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New DSH planetary nebulae and candidates from optical and infrared surveys

Matthias Kronberger[1], Quentin A Parker[2], George H Jacoby[1,3], Agnes Acker[4], Filipe Alves[1], Ivan Bojicic[2], Paul Eigenthaler[5], David J Frew[2], Dianne Harmer[6], Dana Patchick[1], Warren Reid[7,8] and Johannes Schedler[9]

[1] Deep Sky Hunters collaboration
[2] Department of Physics, The University of Hong Kong, Hong Kong
[3] Giant Magellan Telescope/Carnegie Observatories, Pasadena, CA 91101, USA
[4] Observatoire astronomique de Strasbourg, 11 rue de l'Université, F-67000 Strasbourg, France
[5] Instituto de Astrofísica, Pontificia Universidad Católica de Chile, Santiago, Chile
[6] National Optical Astronomy Observatory, 950 N. Cherry Avenue, Tucson, AZ 85719, USA
[7] Department of Physics and Astronomy, Macquarie University, Sydney, NSW 2109, Australia
[8] University of Western Sydney, Locked Bag 1797, Penrith South DC, NSW 1797, Australia
[9] CHART32 Team

E-mail: [1] matthias.kronberger@gmx.at

Abstract. To date, the planetary nebula (PN) survey of the Deep Sky Hunters collaboration has led to the detection of more than 250 previously unknown candidate planetary nebulae (PNe). About 60% of them were found during the past two years and are expected to be true, likely or possible PNe because careful vetting has already thrown out more doubtful objects. The majority of the new PN candidates are located within the boundaries of the SHS and IPHAS Hα surveys and were discovered by combining MIR data from the WideField Infrared Survey Explorer (WISE) with optical data from the IPHAS, SHS and DSS surveys, and UV data from the Galaxy Evolution Explorer (GALEX).

Since the discovery of M 27 by the French astronomer Charles Messier about 250 years ago, $\approx$ 3500 more Galactic PNe have been discovered [1]. However, this number is still short of the total number of Galactic PNe estimated from local volume counts ($N_{tot=11,000}$ [2]). To a great extent, this difference can be attributed to the circumstance that, until recently, PN surveys were conducted mainly at optical wavelengths and over a relatively limited latitude range of the Galactic plane. Consequently, a considerable gain in the number of Galactic PNe can be expected from surveys in the MIR range, allowing for the discovery of highly obscured dust-rich and high excitation PNe that are invisible at optical wavelengths.

The Deep Sky Hunters [3] (DSH) have been scanning the Milky Way for new clusters and nebulae for more than decade now. Until fairly recently, our survey for PN candidates was restricted to medium Galactic latitudes ($5° \leq |b| \leq 20°$), and based on broadband Digitized Sky Survey (DSS) images [2,4,5] as well as on [S II]/Hα/[O III] narrowband images of the Milky Way taken with modestly-sized amateur telescopes equipped with modern CCD imagers [6]. Since then, the focus has shifted to fields closer to the Galactic Equator, and from optical to MIR and UV wavelengths, thanks to the availability of high resolution imagery from the WISE and GALEX missions. This has allowed us to detect 162 true, likely and possible PNe during the past

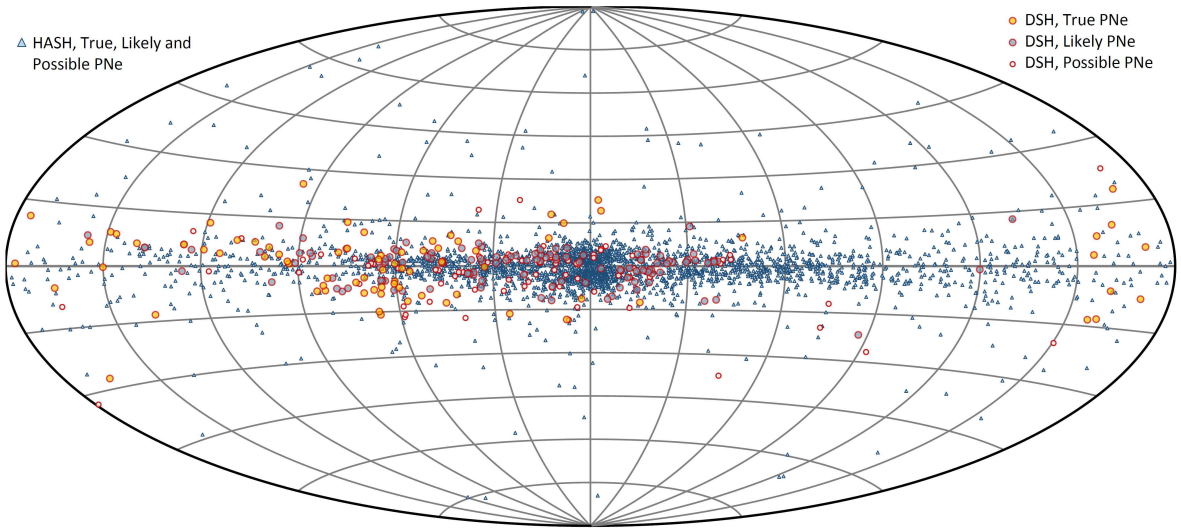

Figure 1. Aitoff-Hammer projection of the Galactic Plane, showing the distribution of all True, Likely and Possible PNe of the DSH sample.

two years, increasing the census of DSH PNe and candidates by more than 150%. It is worth noting that many of the new PN candidates, although originally discovered in the MIR, are clearly visible on SHS [7] and IPHAS [8] survey images but were overlooked thus far, most likely because of their faintness, because of insufficient contrast between Hα and their comparatory broadband imagery, or because of their proximity to bright sources in the field. Object sizes of the new PN candidates found at optical wavelengths range from essentially unresolved to several arcmin. All good quality DSH candidates and all those confirmed spectroscopically will be ingested into the new HASH database [9].

Figure 1 shows the distribution of all True, Likely and Possible PNe of the DSH sample in an Aitoff-Hammer projection of the Galactic Plane. Objects listed as True, Likely and Possible PNe in the HASH database are shown for comparison. Gaps in the DSH candidate distribution correspond to unsurveyed Milky Way regions. We plan to obtain confirmatory spectroscopy of the Possible and Likely PNe during the next years, and Hα + [O III] images of another ≈ 130 objects that we consider to be PN candidates based alone on their MIR characteristics.

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