IR PHOTOMETRY OF SYMBIOTIC STARS AT CALAR ALTO OBSERVATORY

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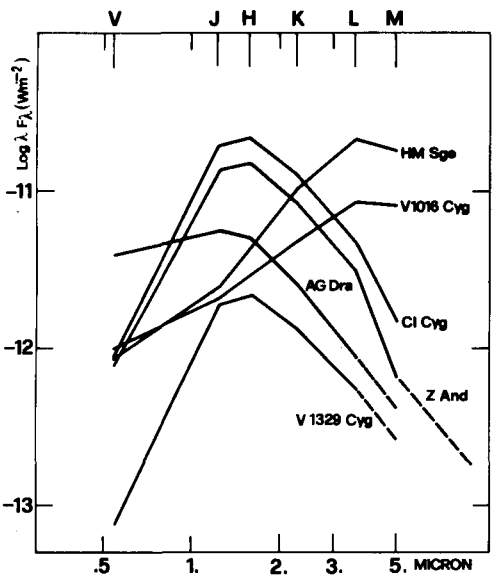

Infrared photometry of symbiotic stars was made with the 2.2 m telescope of the Calar Alto Observatory on July 1981, and are reported in the figure.

Three stars (Z And, CI Cyg, V1329 Cyg) were observed during a phase of minimum activity. We note that they display nearly the same 0.55 to 5 u energy spectrum, which is attributed to the late type star with a colour temperature close to 3000K.

AG Dra shows a similar spectrum from 1.67 u to 5 u, where the cool spectrum dominates, while shortwards there is a large contribution of the "nebular" component, which increased during the recent outburst. The H and K magnitudes are close to those of Swings and Allen (1972) contrary to the result of Bopp (1981).

V1016 Cyg and HM Sge both present a very strong IR flux attributed to dust emission. The IR magnitudes of V1016 Cyg are within the range of variability previously reported. HM Sge is about 0.5–0.9 mag fainter than in June 1977 (Davidson et al. 1978) in spite of the fact that its present visual luminosity is about 0.5 mag brighter.

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DISCUSSION ON INFRARED OBSERVATIONS

Whitelock: It is notable that Allen's IR spectral types of the cool components of symbiotic systems are significantly and systematically later than those determined at shorter wavelengths, as remarked upon by Allen in an earlier paper. This is of importance when considering the galactic population distribution of symbiotic stars.
Allen's classification of the cool component of AR Pav is particularly disturbing. He types it as M6III from which he derives a distance of 10 kpc. This is at odds with the optical photometry (Menzies et al, in press) which suggests that the distance of 3.8 kpc derived by Thackeray and Hutchings is more appropriate.

McCarthy: I suggest that all of us who have occasion to use the important distinction between D and S types among the symbiotic objects, try to imitate the care used by Allen in his text, that is to speak of "D Type Symbiotic Stars" and "S Type Symbiotic Star", to avoid any confusion with the classical stellar temperature sequence, epsecially for S type stars.

Slovak: Andriews (1974 MN 167, 635) estimated $E(B-V) < 0.1$ for AR Pav from studying stars in the nearby field. Yet the IUE spectra, using the 2200 A feature, indicates $E(B-V) \approx 0.30$. Hence a large portion of the reddening may be circumstellar, as opposed to interstellar.

Keyes: AR Pav is well out of the galactic plane, so we would not expect any appreciably large reddening than that observed, even if the object were at great distance.

Michalitsianos: Concerning the 2200 A feature, there may be a significantly different extinction law for material local to the system. How one corrects for E(B-V) separating the interstellar component from the local absorption is not clear for symbiotic stars that appear heavily reddened.

Houziaux: Keyes and Plavec determined a value of $E(B-V)=0.12$ for AG Peg (The Universe in the Ultraviolet Wavelengths, NASA, p.443). Is this determination made from the strength of the 2200 A feature? Was this feature assumed to be entirely of interstellar origin? It would be interesting to know if it is found that the E(B-V)'s determined from such ultraviolet data are always smaller than the E(B-V)'s determined from continuum fluxes in the visible, and if they agree with the E(B-V)'s determined from the emission lines ratios. On the other hand, when a star

shows a strong infrared excess due to dust emission, it is hard to believe that the stellar ultraviolet radiation around 2200 A is not absorbed in the dust envelope.

Nussbaumer: For V1016 Cyg, which displays an intense dust emission, we have determined the reddening in three different ways: 1) from the NeV lines at 1575 and 2973 A; 2) from the HeII recombination lines; 3) from the 2200 A depression. The three methods agree with each other. They also agree with the result obtained from the Balmer lines of H.

Cassatella: About the near infrared molecular absorption bands, I think it is certainly important to have a means of distinguishing between infrared molecular bands produced in the atmosphere of a cool giant, and those produced for example in a molecular cloud in front of it.

Kafatos: I would like to emphasize, and I think Dr. Nussbaumer will say more about it, that there is some evidence that the chemical abundances (particularly C and Si) in the nebular regions of even S-type symbiotics are different than cosmic abundances. In particular the depletion of C and Si may be interpreted as the presence of dust, although it is difficult to understand how dust could survive in the UV rich environment of the symbiotic nebula.

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