SEARCH FOR VARIABILITY IN NEAR INFRARED FLUXES OF PECULIAR EMISSION-LINE OBJECTS*

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Thirty-five peculiar emission line objects (essentially B[e] stars) were observed at J(1.2 μ), H(1.6 μ), K(2.2 μ), L(3.5 μ), and M(4.8 μ) at the E.S.O. 1 m telescope where the photometer is equipped with an InSb detector. The results of the observations performed during several nights and days in Feb. 1979 and March 1980 are listed in Table 1.

Our K magnitudes and H-K color indices are compared in Table 2 with those obtained in the early 1970's and given e.g. in Allen and Swings (1976, Astron. Astrophys. 47, 293). Only one case (M1-11) is definitely variable at K, as already reported by Allen (1973, M.N.R.A.S. 161, 145); six other objects are marginally variable in H-K.

It therefore appears that the dust surrounding these peculiar emission-line objects, although patchy, does exist in sufficient quantities and at relatively constant temperature(s) so that repeated observations in the near infrared do not reveal any really meaningful (> .1 or .2 m) variation.

*Based on data collected at the European Southern Observatory (La Silla, Chile).

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TABLE 1

NEAR INFRARED MAGNITUDES OF B[e] OBJECTS

Object	Date (Yr, Mo, Day)	V	J		H		K		L		M	
HD 45677	79:02:17	8.5	7.79±	.10	6.49±	.08	4.83±	.10	2.13±	.15	1.07±	.16
	79 02 20		7.70	.03	6.44	.05	4.63	.10	1.94	.06	1.00	.11
	80 03 08		7.93	.05	6.76	.04	4.81	.03	2.11	.05	1.30	.07
	80 03 09		7.91	.04	6.79	.04	4.86	.03	2.22	.05	1.35	.07
MWC 819	80 03 09	14.9	12.55	.79	10.76	.13	8.88	.08	6.17	.06	5.23	.54
HD 50138	80 03 10	6.7	5.86	.02	5.10	.02	4.18	.03	2.77	.04	2.16	.08
HD 51585	80 03 09	11.2	-		-		-		6.41	.09	5.83	.40
M 1-11	80 03 10	13.5	11.04	.40	10.09	.14	8.98	.09	7.11	.18	6.18	.56
CD-24°5721	80 03 09	11.4	9.28	.07	8.53	.08	7.33	.03	5.62	.06	4.88	.20
(RX Puppis	80 03 10	~8.5	5.14	.02	4.00	.02	2.79	.02	1.08	.04	0.48	.06)
Ve 27	80 03 09	13.8	11.30	.40	10.28	.17	8.54	.05	5.66	.06	4.34	.13
Hen 230	80 03 09	12.4	9.11	.09	7.79	.04	6.51	.03	4.91	.05	4.26	.10
He 2-34	80 03 10	15.6	8.19	.05	6.58	.02	5.14	.02	3.48	.03	2.94	.07
HD 87643	80 03 08	8.7	6.20	.04	5.04	.04	3.75	.03	2.08	.05	1.46	.08
Hen 373	80 03 10	13.5	9.33	.10	8.19	.03	6.92	.03	5.41	.10	4.69	.20
η Car	80 03 10	6.2	3.61	.02	2.63	.03	1.12	.01	-1.77	.06	-3.13	.05
Hen 485	80 03 10	11.7	8.40	.05	7.24	.02	6.02	.02	4.52	.04	4.07	.17
GG Car	80:03:08	8.7	6.84±	.04	6.09±	.05	5.00±	.03	3.69±	.05	3.09±	.08
	80 03 09		6.87	.04	6.01	.05	4.98	.03	3.56	.05	2.99	.08
	80 03 10		6.86	.03	6.03	.03	4.99	.01	3.58	.04	3.03	.05
He 2-79	80 03 08	14.1	11.76	.86	10.06	.10	7.89	.04	5.42	.05	4.81	.16
He 2-80	80 03 08	13	10.00	.14	8.81	.07	7.44	.03	5.67	.06	4.92	.15
Hen 782	80 03 10	Var.	8.17	.04	6.44	.03	4.90	.01	3.17	.04	2.58	.06
He 2-90	80 03 08	13.3	11.08	.38	10.24	.14	7.89	.04	4.86	.06	3.61	.13
He 2-91	79 02 20	14.4	9.18	.06	7.70	.05	6.36	.09	4.34	.06	3.44	.11
	80 03 08		9.72	.10	8.00	.05	6.44	.03	4.53	.06	3.87	.10
Hen 938	80 03 10	13.3	9.08	.08	7.82	.03	6.23	.02	4.33	.04	3.67	.11
He 2-101	79 02 21	16.9	11.57	.59	9.72	.14	8.33	.05	6.49	.03	5.57	.35
	80 03 09		12.9	.80	10.00	.09	8.46	.05	6.46	.10	5.80	.07
He 2-139	80 03 10	16.8	8.76	.05	7.49	.04	6.38	.02	5.00	.03	4.73	.11
CPD-52°9243	79 02 18	10.3	6.03	.07	5.14	.07	4.06	.25	2.53	.11	1.79	.01
	80 03 08		6.45	.05	5.35	.04	4.08	.03	2.66	.05	2.07	.07
He 2-147	80 03 08	15	6.23	.07	6.13	.04	5.21	.03	4.23	.05	4.15	.12
Mz 3	79 02 18	14	9.30	.07	7.35	.07	5.58	.25	3.04	.11	2.02	.01
	80 03 08		9.32	.07	7.54	.04	5.62	.03	3.19	.05	2.33	.08
Pe 2-9	80 03 10	17.0	11.43	1.00	9.43	.08	7.17	.02	4.67	.04	3.85	.05
Hen 1191	79 02 19	13.8	9.88	.15	8.25	.05	6.25	.03	3.80	.04	2.84	.08
	80 03 08		10.35	.20	8.44	.05	6.43	.03	3.90	.05	3.05	.08
M2-9(core)	79 02 18	14.7	10.91	.15	9.28	.08	7.08	.25	3.95	.11	2.64	.02
	80 03 08		11.32	.44	9.41	.07	7.03	.03	3.90	.05	2.71	.07
AS 222	79:02:20	12.5	7.83±	.02	6.79±	.05	5.68±	.09	4.01±	.06	3.23±	.11
H1-25	80 03 09	16.5	10.55	.18	8.70	.05	6.86	.03	4.61	.05	3.78	.09
HD 316248	80 03 09	12.1	9.93	.40	9.30	.16	8.52	.13	7.32	.52	7.14	1.00
HD 163296	80 03 09	6.8	6.34	.04	5.54	.03	4.72	.02	3.55	.04	3.14	.08
MWC 922	79 02 18	13.9	8.86	.07	7.38	.07	5.66	.25	2.78	.11	1.38	.01
	80 03 09		8.99	.18	7.49	.04	5.59	.08	2.75	.04	1.51	.08
MWC 300	79 02 18	11.6	9.08	.11	8.14	.08	6.19	.25	3.06	.11	1.74	.02
	80 03 09		9.16	.22	8.11	.06	6.12	.02	3.02	.04	1.83	.07
MWC 939	79 02 18	12.4	10.45	.27	8.98	.08	7.23	.25	4.93	.11	4.05	.04
	80 03 09		10.07	.39	8.72	.13	7.01	.03	4.86	.06	4.03	.15
HD 190073	79 02 17	7.9	8.20	.15	7.16	.15	6.18	.03	4.80	.05	4.59	.19

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TABLE 2 : SEARCH FOR INFRARED VARIABILITY

		K			H-K			
Name	Group	Ref. 1976	1979	1980	Ref. 1976	1979	1980	Notes
HD 45677	2	4.6	4.6	4.8	1.87	1.81	1.93	
MWC 819	2	8.3	-	8.9	1.80	-	1.9	
HD 50138	1	4.2	-	4.2	0.91	-	0.92	
M 1-11	3	7.5	-	9.0	1.15	-	1.11	(1)
CD −24°5721	2	7.2	-	7.3	1.02	-	1.20	
RX Pup	3	3.5	-	2.8	1.11	-	1.22	(2)
Ve 27	2	8.5	-	8.5	1.6	-	1.74	
Hen 230	2	6.5	-	6.5	1.23	-	1.29	
He 2-34	3	5.8	-	5.1	1.45	-	1.44	
HD 87643	2	3.6	-	3.7	1.19	-	1.28	
Hen 373	1	6.7	-	6.9	1.14	-	1.27	
η Car	2	1.2	-	1.1	1.51	-	1.51	
Hen 485	1	6.0	-	6.0	1.17	-	1.23	
GG Car	2	4.9	-	5.0	0.97	-	1.04	
He 2-79	2	8.0	-	7.9	2.3	-	2.16	
He 2-80	2	7.3	-	7.4	1.20	-	1.37	
Hen 782	1	4.7	-	4.9	1.16	-	1.54	
He 2-90	3	7.8	-	7.9	1.9	-	2.36	
He 2-91	2	6.3	6.4	6.4	1.55	1.43	1.56	(1)
Hen 938	1	6.1	-	6.2	1.54	-	1.56	
He 2-101	3	8.4	8.3	8.5	1.7	1.39	1.54	
He 2-139	3	5.3	-	6.4	1.0	-	1.11	
CPD −52°9243	1	4.2	4.1	4.1	1.24	1.10	1.26	
Mz 3	3	5.4	5.6	5.6	1.88	1.80	1.92	
Pe 2-9	1	7.0	-	7.2	1.76	-	2.26	
Hen 1191	2	6.3	6.3	6.4	1.95	2.00	2.00	
M 2-9	3	7.0	7.1	7.0	2.24	2.22	2.38	
AS 222	1	5.6	5.7	5.7	1.25	1.19	1.31	
H 1-25	3	7.3	6.6:	6.9	2.1	1.81	1.85	
HD 316248	3	8.1	-	8.5	1.01	-	0.78	
HD 163296	1	4.5	-	4.7	0.73	-	0.82	
MWC 922	2	5.6	5.7	5.6	1.79	1.75	1.90	
MWC 300	2	5.9	6.2	6.1	2.07	1.97	1.99	
MWC 939	2	6.8	7.2	7.0	1.55	1.78	1.71	
HD 190073	1	5.8	6.2	-	0.79	0.91	-	

(1) possibly variable (Allen, 1973)

(2) has mags. and colors varying as for LPV

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DISCUSSION

Selvelli: 1. I think you cannot rule out the possible presence of a cool companion in a star with IR excess by saying that no radial velocity variation has been observed. A not neglegible percentage of objects might be viewed pole-on.
2. Is it straightforward to distinguish between an IR excess produced by a possible cool companion from that produced by a dust envelope?

Swings: I agree; however, the only case I was talking about concerned HD45677 which, as you know, is most probably seen equator-on.
2. I think so because the colours will be very different, especially in the I,J,H band areas.

Coyne: What size temperature change in the dust would give changes in J,H,K,L,M,N of the order of .5 mag?

Swings: It is of course the colours that are important; if one looks for example, at an H-K/K-L diagram, the decrease of K-L of ≈ .5 mag. would change the dust temperature by +200-300K.

Chkhikvadze: It is well known that IR excess is correlated with the presence of some forbidden lines ([FeII] and others). On the other hand there are many such peculiar Be stars (MWC 374, XX Oph, αSco (B), HR3164 etc.), but they have no IR (dust) excess. What do you think about it?

Swings: What I said is that for B[e] stars there exists a strong correlation between the existence of an infrared excess and the presence of e.g. [OI], [FeII] , [SII] in their spectra. The cases you mention are different: for XX Oph, see Swings and Allen (PASP 84, 523, 1972); I do not think αSco B has been measured alone, i.e. without the "contamination" of the M supergiant. I am talking here about VV Cephei stars or symbitics.

Sterken: 1. How did you calculate the reddening correction?
2. How sensitive are the temperatures in the dust shells on the accuracy of the method of the dereddening?

Swings: 1. The reduction was performed by one of us (P.B.) on La Silla, using Wamsteker's calibration (ESO preprint No 132, in press in A&A). The contribution of reddening for dust shells is very small, and if it affects very slightly the magnitudes, I do not think, it will change the IR colours by values greater than the observational errors.
2. See e.g. Allen's graph (fig. 2., MNRAS 161, p 157, 1973): a few tens of degree, may be, which is probably again below the accuracy of the measurements.

Andrillat: In order to decide whether a cool companion is present, perhaps it is possible to study the behaviour of the IR triplet of

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CaII, because in the Be stars the intensities of these three lines are different.

Swings: I agree; one could actually get one's inspiration from a recent paper by G. Herbig on T Tauri stars where that specific problem is examined.

Persi: What is the typical Signal/Noise ratio of your IR observations at 5μ ? To be sure of the presence of dust surrounding your observed Be star it is necessary to have a small statistical error at 5μ and to extend the observations at larger wavelengths.

Swings: I don't have the count rates with me here, but most of the objects observed were much brighter at 5μ than the limit of the system ($m \approx 6$).
Having the H,K,L map is enough to be sure about the presence of dust; having data at longer wavelengths allows one to have an idea about the temperature distribution of the dust graines.

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