Fig. 1: *The positions of the 10 and 12 μm observations in the supernova remnant N63A and the adjacent H II region are indicated with crosses on this sketch from an $H\alpha$ photograph by B. Lasker. The circle shows the size of the observing diaphragm. The probable detection was obtained in the south-east knot of the SNR.*

homogeneously the surface brightness is distance-independent. Finally, the specific properties of the three LMC remnants, N49, N63A and N132D, appear more favourable to the infrared emission than those of most galactic remnants in the southern hemisphere. They are the three brightest X-ray SNR in the LMC and among the brightest X-ray sources on an absolute scale in that galaxy. They have been observed with the Einstein Observatory High Resolution Imaging instrument (HRI) and the Solid State Spectrometer (SSS). When these results will become available we will know both the distribution and temperature of the hot plasma. As for the optical observations, it was already known from the work of, e.g., Dopita (1979, *Ap. J. Suppl.* **40,** 455) that the expansion velocity of the optical filaments is between 100 and 200 km/sec. In N132D, fast moving ($v \sim 4{,}000$ km/sec) knots of emitted materials are also observed. It has been suggested that some of these condensates represent processed material from the supernova explosion, where dust formation would be enhanced.

We observed three positions in N132D and N63A and two positions in N49. At one position in N63A (see Fig. 1) a flux of 130 mJy was measured at a 2.6 σ level. At all other positions no detection was obtained at a 2 σ level (50–80 mJy).

Since the properties of the dust are not defined univocally, we need to know with reasonable accuracy at least the temperature and density of the gas which heats it, to interpret the results. A detailed comparison of theory and IR observations must then wait for the publication of the Einstein Observatory results. However, by using the preliminary estimates which are available and, e.g., the theoretical formulation by Dwek and Werner (1981, *Ap. J.* **248,** 138) it is already possible to estimate the significance of our data. By assuming $\log T = 6.8$ and $n_e = 5$ for the hot gas we derive a grain temperature between 80 and 300 °K depending on the type and size of the grains. At the distance of the LMC, 130 mJy then imply 6.5 $M_\odot$ of dust in the first case, 6×10^{-3} $M_\odot$ in the second. The first appears a much too large value to be acceptable.

The upper limits are also significant. For the higher grain temperature, 50 mJy imply a mass of dust of less than 2×10^{-3} $M_\odot$, and a gas to dust ratio larger than 10^3.

We stress again that these values are only indicative and an estimate of the total mass of dust and of its properties is premature. An additional uncertainty is in the geometrical correction to apply to a partial observation to get the integrated flux. It was pointed out in the preliminary discussion of Long, Helfand and Grabelsky (1981, *Ap. J.* **248,** 925) that the X-ray diameters of the LMC supernova remnants are significantly larger than the optical ones. If heated dust is present whereever hot gas is observed, the total infrared flux may be larger than expected.

From the point of view of the infrared observations, we hope in the near future to confirm the detection at 10 μm and extend the survey to the regions which do not emit optically but are visible in the X-ray maps. Under optimum observing conditions it should be possible to lower the σ level by at least a factor of two and thus placing even more stringent limits on the dust content. It would be also quite useful to complement these results with observations at longer wavelengths with a future space-operated facility to detect or rule out the presence of a significant amount of dust at lower temperature.

If the dust behaves like the theoreticians think it should, the infrared observations of SNR seem indeed a useful way to investigate its presence and its properties.

A Long Period Eclipsing Binary Project – Five Years of Observations at ESO

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The star HD 161387 first caught our eyes when we were reading an article on ζ Aurigae stars by K. O. Wright in *Vistas in Astronomy* No. 12. This was some 8 or 9 years ago.

ζ Aurigae stars are eclipsing binaries formed by a cool supergiant K star and a very much smaller and hotter main-sequence (more or less normal) B star. Out of eclipse the B star dominates the blue spectral region, but a pure K-type spectrum is found in eclipse. The drastic spectral changes for HD 161387 can be seen in Fig 1c and 1d. Periods for these binaries are in the range of 2 to 10 years. The general benefit of ζ Aurigae star studies is the possibility of direct determination of physical parameters of the components such as masses and radii. In practice, what one does observe is the change in radial velocity of the stars as they orbit around their common centre of gravity and the change in magnitude as the light from the B star is eclipsed by the K supergiant. There is also the possibility of studying the structure of the atmosphere of a K supergiant manifested by spectral changes occurring as the point light of the B star shines through the outer parts of the K star close to the total eclipse. Besides ζ Aurigae itself only the stars 31 and 32 Cygni have been studied in greater detail.

Looking through the literature we found that not very much

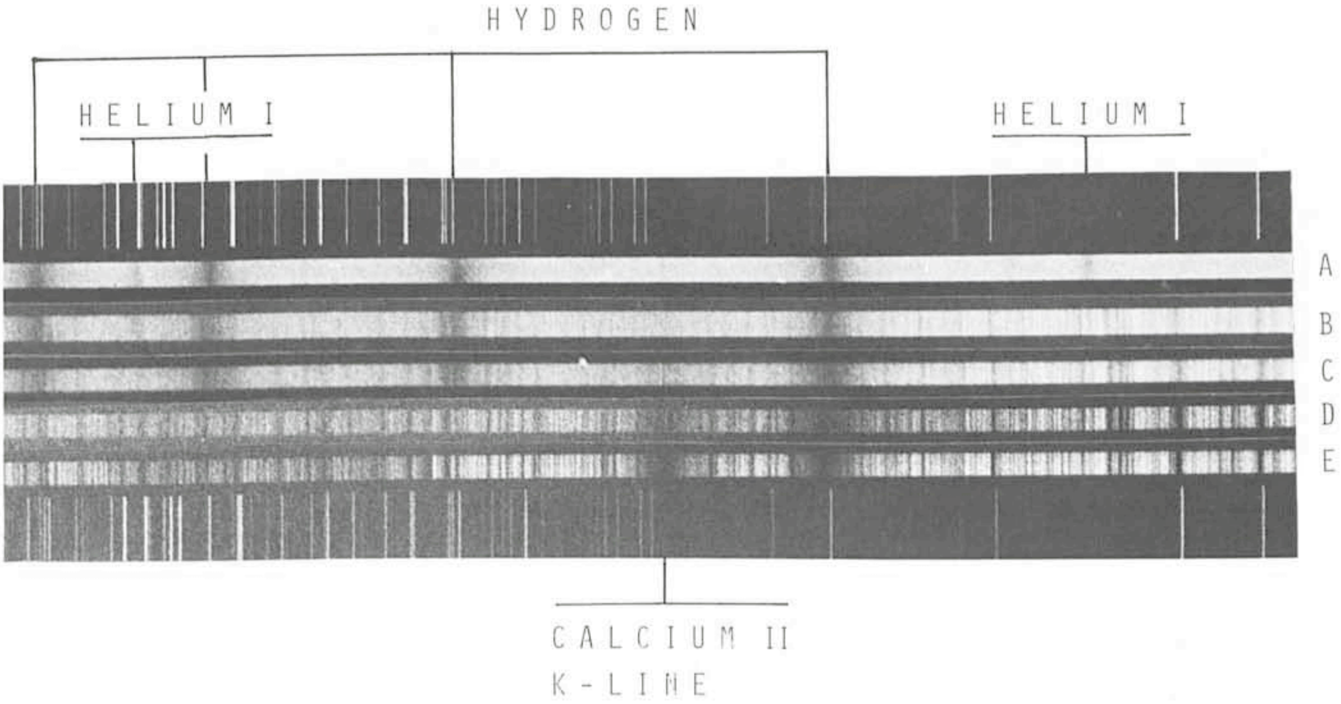

Fig. 1: *A: The B star ρ Aurigae.*
B: The K + B star ζ Aurigae out of eclipse.
C: The K + B star HD 161387 out of eclipse.
D: The K + B star HD 161387 in eclipse, only the K star spectrum is visible.
E: The K star β Apodis.
The spectra A and B were obtained at the Observatoire de Haute-Provence, the spectra C, D and E at ESO. Original dispersion: 20 Å/mm.

had been done on HD 161387 by others lately. There was of course a fundamental paper in the *Harvard Bulletin* 914 by Swope in 1940 (when neither of us was yet born) giving the mean light-curve, period (936 days) and duration of the eclipse (56 days). There was also a spectral classification (K5 Ib + A) made by Popper in 1948, and a warm invitation by Fracastoro in 1956 to all observers of the southern hemisphere to observe this star. A HD 161387 project could therefore certainly be motivated scientifically:

1. Few similar objects had been investigated before.
2. More basic data of great astrophysical importance could be expected.
3. The techniques of observations and reductions were all well established, easily understood and inexpensive.
4. The thorough investigation by Swope gave a solid foundation for further research.
5. A HD 161387 project had been recommended in the literature.

In Stockholm, at latitude 59° north, HD 161387 at best reaches 5° above the horizon close to our midsummer twilit midnight. Was this a star for us to observe?

There were some other major objections to embarking on a project on HD 161387 that first had to be thoroughly looked over.

The first one was time. The period of the star is around 2.5 years and to get an acceptable coverage of all phases of the period it is necessary to observe it for at least 5 years. This should be compared to the ideal thesis-making time of 4–5 years. To the devoted ones, such an objection is however immorally pragmatic. Besides, one of us (Sundman) already had her Ph. D.

Secondly, the frontier of binary science long since swept over the long-period binaries and the general interest is now focusing on short-period contact phenomena. This objection, however, is invalid when practising science as an art.

The only really deterring objection was the prospect of having to cross the Atlantic time and again for half a decade: inconvenient, expensive and inefficient. Nothing would ever have come out of it had it not been for ESO staff—astronomers and administrators—and some visiting astronomers, who put invaluable effort into the project.

Observations

The observations started in April 1976 at the coudé spectrograph of the ESO 1.5 m telescope and were in the beginning carried out mostly by visiting astronomers. Later the need for a coordinator at La Silla was felt, and first Jean Surdej and later Patrice Bouchet made much of the spectroscopic observations. Plates were obtained at 20 Å/mm both in the blue and the red spectral regions.

A first eclipse could be expected in the beginning of October 1977. At this time of the year HD 161387 is difficult to observe since it is close to the horizon and setting early in the evening. We felt, however, that it would be nice to be sure that the star was still on the Swope schedule and we were glad to get a rough confirmation of this by occasional photometry carried out mainly on the ESO 50 cm telescope during August–November 1977.

In the beginning of the spectroscopic part of the programme we applied for a number of fractions (2/3) of nights spaced all through the season of possible observation (March–October). Then nights were shared with other observers. Later, on the initiative of the programmes committee, whole nights were assigned to the project, the reason probably being a need for unambiguity of responsibility. This was an advantage of course—however coupled to an increased vulnerability to bad weather. It opened the possibility of observing other objects similar to HD 161387 at times when our main programme star was below the horizon, mainly at the beginning and end of our observing season.

As the years went by, more plates were accumulated and the next eclipse of HD 161387 in May and June 1980 was in part covered spectroscopically and photometrically though observations were hampered by the weather conditions of the season. The observational part of the programme ended in March 1981, 5 years after the first plates were obtained.

During these years of observations, we made only provisional evaluation of the incoming material, enough for a correct direction of the project. There were many reasons for this. The material needed homogeneity of reductions. We had other obligations of official and private nature. But the main reason was our lack of financial support. Not until July 1981 came the opportunity to put a major effort in the reduction work which is now well under way. Then we found that one of the spin-off stars of the project was very interesting:

The BM Eridani Saga

BM Eridani is one of 2,017 variable stars brighter than the 10th magnitude which were studied from 1938 onwards by the Gaposchkins. Sergei Gaposchkin reports in *Astron. J.* **52,** 43 (1946–47) about a drop in brightness of a star "in the field of YY Eridani" during 1944. It got the variable name BM Eridani. The change in photographic magnitude is approximately 0.8 magnitude: from 8.5 to 9.3. In December 1944 Gaposchkin got a spectrum of the star and found it to be an M6 giant. There was no trace of a secondary spectrum.

Fig. 2: *Astronomer in Library – a most powerful instrument for past observations.*

In 1953 Gaposchkin published in the *Harvard Annals* the results for the eclipsing binaries. There are 281 stars with an average of 1,000 observations for each binary. Here we find BM Eri which had been followed on Harvard patrol plates from March 1888 to December 1945. Altogether 1835 measurements were then available and Gaposchkin concludes that the star had one single minimum in 1944 lasting for less than 321 days. Only the first part of the eclipse could be followed and when the star was observed again the eclipse was over. He gives the period "over 53 and possibly over 57 years".

If there really is a period! If this in fact is an eclipsing binary! But Gaposchkin had some good reason for believing so. The shape of the light-curve looks typical. There is a flat minimum indicating that the secondary component is totally eclipsed. There is an ingress phase lasting for about 25 days which is consistent with a model of an extended atmosphere of the M giant gradually dimming the light of a much smaller star. Gaposchkin had an outstandig experience in handling the plate material of the Havard variable programme, so there is good reason to be confident in his judgement that the drop in brightness is real and not a construction from poor data. It is true that intrinsic variations of M stars are frequent and later BM Eri was found to vary with an amplitude of 0.2 in the V-magnitude. But 0.8 in the blue, that is too much. Still there is no trace of any other star in the spectrum. From the light-curve one would expect a hot star of approximately the same absolute magnitude as the primary. Then why is it not seen?

We went searching the literature for more photometric work on this star. There were not many, but the ones we found turned out to be very interesting. They can be summarized in the following table together with a recent observation made on our request.

Year of observation	Magnitude			Reference
	V	I	K	
1966		4.48	1.28	Neugebauer, Leighton, Two micron survey, NASA 1969
1970	8.06	4.46		Stokes, *Mon. Not. R. Astr. Soc.* (1971) **152,** 165
1972	7.29			Hilditch, Hill, *Mem. R. Astr. Soc.* (1975) **79,** 101
1981			1.27	Fridlund, private communication

Strangely enough we find that the V-magnitude differs by about 0.8 magnitudes between the 1970 and the 1972 measurements. Was BM Eri in eclipse during the observations of 1970? Without the I-magnitude being affected at all, and with a drop in the V-magnitude equal to the photographic magnitude change during the 1944 eclipse? The 1972 observers make no reference to the 1970 one, so the discrepancy has probably not been noticed before. Somewhat astonished, we concluded that we had found an eclipse in the library (Fig. 2). However, the conclusions should not be drawn too hastily since the number of observations is low. Luckily we had an almost immediate opportunity to get some more: In December 1981 Malcolm Fridlund from the Stockholm Observatory obtained photometric measurements in the infrared. While still awaiting the final reductions, we find that the K-magnitude is very close to the 1966 value and from the other colours we make the preliminary conclusion that our invisible secondary star is exactly that: not

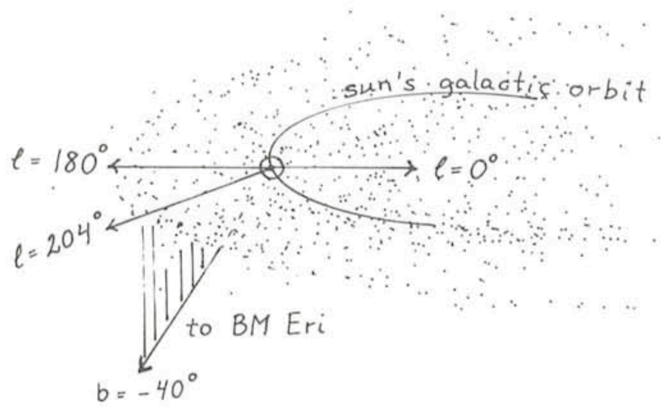

Fig. 3: *BM Eridani is at least 400–800 pc off the galactic plane, a population II giant of high luminosity.*

in the visible but showing up as embedded in dust, radiating in the infrared.

Then what kind of star could that be? BM Eridani is situated at least 400 pc below the galactic plane (Fig. 3). It is probably an "old disk" star and the companion to the M giant could not be too young. That is what can be said for the moment; we will be able to present an estimate of the absolute magnitude from the width of the emission in the K-line—the Wilson-Bappu effect—and also the radial velocity of the system. Most probably the long period and the slow internal motions of the components in this phase will not allow radial velocity changes with time to show up in our present data.

The reason for including BM Eridani in the observing programme was its status as a long-period eclipsing binary, but that is not the whole truth: Another good reason was its situation in the sky, nicely observable when HD 161387 was not up. It just happened like that.

> "Tracking something," said Winnie-the-Pooh very mysteriously.
> "Tracking what?" said Piglet, coming closer.
> "That's just what I ask myself. I ask myself, What?"
> "What do you think you'll answer?"
> "I shall have to wait until I catch up with it," said Winnie-the-Pooh.
> (A. A. Milne, Winnie-the-Pooh, 1926)

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It is a pleasure to thank the visiting astronomers and ESO staff who made the HD 161387 observation project possible:

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Frame inspired by the stone paintings in the surroundings of La Silla.

The Photometric Reduction Service on La Silla

R. Barbier, ESO-La Silla

Observing with a photometric telescope needs interaction from the astronomer: he is the one who can exercise the soundest judgement on how to proceed with his programme. He will for instance decide to change instrumental parameters such as integration time, sequence of filters, diaphragm . . ., or to reobserve a given object which was not measured accurately enough or which shows interesting variations.

Those decisions are reached after a careful examination of the results. Raw numbers, such as counts, do not lend themselves easily to the operation but have to undergo a prior transformation which, in its simplest form, will yield on-line magnitudes that may include or not corrections for zero-point and average extinction. That kind of facility is included, for ESO telescopes, in the data-acquisition programme. An off-line service is also offered to the visiting astronomers to La Silla, the "quick-look reductions". Its main goal is to provide the observer with data where systematic trends coming from non-standard extinction and colour transformation have been removed, thus giving a much clearer idea of what the results are and making the previously mentioned decision-taking procedure easier.

During daytime, an operator saves the raw data from the previous night onto magtape and disk and reduces them, abiding by any special wills expressed by the astronomer. This is by no means an easy task, above all when some data come to him without any indication about source, telescope, photometric system used, names and magnitudes of standard stars . . . For best efficiency, the astronomer should either contact the operator and explain his needs to him, previous to the observations, or go to the computer centre and reduce the data himself, alone or with the help of the operator. Anyhow, if the astronomer is not present during the reductions, they should normally not be thought of as being final. Definitive ones are to be made by the user either in his home institute or at the end of his run on La Silla, using there the available programmes.

The procedure thus briefly outlined has now been in use for several years, since 1974 when Frank Middelburg wrote "REDUC". Many thanks are certainly due from the users' community to the past and present operators, Francisco Browne, Saul Vidal, and Raimundo Arancibia, for the numberless hours they spent since then, giving the visiting astronomers that service.

REDUC can handle the main photometric systems that are used on La Silla, i.e. UBV, uvby, H-Beta, VRI. However, some observers are coming with their own filters for special applications, and new photometric systems are being installed with