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The Southern Crab

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Heavenly Crabs

The object under scrutiny in this article – a suspected symbiotic star with the prosaic name of He2-104 – looks far more like a crab than the Crab nebula. A quick look at Figure 1 will convince you that the name Southern Crab is most suitable and fully deserved! Our search for such objects was started by selection of special cases in the adapted emission line ratio diagram used by Schwarz (1988). Four possible proto-planetary nebulae were found of which He2-104 is by far the most spectacular example.

A recent literature search on He2-104 yielded 36 references. The object was classified by 17 authors as a planetary nebula (PN), by 14 as a symbiotic star, and 5 simply referred to it as an emission-line star. The spatial extent was in all cases recorded as less than 5″. Recent distance determinations based on the Cudworth method gave 6 to 7 kpc.

Near IR photometry was used to classify the object as a possible symbiotic star containing dust (Allen, 1984) and a recent IR photometric period of 400 days has been found by Whitelock (1988), indicating a Mira-like star.

No emission-line variability has been observed in the spectrum which shows lines up to [FeVII], [ArV] and HeII but also low-excitation lines like [SII], [NII] and [OI]. Generally, the spectrum is that of a dusty symbiotic star and is quite similar to that of H1-36 (Allen, 1983).

He2-104 is in the IRAS point source catalogue as 14085-5112 and has fluxes on the order of 10 Jy up to 100 micron.

New Observations

Inspection of Figure 1 shows that the object extends over about 75″ or is 15 times larger than previously thought. The three images in the light of the Hα 6563, the [NII] 6584 and the [SII] 6731 lines clearly show that the structure is different in each of the emission lines. Excitation and therefore density and

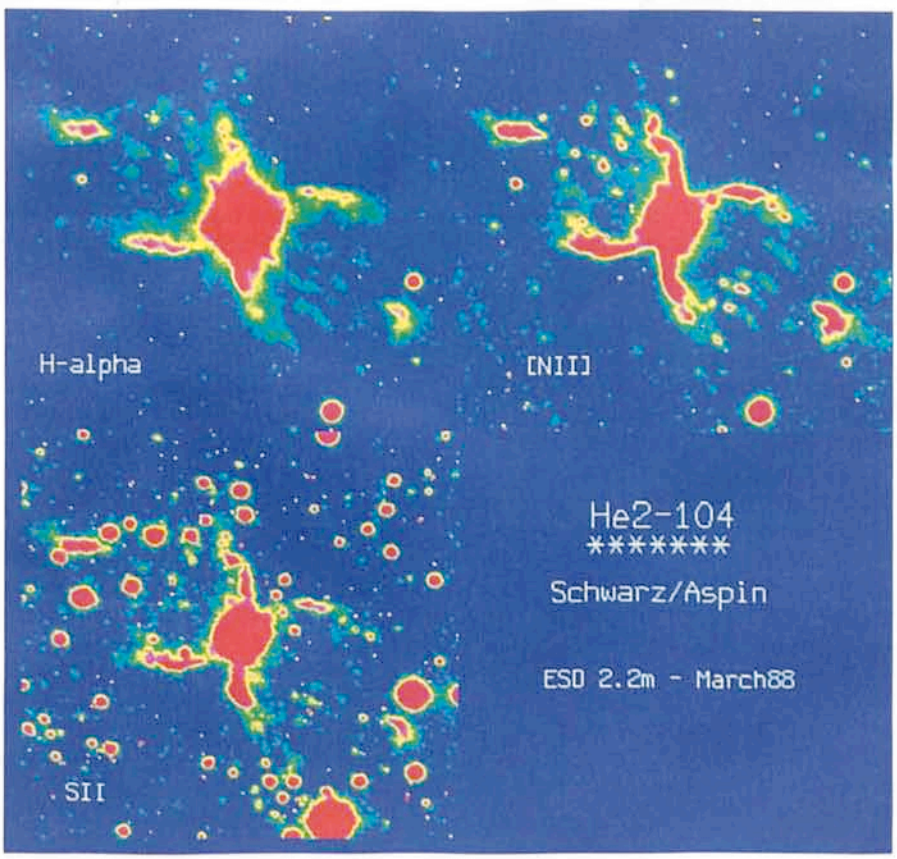

Figure 1: *False-colour images of He2-104 in the light of Hα 6563, [NII] 6584 and [SII] 6731. They have been taken with the adapter/CCD at the 2.2-m telescope at La Silla in March 1988. The exposure times are 30 minutes for the Hα and [NII] images and 1 hour for the [SII] frame. Data reduction was done at ESO, La Silla, and at the JAC, Hawaii.*

temperature vary throughout the nebula.

We interpret the object as follows. The "legs of the Crab" are bubbles formed by the red giant primary stellar wind which due to the presence of a dust torus cannot escape in the equatorial direction. The Herbig-Haro type blobs at either end are moving shocks due to a highly collimated wind from the hot secondary which is surrounded by a thick accretion disk. For more details on this kind of scenario, see Morris (1987).

High resolution spectra taken at the 2.2-m telescope at La Silla show that the radial velocity of the central object is −139 km per second. The blobs have velocities of −36 and −235 km per sec. indicating that they are moving away from the central star with at least 100 km per second. Since the object looks like being near the plane of the sky, the space velocities could be as high as 400 to 600 km per second.

Photometry in the visual and IR combined with the IRAS data have allowed us to determine the energy distribution of He2-104. From this curve the bolometric magnitude has been derived and when the fluxes are de-reddened with a measured A_v of 1.5 magnitude and assuming that the central star has a bolometric magnitude of −2 we arrive at a distance of 1 kpc. This places the object much nearer than previously thought and this is also borne out by using arguments on the size and mass limits of the ejected nebula by comparing with typical values for PNe.

Other independent estimates of the distance of He2-104 can be obtained by comparing the absorption with the 21-cm hydrogen flux in the same direction. A distance of more than about 1-2 kpc is also made unlikely by considering that with a galactic latitude of 10 degrees, the object would be out of the plane by about 1.2 kpc, assuming a distance of 7 kpc.

With our derived distance of 1 kpc the Herbig-Haro objects are at a distance from the central object of 0.2 pc giving, with the measured expansion velocity of 100 km per second, a dynamical age of the nebula of 2,000 years. Since we have ignored any projection effects on the radial velocity, this represents an upper limit to the age which could actually be as low as 300–500 years.

The Future

Clearly, more work needs to be done on this fascinating object: we have planned SEST observations to look for the presence of an SiO maser, high resolution spectroscopy to determine the velocity structure in detail and photometric imaging to find the temperature and density structure of the nebula.

IR spectrophotometry could tell us something more about the central star(s) since nothing is detected in the visual. Finally, IR imaging with the new ESO IR camera, IRAC, could provide information about the dust distribution and temperature in the object.

In the near future we hope to spend a lot more time with our southern Crab!

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Key Programmes on La Silla: First Allocations

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Introduction

With the Observing Programmes Committee's recommendations in hand, early December last year, all information was available to allocate and plan the observations for Period 43 (normal programmes) and Periods 43 and 44 (Key Programmes). The scenario of preparations and decisions has precisely followed the intentions outlined in my original article in the *Messenger* of March 1988 (No. 51). Here the community is briefly informed about the procedures, the proposals and the allocations. Investigators of Key Programme Proposals successful in this first round will themselves describe their research plans in brief *Messenger* articles, starting with three such contributions in this issue and to be continued. Later in this article there is an overview of Key Programme time committed and time expected to be available for subsequent rounds, with the 15th of October 1989 as the next deadline.

Proposal Evaluation

There were 42 proposals submitted for the 15 October deadline last year. These were grouped according to the normal OPC classification (see Table 1).

The column "Comparison" in the table gives the relative numbers of proposals per class, normalized to the same total, received for periods 38 to 42 incl., more than 1,750 proposals in total. The difference, where significant, is interesting and is probably attributable to at least two factors. First, the Key Programmes concern primarily the use of the bigger telescopes (1.5-m and larger); secondly it has been emphasized, in written and verbal presentations and in discussions, that Key Programmes afford an opportunity to gently re-orient European astronomy towards fields now relatively underdeveloped in our community but obviously crucial for the VLT era. This emphasis appears to provide an appropriate stimulus, resulting in more proposals of class 1 + 2 and fewer of class 4 through 7.

For each class of programmes two referees external to the OPC, mostly but not exclusively from ESO member states, and one OPC member were asked to evaluate and grade the programmes as well as to rank them within their class. A special form designed for the purpose asked the referees to justify their grade and rank in prose. Without exception everyone approached to contribute their expertise and time towards

TABLE 1.

Class	Number of proposals	Comparison
1. Galaxies and clusters	14	8.8
2. Quasars, Seyferts, radio galaxies	8	6.2
3. Magellanic Clouds	3	3.4
4. Interstellar matter	3	5.9
5. Star clusters and galactic structure	4	3.8
6. X-ray sources	1	1.3
7. Stars	7	10.4
8. Solar system	1	1.8
9. Miscellaneous	1	0.4