Planetary Nebulae in our Galaxy and Beyond
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400 new Planetary Nebulae in the Galactic Bulge

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Abstract. About 500 MASH(Macquarie/AAO/Strasbourg Hα planetary nebula project) PNe were discovered towards the galactic bulge (Parker *et al.* 2006). For 405 MASH PNe with a diameter < 35 arcsec, we obtain surface brightness, diameter and dynamical age of the nebulae. From line intensity ratios of 133 GBPN observed with the 6dF device, we obtain their density and ionized mass, and their central star temperatures. We discover 15 bipolar and/or nitrogen-rich GBPNe having probably massive stellar progenitors (Peyaud, 2005).

Keywords. Planetary Nebulae, Galactic Bulge

The detection of ~ 500 MASH PNe towards the galactic bulge using the AAO/UKST Hα survey has doubled the number of catalogued PNe (422 CAT PNe, Peyaud 2003 and 2005).

1. Image analysis on SuperCOSMOS digitized plates

Both the angular diameters and relative Hα surface brightness of the new PNe were estimated directly from the FITS images of each PN.

We made an attempt to separate disk and bulge PNe by applying a diameter criterion. By analysing the distribution of the diameters it seems that the previous cut-off of 20 arcsec for GBPNe should be extended to 35 arcsec (see Figure 1). Our definitive sample of true GBPNe within 15 degrees from the galactic center consists of 802 PNe : 396 CAT GBPNe with a diameter < 20 arcsec, and 405 MASH GBPNe with a diameter < 35 arcsec. For these GBPNe we determine a dynamical age based on the linear radius and on a mean expansion velocity of 20 km s^{-1}.

The surface brightness SB(Hα+[NII]) is estimated for 348 PNe on the SuperCOSMOS Hα images. This relative photometry measurement enabled us to estimate the Hα flux for 133 GBPNe with measured 6dF spectra. The surface brightness appears to be linked to size, morphology (Figure 2 left), and the ratio $R = (I[NII]_{6548} + I[NII]_{6584})/I(H\alpha)$.

2. Nebular and stellar parameters deduced from spectral analysis

For 157 GBPNe with measured spectral lines on 6dF spectra, we confirmed their PN status on the Hα/[NII] - Hα/[SII] diagnostic diagram. The nebular density deduced from the [SII] red doublet ratio shows a distribution well spread over the range 10–5.10^4 cm^{-3}. The temperature of the central star (deduced from the excitation class of the PNe) related to the 'dynamical age' of the shell gives some information on the central star mass (Figure 2 right).

In conclusion, the new MASH sample of GBPNe shows basic properties (density, stellar temperature) comparable to the results found for the about 300 GBPNe reported

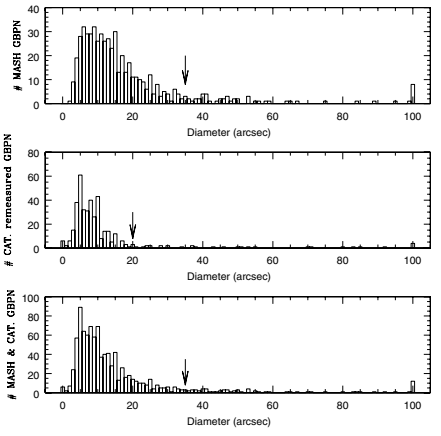

Figure 1. Histograms of the diameter distribution of MASH GBPNe & Catalogue GBPNe - Top : MASH sample - Middle : CAT sample - Below : All PNe

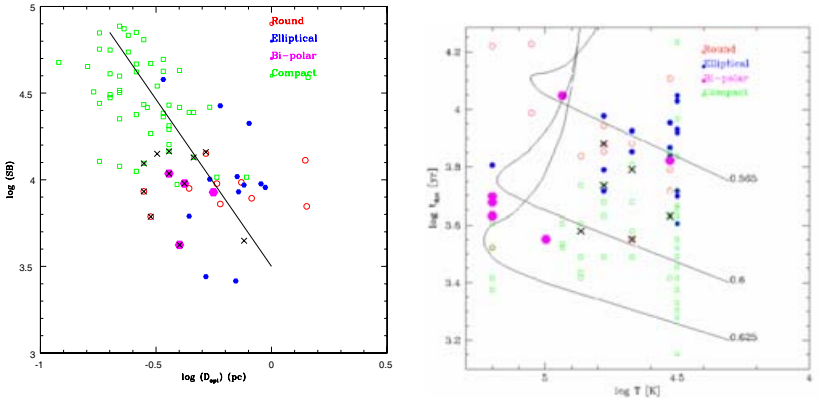

Figure 2. Left: Relative surface brightness vs. diameter in parsecs for 133 GBPNe. Morphological types are indicated, and crosses mean R>1.7. Right: Nebular dynamical age versus central star temperature. The tracks correspond to models with three different central star masses (Schonberner tracks)

in the CAT (Acker *et al.* 1992). However, we found 15 PNe with a bipolar morphology and/or with very intense [NII] lines. These objects have low surface brightness and large dimensions, and often seem nitrogen-rich. They should undergo a rapid dynamical evolution and could belong to a more recent stellar population with larger progenitors masses (stellar nucleus reaching 0.65 solar mass, that means a progenitor of about 5 $M_{\odot}$).

Acknowledgements

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References

Q.A. Parker, A. Acker, *et al.*. 2006, *MASH Planetary Nebulae from the AAO/ukst Hα Survey. MNRAS, in press*

A.E. Peyaud. 2005, *The Galactic Bulge traced by Planetary Nebulae, PhD thesis, Strasbourg ULP University, France, and Macquarie University, Sydney, Australia, 2005*

A.E. Peyaud, Q.A. Parker, A. Acker, and I.A. Bond. 2003, *New Bulge Planetary Nebulae from the AAO/UKST Hα Survey. White Dwarfs: Galactic and Cosmologic Probes, 25th meeting of the IAU, Joint Discussion 5, 16-17 July 2003, Sydney, Australia, 5, 2003*