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CHEMICAL ABUNDANCES AND KINEMATIC PROPERTIES OF A PLANETARY NEBULAE SAMPLE TOWARDS THE GALACTIC BULGE

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As part of a long term program of determination of chemical abundances of southern planetary nebulae (PNe) held at the University of São Paulo, Brazil, we report here the study of a sample of recently discovered PNe towards the Galactic bulge. Their chemical abundances were determined spectrophotometrically and their kinematic parameters were obtained from the literature. These results are intended to contribute to the study of the bulge's intermediate mass population.

Objects were selected from Beaulieu et al. (1999) and Kohoutek (1994). Observations were made at the 1.60-m telescope of the National Laboratory for Astrophysics (LNA, Brasópolis, Brazil) and at the 1.52-m of the European Southern Observatory (ESO/La Silla, Chile). In both telescopes, Cassegrain Boller & Chivens spectrographs were used, with reciprocal dispersions of 4.4 Å/pixel at LNA and 2.2 Å/pixel at ESO. A long east-west slit was used in all observations. Data reduction was performed using the IRAF package, following the standard procedure for longslit spectra: correction of bias, flat-field, extraction, and wavelength and flux calibration.

Electron densities were derived from the [S II] $\lambda6716/\lambda6731$ line ratio, while electron temperatures were derived from both [O III] $\lambda4363/\lambda5007$ and [N II] $\lambda5754/\lambda6584$ line ratios. Ionic abundances were calculated for the ions present in the optical spectra by solving the statistical equilibrium equations for a three-level atom model, including radiative and collisional transitions. Elemental abundances were then derived adopting ionization correction factors (icf's) to account for unobserved ions of each element.

Results show a pattern of abundances similar to the Galactic disk, with both low and high abundance objects. In spite of the smaller bulge volume, it should be noted that average and standard deviation for bulge PNe abundances are quite similar to disk objects. In particular, we noted that for any given He value, bulge objects display log(N/O) values spreading over a wider range than those of the disk. These effects indicate a star formation process spanning over a long time.

When examined with respect to the Galactic coordinates of the nebulae, abundances display a negative gradient with respect to latitude, similar to the effect found by Frogel et al. (1999) for iron abundance towards the Galactic bulge. Apparently there are no similar effect with respect to longitudes, but our sample is still poor for objects with $|l| > 5°$.

Taking heliocentric velocity, diameter and flux at 6 cm from the literature, we examined the kinematic properties for a subsample of our objects. Results indicate clearly the rotation of the bulge PNe population. Is easy to see that this movement can be affected by the whole bulge structure, as well as by the disk surrounding it: taking only objects with higher probability to belong to the bulge ($R < 2$ kpc), a steeper correlation between velocity and longitude is derived. These objects have higher probability to belong effectively to the bulge due mainly to uncertainties in the distances, and therefore should represent more precisely this relation. We adopted $R_\odot = 7.8$ kpc, Solar velocity with respect to LSR $V_\odot = 16.5$ km s^{-1} towards $l = 53°$, $b = 25°$, and $V_{\rm LSR} = 180$ km s^{-1} (Olling & Merrifield 1998). Distances were calculated according to Schneider & Buckley (1996).

A more complete description of this work can be found in Escudero & Costa (2001). This work was supported by the Brazilian agencies CAPES and FAPESP, and by Universidade de São Paulo.

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