

## PLANETARY NEBULAE

## NEAR IR OBSERVATIONS OF IRAS PLANETARY NEBULAE

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We have observed 117 faint planetary nebulae in the J, H, K, and sometimes L and M bands. The objects are all listed in the Perek-Kouteck (PK) catalogue and were observed by IRAS.

The observations were carried out in three observing runs at the 1.0m and 3.6m E.S.O. telescopes and at the Italian infrared telescope (TIRGO), all equipped with InSb photometers / spectrophotometers. More than 70% of the sources were observed for the first time in the near IR.

We selected the sources according to the following criteria:

(i) all the objects are listed in the PK catalogue, and have been detected by the IRAS satellite; (ii) they are preferentially optically faint and compact sources. Two third of the selected sources have been observed in the radio continuum at 6cm, and show small angular sizes ( $\leq 15''$ ).

With these criteria, our sample may contain emission line objects, symbiotic stars, peculiar emission line objects, other than classical planetary nebulae. Ten sources are in common with the sample of faint PNe observed by Whitelock (1985). Other 27 objects have been also previously observed by different authors, though most of them only in one or two bands.

The results are shown in the colour-colour diagram J-H vs. H-K of Figure 1. According to Fig.1 the observed objects may be divided in at least three different classes:

- N (nebular): The near IR emission is dominated by ff+fb emission, with the addition of ionic emission lines (H, He,...). N-objects are located in the region  $(J-H) \leq 0.2$ . 32 objects in our sample can be classified as N-type.

- S (stellar): These objects are located on the main sequence, and in the region occupied by Mira variables, carbon stars, and symbiotic stars (see Allen, 1973). The near IR emission is dominated by a stellar

continuum. 67 objects fall into this class.

- D (dust): In this class a combination of hot dust and either nebular or stellar emission (from a hot star) is present. The objects lie in the region of the diagram to the left of the main sequence and black-body curves, above the nebular emission curve (dashed line).

The presence of hot dust in N- or S-type objects can be inferred from the analysis of the L-photometry. A study of the energy distribution for the objects of the sample from 1 to 100  $\mu\text{m}$  is necessary, adding ground based observations to IRAS data. To complete the analysis of the sources, a programme of spectrophotometry with CVF around the Brackett lines and between 8-13  $\mu\text{m}$  is in progress.

From this additional information we can preliminary conclude that S-type objects are most probably symbiotic stars or other kind of emission line stars.

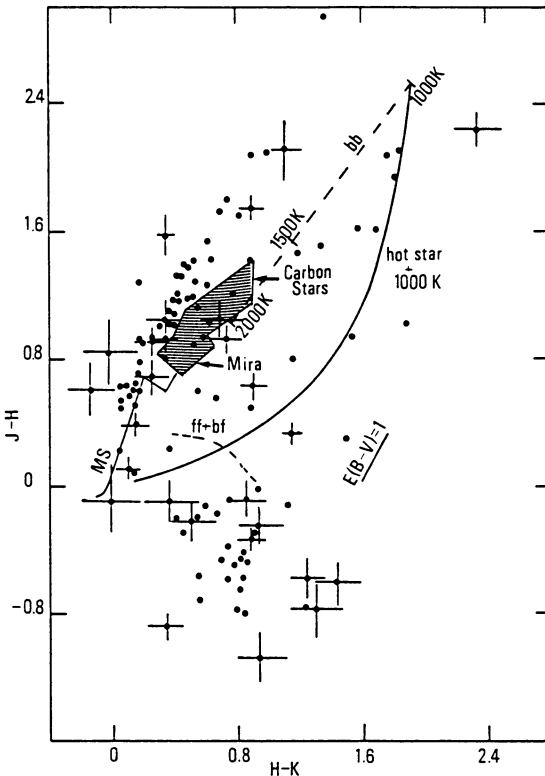


Fig.1: (J-H) vs. (H-K) colours of the observed PK sources.

#### References

- Allen, D.A.: 1973, *Mon. Not. R. astr. Soc.*, **161**, 145  
 Whitelock, P.A.: 1985, *Mon. Not. R. astr. Soc.*, **213**, 59