

A SEARCH FOR COOL COMPANIONS OF PLANETARY NEBULA NUCLEI

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At present only a small number of planetary nebulae are known to possess binary nuclei. Since approximately 2/3 of main sequence stars are members of binary or multiple star systems, one might expect a large fraction of PN central stars to have gravitationally bound companions. Additionally, late-type stars are more numerous, and due to their low luminosities would be difficult to detect by visual observational methods at distances where PN are typically found ( $\geq 1$  kpc). (Only 5 known PN are thought to be nearer than 0.5 kpc). It is thus possible, and in our view probable, that a significant number of PN nuclei possess cool companions, hitherto undetected.

Since K and M stars emit a considerable fraction of their energy in the infrared, we calculated the feasibility of detecting them with the Wyoming InSb photometer, and found that such detections might be possible out to distances of  $\approx 2$  kpc. To date 13 objects have been observed, including a sample of planetaries with known binary nuclei to test our hypothesis. The results are listed below.

<u>Object</u>	<u>IR Excess</u>	<u>Remark</u>	<u>Object</u>	<u>IR Excess</u>	<u>Remark</u>
NGC 7293	no		NGC 6905	no	
NGC 6853	.	no detection	NGC 6543	yes	known binary
NGC 246	yes	known binary	NGC 6572	yes	known binary
NGC 7008	?		NGC 6790	yes	
NGC 40	?		NGC 6210	yes	new binary?
NGC 6826	yes	new binary ?	A 63	yes	known binary
NGC 7009	yes	new binary ?			

The observations were made using standard infrared techniques in the J, H, K, and L bands. We used a 5 arc-sec aperture centered on the hot star. Any companion located within 2 arc-sec of the nucleus should have been within our beam. Thus, at a distance of 1 kpc, any binary system with a separation of  $\leq 4000$  A.U. should have been observed.

We caution that the results presented here are preliminary, and still subject to analysis. Specific models to fit the data are presently being constructed. We think that we may have detected 3 new binary nuclei, NGC 7009, NGC 6210, and NGC 6826. The interpretation for NGC 6790 is not clear. This work was supported by the U.S. Air Force Office of Scientific Research, the NSF, and University of Wyoming.