

Table 5.3.4a. The selected 68 fine-structure levels from the 140 levels included in the calculation (97Z2) and their observed energies in rydbergs (85S1) for Fe IV. The index i is used in Table 5.3.4b for transition keys; J is the total angular momentum for specifying the fine-structure level.

i	LS Term		J	Energy	i	LS Term		J	Energy
1	$3d^5$	6S	5/2	0.00000	37	$3d^4(^3G)4s$	4G	11/2	1.45200
2	$3d^5$	4G	11/2	0.29384	38			9/2	1.45100
3			9/2	0.29427	39			7/2	1.44900
4			7/2	0.29439	40			5/2	1.44650
5			5/2	0.29435	41	$3d^4(^3D)4s$	4D	7/2	1.50810
6	$3d^5$	4P	5/2	0.32126	42			5/2	1.50910
7			3/2	0.32198	43			3/2	1.51020
8			1/2	0.32265	44			1/2	1.51090
9	$3d^5$	4D	7/2	0.35338	45	$3d^4(^5D)4p$	$^6F^o$	11/2	1.73390
10			5/2	0.35480	46			9/2	1.72700
11			3/2	0.35483	47			7/2	1.72140
12			1/2	0.35445	48			5/2	1.71710
13	$3d^5$	4F	9/2	0.47952	49			3/2	1.71400
14			7/2	0.48020	50			1/2	1.71210
15			5/2	0.48150	51	$3d^4(^5D)4p$	$^6P^o$	7/2	1.73350
16			3/2	0.48149	52			5/2	1.73150
17	$3d^4(^5D)4s$	6D	9/2	1.17520	53			3/2	1.73040
18			7/2	1.17140	54	$3d^4(^3P1)4s$	4P	5/2	1.73120
19			5/2	1.16820	55			3/2	1.73880
20			3/2	1.16580	56			1/2	1.74360
21			1/2	1.16430	57	$3d^4(^3F1)4s$	4F	9/2	1.73430
22	$3d^4(^5D)4s$	4D	7/2	1.26520	58			7/2	1.73530
23			5/2	1.26060	59			5/2	1.73540
24			3/2	1.25710	60			3/2	1.73510
25			1/2	1.25480	61	$3d^4(^5D)4p$	$^4P^o$	5/2	1.76380
26	$3d^4(^3P2)4s$	4P	5/2	1.41930	62			3/2	1.74680
27			3/2	1.40770	63			1/2	1.74070
28			1/2	1.40020	64	$3d^4(^5D)4p$	$^6D^o$	9/2	1.76590
29	$3d^4(^3H)4s$	4H	13/2	1.41000	65			7/2	1.76230
30			11/2	1.40800	66			5/2	1.75510
31			9/2	1.40630	67			3/2	1.76120
32			7/2	1.40500	68			1/2	1.75980
33	$3d^4(^3F2)4s$	4F	9/2	1.42360					
34			7/2	1.42270					
35			5/2	1.42200					
36			3/2	1.42170					

Table 5.3.4b. The effective collision strengths $\Upsilon(i, j)$ as a function of temperature $T(\text{K})$ for the transitions between the first 12 metastable levels and the transitions between the ground level $3d^5\ ^6S_{5/2}$ and the 56 higher levels, $i = 13 - 68$ as specified in Table 5.3.4a for Fe IV (97Z2).

Levels		$T(\text{K})$							
i	j	2000	4000	6000	10000	15000	20000	30000	50000
1	2	1.60	1.38	1.26	1.15	1.09	1.06	1.02	9.88[-1]
1	3	1.34	1.15	1.05	9.58[-1]	9.08[-1]	8.82[-1]	8.54[-1]	8.24[-1]
2	3	3.86	3.45	3.27	3.05	2.83	2.66	2.41	2.15
1	4	1.07	9.20[-1]	8.43[-1]	7.67[-1]	7.26[-1]	7.06[-1]	6.83[-1]	6.59[-1]
2	4	8.99[-1]	7.75[-1]	7.14[-1]	6.48[-1]	5.93[-1]	5.50[-1]	4.92[-1]	4.31[-1]
3	4	3.55	3.21	3.06	2.88	2.69	2.53	2.32	2.10
1	5	8.01[-1]	6.90[-1]	6.32[-1]	5.75[-1]	5.45[-1]	5.29[-1]	5.12[-1]	4.94[-1]
2	5	1.98[-1]	1.62[-1]	1.44[-1]	1.26[-1]	1.14[-1]	1.05[-1]	9.61[-2]	9.25[-2]
3	5	9.44[-1]	8.21[-1]	7.61[-1]	6.94[-1]	6.36[-1]	5.92[-1]	5.34[-1]	4.94[-1]
4	5	2.95	2.66	2.54	2.38	2.22	2.09	1.92	1.75
1	6	5.99[-1]	5.91[-1]	5.95[-1]	5.87[-1]	5.62[-1]	5.37[-1]	5.03[-1]	4.69[-1]
2	6	6.84[-1]	7.28[-1]	7.50[-1]	7.63[-1]	7.44[-1]	7.14[-1]	6.59[-1]	5.82[-1]
3	6	5.01[-1]	5.23[-1]	5.34[-1]	5.37[-1]	5.22[-1]	5.01[-1]	4.65[-1]	4.16[-1]
4	6	2.98[-1]	3.07[-1]	3.11[-1]	3.12[-1]	3.02[-1]	2.91[-1]	2.70[-1]	2.43[-1]
5	6	1.37[-1]	1.39[-1]	1.40[-1]	1.40[-1]	1.36[-1]	1.31[-1]	1.22[-1]	1.10[-1]
1	7	3.99[-1]	3.94[-1]	3.97[-1]	3.92[-1]	3.75[-1]	3.58[-1]	3.36[-1]	3.13[-1]
2	7	3.56[-1]	3.64[-1]	3.68[-1]	3.65[-1]	3.53[-1]	3.39[-1]	3.17[-1]	2.87[-1]
3	7	1.92[-1]	2.06[-1]	2.14[-1]	2.22[-1]	2.18[-1]	2.10[-1]	1.92[-1]	1.66[-1]
4	7	2.37[-1]	2.52[-1]	2.60[-1]	2.65[-1]	2.59[-1]	2.49[-1]	2.29[-1]	2.02[-1]
5	7	2.97[-1]	3.10[-1]	3.16[-1]	3.16[-1]	3.06[-1]	2.94[-1]	2.73[-1]	2.46[-1]
6	7	9.22[-1]	8.70[-1]	8.75[-1]	8.81[-1]	8.55[-1]	8.18[-1]	7.53[-1]	6.69[-1]
1	8	2.00[-1]	1.97[-1]	1.98[-1]	1.96[-1]	1.87[-1]	1.79[-1]	1.68[-1]	1.56[-1]
2	8	4.18[-2]	4.00[-2]	3.98[-2]	4.01[-2]	3.95[-2]	3.82[-2]	3.54[-2]	3.12[-2]
3	8	2.08[-1]	2.14[-1]	2.17[-1]	2.15[-1]	2.07[-1]	1.99[-1]	1.86[-1]	1.69[-1]
4	8	1.85[-1]	1.95[-1]	2.00[-1]	2.02[-1]	1.96[-1]	1.88[-1]	1.74[-1]	1.56[-1]
5	8	1.06[-1]	1.16[-1]	1.22[-1]	1.27[-1]	1.25[-1]	1.20[-1]	1.10[-1]	9.43[-2]
6	8	3.36[-1]	3.06[-1]	3.03[-1]	3.04[-1]	2.96[-1]	2.84[-1]	2.61[-1]	2.30[-1]
7	8	4.56[-1]	4.43[-1]	4.52[-1]	4.56[-1]	4.41[-1]	4.21[-1]	3.88[-1]	3.47[-1]
1	9	5.64[-1]	5.47[-1]	5.46[-1]	5.57[-1]	5.68[-1]	5.76[-1]	5.84[-1]	5.89[-1]
2	9	1.88	1.88	1.85	1.79	1.71	1.64	1.54	1.43
3	9	1.01	1.00	9.93[-1]	9.74[-1]	9.46[-1]	9.19[-1]	8.76[-1]	8.22[-1]
4	9	4.98[-1]	4.84[-1]	4.79[-1]	4.75[-1]	4.67[-1]	4.58[-1]	4.44[-1]	4.23[-1]
5	9	2.07[-1]	1.96[-1]	1.92[-1]	1.90[-1]	1.88[-1]	1.86[-1]	1.82[-1]	1.78[-1]
6	9	8.40[-1]	8.86[-1]	9.16[-1]	9.30[-1]	9.12[-1]	8.86[-1]	8.41[-1]	7.77[-1]
7	9	4.39[-1]	4.55[-1]	4.67[-1]	4.74[-1]	4.67[-1]	4.56[-1]	4.35[-1]	4.04[-1]
8	9	1.49[-1]	1.53[-1]	1.57[-1]	1.58[-1]	1.54[-1]	1.48[-1]	1.37[-1]	1.22[-1]
1	10	4.23[-1]	4.10[-1]	4.10[-1]	4.17[-1]	4.26[-1]	4.32[-1]	4.38[-1]	4.42[-1]
2	10	7.76[-1]	7.64[-1]	7.59[-1]	7.50[-1]	7.34[-1]	7.17[-1]	6.88[-1]	6.50[-1]
3	10	8.08[-1]	7.99[-1]	7.84[-1]	7.52[-1]	7.15[-1]	6.86[-1]	6.46[-1]	5.99[-1]
4	10	6.48[-1]	6.44[-1]	6.36[-1]	6.15[-1]	5.89[-1]	5.66[-1]	5.33[-1]	4.94[-1]
5	10	4.67[-1]	4.60[-1]	4.58[-1]	4.54[-1]	4.45[-1]	4.35[-1]	4.19[-1]	3.96[-1]
6	10	5.35[-1]	5.57[-1]	5.74[-1]	5.83[-1]	5.73[-1]	5.58[-1]	5.31[-1]	4.93[-1]
7	10	3.21[-1]	3.40[-1]	3.52[-1]	3.56[-1]	3.46[-1]	3.32[-1]	3.09[-1]	2.77[-1]
8	10	2.15[-1]	2.23[-1]	2.30[-1]	2.34[-1]	2.32[-1]	2.28[-1]	2.20[-1]	2.08[-1]
9	10	1.27	1.25	1.23	1.20	1.15	1.10	1.03	9.32[-1]
1	11	2.82[-1]	2.74[-1]	2.73[-1]	2.78[-1]	2.84[-1]	2.88[-1]	2.92[-1]	2.95[-1]
2	11	2.73[-1]	2.61[-1]	2.58[-1]	2.57[-1]	2.56[-1]	2.53[-1]	2.48[-1]	2.40[-1]
3	11	4.66[-1]	4.62[-1]	4.58[-1]	4.48[-1]	4.32[-1]	4.18[-1]	3.96[-1]	3.69[-1]
4	11	5.61[-1]	5.54[-1]	5.46[-1]	5.30[-1]	5.09[-1]	4.92[-1]	4.67[-1]	4.37[-1]

Table 5.3.4b. (continued)

Levels		$T(K)$							
i	j	2000	4000	6000	10000	15000	20000	30000	50000
6	11	2.90[-1]	3.00[-1]	3.08[-1]	3.12[-1]	3.06[-1]	2.97[-1]	2.81[-1]	2.58[-1]
7	11	2.68[-1]	2.82[-1]	2.91[-1]	2.96[-1]	2.90[-1]	2.82[-1]	2.68[-1]	2.48[-1]
8	11	1.57[-1]	1.66[-1]	1.71[-1]	1.74[-1]	1.71[-1]	1.66[-1]	1.58[-1]	1.47[-1]
9	11	4.66[-1]	4.47[-1]	4.38[-1]	4.25[-1]	4.06[-1]	3.87[-1]	3.57[-1]	3.15[-1]
10	11	9.69[-1]	9.55[-1]	9.44[-1]	9.21[-1]	8.85[-1]	8.51[-1]	7.99[-1]	7.35[-1]
1	12	1.41[-1]	1.37[-1]	1.37[-1]	1.39[-1]	1.42[-1]	1.44[-1]	1.46[-1]	1.47[-1]
2	12	6.95[-2]	6.37[-2]	6.15[-2]	6.02[-2]	5.97[-2]	5.93[-2]	5.88[-2]	5.82[-2]
3	12	2.12[-1]	2.07[-1]	2.06[-1]	2.07[-1]	2.06[-1]	2.03[-1]	1.98[-1]	1.90[-1]
4	12	2.93[-1]	2.94[-1]	2.92[-1]	2.85[-1]	2.75[-1]	2.65[-1]	2.50[-1]	2.31[-1]
5	12	3.25[-1]	3.25[-1]	3.20[-1]	3.05[-1]	2.88[-1]	2.74[-1]	2.56[-1]	2.34[-1]
6	12	1.20[-1]	1.24[-1]	1.27[-1]	1.29[-1]	1.26[-1]	1.21[-1]	1.13[-1]	1.02[-1]
7	12	1.62[-1]	1.69[-1]	1.74[-1]	1.77[-1]	1.75[-1]	1.72[-1]	1.67[-1]	1.58[-1]
8	12	7.50[-2]	8.07[-2]	8.42[-2]	8.53[-2]	8.26[-2]	7.93[-2]	7.37[-2]	6.63[-2]
9	12	2.01[-1]	1.88[-1]	1.84[-1]	1.79[-1]	1.72[-1]	1.65[-1]	1.52[-1]	1.33[-1]
10	12	2.35[-1]	2.34[-1]	2.30[-1]	2.21[-1]	2.09[-1]	2.00[-1]	1.84[-1]	1.63[-1]
11	12	5.59[-1]	5.55[-1]	5.49[-1]	5.37[-1]	5.16[-1]	4.97[-1]	4.69[-1]	4.35[-1]
1	13	6.41[-1]	5.29[-1]	4.67[-1]	4.13[-1]	3.91[-1]	3.85[-1]	3.88[-1]	3.95[-1]
1	14	5.13[-1]	4.23[-1]	3.73[-1]	3.30[-1]	3.13[-1]	3.08[-1]	3.10[-1]	3.16[-1]
1	15	3.85[-1]	3.17[-1]	2.80[-1]	2.48[-1]	2.34[-1]	2.31[-1]	2.33[-1]	2.37[-1]
1	16	2.56[-1]	2.11[-1]	1.87[-1]	1.65[-1]	1.56[-1]	1.54[-1]	1.55[-1]	1.58[-1]
1	17	1.99	2.00	1.90	1.71	1.58	1.51	1.42	1.26
1	18	1.59	1.61	1.52	1.37	1.27	1.22	1.14	1.01
1	19	1.20	1.20	1.14	1.03	9.54[-1]	9.13[-1]	8.58[-1]	7.62[-1]
1	20	7.97[-1]	8.03[-1]	7.62[-1]	6.87[-1]	6.36[-1]	6.09[-1]	5.73[-1]	5.08[-1]
1	21	3.98[-1]	4.01[-1]	3.81[-1]	3.43[-1]	3.18[-1]	3.04[-1]	2.86[-1]	2.54[-1]
1	22	7.36[-1]	6.33[-1]	5.81[-1]	5.29[-1]	4.98[-1]	4.78[-1]	4.44[-1]	3.83[-1]
1	23	5.52[-1]	4.75[-1]	4.36[-1]	3.97[-1]	3.74[-1]	3.59[-1]	3.32[-1]	2.86[-1]
1	24	3.68[-1]	3.17[-1]	2.91[-1]	2.65[-1]	2.49[-1]	2.39[-1]	2.21[-1]	1.90[-1]
1	25	1.84[-1]	1.58[-1]	1.45[-1]	1.32[-1]	1.25[-1]	1.19[-1]	1.10[-1]	9.45[-2]
1	26	1.85[-2]	1.64[-2]	1.59[-2]	1.60[-2]	1.58[-2]	1.53[-2]	1.39[-2]	1.12[-2]
1	27	1.23[-2]	1.09[-2]	1.06[-2]	1.06[-2]	1.06[-2]	1.02[-2]	9.31[-3]	7.51[-3]
1	28	6.17[-3]	5.47[-3]	5.32[-3]	5.32[-3]	5.26[-3]	5.08[-3]	4.59[-3]	3.68[-3]
1	29	1.20[-2]	1.02[-2]	9.30[-3]	9.03[-3]	9.17[-3]	9.11[-3]	8.53[-3]	7.10[-3]
1	30	1.02[-2]	8.76[-3]	7.97[-3]	7.74[-3]	7.86[-3]	7.80[-3]	7.30[-3]	6.07[-3]
1	31	8.54[-3]	7.30[-3]	6.64[-3]	6.45[-3]	6.55[-3]	6.50[-3]	6.08[-3]	5.05[-3]
1	32	6.83[-3]	5.84[-3]	5.31[-3]	5.16[-3]	5.24[-3]	5.20[-3]	4.86[-3]	4.03[-3]
1	33	1.63[-2]	1.42[-2]	1.32[-2]	1.28[-2]	1.31[-2]	1.31[-2]	1.26[-2]	1.07[-2]
1	34	1.31[-2]	1.14[-2]	1.05[-2]	1.03[-2]	1.05[-2]	1.05[-2]	1.00[-2]	8.50[-3]
1	35	9.81[-3]	8.54[-3]	7.89[-3]	7.69[-3]	7.85[-3]	7.88[-3]	7.52[-3]	6.40[-3]
1	36	6.54[-3]	5.69[-3]	5.26[-3]	5.13[-3]	5.22[-3]	5.23[-3]	4.98[-3]	4.23[-3]
1	37	2.94[-2]	1.96[-2]	1.79[-2]	1.89[-2]	1.98[-2]	1.98[-2]	1.82[-2]	1.47[-2]
1	38	2.45[-2]	1.63[-2]	1.49[-2]	1.57[-2]	1.66[-2]	1.66[-2]	1.54[-2]	1.26[-2]
1	39	1.96[-2]	1.30[-2]	1.20[-2]	1.26[-2]	1.33[-2]	1.34[-2]	1.25[-2]	1.02[-2]
1	40	1.47[-2]	9.78[-3]	8.97[-3]	9.45[-3]	1.00[-2]	1.00[-2]	9.37[-3]	7.65[-3]
1	41	1.52[-2]	1.13[-2]	1.02[-2]	9.46[-3]	8.87[-3]	8.32[-3]	7.32[-3]	5.82[-3]
1	42	1.14[-2]	8.45[-3]	7.67[-3]	7.08[-3]	6.60[-3]	6.15[-3]	5.34[-3]	4.18[-3]
1	43	7.58[-3]	5.63[-3]	5.11[-3]	4.72[-3]	4.39[-3]	4.09[-3]	3.54[-3]	2.76[-3]
1	44	3.79[-3]	2.82[-3]	2.56[-3]	2.35[-3]	2.18[-3]	2.03[-3]	1.75[-3]	1.36[-3]
1	45	2.04[-1]	1.95[-1]	1.87[-1]	1.77[-1]	1.69[-1]	1.64[-1]	1.59[-1]	1.56[-1]
1	46	1.59[-1]	1.46[-1]	1.37[-1]	1.27[-1]	1.20[-1]	1.16[-1]	1.11[-1]	1.09[-1]

Table 5.3.4b. (continued)

Levels		$T(K)$							
i	j	2000	4000	6000	10000	15000	20000	30000	50000
1	47	1.26[-1]	1.15[-1]	1.08[-1]	1.00[-1]	9.39[-2]	9.03[-2]	8.68[-2]	8.44[-2]
1	48	9.63[-2]	8.85[-2]	8.35[-2]	7.72[-2]	7.26[-2]	6.98[-2]	6.70[-2]	6.51[-2]
1	49	6.70[-2]	6.26[-2]	5.95[-2]	5.55[-2]	5.23[-2]	5.04[-2]	4.85[-2]	4.72[-2]
1	50	3.45[-2]	3.27[-2]	3.13[-2]	2.94[-2]	2.78[-2]	2.69[-2]	2.59[-2]	2.52[-2]
1	51	1.67	1.68	1.69	1.70	1.70	1.71	1.75	1.85
1	52	1.22	1.22	1.22	1.22	1.22	1.23	1.25	1.33
1	53	8.09[-1]	7.99[-1]	7.99[-1]	7.98[-1]	7.95[-1]	7.96[-1]	8.11[-1]	8.55[-1]
1	54	3.23[-4]	3.72[-4]	4.03[-4]	4.49[-4]	4.82[-4]	5.00[-4]	5.12[-4]	4.99[-4]
1	55	2.48[-4]	2.88[-4]	3.12[-4]	3.47[-4]	3.71[-4]	3.83[-4]	3.91[-4]	3.80[-4]
1	56	1.22[-4]	1.37[-4]	1.45[-4]	1.54[-4]	1.59[-4]	1.60[-4]	1.60[-4]	1.52[-4]
1	57	4.31[-4]	4.55[-4]	4.58[-4]	4.44[-4]	4.27[-4]	4.19[-4]	4.15[-4]	4.10[-4]
1	58	3.06[-4]	3.36[-4]	3.56[-4]	3.71[-4]	3.69[-4]	3.64[-4]	3.55[-4]	3.40[-4]
1	59	2.35[-4]	2.57[-4]	2.71[-4]	2.78[-4]	2.68[-4]	2.55[-4]	2.34[-4]	2.06[-4]
1	60	1.51[-4]	1.62[-4]	1.68[-4]	1.70[-4]	1.63[-4]	1.54[-4]	1.40[-4]	1.22[-4]
1	61	1.41[-1]	1.41[-1]	1.38[-1]	1.29[-1]	1.21[-1]	1.15[-1]	1.09[-1]	1.04[-1]
1	62	8.07[-2]	8.02[-2]	7.80[-2]	7.35[-2]	6.92[-2]	6.63[-2]	6.32[-2]	6.06[-2]
1	63	3.57[-2]	3.55[-2]	3.47[-2]	3.29[-2]	3.12[-2]	3.02[-2]	2.91[-2]	2.85[-2]
1	64	9.18[-2]	9.03[-2]	8.86[-2]	8.52[-2]	8.17[-2]	7.94[-2]	7.68[-2]	7.44[-2]
1	65	8.45[-2]	8.33[-2]	8.19[-2]	7.90[-2]	7.60[-2]	7.40[-2]	7.17[-2]	6.96[-2]
1	66	6.18[-2]	6.08[-2]	5.97[-2]	5.75[-2]	5.51[-2]	5.36[-2]	5.18[-2]	5.01[-2]
1	67	3.50[-2]	3.44[-2]	3.37[-2]	3.24[-2]	3.11[-2]	3.02[-2]	2.92[-2]	2.83[-2]
1	68	1.55[-2]	1.52[-2]	1.49[-2]	1.42[-2]	1.36[-2]	1.31[-2]	1.27[-2]	1.22[-2]