

NGC 2899: AN EVOLVED BIPOLAR PLANETARY NEBULA

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**ABSTRACT.** NGC 2899 (PK 277-3°1, He 2-30, RCW 43) is a southern planetary nebula of fairly large angular size ( $\sim 2!6 \times 1!4$ ) and moderate high surface brightness. Its morphology strongly resembles a loose bipolar structure with conspicuous bright condensations of toroidal geometry placed along the minor axis, on each side of the central object.

Results of long-slit echelle observations, low dispersion flux calibrated spectra and near infrared photometry are presented. The observations were obtained at the 3.9-m AAT and the 4-m and 1.5-m telescopes of CTIO.

The long-slit spectra obtained in the light of H $\alpha$  and [N II] reveal an object with a complex kinematical field. Line splitting is present over the face of the nebula with a mean nebular expansion of  $\sim 25 \text{ km s}^{-1}$ . In addition, remarkably high velocity structure, up to +110 and -135  $\text{km s}^{-1}$  is detected in the expanding equatorial toroid. Location of the slits is a critical factor that determines the spatial asymmetries found in the high velocity features. These data are interpreted in terms of the interaction of the hot stellar wind with the eroded constraining circumstellar shell/toroid that originally focused the bipolar structure.

Limited J, H and K mapping indicates that the near infrared emission arises predominantly from dust grains.

The low dispersion nebular spectrum shows a rich emission line spectrum. The [O III]/H $\beta$  and He II/H $\beta$  line ratios indicate an excitation class 6-7. A logarithmic extinction at H $\beta$   $c(\text{H}\beta) = 0.71$  was used to deredden the line fluxes. For the electron temperature we found  $T_e[\text{N II}] = 10,800^\circ\text{K}$  and  $T_e[\text{O III}] = 15,600^\circ\text{K}$ . For Ne a value of  $10^3 \text{ cm}^{-3}$  is adopted from the [C II] line ratio. The derived ionic abundances are:  $\log \text{N}^+/\text{H}^+ = -3.53$ ,  $\log \text{O}^+/\text{H}^+ = -3.79$ ,  $\log \text{N/O} = +0.26$ ,  $\log \text{He}^{++}/\text{He}^+ = -1.17$ ,  $\log \text{He}^+/\text{H}^+ = 0.89$  and  $\text{He/H} = 0.196$ . These values place NGC 2899 among the planetary nebulae of Type I.

The spectrum of the central object denotes an early G-type star with a strong blue excess in its continuum energy distribution suggesting the presence of a central binary system.