the well-known cluster M 7 (NGC 6475) and two rather loose clusterings in the Milky Way, the physical reality of which is almost certain although not convincingly confirmed. Attempts have been made to plot the relevant part of the HR diagram on a format where the main sequence should be a straight line. The inclination of this line is indicated in the figures. In no case the connection to the line seems to be particularly nice. Before blaming the multiplicity we have to make a few reservations, of course. Firstly, it is reasonable to expect a few background or foreground stars in the material. Secondly, the main sequence has a finite width.

However, as the multiplicity of a number of stars has been revealed by their spectra, obtained with the coudé spectrograph of the 1.5 m ESO telescope (dispersion 20 Å/mm) and at the Observatoire de Haute-Provence (10 Å/mm), we know that it is there and that it must contribute to the observed scatter. The question then is: Are there no possibilities to correct for the effect of duplicity? Superficially it sounds relatively simple but in practice it is generally not simple at all. In the idealized case, when a system is composed by two identical stars, you just add 0.75 to the observed V value. The problem is that it is never possible to be sure that there are really two identical stars. In most cases one has only access to the colours and any observed total colour of a system can be synthesized by a multitude of combinations of various stars. Also in cases when spectra are available, there is no unique component composition behind every observed spectrum and, in addition, the result of the classification of a composite spectrum is highly dependent on the actual classification criteria. The most crucial fact is that the revealed number of components is only a lower limit so that the true number, as mentioned above, may be considerably larger. Fig. 3 shows a simulated case of a colour-magnitude diagram on the same format as the diagrams in Fig. 2 in which a number of multiple stars with typical component combinations are illustrated.

The study of double stars, triple stars, quadruple stars or stars of still higher degree of multiplicity is thrilling and interesting indeed, but when they appear with too high a frequency in stellar clusters, they definitely constitute a nuisance to the observer.

Exciting Stars in the Omega Nebula

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Every astronomer has his favourite object, which he studies sometimes throughout many years. Whenever he gets a few nights for observation he looks at "his" object to see how it is doing. My favourite object is the Omega Nebula, also known as M 17.

M 17 is one of the brightest H II regions in our galaxy. Numerous observations at radio and infrared wavelengths have shown that this complex, associated with a huge molecular cloud, is a site of recent star formation. Due to the large amount of interstellar dust within and around the H II region the exciting stars responsible for the visible nebula could not be identified uniquely. In 1976, I started an investigation of the stellar content of M 17 by photometry of more than 100 stars to be seen within the area marked in Fig. 1. This photometry—which was performed at the Calar Alto Observatory in the wavelength range from 0.3 to 0.9 μm—revealed that a large number of young massive O and B type stars have been born within the region. Some of the objects, however, had energy distributions which could not originate from "normal" stars: according to the spectral type derived from the UBV data, i.e. from 0.3–0.55 μm, the measured brightness at R (0.7 μm) and I (0.9 μm) considerably exceeded the expected values. These IR excesses could be produced either by circumstellar dust shells or by gaseous envelopes. To investigate this problem (and some others) I applied—for the first time—for some nights at the ESO 1 m telescope on La Silla with the IR photometer. Fortunately, some time was allocated to my programme, and I had the opportunity to observe M 17 for about 7 hours per night, as it passed through the zenith. For a northern hemisphere observer, who is used to observe the Omega Nebula for only 2 or 3 hours and even then always close to the horizon, this is an unforgettable event. Most of my favourite stars were too faint to be seen in the eyepiece of the IR photometer, but with the help of the experienced night assistant R. Vega, I was able to pick them up at 2.2 μm by scanning the telescope around the expected positions and by watching the equipment to show a signal. Due to excellent weather in August 1981 I could measure all of my interesting objects from 1.2 to 3.5 μm. Surprisingly, the objects became still brighter with increasing wavelength, i.e. the IR excesses already present at R and I got even larger: The faint optical stars had turned into strong IR sources.

Back in Germany, I tried to understand the new observations and fitted black-body curves to the energy distributions between 1.2 and 3.5 μm. The result was that only extremely

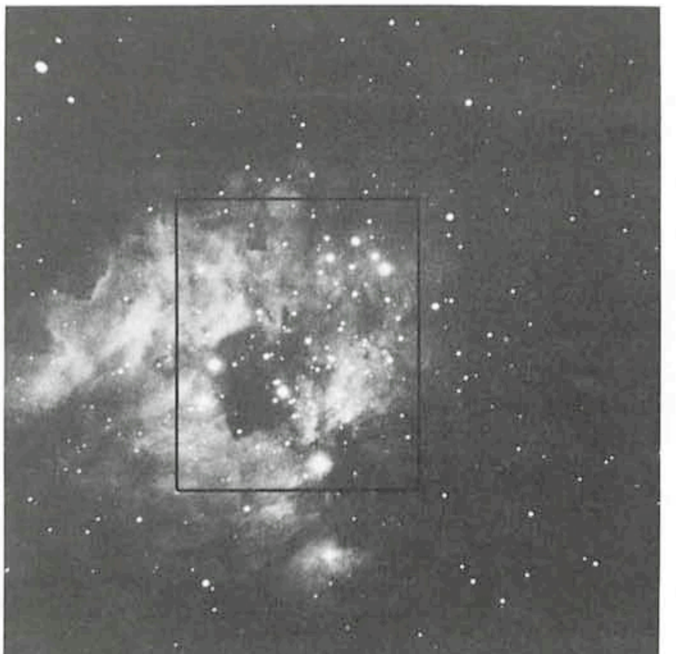

Fig. 1: *The Omega Nebula at 0.9 μm. This photograph was taken with an image-tube camera attached to the 1.2 m telescope at Calar Alto. North is at the top, east to the left. Inside the marked area many young stars are embedded in the dust.*

hot dust shells with temperatures of 1,800–3,600 K could explain the measurements. Some colleagues argued that also small H II regions around the stars might be responsible for these IR excesses. So I tried another approach towards the solution of the problem a year later. This time I intended to get some spectra of the stars, to learn about their temperature and mass. Furthermore, I wanted to observe the energy distribution out to 20 μm; this would have answered the question whether the stars are still embedded in dust shells. Therefore I submitted two proposals for spectroscopy and IR photometry, respectively. "Due to heavy demand on the 3.6 m telescope" I got no time for spectroscopy but 7 nights for photometry.

July 1982 was one of the worst observing runs I have ever had: blue skies throughout the day and complete cloud coverage during the night. I could not open the dome for a single hour and left La Silla without any IR observations but with a large number of colour slides of amazing sunsets from these days. I had to wait a whole year before I could "see" my objects again. The application for another IR observing run at the 1 m Telescope was successful and I went to La Silla at the end of August 1983.

Measurements between 5 and 20 μm require excellent weather conditions, a sensitive bolometer and a night assistant familiar with the equipment; a lot of constraints, but I was lucky to find all requirements satisfied. It was possible to observe during 3 nights with a newly developed Ge-bolometer and with the help of R. Vega. After a short time we found that at 10 and 20 μm my objects were so bright that they might well have served as standard stars. This clearly indicated that a lot of hot dust around these stars must give rise to the large IR excesses. Within one night the objects had turned into some of the most heavily reddened visible stars known today. By means of the new infrared equipment on La Silla it was also possible to search for hydrogen recombination lines at 2.2 and 4 μm. They should show up if the stars had formed small H II regions in their environment. No such lines could be found, and that was a further indication that the IR excesses are mainly caused by circumstellar dust.

The observations described so far, i.e. the energy distribution from 0.3 to 20 μm, are shown for a typical object of the sample (C 24) in Fig. 2. For illustration the spectrum of a B2 V star with 6.4 mag of visual extinction (these values have been derived from the UBV photometry) and two black-body curves for temperatures of 1,100 and 170 K have been included. Obviously, these fits do not reproduce the observations very well, but they may help to understand the objects qualitatively: the visible light which is heavily reddened comes from a young luminous star, whose spectral type is uncertain. This star is still embedded in its protostellar dust shell and has not yet formed a detectable H II region. The radiation at IR wavelengths comes from the hot dust shell, whose temperature varies with the distance from the star. The inner regions are comparatively hot (e.g. 1,100 K) whereas the outer regions are "fairly cool" (e.g. 170 K). If this interpretation is correct, we are witnessing a very early short-lived stage of stellar evolution. Additional support for this idea comes from the location of the objects within the M 17 complex. In fact, they are all situated near the interface of the H II region and the molecular cloud, probably indicating that they belong to the youngest generation of newly born stars within that complex. Slightly older stars are found inside the H II region itself and even older stars at larger distances from the complex. In that sense M 17 would be an example of "sequential star formation", where stellar winds of newly formed stars compress the interstellar medium in their surroundings and thus give rise to a subsequent star-forming process.

These far-reaching conclusions need, of course, additional observational support. For that purpose I applied again for telescope time on La Silla to perform the necessary spectroscopic observations. This time I was successful. Three nights have been allotted to my programme at the new 2.2 m telescope during June 1984. Then I hope to clarify the physical nature of the embedded stars. During five additional nights of IR observations in the same period I want to investigate whether the dust shells are very compact structures or possibly extend to larger distances from the stars. If the objects continue to give me further surprise during future observations I shall still have to spend quite a few hours at the telescope until I may say: "Now I do know my objects."

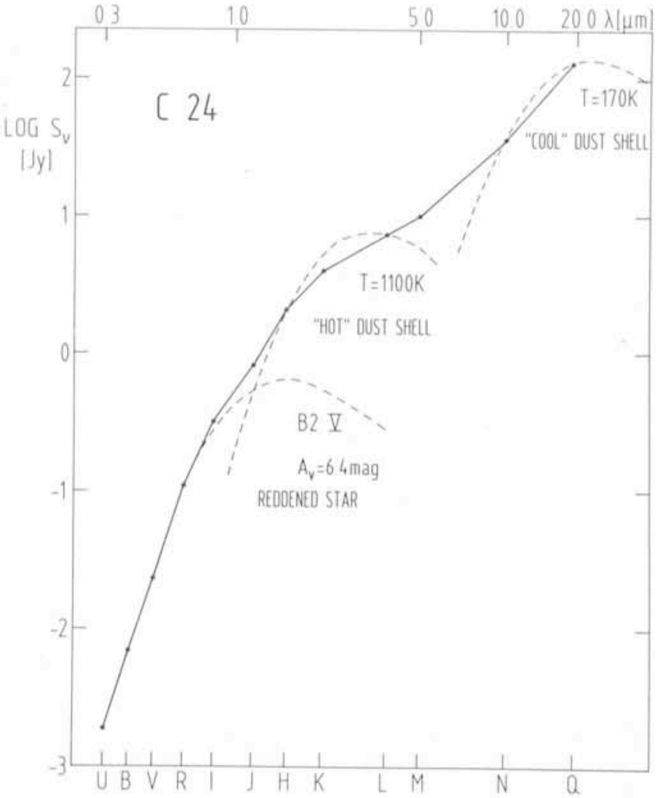

Fig. 2: *The observed energy distribution of one of the objects with strong IR excess. Between 0.3 and 0.9 μm the data points can be fitted by a B2V star with 6.4 mag of visual extinction. At longer wavelengths a circumstellar dust shell of various temperatures might explain the observational points. For illustration, two black-body curves of 1,100 and 170 K are shown.*

Visiting Astronomers

(April 1–October 1, 1984)

Observing time has now been allocated for period 33 (April 1–October 1, 1984). The demand for telescope time was again much greater than the time actually available.

The following list gives the names of the visiting astronomers, by telescope and in chronological order. The complete list, with dates, equipment and programme titles, is available from ESO-Garching.

3.6 m Telescope

April: Ulrich / Iye, Zuiderwijk / v. Paradijs, Hunger / Heber / Drilling / Kudritzki, Zuiderwijk / v. Paradijs, D'Odorico / Iye / Bouvier, Zuiderwijk / v. Paradijs, Iye, Zuider-