THE DISCOVERY OF A HIGHLY POLARIZED BIPOLAR NEBULA

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During a search for the optical counterparts of IRAS sources whose flux peaks at 25 microns we have discovered a small faint bipolar nebula in Monoceros at the position of IRAS 07131-0147.

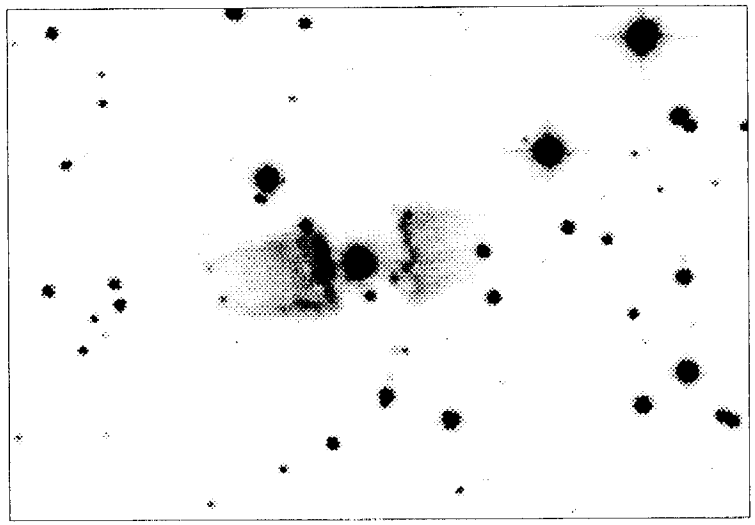
In the CCD images displayed in fig.1 the object shows considerable structure. The central star seems relatively free of closeby nebulosity, the two lobes have a bow-tie structure with those parts nearest to the star consisting of series of small knots. The outer parts of the lobes seem to be made up of filaments streaming away from the knots.

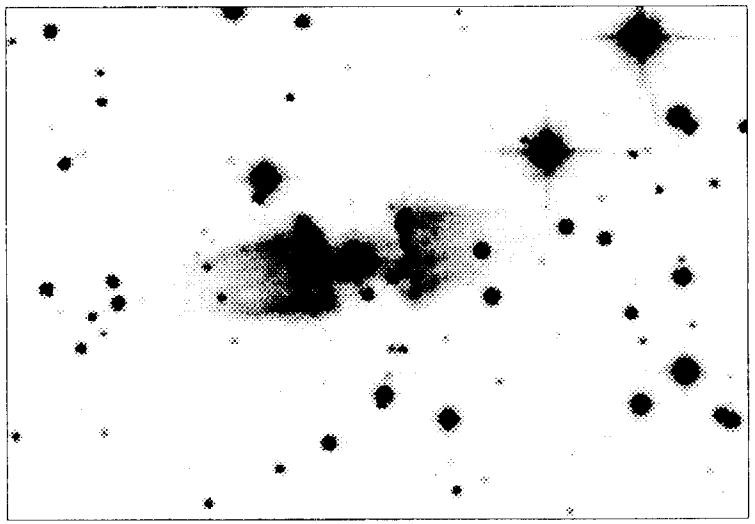
The linear polarization map in fig.2 shows a circular pattern of vectors indicating that the system is a reflection nebula illuminated by the central star. Throughout the lobes and including the regions occupied by the knots the levels of polarization are remarkably high (~ 60-70%).

Bipolar nebulae are associated with both young and old stars. On the basis of its optical spectrum we classify the central star as a M5-6 giant. In the IRAS colour classification scheme of Van der Veen & Habing (1988) the central star is VIb which indicates that there are distinct hot and cold components of circumstellar dust and that the mass loss process may have temporarily abated. We therefore propose that our object is in the post main sequence stage of evolution and is a protoplanetary nebula.

Young protoplanetary nebulae (e.g. CRL2688) have totally obscured central stars illuminating relflective lobes whereas older ones such as M2-9 have lobes seen in emission from gas ionized by the central hot star which is clearly visible. Since the central object of IRAS07131-0147 is a relatively unobscured late type star and the lobes are seen only by reflection we suggest that this nebula is a protoplanetary nebula in an evolutionary stage intermediate between that of CRL2688 and M2-9.

Van der Veen, W. & Habing, H.J. : 1988, Astr.Astrophys. 194, 125.





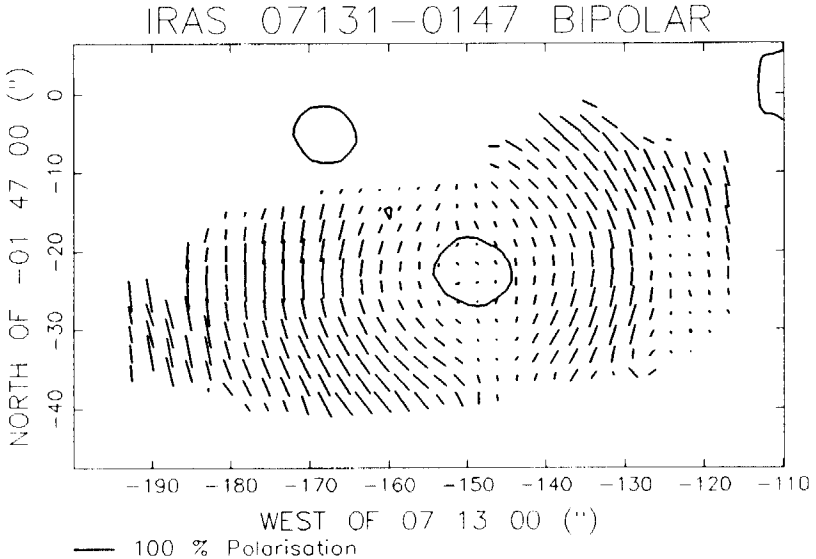


Fig.1 (top left and right).
R waveband CCD images of the IRAS 07131-0147 bipolar nebula. Note the string of knots of the inner parts of the lobes. The extent of the images is 140 by 100". Seeing was ~1".

Fig.2 (below left).
A linear polarization map of the bipolar nebula. The circular pattern is typical of a reflection nebula illuminated by a central star.