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SEARCH FOR NEW PLANETARY NEBULAE WITH THE IPHAS Hα SURVEY

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RESUMEN

El censo INT fotométrico en H-alfa (IPHAS) finalizado recientemente, es una nueva herramienta que ayuda en la detección de Nebulosas Planetarias (NPs) al norte del plano Galáctico. De hecho, se ha escaneado ya un área del cielo de 1800 grados cuadrados en donde se han descubierto cientos de nuevas candidatas a NPs localizadas en el plano (que abarca desde el abarrotado y polvoso centro Galáctico hasta el área poco conocida del anticentro). El objetivo de IPHAS es llenar el hueco en la población general de NPs, de aquellas que se localizan en el plano Galáctico, y establecer así un nuevo censo. Presentamos el censo y algunos resultados preliminares sobre las NPs hasta ahora identificadas.

ABSTRACT

The now completed INT photometric H-alpha Survey (IPHAS) is a valuable resource to detect planetary nebulae (PNe) in the Northern Galactic Plane. An area of 1800 deg^2 of sky has been scanned and hundreds of new PN candidates have been discovered, from the direction of the crowded and dusty Galactic center to the less widely explored Galactic Anticenter area. The final goal is to provide a complete, surface-brightness limited census of PNe in the Galactic Plane. We present the survey and some preliminary results on PNe so far identified.

Key Words: planetary nebulae — surveys

1. INTRODUCTION

To date around 3000 PNe are known to exist in the Galaxy (Acker et al. (1992), Parker et al. (2005), Miszalski et al. (2008)). This may seem a large number but it is still much lower than the expected total PN population of the Milky Way. Indeed, a global population oscillating between ~20000 and ~50000 objects (Frew & Parker (2006), Moe & De Marco (2006)) is predicted, of which only ~8000 only would be visible (Moe & De Marco 2006). Among the "missing" PNe are those highly reddened by the Interstellar Medium (ISM) and particularly those at low Galactic height which are more likely to suffer higher extinction, PNe with low surface brightnesses and therefore including (very) evolved objects, those located at large distances and barely recognizable as nebulae or unresolved (in the Anticenter region for example), and finally PNe located in crowded environments. A more complete census of PNe than available so far is therefore needed to understand the general properties of PNe such as their population size, evolutionary timescales, the Galactic abundance gradient, and to refine classification schemes related to PNe chemical composition, morphology and Galactic distribution.

2. IPHAS AND THE SEARCH FOR PNE

IPHAS[4] (Drew et al. 2005) is a fully-photometric CCD Hα survey carried out at the 2.5 m INT telescope at the Observatorio del Roque de los Muchachos (ORM, La Palma, Spain). The instrument used was the Wide Field Camera with its 32 arcmin field of view and small pixel scale of 0.33"/pix. The portion of the Galactic Plane visible from the Northern hemisphere was mapped at a latitude range from $b = +5$ to $b = -5$ deg using a narrow-band Hα, and broad-band Sloan r' and Sloan i' filters. The strength of the survey also lies in its sensitivity limit, which allows the detection of compact sources between 13 mag $< r' <$ 20 mag, and extended source with an Hα surface brightness as low as $\simeq 2.5\times10^{-16}$ erg cm^{-2} s^{-1} arcsec^{-2} (Corradi et al. 2005).

The adopted PNe detection method varies according to the nebular size. Point source PN candidates are identified based on the IPHAS automated photometry according to their location in the IPHAS

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

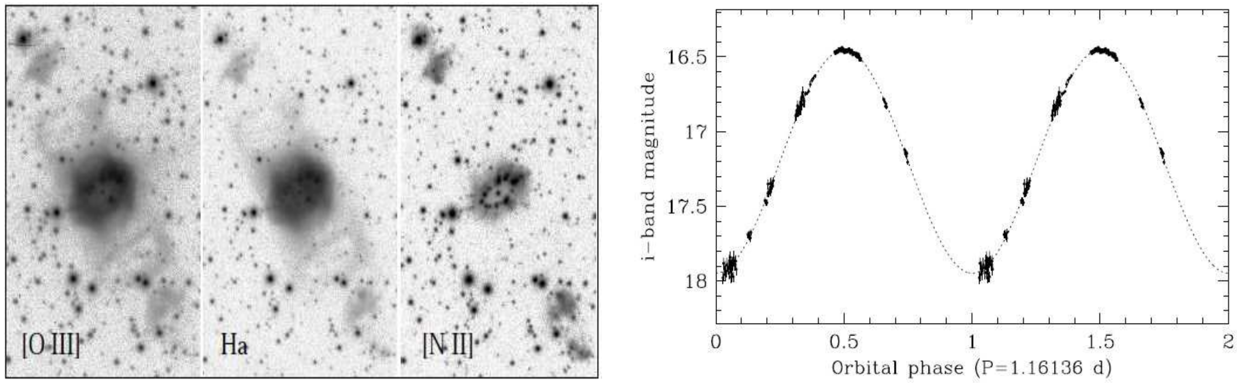

Fig. 1. Left: Narrow band [OIII], Hα and [NII] images of IPHASX J194359.5+170901 taken with the NOT Telescope (ORM, La Palma) with a field of view of 70×110 arcsec^2. North is up and East is left. Right: Light curve of the central star indicating a binary system with a period of $\sim$1.16 days (Corradi et al. 2011).

$(r' - \mathrm{H}\alpha)$ vs.$(r' - i')$ colour-colour diagram (Viironen et al. 2009). Extended sources are detected in H$\alpha - r'$ mosaic images binned at 1.6×1.6 and 5×5 arcsec^2 which are visually inspected: all remarkable nebulae/morphologies are selected (Sabin et al. 2010). The subsequent follow-up spectroscopy was done using a number of telescopes such as the WHT and INT telescopes at ORM, the 2.1 m SPM-OAN (Mexico), the 1.9 m at Siding Spring (Australia) and the 2.1 m at Kitt Peak (US). In terms of extended sources, 161 PN candidates have been spectroscopically observed and around 30 new PNe have been unveiled so far out of the first 50 analysed. Another 10 new PNe are also in the list of new PNe from MASH by Parker et al. (2005) in the overlapping region of the two surveys. As an illustration of the results obtained so far, and of the potential of IPHAS, the so-called Necklace nebula is presented in Figure 1. In addition to its remarkable morphology (with a spectacular knotty ring and polar collimated, high velocity outflows), the nebula is of very high excitation and possesses a post-common envelope binary central star (Corradi et al. 2011).

3. CONCLUSION

The IPHAS survey can potentially discover hundreds of new PNe in the Galactic Plane. So far, we have identified and spectroscopically confirmed several tens of new PNe, as well as a number of sources of different classes, such as symbiotic stars and young and/or massive emission-line stars. Many of the new PNe are either point sources (compact) or extended (up to several arcmin in size) and generally faint. It is too early to draw any full picture, but clearly the undergoing search and analysis will greatly improve the census of PNe in the Milky Way. This will help to understand not only the PNe Galactic population size and distribution, but also many details of their physical characteristics and evolution properties.

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