between many photometric and CORAVEL observers in order to complete the data.

Another unusual acquaintance was the pre-main sequence star HR 5999 (see Thé and Tjin A Djie, *Messenger* No. **16,** 33, and **23,** 25): One night, we suddenly found ourselves exposing for over half an hour on a programme star! Clearly, something quite exceptional must be happening, and, indeed, until very recently ours were the only plates taken at a deep photometric minimum. From them, it was possible to detect differences between the circumstellar dust and that in normal interstellar matter (*Astronomy and Astrophysics* **113,** 176). The B-type visual companion HR 6000 shows a variety of bizarre abundance anomalies which we are studying more closely at present.

So, although our programme – like many others – involved a large amount of routine work, there was a sprinkling of spices to sustain the appetite. But, of course, we still hope that our results for the 95 % normal stars will also be found useful.

Envelopes Around Carbon Stars

First Spectrophotometric Observations with the New Infrared Photometer at the 1 m Telescope

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Introduction

The new infrared photometer was installed and checked at the 1 m telescope for the first time in June 1982. However, the software facilities being not fully operational, it was then impossible to test it on astronomical observations. The first successful observations with this system were carried out in December 1982. Despite poor weather conditions, some interesting results could be obtained in the spectrophotometry mode, which make this new facility very attractive and worthwhile to be reported as an example of what can be achieved.

Observations

The photometer is mainly similar to the one used with the 3.6 m telescope. It has been described by A. F. M. Moorwood in *The Messenger* (No. 27, March 1982). It was used for these first tests with a bolometer equipped with a circular variable filter (CVF) covering the 8 – 14-μm region at a resolving power ≃ 100.

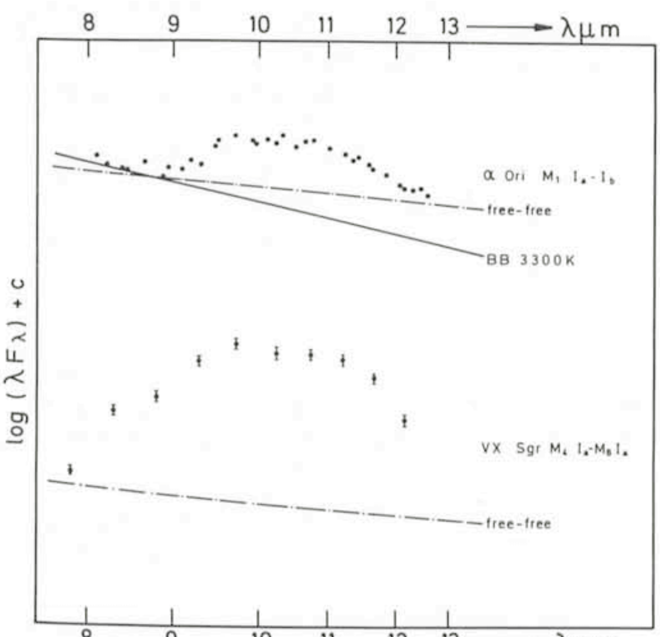

Fig. 1: *Spectrophotometry of representative supergiants showing the 9.7-μm silicate emission band. A 3300° K blackbody and an ionic free-free slope, as suggested by R. C. Gilman, 1974* (Astrophysical Journal, **188,** *87), are included for comparison.*

The principal features readily recognized in that observed spectral range are the silicate band at 9.7 μm (Δλ ~ 3 μm) and the silicon carbide near 11.2 μm (Δλ ~ 1.7 μm). These two bands infer the presence of circumstellar dust envelopes in

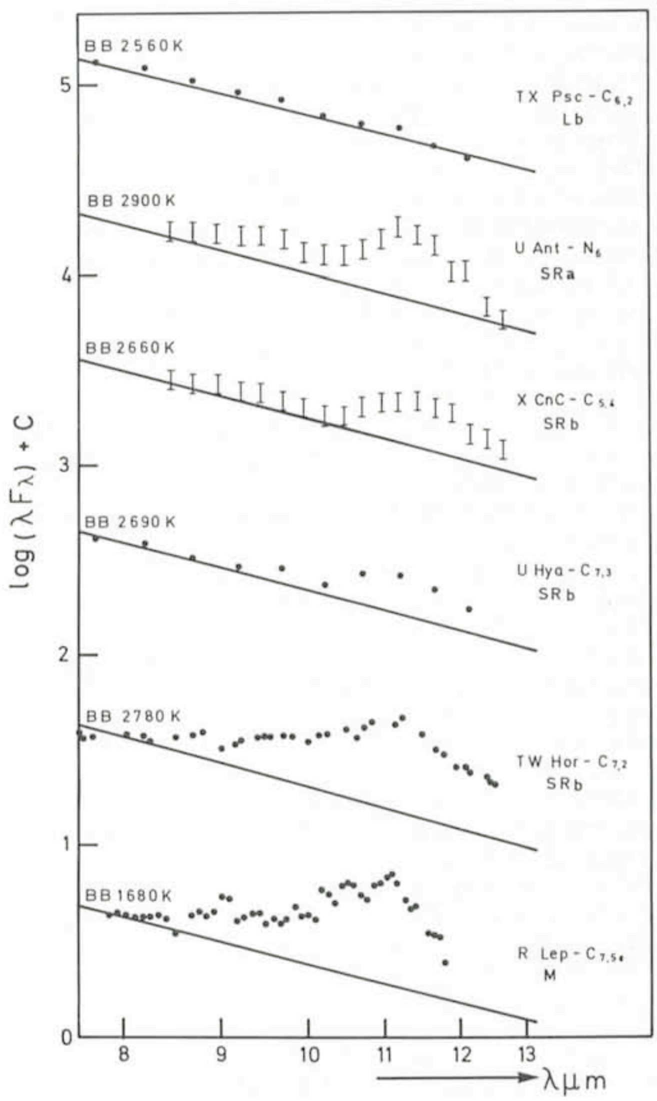

Fig. 2: *Spectrophotometry of a sample of carbon stars, identified by their spectral type and type of variability. Note the dense dust envelope around R Lep and TW Hor.*

late-type stars and have been extensively discussed by K.M. Merrill (IAU Symposium No. 42, Bamberg, 1977).

The observations were carried out during the nights of 4 and 5 December, 1982. The reductions have been made using the stars B1 Ori (spectral type C6.2; $T_e = 2670°K$) and TX Psc (spectral type C6.2; $T_e = 2650°K$) as standards. Both stars are known to lack an envelope and to show no infrared feature in the spectral range observed. The results are shown in Figures 1 and 2. When no error bar is given, the internal accuracy is roughly equal to the size of the plotted points. In 1-min integration time, the signal-to-noise ratio achieved for R Lep ($N = -2.5$) was approximately 100.

The silicate emission band is seen in oxygen-rich stars. Fig. 1 shows the relative $\lambda\lambda$ 8 – 13-μm spectrophotometry of two representative M supergiants, α Ori and VX Sgr. The silicate emission band is clearly seen in α Ori and very strong in VX Sgr, which are well-known results.

The silicon carbide band is seen in carbon-rich stars. The fundamental constituent of the dust in the envelope of these stars is relatively featureless (Forrest et al., 1975, *Astrophysical Journal* **195,** 423) and is generally considered to be condensed carbon. That carbon is mixed with SiC, gaseous CO and other metallic molecules in an expanding envelope of which the principal indicator is then the emission due to the SiC.

Fig. 2 shows the relative $\lambda\lambda$ 8–13-μm spectrophotometry of a sample of carbon stars, together with the appropriate black-body slopes for each star. Some of the stars of the sample were already known to have an envelope (X Cnc, U Hya and the famous Mira variable R Lep). The detection of an envelope (X Cnc, U Hya and the famous Mira variable R Lep). The detection of an envelope around U Ant is new, however, as is the detection of a very dense one around TW Hor. This latter envelope deserves special mention regarding the controversy on its reality, as discussed by P. Bouchet et al. in the same issue of *The Messenger.*

Two other carbon stars, not known to bear an envelope, were also observed and were not included in Fig. 2: W CMa (spectral type R_8, variability type L_b), which did not show any silicon carbide emission, and AB Ant (spectral type N_o, variability type SR_b), which does seem to show such emission. However, the S/N in the latter case is too small to lead to a definite conclusion.

Conclusion

Envelopes have been detected around the carbon stars U Ant and TW Hor and, probably, AB Ant, while the spectrum of W CMa does not show any SiC signature. The existence of envelopes around X Cnc and U Hya has been confirmed, and our results for the M supergiants α Ori and VX Sgr and the carbon-Mira R Lep reproduced perfectly those obtained by Merrill (1977) and previous observers.

These results should give a good notion about the exciting new infrared facilities offered henceforth at the 1 m telescope on La Silla. It should also be emphasized that these observations were made during the first observational test of the equipment and, as such, the signal-to-noise ratio achieved in our measurements should further improve in a very near future, when the system becomes thoroughly operational. Special thanks should be given to the ESO staff in Garching who made the project a reality, namely A.F.M. Moorwood and A. van Dijsseldonk, and the technical staff at La Silla, especially J. Roucher and F. Gutiérrez, who assisted and helped me with their active efficiency during these first tests. I would like to thank also Miss Victoria Tapia who made the drawings.

Chemical Composition in the Small Magellanic Cloud

R. Foy, Observatoire de Calern

The Magellanic Clouds are the two nearest galaxies; the well-known great Andromeda Nebula M31 is about ten times farther away than the clouds. They are much smaller than M31, but their nearness justifies the large amount of observations devoted to them, particularly at La Silla. They provide us the best suitable tests at least for two fields of theoretical astronomy.

The first one concerns models describing the evolution of the mean chemical compositon in a galaxy. The nuclear reactions which produce the energy radiated by stars lead to the synthesis of heavy elements (i.e. heavier than helium). Part of these heavy elements are then ejected in the interstellar medium by way of stellar winds or novae or supernovae explosions. Then the enriched interstellar matter is recycled to form a new generation of stars. This behaviour is modelled as a function of various parameters. The total mass of the galaxy, and the ratio of the mass of the interstellar gas to the mass condensed in stars are two major parameters in these models. The large and small clouds have different masses, 6×10^9 and 1×10^9 $M_\odot$ respectively, which is small compared to the mass of our galaxy (about 150×10^9 $M_\odot$).

The ratio mass of interstellar gas/mass of stars is also different (5 per cent in the LMC, and 30 per cent in the SMC). Therefore, models of chemical evolution of galaxies can be applied to two very different objects which are also very different from our galaxy. Obviously a crucial check for these models is to compare the predicted chemical composition with the observed one.

Before discussing how the chemical composition in the clouds can be determined, let us briefly mention the second main interest of the clouds: the kinematical interaction between galaxies. The clouds are gravitationally linked to the Galaxy. Tidal effects due to the large mass of the galaxy are expected to be a major factor in the dynamical and kinematical evolution of the clouds, at least when the "first close encounter" between the clouds and our galaxy occurred, presumably, 1 to 3×10^8 years ago. Observational tests in this field are the determination of the three-dimension morphology of the clouds, which is still much debated, and the study of the velocity field distribution, from radial velocity measurements.

(A) From Which Objects Can We Determine the Chemical Composition?

Traditionally, chemical compositions are determined from high-dispersion stellar spectra, but another interesting way is the spectroscopy of bright gaseous nebulae: H II regions, planetary nebulae or supernova remnants.