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LOW DISPERSION SPECTROSCOPY OF POINT-SYMMETRIC PNe

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An observational study of a sample of point-symmetric PNe is presented. The study includes an analysis of physical conditions and nature of the emission. A description of each object, taking into account morphological and kinematic data obtained from literature, is discussed within the context of collimated outflows in PNe.

Point-symmetry is a morphological feature of many kinds of astrophysical systems, which is being found increasingly frequently in Planetary Nebulae (PNe). As in many other phenomena, the most relevant and systematic data are needed in order to reveal the nature, origin, and evolution of such systems. The goal of this work is to find out the physical conditions in particular regions (point-symmetric features) for a sample of PNe, for which the kinematics has been analyzed in the past. In this case, the sample corresponds to the four point-symmetric PNe studied by Guerrero, Vázquez, & López (1999), namely, Pe 1-17, PC 19, He 1-1, and He 2-429.

Long slit low-dispersion spectroscopy was obtained with the B&Ch spectrometer, combined with the $f/7.5$ focus in the 2.1-m UNAM telescope at the San Pedro Mártir Observatory (México). Observations were made on 1999 July 18 to 21. A 300 lines/mm grating was used, whereas a CCD Tektronix 1024 × 1024 was the detector (24 μm pix^{-1}). The wavelength ranged from 3400 to 7500 Å, with a dispersion of 4 Å pix^{-1}, and an angular scale of 0.84″ pixel^{-1}. Seeing was 1.″4 during observations and spectral resolution was 9 Å. A typical spectrum is shown in Figure 1.

With no intention to generalize, we found that, for these objects, electron temperature ranges from 10 000 to 16 000 K, but there is a wide range of densities, from 300 to 10 000 cm^{-3} (or even more). There is no apparent correlation between radial velocity and physical conditions. The two higher velocity features ($\sim$ 30 to 40 km s^{-1}) have very different densities, from a few hundreds to more than 3000 (or even more than 10^4). On the contrary, low velocity features seem to correspond to medium to high densities. A more complete analysis, including comparison among other regions from the same nebula, and a study of their chemical abundances, will be made in the near future.

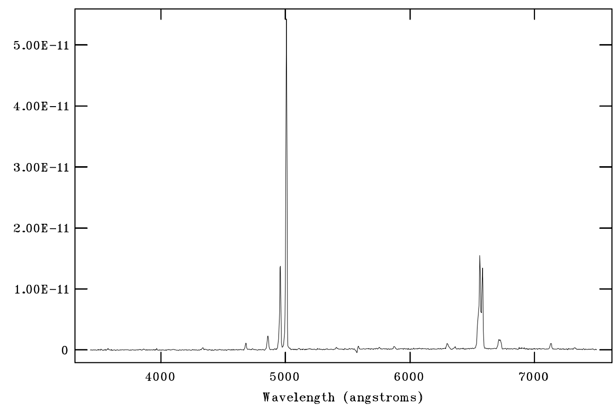

Fig. 1. Optical spectrum from the SE knot of He 1-1.

TABLE 1

PHYSICAL PARAMETERS FOR SOME KNOTS IN THE PNe SAMPLE

Object	Knot	T_e (K)	N_e (cm^{-3})	V_{rad} (km s^{-1})
He 1-1	SE	10 000[a]	300	36
He 1-1	NW	11 300	600	−29
He 2-429	E	10 000[a]	700	2
He 2-429	W	11 500	5000	4
PC 19	S	15 000	$> 10^4$	−40
PC 19	N	10 000	3300	26
Pe 1-17	NE	16 000	$> 10^4$	2
Pe 1-17	SW	12 200	500	6

[a] Assumed.

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