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PHOTOMETRIC LINE INTENSITIES FOR NORMAL AND SUPERGIANT STARS

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The excessive strength of the lines in the spectra of supergiant stars has long been a matter for comment, and it was clear that one of the first useful applications of the new methods of spectrophotometry would be the comparison of the intensities of the lines of supergiant and normal stars. It is probable that the comparison will throw light on the physical constitution of the supergiants. The measured line intensities for two pairs of stars of similar spectral class are contained in the present paper; one of the pairs consists of supergiant and giant, and the other of supergiant and dwarf. A list of the stars, and particulars of the material, are contained in Table I.

TABLE I

Star	Number of Prisms	Number of Spectra	Spectral Class	Absolute Magnitude
α Persei	1	4	cF5	..
α Canis Minoris	1	4	dF5	+3.4
γ Cygni	1, 2	12	cF8	..
α Aurigae	1	12	gG0	+0.2

The measured line intensities, expressed in percentage light losses, are contained in Table II for the pair α Persei and α Canis Minoris, and in Table III for the pair γ Cygni and α Aurigae. The tables contain the wave lengths, expressed to the nearest Angstrom, the attributions of the more prominent lines, which are effectively unblended, and the intensities in the spectra of the stars. The tables are of the same form as Table II of Harvard Circular 305, which contains similar data for a series of spectra ranging from Class G0 to Class M1. The tables in the present paper give fuller attributions, because each contains only a pair of stars of very similar temperature, and the sources of the lines are in most cases the same for both stars of one table.

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TABLE II

Line		α Per	α CMi	Line		α Per	α CMi	Line		α Per	α CMi
3735		59	41	4025	Ti+	18	15	4321	Ti+, Sc+	11	..
3749	H	70	42	*4031	Mn	28	20	4330	Ti+	19	16
3758		36	21	4033	Mn	23	18	*4340	H	57	47
3764		28	20	*4041	Mn	12	05	*4352	Fe+	23	20
3767		46	18	*4046	Fe	20	21	4368		04	11
3771		56	21	4055		21	15	4375		13	11
3798	H	29	47	*4064	Fe	20	19	*4384	Fe	18	14
3815		19	23	4067		18	21	4395	Ti+	12	..
3820		31	21	*4072	Fe	18	18	4400	Ti+	27	19
3824		36	26	*4078	Sr+	32	28	*4415	Fe+	20	13
3826		44	28	4087		19	17	4417	Ti+	19	12
3835	H	65	51	4092		17	15	*4425	Ca	12	12
3850		28	18	4096		32	26	*4435	Ca	16	12
3856		18	11	*4101	H	49	51	*4444	Ti+	23	12
3860		25	20	4110		25	21	4450	Ti+	14	..
3866		13	07	4114		09	14	*4455	Ca	12	05
3872		30	18	4119		20	14	4468	Ti+	21	07
3879		31	17	4123		21	14	4481		18	12
3886		49	23	4128	Fe+	26	12	*4489	Fe+	21	10
3889		62	48	*4132	Fe	27	20	4501	Ti+	19	10
3896		32	27	4137		11	06	4515	Fe+	18	12
3901	Ti+	28	17	*4144	Fe	21	19	4523	Fe+	14	10
*3905	Si	30	15	4154		16	10	*4534	Ti+, Fe+	11	04
3916		28	10	4161		21	15	4535		10	04
3920		28	11	4173	Fe+	34	13	4572	Ti+	18	12
3923		23	25	4177	Fe+	26	23	4576	Fe+	11	07
*3933	Ca+	92	75	4187	Fe	22	16	4581		18	08
3941		39	..	4196		25	14	4584	Fe+	17	07
*3944	Al	33	23	*4202	Fe	23	17	4592	Cr+	14	..
3950		35	19	4205		18	12	4601		13	04
3956	Ti	34	21	*4215	Sr+	24	12	4603		11	05
*3962	Al	36	36	*4227	Ca	28	17	4619		26	11
*3968	Ca+	92	73	4233	Fe+	20	15	4629	Fe+	11	09
3982		27	12	4242		14	14	4638		07	06
3991		17	18	4258		11	11	4657		10	06
4001		28	19	*4272	Fe	21	10	4663		10	04
4002		14	07	4290	Ti+	28	06	*4667	Fe+	06	04
*4005	Fe	26	21	4300	Ti+	32	20	4682		09	09
4012	Ti+	11	05	4306	Ti+	19	15	*4861		45	40
4018		11	05	4314	Ti+	23	18				

TABLE III

Line		γ Cyg	α Aur	Line		γ Cyg	α Aur	Line		γ Cyg	α Aur
*3933	Ca+	87	72	*3962	Al	50	44	3995		32	15
*3945	Al	38	41	3970	Ca+	88	75:	4002		23	22
3952		31	30	3982		36	36	*4005	Fe	30	29
3956	Ti	38	32	3987		22	24	4012	Ti+	16	..

Line		γ Cyg	α Aur	Line		γ Cyg	α Aur	Line		γ Cyg	α Aur
4014		15	12	4191	Fe	22	28	4405	Fe	18	24
4028	Ti+	25	12	4196		24	22	4408	Fe	27	22
*4031	Mn	33	27	*4202	Fe	30	34	*4415	Fe+	32	23
4033	Mn	..	25	4205		33	30	4423		19	28
*4041	Mn	18	12	4209		22	27	*4425	Ca	16	22
*4046	Fe	29	38	*4215	Sr+	27	34	4430		22	24
4050		18	10	*4227	Ca	38	45	4444	Ti+	35	18
4054		26	17	4233	Fe+	29	22	4450	Ti+	21	23
4059		14	24	4239		25	26	4467	Ti+	29	23
*4064	Fe	28	25	4242		16	16	4481	Fe	22	25
4067		20	20	4247		30	24	4494		20	21
*4072	Fe	24	24	4251	Fe	24	24	4508	Fe+	14	21
*4078	Sr+	44	39	4258	Cr, Fe	20	22	4515	Fe+	21	18
4087		23	18	*4272	Fe	28	34	4522	Fe+	23	20
4092		06	10	4274	Cr	23	20	*4534	Ti+, Fe+	20	09
4098		26	26	4282	Fe	18	24	4544		09	14
*4101	H	46	41	4290	Ti+	36	36	4550	Fe+, Ti+	26	12
4119		24	16	4294	Fe+, Ti+	26	28	*4554	Ba+	28	22
4123		25	20	4299	Ti+, Ca	38	43	4564	Ti+	23	12
4128		36	20	4300	Ti+	36	41	4572	Ti+	17	18
*4132	Fe	30	28	4306	Ti+	26	48	4765		20	11
4139		14	13	4314	Ti+	34	..	4824		30	10
*4144	Fe	30	30	4326	Fe, Sc+	26	38	4848		12	10
4149		20	24	4331	Ti+	18	..	4854		14	19
4156		24	24	*4340	H	51	46	*4861	H	24	36
4164		22	18	*4352	Fe+	28	26	4871		15	20
4167		12	24	4368		22	16	4903		10	19
4173	Fe+	41	36	4375		27	26	4924	Fe+	20	..
4177	Fe+	38	..	*4383	Fe	39	42	4968		24	09
4182		26	32	4395	Ti+	28	..	5018	Fe+	19	09
4187	Fe	27	28	4400	Ti+	32	..				

The intensities of the lines in the spectra of stars of similar spectral class and very different luminosity may be compared by means of the two preceding tables. It is clear that the lines of both the supergiants are stronger than the lines of the normal stars, and that the lines of the dwarf are relatively much fainter than the lines of the normal giant. The differences between the intensities of the lines are an index to differences of physical constitution, and some of the implications of the result will be discussed in a later paper.

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