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THE STRUCTURE OF THE PLANETARY NEBULA IC 2149: A JET OR AN EDGE-ON RING?

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A set of optical and radio observations of the peculiar planetary nebula (PN) IC 2149 is presented. A bow-shock-like feature towards the NE edge is first detected with the VLA-A, and is also confirmed with *HST* archive images. Optical spectroscopy leads to apparently contradictory results, leaving this object as a unique case among the planetary nebulae.

The rare stretch morphology of the PN IC 2149 has already been detected by Sistla & Kaftan-Kassim (1977) in radio continuum and by Balick (1987) in narrow-band optical images. In this work, we present the results of a multiwavelength observational study, carried out in order to understand the structure of this up to now unclassified PN.

Narrow-band images of IC 2149 were obtained in 2000 October 18, in the 1.5-m telescope at the Observatorio de Sierra Nevada (OSN, Granada, Spain). Images were obtained in Hα, [N II] λ6584, [O I] λ6300, [O III] λ5007, and [S II] λ6716+6731. The images show that the emission from the nebula is concentrated in a band at PA +67°, the NE extreme of which is particularly bright in low-excitation lines.

The 3.6-cm continuum observations were made with the VLA-A of the NRAO in 1996 December 23. The standard VLA continuum mode with a bandwidth of 100 MHz and two circular polarizations was employed. Figure 1 shows the resulting cleaned map of IC 2149 ($0\farcs3$ beamsize). This is the first detection of the bow-shock-like feature located towards the NE (hereinafter "East Knot", EK).

We have also retrieved two images from the *Hubble Space Telescope* (*HST*) archive. These observations were made using the Wide Field Planetary Camera (WFPC2) in 1995 November 6 (Proposal 6119, PI: H. Bond) using two filters, V (F555W) and I (F814W). Both images also show the bow-shock-like structure at EK as in the radio map.

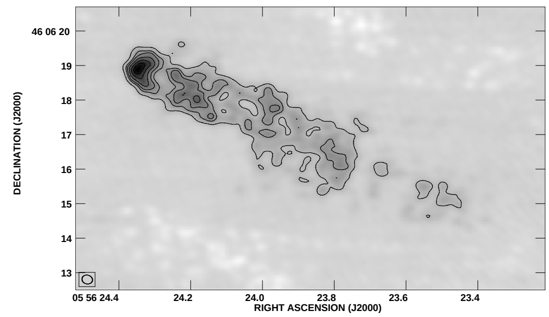

Fig. 1. Grayscale/contour map of the λ3.6-cm radio continuum of the planetary nebula IC 2149. Beam size is $3'' \times 2\farcs6$ (PA 76°) and it is shown at the lower left corner.

Long-slit echelle spectroscopy was obtained in 1998 August 2, with the IACUB spectrometer in the 2.56-m Nordic Optical Telescope (NOT) at Roque de los Muchachos Observatory (La Palma, Spain). Two spectra were obtained at PA +67° and PA −23° at a spectral resolution of 0.17 Å (7.8 km s^{-1}). Surprisingly, the spectra are not consistent with those expected from a bow-shock but rather indicate an expanding edge-on ring.

Finally, low-dispersion spectroscopic data for IC 2149 were obtained with a B&Ch spectrometer using the 2.1-m UNAM telescope (San Pedro Mártir, México) in 2000 January 14. A 300 lines/mm grating was used covering a wavelength range from 3400–7500 Å. We found that the resulting spectra, even that of the EK, are dominated by radiative emission processes (photoionization).

The possible scenarios to explain this apparent contradictory results between spectra and images will be fully discussed in a future paper.

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REFERENCES

Balick, B. 1987, AJ, 94, 671
Sistla, G., & Kaftan-Kassim, M. A. 1977, MNRAS, 178, 325