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PROPERTIES OF GALACTIC AND MC CSPN DISCLOSED BY FAR-ULTRAVIOLET SPECTROSCOPY

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We are performing a comprehensive spectral analysis of *FUSE*, *IUE*, *HST* and ground-based data of Galactic, and Large and Small Magellanic Cloud (LMC and SMC) central stars of planetary nebulae (CSPN), with the aim of understanding the overall evolution of PN in environments of differing metallicities. We determine the parameters of the central stars as well as the characteristics of the circumstellar environment.

Bianchi's CSPN *FUSE* program is a comprehensive study of Galactic (P 133), LMC (B 001), and SMC (C 056) CSPN in environments of differing metallicities. We use the *FUSE* data in conjunction with *IUE*/*HST*/optical data to study the central stars and their circumstellar material. Hot star spectra are modeled with non-LTE codes such as CMFGEN (Hillier & Miller 1998) for stars with extended atmospheres such as the [WC] objects, and TLUSTY (Hubeny & Lanz 1995) for plane parallel atmospheres such as white dwarfs. Stellar parameters such as $T_{\rm eff}$, $\log g$, $\dot{M}$, and chemical abundances are determined. Furthermore, we study the circumstellar H_2 by analyzing its many features observed in the far-UV range by *FUSE*.

The optical and near-UV light of Magellanic Cloud CSPN is masked by their nebula. The wavelength range of *FUSE* (905 to 1187 Å) reveals the continuum of the hot central stars of such objects, and contains important diagnostic lines (e.g., O VI 1032,1037) for the determination of the central stars' photospheric and wind parameters. The Galactic CSPN of our study are listed below in Table 1 (results in parenthesis are preliminary).

An example of our work is shown in Figure 1. We modeled the DAO white dwarf CS of the Galactic PN Abell 35 (A 35) with TLUSTY. The complexity of the spectra is caused by numerous H_2 transitions from a hot, circumstellar gas associated with the nebula. We modeled the H_2 (and H I) concurrently, and derived their column density and inferred their masses. Together with the mass of the central star determined through our stellar modeling, we were able to estimate the progenitor mass of the PN. These results provide a complete evolutionary picture for the object (Herald & Bianchi 2002a).

TABLE 1

GALACTIC CSPN SAMPLE

Name	Type	$T_{\rm eff}$[a]	$\log g$	$\dot{M}$[b]
A 35	DAO WD	80	7.7	···
NGC 2371	O VI PNN	(125)	···	(7.5)
NGC 3132	hot star	100	7.8	···
IC 4776	[WC6]	(88)	···	(1.0)
K 1-26	O(H)	(100)	(7.0)	···

[a]Units of 10^3 K. [b]Units of $10^{-8} M_\odot\,{\rm yr}^{-1}$.

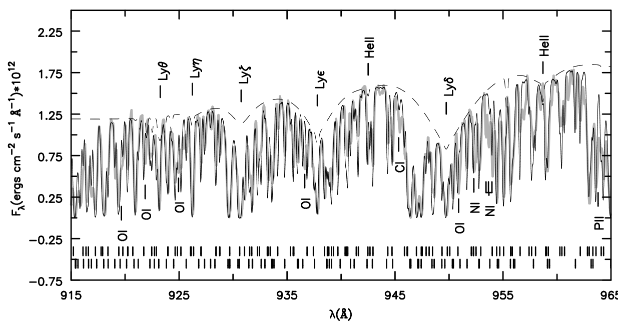

Fig. 1. *FUSE* spectrum of Abell 35 (heavy gray), our stellar model of the DAO white dwarf CS (dashed), and our stellar model with our H I and H_2 absorption models applied (solid). The strongest stellar and interstellar features are labeled, and the main contributing transitions of the H_2 Lyman and Werner bands are indicated by the upper and lower tick marks, respectively.

Our multi-wavelength approach allows us to identify the nebular contribution, constrain the reddening and derive stellar as well as nebular parameters. This information can be used to infer information on the CSPN progenitor (mass and evolution). This work is currently being expanded to our LMC and SMC samples (Herald & Bianchi 2002b).

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