From Stars to Galaxies: Building the Pieces to Build up the Universe
ASP Conference Series, Vol. 374, 2007
A. Vallenari, R. Tantalo, L. Portinari, A. Moretti

A Search for New Planetary Nebulae Located at Large Galactocentric Distances

A. Mampaso,[1] K. Viironen,[1] R. L. M. Corradi,[1,2] J. E. Drew,[3] R. Greimel,[2] L. Sabin[1] and the IPHAS Collaboration[4]

[1] *IAC - Instituto de Astrofísica de Canarias, C/ Vía Lactea s/n, E-38200 La Laguna, Tenerife, Spain*

[2] *Isaac Newton Group of Telescopes, Apdo. 321, E-38700 Santa Cruz de La Palma, Spain*

[3] *Imperial College, Blackett Laboratory, Exhibition Road, London SW7 2AZ, UK*

[4] *http://www.iphas.org*

Abstract. We introduce the new Galactic Plane Hα survey IPHAS, present our PNe selection method, and discuss two examples of very distant new PNe.

1. Context

The planetary nebulae (PNe) abundance gradient provides one of the keys to understand the chemical evolution of the Galaxy. However, measure of PNe gradients it suffers from three severe limitations: (i) very few PNe are known at large galactocentric distances (D_{GC}); (ii) distances to PNe are very uncertain; (iii) measuring accurately abundances is difficult. Recent determinations of O/H gradients (dex/kpc) from PNe show disparate results differing by a factor of 8: -0.037 $\pm$ 0.008 (Henry, Kwitter & Balic 2004); -0.010 $\pm$ 0.02 (Stanghellini et al. 2006); -0.020 $\pm$ 0.01 (Perinotto & Morbidelli 2006) and -0.085 (Pottasch & Bernard-Salas 2006).

The IPHAS survey will contribute by adding several hundred new PNe (some will be located towards the Anticenter region, where the largest D_{GC} are expected) and also providing a new 3-D extinction-distance method by using A-type stars (Drew et al. 2005).

2. The IPHAS Survey

The Isaac Newton telescope Photometric H-alpha survey (http://www.iphas.org) is mapping a band between $b^{II} = -5$ to $+5^\circ$ of the Northern Galactic plane using the INT Wide Field Camera at the Observatorio del Roque de los Muchachos (La Palma, Spain). A narrow-band Hα and two Sloan r', i' filters are used for matched 120, 30, and 10 s exposures, respectively, spanning the range r'=13 to 20 mag for point sources. IPHAS is the first fully-photometric Hα survey of the Galactic plane. It will discover around 40,000 new emission-line stars, and thousands of ionized nebulae such as PNe, H-H objects, HII regions, SN remnants, etc. (Drew et al. 2005).

3. PNe Search Methods and First PNe Analyzed

Large nebulae are detected on the IPHAS Hα-r' mosaic images by visual inspection. Point-like and slightly-extended candidate PNe are selected from the automatically generated catalogue using a colour-colour diagram. Fig. 1 shows $\approx$2,000 extended (1 to 5$''$) candidates located towards the Anticenter region ($120 < l^{II} < 210^{\circ}$) and showing strong H$\alpha$ emission ($\geq$1 mag above the MS stellar loci). Most could be spurious detections, condensations in HII regions, and known Hα-emitting objects; however some are *bona-fide* small nebulae that we are currently studying. The first two new PNe confirmed so far are both likely located at very large galactocentric distances. IPHASX J052531.2+281946 (PNG 178.1-04.0) is a round Type II PN located very near to the Anticenter direction. Its Oxygen abundance is O/H = 8.55 and the "Shklovskii" galactocentric distance is D_{GC} = 14 to 20 kpc, if a nebular mass from 0.1 to 0.4 $M_{\odot}$ is assumed (Viironen et al. 2007, in preparation).

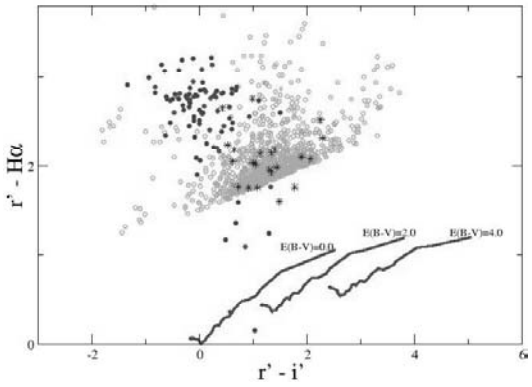

Figure 1. Two colour diagram showing the location of PNe (both known PNe from the Strasbourg Catalogue and new IPHAS PNe; *filled circles*), and IPHAS emission-line stars (*stars*). The Main Sequence stellar loci with three different reddening are also shown. Mildly extended candidate PNe (*grey empty circles*) are selected above a line parallel to the reddening vector.

IPHASX J012507.9+635652 (PNG 126.6+1.3) is an unusual quadrupolar PN showing a ring surrounding the central star, bright inner lobes with an enhanced waist, and very faint lobular extensions reaching up to more than 100 arcsec. It is a Type I PN located at D_{GC} = 13.4 kpc and showing an extremely low oxygen abundance of O/H= 8.17 (Mampaso et al. 2006).

References

Drew, J.E. et al. 2005, MNRAS, 362, 753
Henry, R.B.C., Kwitter, K.B., Balick, B. 2004, AJ, 127, 2284
Mampaso, A. et al. 2006, A&A, 458, 203
Perinotto, M., Morbidelli, L. 2006, MNRAS, 372, 45
Pottasch, S.R., Bernard-Salas, J. 2006, A&A, 457, 189
Stanghellini, L., et al. 2006, ApJ, 651, 898