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New Planetary Nebulae towards the Galactic bulge

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Abstract. New Planetary Nebulae (PNe) were discovered through an [O III] 5007 Å emission line survey in the Galactic bulge region with $l > 0°$. We detected 240 objects, including 44 new PNe. Deep Hα+[N II] CCD images as well as low resolution spectra were obtained for the new PNe in order to study them in detail. Preliminary photo–ionization models of the new PNe with Cloudy resulted in first estimates of the physical parameters and abundances. They are compared to the abundances of Galactic PNe.

Keywords. surveys, ISM: abundances, ISM: planetary nebulae: general.

1. Introduction

Galactic Planetary Nebulae (PNe) are of great interest because of their important role in the chemical enrichment history of the interstellar medium as well as in the stellar evolution of our Galaxy (Beaulieu *et al.* 2000 and references therein). Many surveys have been made in the past in order to discover new PNe (Boumis *et al.* 2003 and references therein – Paper I, Boumis *et al.* 2006 – Paper II, Parker *et al.* 2006 and references therein).

2. Observations

The survey was performed during the 2000–2001 observing seasons with the 0.3 m telescope at Skinakas Observatory in Crete, Greece. Our aim was to discover PNe which are extended or pointlike showing strong [O III] 5007 Å emission with a signal-to-noise ratio greater than 4. The observational details and the detection method are given in Paper I and Boumis & Papamastorakis (2001), respectively. Follow–up observations (images and spectra) were obtained with the 1.3 m telescope at the same site during 2001–2003 and complementary spectral observations during 2005–2006. The images were obtained in Hα+[N II] in order to study the morphology of the PNe and also measure their angular extent while their low–resolution spectra confirmed their photo-ionized nature. All new PNe can be seen in Papers I and II.

3. Preliminary Photoionization Results

A number of different techniques are in use to determine the physical parameters of PNe. In our case, we decided to use the photo-ionization code Cloudy, last described by Ferland *et al.* (1998), since this code is widely used and has been tested for many different physical conditions. In this work, we present preliminary results for four of our new PNe.

Parameters	PTB17	PTB26	PTB31	PTB34	mean bulge[g]	mean disk[g]
log(L/L$_\odot$)	2.80	2.78	3.82	4.12		
T$_{eff}$[b]	111.4	65.0	56.9	85.9		
n$_e$[d]	0.17	0.06	0.18	0.59		
T$_e$[b]	9.8	6.49	9.72	8.20		
log(M/$M_\odot$)	0.19	0.46	-0.16	-0.61		
radius in[e]	0.20	0.28	0.10	0.05		
radius out[e]	0.40	0.72	0.29	0.21		
filling factor	1.00	1.00	1.00	0.58		
log(U)	-2.75	-2.53	-1.11	-0.72		
dust/gas[a]	5.56	6.15	6.08	5.66		
distance[f]	7.80	7.80	7.80	7.00		
ϵ(He)	11.17	11.02	11.01	11.14	11.09	11.06
ϵ(O)	8.47	9.16:	8.35	9.06	8.66	8.67
ϵ(N)	8.12	8.01	8.32	8.34	8.43	8.34
ϵ(S)	6.58	6.79	7.10	7.55	7.05	6.93
ϵ(Ne)	–	8.00†	8.00†	–	8.03	8.08
ϵ(Ar)	–	–	–	6.96	6.60	6.42

Table 1. The physical parameters of our sample's PNe determined with Cloudy. (a) 10^{-3}, (b) kK, (c) Log(X/H)+12, (d) 10^3 cm−3, (e) pc, (f) kpc, (g) Exter *et al.* (2004), (†) fixed at an assumed value, (:) the value is uncertain.

Full results will be presented in Akras *et al.* (2006). The model assumptions can be found in van Hoof & Van de Steene (1999). It should be noted that as nebular distances we used both the fixed bulge distance (7.8 kpc), and distances determined with the method described in Van de Steene & Zijlstra (1995). All results will be presented analytically by Akras *et al.* (2006). The observed quantities used to derive the physical parameters of our PNe are (a) the emission line spectrum of each nebula, (b) their angular diameters and (c) the total hydrogen flux. Further modeling will be performed including radio and/or infrared data whenever they are available. The resulting physical parameters for our sample PNe determined with Cloudy are given in Table 1. We also present the mean bulge and disc abundances taken from Exter *et al.* (2004).

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