I. PHOTOMETRY

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SOME PHOTOMETRIC CHARACTERISTICS OF Be STARS
(Review Paper)

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Abstract. Homogeneous observational data on four photometric systems which cover the spectral range from 0.14 to 4 microns through narrow, intermediate and broad passband filters are used to review and derive some photometric characteristics of Be stars. We find that 60% of the stars under discussion have ultraviolet and infrared excesses.

1. INTRODUCTION

The subject "Photometry of Be Stars" is too extense to give a full account of it at this symposium. Therefore, I have to restrict myself to a selection, which naturally is biased by my own knowledge and interests. However, some facts derived from photometric measurements will be discussed.

2. FOUR PHOTOMETRIC SYSTEMS

We are including in our discussion observational data taken in four photometric systems, namely,

1) Absolutes fluxes in four passbands centered at $\lambda\lambda$1565, 1956, 2365 and 2740A observed by the Ultraviolet Sky Survey Telescope. Its main photometric characteristics are given in the Catalogue of stellar Ultraviolet Fluxes compiled by Thompson et al. (1978).
2) The UBVRIJHKL-system (Johnson et al., 1966).
3) The 13-color photometric system (Johnson and Mitchell, 1975).
4) The $\alpha(16)$, $\Lambda(9)$ photometric system (Mendoza, 1977, 1979). These photometric systems cover the spectral range from 0.14 to 4 microns, approximately, through broad intermediate and narrow passbands filters.

3. THE OBSERVATIONAL DATA

We have reduced the observational data very much to be discussed herein. The criterium was to include 09.5-B8 type stars which have $\alpha(16)$ and $\Lambda(9)$ measurements made by ourselves, and which are also suspected or

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confirmed to have Balmer lines contaminated by emission. We have collected 56 stars altogether. They are listed in Table 1. The star's designations are HD numbers; spectral types are from Mendoza (1958), and Jaschek et al. (1971). The $\alpha(16)$ and $\Lambda(9)$-indices are new, except for the four Be Pleiades stars (Mendoza, 1979). The UBVRIJHKL photometry has been taken from Mendoza (1967, 1969), and Johnson et al. (1966). H-magnitudes from Iriarte (1969), and Morel and Magnenat (1978). The 13-color photometry from Johnson and Mitchell (1975). The ultraviolet fluxes were transformed to the visual magnitude scale using the absolute calibration of Hayes and Lathman (1975):

$$m(\lambda) = - 2.5\log F(\lambda) - 21.175$$

the derived magnitudes are referred in Table 1 and herein as 16, 20, 24 and 27-magnitudes.

The photometry given in Table 1 is characterized by its homogeneity and high quality. We illustrate in Figure 1, as an example, a comparison of the $\alpha(16)$-indices and the strengths of Hα given by Andrews (1968). This comparison includes 100 normal early type stars, plotted as a solid line. The actual scatter is very small around it, less than 0.03 magnitudes, no a single normal star departs from the line more than this amount. The open circles in Figure 1 represent the Be stars listed in Table 1. Its scatter is not unexpected since the strength of the emission in Hα varies as function of time. The time difference between Andrew's data and ours in about 15 years. We notice from figure 1 that around one-third of the stars listed in Table 1 have changed their Hα

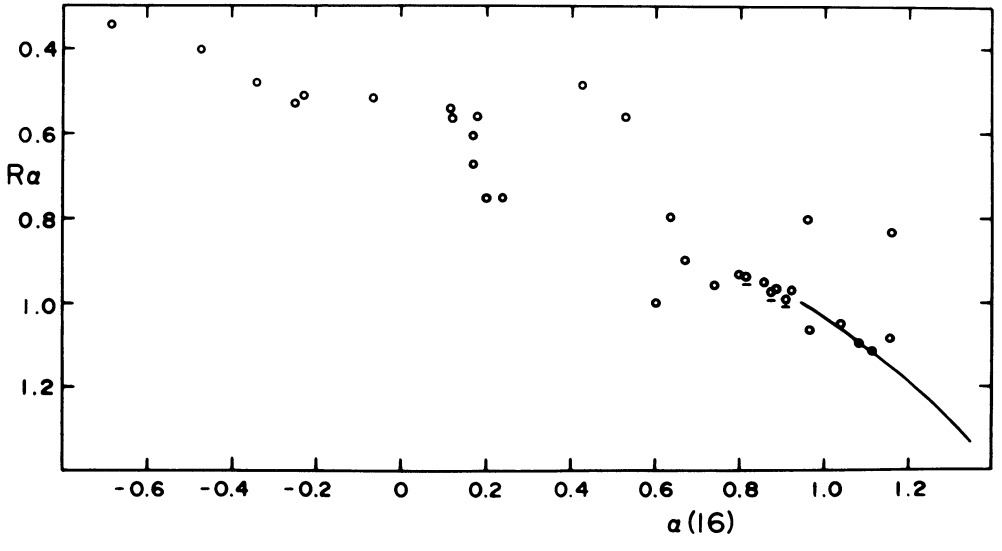

Fig. 1.- A comparison of two Hα-photometric systems

TABLA 1.- OBSERVATIONAL DATA

HD	α(16)	16	20	24	27	*U*	*B*	*V*	*R*	*I*	*J*	*H*	*K*	*L*
MK	Λ(9)	33	35	37	40	45	52	58	63	72	80	86	99	110
2905	0.794	2.60	3.15	3.18	3.11	3.50	4.30	4.16	4.02	3.96	3.99		3.92	3.91
B1 IA	0.288	3.177	3.234	3.638	4.288	4.362	4.220	4.128	4.056	4.001	3.949	3.959	4.002	3.934
5394	0.199	-1.01	-0.56	-0.17	-0.42	1.18	2.29	2.39	2.32	2.40	2.47	2.20	2.20	2.00
B0.5 IV E	0.244	0.695	0.759	1.365	2.105	2.292	2.270	2.262	2.184	2.141	2.079	2.181	2.301	2.260
10144	0.994	-2.13	-1.64	-1.28	-0.89	-0.35	0.32	0.47	0.50	0.57	0.79	0.86	0.88	0.95
B5 V E	0.351	-0.508	-0.482	-0.215	0.248	0.459	0.471	0.491	0.562	0.593	0.644	0.646	0.723	0.699
10516	-0.473	0.98	1.68	1.91	2.44	3.10	4.02	4.06	3.90	3.88	3.83	3.57	3.35	2.83
B1 III,IV PE	0.217	2.738	2.792	3.319	3.984	4.136	4.095	4.086	3.917	3.924	3.831	3.904	3.999	3.889
13854	0.867					6.10	6.76	6.48	6.14	5.95				
B1 IAB	0.291													
18552	0.233	4.43	4.78	5.15	5.38	5.55	5.94	6:						
B8 V E	0.264													
20336	0.856	1.88	2.45	2.84	3.30	3.93	4.70	4.85	4.88	5.01		5.17	5.25	
B2 V E	0.294	3.645	3.732	4.105	4.631	4.805	4.841	4.867	4.899	4.904	4.937	4.978	5.073	5.063
22192	-0.225	2.17	2.67	3.03	3.29	3.61	4.17	4.23	4.13	4.14				
B5 E	0.245	3.355	3.392	3.649	4.109	4.237	4.234	4.243	4.168	4.198	4.154	4.178	4.232	4.164
23180	1.082	1.59	2.36	2.65	2.74	3.13	3.88	3.83	3.71	3.71			3.76	3.89
B1 III	0.299	2.805	2.868	3.280	3.837	3.945	3.857	3.828	3.774	3.754	3.712	3.728	3.767	3.767
23302	1.115	1.75	2.16	2.59	2.92	3.18	3.58	3.70	3.71	3.81	3.88	3.92	3.94	4.01
B6 III	0.314	3.044	3.100	3.211	3.549	3.689	3.709	3.722	3.739	3.751	3.780	3.755	3.842	3.800
23480	0.869	2.37	2.83	3.19	3.46	3.70	4.12	4.18	4.11	4.15	4.16	4.21	4.06	3.97
B6 IV NN	0.302	3.523	3.569	3.711	4.104	4.184	4.184	4.172	4.131	4.151	4.120	4.139	4.160	4.149
23630	0.670					2.43	2.78	2.87	2.84	2.88	2.97		2.96	2.90
B7 III	0.284	2.313	2.354	2.376	2.724	2.864	2.875	2.887	2.869	2.882	2.929	2.894	2.931	2.933
23862	0.529				4.83	4.73	5.01	5.09	5.02	5.08	5.11	5.15	5.06	4.95
B8 PE	0.511	4.311	4.359	4.545	4.884	5.003	5.007	5.014	4.992	5.027	5.020	5.039	5.093	5.049
24398	1.034	1.06	1.82	1.96	1.94	2.19	2.97	2.85	2.99	3.08	3.05		3.03	3.04
B1 IB	0.295	1.924	1.963	2.358	2.972	3.054	2.927	2.844	2.765	2.707	2.647	2.648	2.703	2.646

TABLA 1.- CONTINUED

HD *MK*	α(16) Λ(9)	16 33	20 35	24 37	27 40	*U* 45	*B* 52	*V* 58	*R* 63	*I* 72	*J* 80	*H* 86	*K* 99	*L* 110
24534 *B0: PE*	0.421 0.259	4.36	5.10	5.57	5.49	6.03	6.87	6.76	6.51	6.40		5.43	5.28	5.14
25940 *B3 V PE*	0.167 0.270	1.91 3.240	2.53 3.285	2.97 3.564	3.12 4.005	3.45 4.120	4.00 4.084	4.03 4.064	3.91 3.996	3.93 4.033	3.982	3.979	4.047	3.70 3.992
28497 *B1 E*	-0.106 0.226	2.22	2.75	3.06	3.62	4.36	5.30	5.44	5.41	5.53				
29866 *B7: E*	1.154 0.325	4.82	5.46	5.95	5.81	5.89	6.18	6.08						
30614 09.5 *IA*	0.814 0.278	2.06 3.043	2.46 3.125	2.90 3.604	2.92 4.280	3.44 4.416	4.32 4.343	4.29 4.271	4.18 4.224	4.18 4.185	4.132	4.144	4.226	4.192
32343 *B2 V: PE*	0.170 0.251	2.64	3.15	3.53	3.93	4.39	5.12	5.20				5.29	5.15	
32991 *B2 V P*	-0.066 0.252	4.52	5.26	5.54	5.33	5.46	6.02	5.82				5.27	5.08	4.70
34085 *B8 IA*	0.917 0.414	-1.04 -0.773	-0.93 -0.731	-0.79 -0.519	-0.62 0.062	-0.55 0.218	0.10 0.172	0.13 0.151	0.12 0.125	0.14 0.092	0.22 0.099	0.11 0.072	0.20 0.168	0.17 0.172
34959 *B5 P*	0.643 0.403	4.40	4.87	5.24	5.55	6.11	6.57	6.65	6.61	6.65				
35165 *B5 NE*	0.860 0.425	3.03	3.63	4.00	4.50		5.92	6.11				6.30	6.40	
35411 *B1 V*	1.083 0.287	-0.10 1.814	0.64 1.918	1.02 2.391	1.55 3.050	2.25 3.276	3.18 3.324	3.35 3.368	3.40 3.395	3.65 3.432	3.75 3.466	3.507	3.87 3.652	3.92 3.700
35439 *B1 V: PE*	0.965 0.298	3.456	3.573	4.019	4.641	3.83 4.871	4.76 4.934	4.96 4.996	5.04 5.044	5.26 5.090	5.113	5.44 5.174	5.47 5.323	5.352
36576 *B1 E*	0.118 0.251	3.28	3.92	4.25	4.36			5.50						
37128 *B0 IA*	0.905 0.276	-1.50 0.100	-1.16 0.209	-0.85 0.722	-0.39 1.437	0.48 1.666	1.51 1.694	1.69 1.740	1.76 1.763	1.93 1.807	2.06 1.849	1.908	2.17 2.036	2.15 2.037

TABLA 1.- CONTINUED

HD	α(16)	16	20	24	27	*U*	*B*	*V*	*R*	*I*	*J*	*H*	*K*	*L*
MK	Λ(9)	33	35	37	40	45	52	58	63	72	80	86	99	110
37202	0.177	0.26	1.01	1.27	1.75	2.22	2.84	3.03	3.06	3.15	3.20		2.94	
B3 IV E	0.409	1.741	1.824	2.106	2.688	2.916	2.955	3.013	2.961	3.124	3.158	3.104	3.207	3.123
37490	0.603	1.89	2.41	2.65	3.06	3.73	4.49	4.59	4.57	4.67	4.76		4.82	4.80
B2 III E	0.278	3.379	3.467	3.831	4.397	4.575	4.568	4.587	4.564	4.579	4.544	4.614	4.684	4.653
37742	0.908	-1.74	-1.34	-0.92	-0.43	0.50	1.56	1.77	1.85	2.05	2.21	2.27	2.33	2.31
09.5 *IB*	0.282	0.082	0.196	0.733	1.450	1.694	1.744	1.795	1.824	1.871	1.913	2.007	2.110	2.145
37795	0.544	0.64	1.02	1.38	1.80	2.05	2.52	2.64	2.66	2.76	2.81		2.84	
B8 NE	0.280	1.940	1.949	2.125	2.426	2.625	2.635	2.642	2.660	2.691	2.709	2.696	2.770	2.734
37967	-0.340	3.72	4.31	4.69	4.98	5.29	5.94	6:						
B3 PE	0.218													
41117	0.870	3.97	4.71	4.54	4.08	4.24	4.91	4.63	4.32	4.10	4.04		3.86	3.71
B2 IA	0.310	3.902	3.907	4.294	4.912	4.919	4.680	4.542	4.417	4.329	4.214	4.160	4.162	4.035
43285	0.960	3.64	4.11	4.53	4.96	5.40	5.93	6.05						
B5 E	0.305													
44458	-0.120	3.23	3.76	3.97	4.25	4.72	5.55	5.63	5.37	5.32				
B2 V E	0.227													
45546	0.813					4.10	4.87	5.05	5.15	5.32				
B2 V	0.288	3.775	3.881	4.281	4.788	4.988	5.032	5.094	5.129	5.215	5.237	5.273	5.402	5.328
45725-7	0.105					2.87	3.61	3.76	3.77	3.93		3.86	3.76	3.66
B3 E	0.287	2.496	2.578	2.961	3.491	3.664	3.720	3.776	3.723	3.841	3.833	3.888	3.999	3.999
45995	0.112					5.20	6.06	6.14						
B2 V E	0.237													
47129	0.807				4.75	5.22	6.1:	6.06						
B0 P	0.270													
48917	0.042	2.28	2.77	3.03	3.52	4.27	5.19	5.35						
B3 NE	0.246													
50013	0.272	0.36	0.91	1.28	1.91	2.79	3.72	3.95	4.05	4.25		3.79	3.57	3.07
B2 NE	0.259	2.135	2.201	2.869	3.518	3.730	4.228	3.765	3.712	3.702	3.665	3.776	3.981	3.892

TABLA 1.- CONTINUED

HD	α(16)	16	20	24	27	*U*	*B*	*V*	*R*	*I*	*J*	*H*	*K*	*L*
MK	Λ(9)	33	35	37	40	45	52	58	63	72	80	86	99	110
56139	0.342	1.17	1.63	1.99	2.50	2.90	3.64	3.82	3.80	3.90	4.23		4.28	
B3 E	0.270	2.657	2.719	3.172	3.697	3.864	3.894	3.937	3.882	3.887	3.861	3.963	4.086	3.940
58715	0.739	1.30	1.62	1.97	2.31	2.52	2.80	2.89	2.90	2.96	3.06	3.04	3.06	
B8 NE	0.270	2.383	2.455	2.524	2.731	2.833	2.863	2.912	2.915	2.949	2.951	2.945	2.990	2.970
60606	-0.266	3.05	3.54	3.77	4.21	4.67	5.37	5.44	5.33	5.32				
B5 E	0.235													
60855	1.132	2.95	3.66	4.11	4.32	4.82	5.55	5.66						
B2 IV E	0.322													
63462	0.422	1.11	1.66	2.06	2.67	3.45	4.47	4.52	4.37	4.39		4.16	3.98	3.73
B3 E	0.255													
68980	-0.406	1.64	2.15	2.47	3.01	3.68	4.66	4.77	4.68	4.77	4.71	4.73	4.37	
B3 NE	0.181													
83953	0.451	2.36	2.80	3.14	3.57	4.08	4.66	4.78	4.76	4.85		4.87	4.82	4.77
B5 E	0.267													
105435	-0.260				0.91	1.64	2.56	2.65	2.61	2.73				
B2 V PE	0.185	1.096	1.211	1.705	2.315	2.489	2.509	2.568	2.516	2.514	2.537	2.547	2.701	2.630
120324	1.085	0.10	0.65	1.09	1.73	1.88	2.78	2.94	2.91	3.00				
B2 V PE	0.301	2.008	2.102	2.604	3.186	3.391	3.429	3.478	3.457	3.579	3.618	3.685	3.808	3.871
127972,3	0.823	-0.93	-0.40	-0.04	0.67	1.30	2.12	2.31	2.41	2.59		3.08	3.04	2.99
B2 V E	0.359	0.979	1.080	1.509	2.053	2.278	2.339	2.399	2.429	2.500	2.558	2.611	2.756	2.812
142983	0.215	2.35	3.07	3.54	3.80	4.61	4.77	4.87	4.91	4.96		4.67	4.54	4.15
A PE A	0.478	4.552	4.657	4.450	4.827	4.922	4.946	4.978	4.960	4.999	4.990	4.949	4.984	4.999
193237	-0.685	4.87	5.60	5.47	4.72	4.66	5.24	4.82	4.28	4.02	3.78	3.49	3.31	2.87
B1 EQ	0.270	4.339	4.326	4.720	5.301	5.239	4.956	4.659	4.426	4.390	4.272	4.213	4.097	3.849
198478	0.894	5.23	5.88	5.72	4.99	4.83	5.28	4.86	4.41	4.10				
B3 IA	0.356	4.534	4.516	4.742	5.272	5.202	4.933	4.706	4.546	4.393	4.255	4.185	4.116	4.015
217675	1.154	1.51	1.96	2.31	2.63	3.00	3.53	3.62	3.61	3.69		3.80	3.86	3.86
B6.5 E	0.330	2.756	2.831	2.996	3.458	3.615	3.637	3.645	3.663	3.651	3.665	3.661	3.722	3.730

strength in this lapse of time, a few of them as much as 0.4 mag. other Be stars show only a faint emission, if any. It should also be pointed out that several of the Be stars listed in Table 1 have changed their Hα strength from one year to the next. For instance X Persei brightened by 0.12 mag. from 1978 to 1979, and ζ Tauri by 0.06 mag. from 1977 to 1978. The probable error of a single observation of the α(16)-index is around 0.004 mag. (Mendoza 1979). Thus these changes are 30 and 15 times this observational error. It is interesting to mention that two stars listed in Table 1 with α(16)-indices contaminated by emission do not appear in the Be catalogue (Jaschek et al. 1971), namely, BS 1761 and 10 Monocerotis. The first one is in Andrew's (1968) catalogue with an Rα value which indicates its Be nature.

4. SOME PHOTOMETRIC PROBLEMS

Normal stars are often obscured by interstellar extinction, thus, their colors depart from the intrinsic colors, which in most cases are not accurately known. A study of 800 normal Main Sequence stars, taken mostly from the Bright Star Catalogue (Mendoza, 1975), which contains many unreddened stars, indicates that mean colors deviate from Johnson's (1966) as much as 0.3 magnitudes. The exact amount depends on wavelength and spectral type. For instance, at B1 V mean colors are redder than intrinsic colors from 0.03 (visual) to 0.17 (infrared) mag. This can be interpreted either as there are not unreddened early type stars or Johnson's intrinsic colors are too blue or the "cosmic scatter" is too large. More work is needed in this direction.

Additional problems are encountered in the Be stars, per example,
1) Variability. Hα emission variations were stated above. In addition, Banhg (1976), among others, have reported rapid variations of Hα Variability in the UBVRI has also been reported by many authors, see for instance Feinstein (1968). A systematic study of a number of Be stars by Alvarez and Schuster (1981) in the 13 color system shows that a number of Be stars are undoubtedly variable stars. Variations in the 52 and 58 magnitudes are the most common form of variability. Variations in the Balmer continuum and near infrared are the most common color changes.
2) Emission. Several filters of the Photometric systems under consideration allow the pass of spectral features contaminated by emission, such as the R-filter which transmits at the Hα-wavelength. Thus, the colors containing the R-magnitude may be different in Be stars than in normal B-type stars.
3) Color excesses. Ultraviolet and infrared color excesses have been reported by several authors (Mendoza 1958, 1969; Feinstein 1968) which are unexplainable solely by interstellar extinction.
4) Binaries. Several Be stars are binaries with a probable red companion (Polidan and Peters, 1976). If this is the case their colors may be distorted.

5. TWO COLOR DIAGRAMS

The analysis of the 28-color photometry contained in Table 1 could include many comparison of the several color indices. We begin by plotting α(16) versus Λ(9) in Figure 2. The symbols in Figure 2 represent: the solid line, the standard relationship for normal O9.5-B8 Main Sequence early type stars. In addition, extreme shell Be stars lie in Figure 2 to the right, even further than the early type supergiants. This probably means that these Be stars have larger but similar envelopes than early type supergiant stars. A number of Be stars have

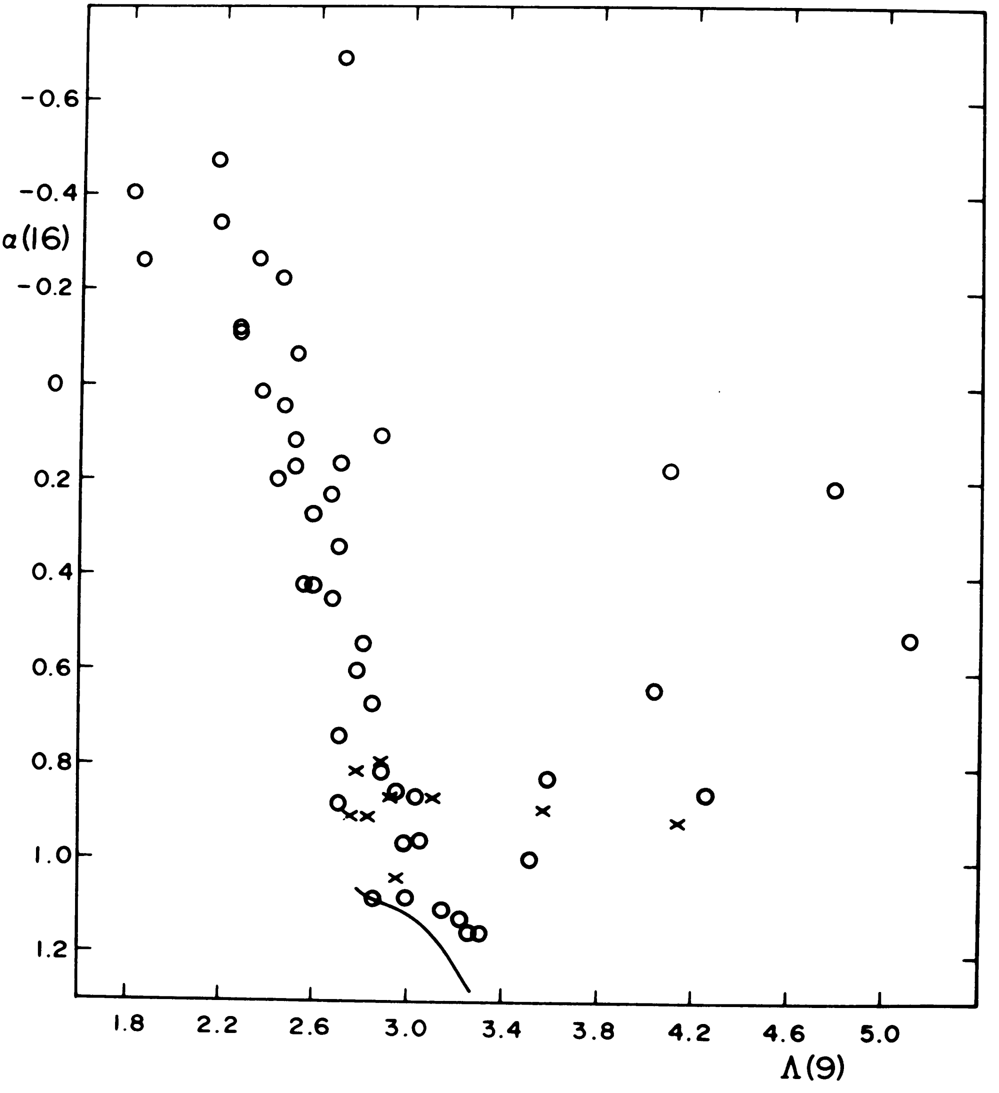

Fig. 2.- The α(16),Λ(9)-plane

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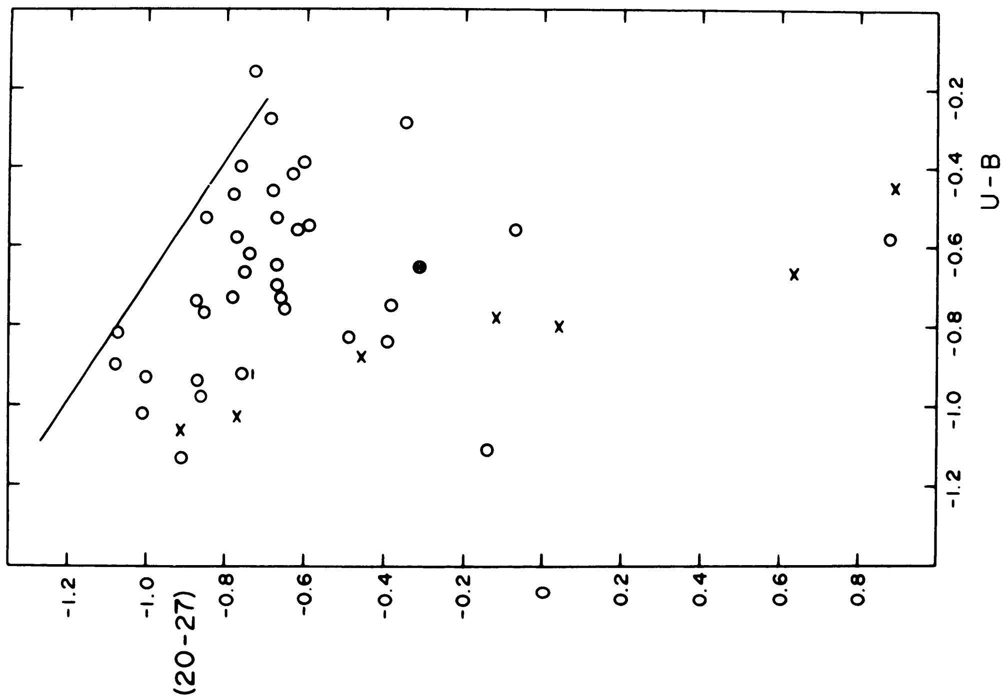

Fig. 4.- The (20-27, U-B)-plane

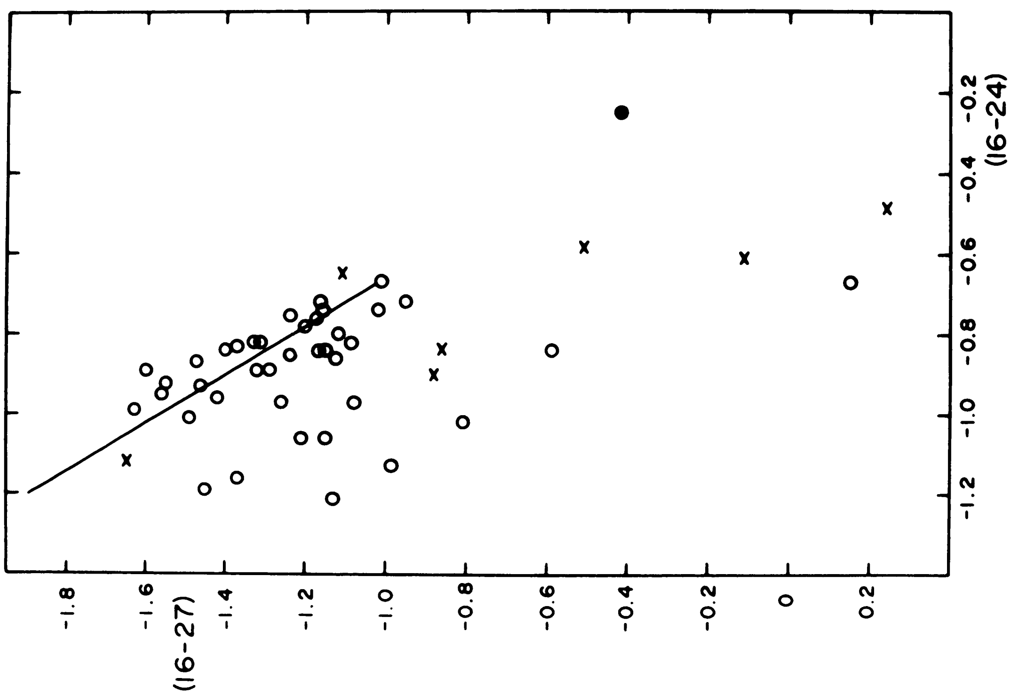

Fig. 3.- The (16-27), (16-24)-plane

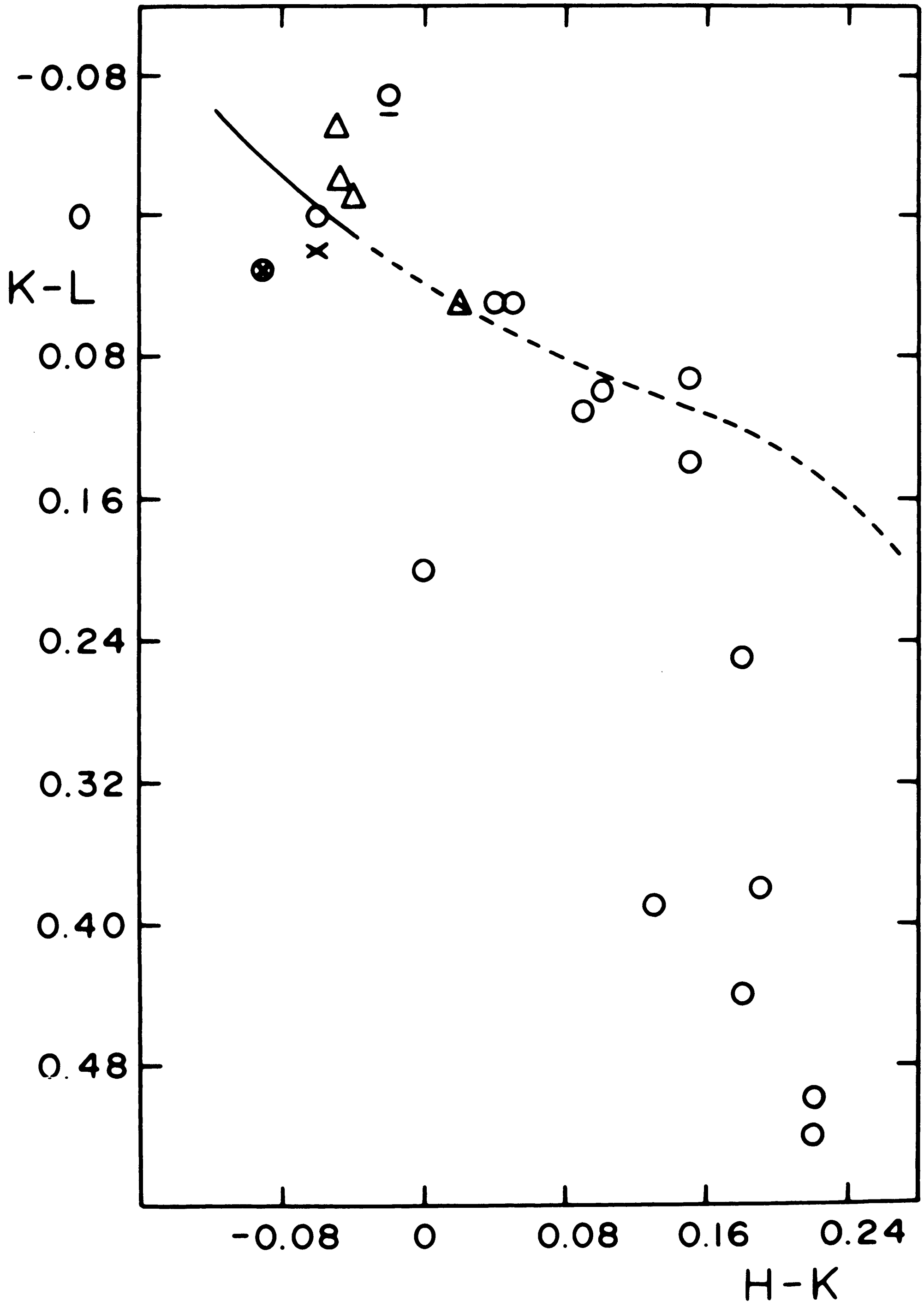

Fig. 5.- The (K-L, H-K)-plane

an Λ(9)-index contaminated by emission, such as those shown in the extreme left in figure 2. However, the reverse is not true. For instance P Cygni has an OI (λ7774A) both in emission and in absorption (Mendoza and Johnson, 1979) which yields an Λ(9)-index similar to that of a Main Sequence B-type star.

The photometry from the Ultraviolet Sky Survey Telescope indicates that roughly half of the Be stars listed in Table 1 have UV-Main Sequence colors like. The other half sets aside from the unreddened Main Sequence B-type stars. We show, as an example, the relationship between the (16-27) and (16-24) colors in Figure 3. The symbols in this Figure represent: solid line, an approximate Main Sequence relationship for unreddened B-type stars; open circles, Be stars; crosses, supergiant stars (the crossed cirle represents β Orionis). In the (20-27, U-B)-array Be stars are better separated than in the (16-27, 16-24)-diagram. This is illustrated graphically in Figure 4 (the symbols in Fig. 4 have the same meaning as in Fig. 3). Infrared colors

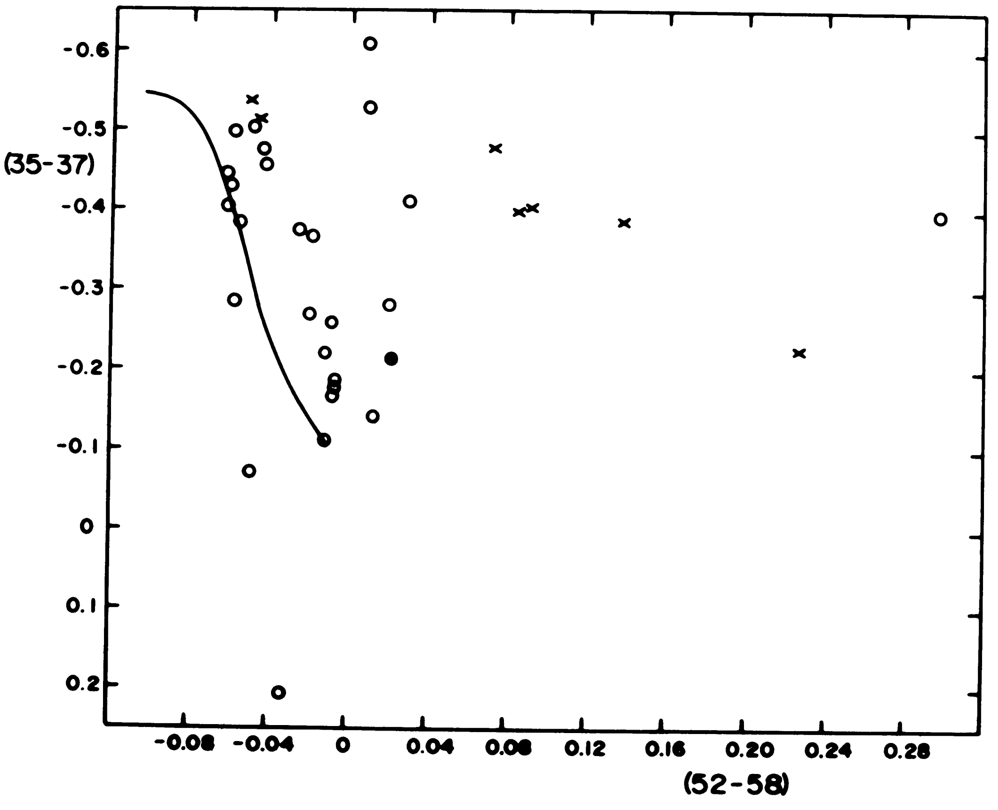

Fig. 6.- The (35-37), (52-58)-plane

can also be used to divide color diagrams in two regions, namely, Be and normal B-type stars. In figure 5 the stars listed in Table 1 are plotted in the (K-L, H-K) array. Other stars which are not contained in Table 1 also show the same characteristics. Early type supergiant stars perhaps do not lie far from the unreddened Main Sequence in the (K-L, H-K)-plane. The triangles in Figure 5 represent early type supergiant stars not listed in Table 1. The broken line represents the Main Sequence for spectral type later than B8. Another interesting two-color diagram is (35-37) vs (52-58) shown in Figure 6, where again a number of Be stars are separated from normal B-type stars.

6. COLOR-EXCESSES

Two-color diagrams which involve either ultraviolet or infrared colors (see for instance Figs. 3-6) give a qualitative account of color excesses for a number of Be stars. These excesses can be investigated further with the aid of intrinsic colors. Since the infrared excesses seem to be too large to be explained by solely interstellar obscuration, then it is also necessary to know the extinction law valid in the direction of each Be star.

We are going to assume a single normal extrinction law, such as the one of Cygnus (Mendoza 1968) and to use Johnson's (1966) intrinsic colors for the UBVRIJHKL-photometry, and provisional values, derived from hopefully unreddened Main Sequence early type stars for the far ultraviolet and 13-color photometries. We are also going to assume that the colors least disturbed by the Be-phenomenon are (V-R) and (52-58). Let us once more recall that variability, less accurate types for Be stars, and other items mentioned above may affect the end product.

The results indicate that the Be stars listed in Table 1, around 60% of them have ultraviolet and infrared excesses, the 13-color photometry shows that in the 0.3-1.1 micron region some of the Be stars with color excesses have secondary peaks in both the Balmer and Paschen continua (filters 37 and 80), probably contaminated by emission. The broad passband photometry does not show these features; however, it indicates that larger excesses exist in the neighborhood of λ2365 in the UV, and 4 microns and at longer wavelengths in the infrared. γ Cas and ϕ Per have these properties. Their color excesses versus $1/\lambda$ are shown in Figure 7.

7. SUMMARY AND CONCLUSIONS

The four photometric systems which yield 28 color indices in the wavelength interval from 0.14 to 4 microns, approximately show that Be stars have as a group:

1) Light variations in their continua and in some spectral lines.
2) Ultraviolet and infrared color excesses (see Fig. 7) for about 60% of the Be stars under discussion.
3) Some extreme shell Be stars have the OI λ7774Å enhanced absorption stronger than in supergiant stars of the same spectral type. This

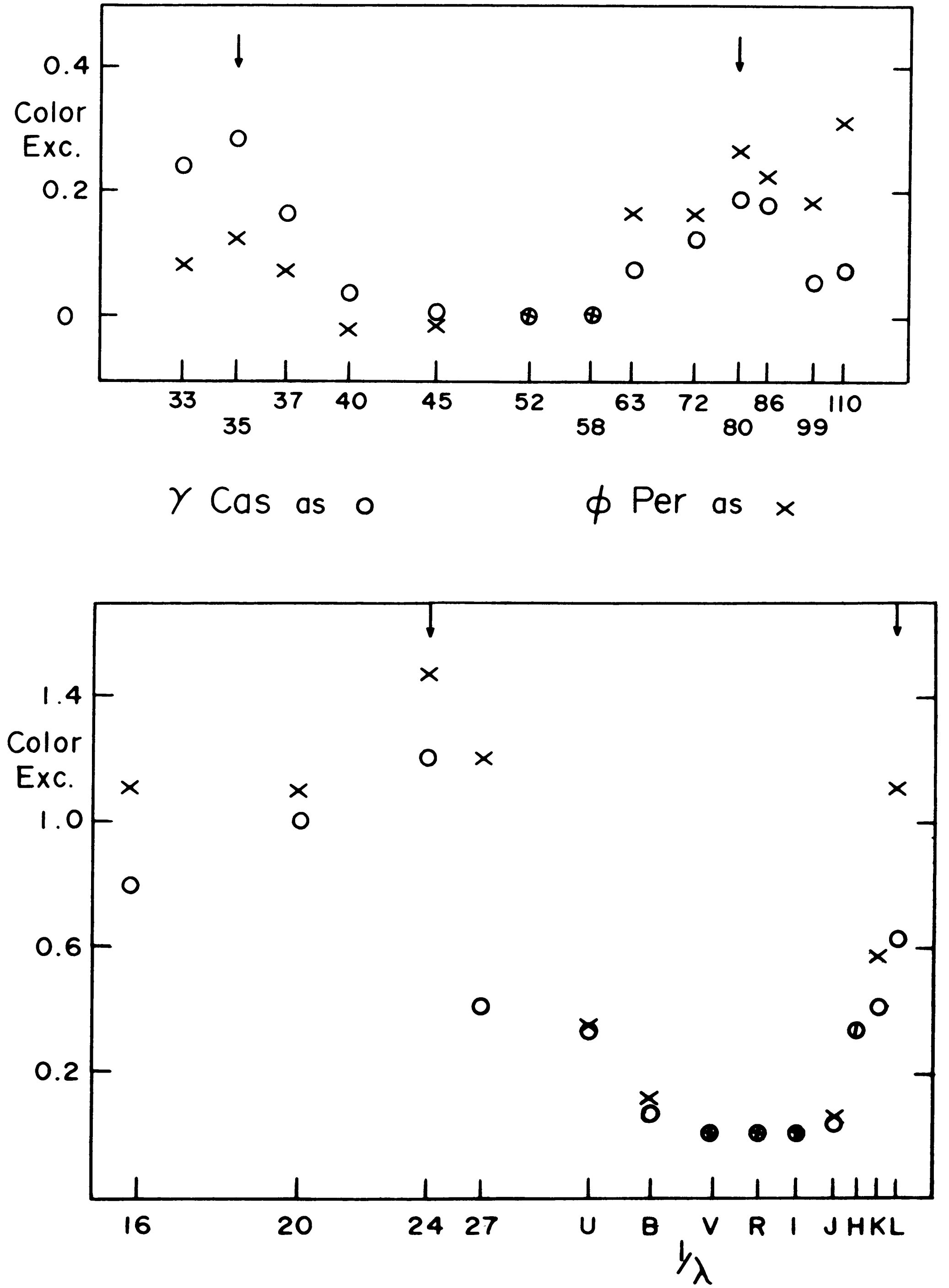

Fig. 7.- Color excesses for two Be stars in two photometric systems

information may be obtained from the $\Lambda(9)$-index.

It should be pointed out that a few specific Be stars have quite different photometric characteristics than the average. P Cygni is one of them. Its (V-R) and (52-58) seem to have an additional reddening, other than interstellar, which perhaps will make that the derived color excesses from these indices may be wrong by a considerable amount (too large in the far UV and too small in the near IR). P Cygny in most two-color diagrams lies close to the 55 Cygni locus (see Figs. 3, 4, 6) the supergiant star listed in Table 1 with the strongest Hα-emission (Mendoza and Johnson, 1979).

Current work on Be stars at the University of Mexico is:
1) Light variability on the 13-color (Alvarez and Schuster)
2) Michelson Fourier Spectra.
3) H, He and OI-line strength measurements (Mendoza and Ortega).

More new observations and explanations of the photometric characteristics presented here, most likely, will be treated in this symposium.

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DISCUSSION

Jaschek: Which is the least affected passband by colour excess, both ultraviolett and infrared?

Mendoza: Perhaps the (52-58) colour index of the 13 colour system. For the broad passband photometric system I have assumed that V-R is the least affected by the colour excess.

Kozok: How does a star behave in your colour system, if it loses its emission?

Mendoza: A Be star without emission is not seperated from the normal early type star relationship, when an emission index is used. However it may still keep a colour excess, thus, for instance it behaves like a Be star in the K-L vs. H-K colour diagram.

Traving: Did you include in your program Herbig-Be stars?

Mendoza: No, only Be stars from the Bright Star Catalogue.

Harmanec: Referring to the probable variability of most Be stars on different time scales, it would be important to publish exact J D of every observation even in studies of statistical character. Otherwise an important piece of infromation is lost.

Mendoza: The J D is included in the broad band pass photometry and 13 colour photometry. The J D for the $\alpha(16)$, $\Lambda(9)$ indices will be given on request.

Feinstein: Do the same stars have infrared and ultraviolet excesses?

Mendoza: Be stars have sometimes only UV excess other times only IR excess, and also sometimes both UV and IR excess.

Viotti: In your sample of Be stars you included some objects that cannot be considered properly as Be stars, like P Cygni which has no signs of "photospheric" lines in its optical spectrum, and even β Lyrae. But it could be useful to find out some statistical properties of these stars, in particular to have a basis for modelling, looking at their time variations.