CHEMICAL ABUNDANCE BEHAVIOR OF TYPE I PLANETARY NEBULAE

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In this work 13 planetary nebulae have been classified as Type I according to Peimbert's criteria (Peimbert 1978, IAU Symposium 76, 215). These objects have been added to a previous sample (Maciel & Faúndez-Abans 1985, A&A, 149, 365) and diagrams of O/H versus N/H, S/H, Ne/H, and Ar/H, as well as N/H versus S/H, Ne/H, and Ar/H have been drawn. All of them exhibit a tendency for linear correlation; moreover, the behavior of O and N versus Ar and S are very similar, with approximately the same slope. When the excitation class parameter was included in the diagrams, no clear tendency can be discerned, for any class.

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H_2 V = 1–0 (S1) IMAGES OF SOUTHERN PLANETARY NEBULAE

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We have searched for molecular hydrogen in a sample of Southern planetary nebulae. The images in the light of H_2 with subtracted continuum of Mz-1, Mz-3 and IC 4406 are presented. The spatial distribution of molecular hydrogen is discussed and analyzed in terms of the physical characteristics of these objects and compared with CCD images obtained in a number of low-excitation lines.

The infrared images reported here were obtained with the NICMOS 3 array in the IR-Camera at the duPont telescope of Las Campanas Observatory.

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EPISODIC SYMMETRIC JETS IN THE PLANETARY NEBULA FG 1

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Deep CCD imaging and long-slit spectroscopy have been obtained for the elliptical planetary nebula Fg-1 (He 2–66). We report the discovery of a symmetric jet-like structure, consisting of two opposed strings of ionized knots, highly reminiscent of Herbig-Haro objects. The strings are bent in opposite directions and span 2 arcmin to either side of the PN. The main body of Fg-1 is found to consist of an orthogonal system of elliptical structures. The spectra from the opposite innermost knots intersected by the slit show expanding velocities and line ratios typical of collisionaly excited gas. The knots that make up the strings are remarkably equidistant with respect to the nucleus. These knots are interpreted as multiple ansae that have been formed and blown away in episodic events by symmetric collimated flows, probably produced by a precessing source.

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TIME EVOLUTION OF GALACTIC ABUNDANCE GRADIENTS

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Galactic abundance gradients can be determined from H II regions, planetary nebulae, and stars of different ages and populations. Although most determinations are similar (~ -0.07 dex/kpc) for ratios such as O/H and S/H in young objects, there are several indications that older systems present flatter gradients.

This is particularly true for disk planetary nebulae, which comprise Peimbert's types I, II, and III. There are presently compelling evidences from their space distribution, kinematics, and chemical composition, in the sense that planetary nebulae form a true population (or age) sequence. As a consequence, the abundances derived from these objects are extremely important to the study of the time evolution of the gradients, even though their corresponding distances are still poorly known.

In the present work, the radial abundance gradients (O/H, S/H, Ne/H and Ar/H) from planetary nebulae are compared with similar data for stars and H II regions, in order to study the temporal variations of the gradients. Our results are consistent with a continuous flattening of the gradients, which poses some constraints on possible models for the chemical evolution of the Galaxy. In particular, strongly non-linear variations of the star formation rate (SFR) with the gas density and weak radial flows are limited by the available data. (CNPq/FAPESP/CAPES/DFG).

DIFFERENTIAL CCD PHOTOMETRY OF WX CET, AQ ERI AND CU VEL

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Observations of three SU UMa or WZ Sge type dwarf novae in quiescence were obtained from December 8 to 11, 1991 at the 1-m telescope at Las Campanas Observatory in Chile, with a typical time resolution of 4 minutes and an internal mean error of $0^m.04$ for stars of $\sim 17^m$ (similar as the variables). We searched for periods using a phase dispersion minimization analysis (part of the IRAF package). WX Cet was monitored for 5 hours during 2 nights in the *B* bandpass, showing a hump like light curve with $0^m.4$ amplitude similar as the reported by Howell et al. (1991, PASP, 103, 300). The best period of our data $1^h.907 \pm 0^h.029$ (with possible aliases at $1^h.757$ and $2^h.058$) is considerably larger than expected from the superhump period ($\approx 1^h.3$) found by O'Donoghue et al. (1991, MNRAS, 250, 363). In addition, we found spikes in our light curves with a period of $\approx 0^h.75$, the same as found by Howell et al. They may refer to the rotational period of a magnetic white dwarf. AQ Eri, which was monitored for $6^h.4$ in 3 nights using the *V* filter, reveals a quasi-sinusoidal modulation with a period between $1^h.38$ and $1^h.70$ and $0^m.35$ amplitude, which could be the binary period, compatible with the superhump period ($1^h.494$ or $1^h.405$) found by Kato (1991, IBVS, 3671). An additional $0^h.54 \pm 0^h.03$ periodicity is present each night, which again could refer to the white dwarf rotation. There are also indications for a hump like light curve of CU Vel with an amplitude of $\approx 0^m.25$ (*V* bandpass) and a period similar to the superhump period ($1^h.918$, Ritter 1990, A&AS, 85, 1179).

This research was supported by FONDECYT grant 91-0637.

ULTRAVIOLET AND OPTICAL SPECTRA OF CENTRAL STARS OF HALO PLANETARY NEBULAE

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Optical and *UV* spectrophotometric data are analyzed for the central stars of Population II planetary nebulae: M2-29, PN 6–41.1, GJJC-1, DDDM-1, K 648, NGC 2242, PN 242–37.1, and NGC 4361. From these data, we derive visual magnitudes, spectral classification, color temperatures, luminosities and masses of the objects. We find the following results:

– All the stars show absorption type spectrum and most of them have normal H and He photospheric abundances, the only possible exceptions are M2–29 and GJJC-1 which seem to be H-deficient stars.

– The effective temperatures of the sample range from less than 40 000 to more than 80 000 K. The stellar temperatures derived from *UV* colors in general are in agreement with the effective temperatures derived from other methods (Zanstra temperature and model ionization structure for the nebulae).

– From comparison with evolutionary tracks it is found that the stellar masses of the objects in this sample are lower than 0.58 $M_\odot$. The range of masses is very narrow, from 0.55 to 0.57 $M_\odot$; and it is lower than that for disk and bulge planetary nebulae.

– NGC 4361 shows anomalous *UV* colors. This fact could be due either to *UV* excess in the $\lambda\lambda 1200$ – 2000 range or to a lower reddening value than reported from nebular data.

– The visual magnitude of the central star of NGC 2242 is of 17.1 instead of the 15.02 that has been reported in the literature. We have also calculated the visual magnitude of the central star of M2–29 to be 17.7 mag.

– Three of the stars (PN 6–41.1, K 648 and DDDM-1) show evidence of stellar wind with terminal velocities in the range from 2000 to 3000 km s^{-1}.

The full version of this work is in Peña et al. (1992, A&A, 264, 752).