	0	0	0	1998

69	Tm	401	581	21	0	0	0	0	0	0	0	1003
70	Yb	983	378	3	0	0	0	0	0	0	0	1364
71	Lu	128	78	94	0	0	0	0	0	0	1	301
72	Hf	546	443	0	0	0	0	0	0	0	0	989
73	Ta	1046	432	0	0	0	0	0	0	0	0	1478
74	W	1749	289	0	0	0	0	0	0	0	0	2038
75	Re	938	69	0	0	0	0	0	0	0	0	1007
76	Os	1000	49	0	0	0	0	0	0	0	0	1049
77	Ir	529	23	0	0	0	0	0	0	0	0	552
78	Pt	425	577	0	0	0	0	0	0	0	1704	2706
79	Au	188	108	294	197	0	0	0	0	0	0	787
80	Hg	254	56	39	293	193	0	0	0	0	0	835
81	Tl	104	42	0	0	0	0	0	0	0	0	146
82	Pb	407	80	17	0	0	0	0	0	0	0	504
83	Bi	375	40	19	0	0	0	0	0	0	0	434
84	Po	15	0	0	0	0	0	0	0	0	0	15
85	At	0	0	0	0	0	0	0	0	0	0	0
86	Rn	2	0	0	0	0	0	0	0	0	0	2
87	Fr	0	0	0	0	0	0	0	0	0	0	0
88	Ra	2	23	0	0	0	0	0	0	0	0	25
89	Ac	0	0	0	0	0	0	0	0	0	0	0
90	Th	10152	6617	1010	0	0	0	0	0	0	2734	20513
91	Pa	0	0	0	0	0	0	0	0	0	0	0
92	U	4715	1603	0	0	0	0	0	0	0	517	6835
sum		203769226929	98041	41301	31457	20350	1554	482	725		5163629771	

## B. Explanation of columns in each table

file 1: Description and status report for indivisual ion(this file)

free format

file 2: table of references

1- 4 REFNO A4 reference number  
numerical code: defined by Kelly(1987,=K003)  
alphanumeric code: our definition

5- 5 A1 dummy

6- 9 YR A4 published year

10- 10 A1 dummy

11-152 free format  
11- : authors  
after \* : journal  
after % : contents  
after # : number of lines appeared in the paper

file 3: atomic line table

				Notes
1-	4	ION	I4	ion number(e.g. 2602=Fe II)
5-	13	LAM	F9.4	wavelength in Angstrom
14-	14	VA	A1	'-'=vacuum wavelength (1)
				'+'= air wavelength (1)
15-	15	HYB	A1	numerals:number of component (2) 以上