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Aperture Effects in the Long Slit Spectrophotometry of the Polar Ring Galaxy IIZw71

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Abstract. Polar ring galaxies are composed by an early type galaxy and a polar ring rotating around it and which is rich in gas, dust and star formation. IIZw71 is catalogued as a blue compact dwarf galaxy and as a probable polar ring galaxy (Whitmore et al. 1990). The formation of the polar ring and the very luminous bursts of star formation along it, is a consequence of the interaction with a close companion, IIZw70, situated at 18.1 kpc (Cox et al. 2001). We have carried out spectrophotometric observations of the bursts of star formation along the polar ring in order to study differences in the physical properties or the star formation histories between the knots

Data were obtained using the ISIS double beam spectrograph mounted on the 4.2-m William Herschel Telescope in the observatory of El Roque de los Muchachos (La Palma, Spain). The spectral range covers from 3670 to 10150 Å. No major effects due to atmospheric differential diffraction have been found as compared with the curves calculated by Filippenko (1982). Nevertheless, the comparison between the spatial profile of Hα with the available photometry (Gil de Paz et al. 2003) leads to the probable slit position shown in left panel of Fig. 1, with good coverage only in knots C and D, being a bit worst in knot B and A.

Underlying stellar population has been studied using the best fitting found by the spectral synthesis code STARLIGHT (Cid-Fernandes et al. 2004) at the metallicity measured in the brightest knots ($Z = 0.004$). The specific weight of the youngest population is larger in knots A and B, which are the worst covered by the slit, while we find that the stellar population of host galaxy is quite clear in the spectrum of knot C. We find as well that the most part of the stellar population, responsible of the chemical evolution in these knots, is older than 500 Myr.

Reddening has been measured using the most prominent hydrogen recombination Balmer lines once the absorption features of the underlying stellar population have been subtracted. The found values are compatible with those found by STARLIGHT pointing to lower values in the knots worst covered by the slit. We show in the upper right panel of Fig. 1 the best fits to the relative theoretical-to-measured ratios of recombination hydrogen lines with the extinction law.

Line temperature of [O III] has been measured in knots B and C, so oxygen abundances have been determined by the direct method in these knots. In the other knots, empirical parameters have been used pointing towards a chemical

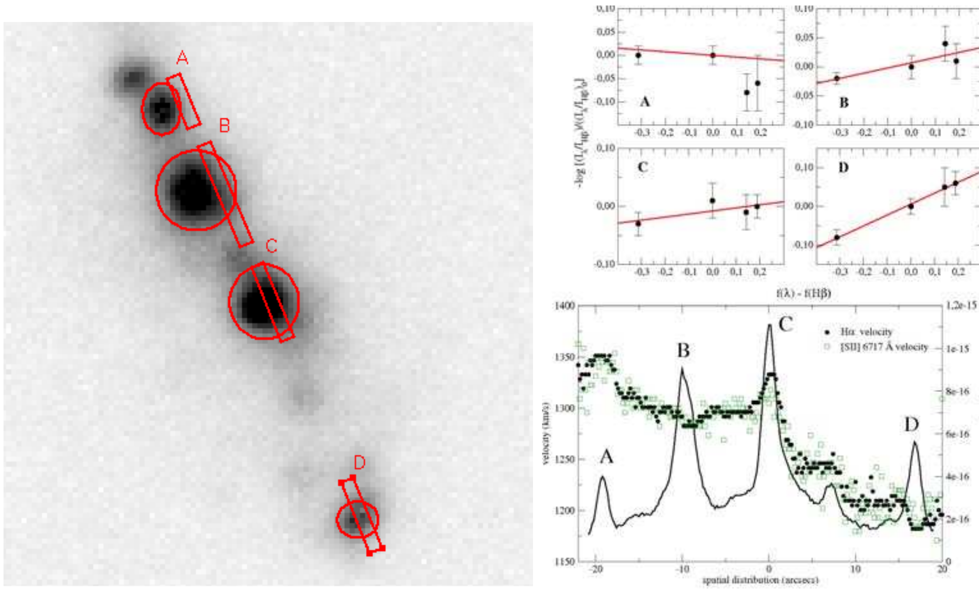

Figure 1. Left panel: Hα image of IIZw71 with the calculated position of the slit. Right panel: calculation of reddening for each knot and heliocentric velocities of Hα and [S II] (top) compared with Hα spatial profile along the polar ring (bottom).

homogeneity between the knots. Parameters involving high excitation lines of oxygen (O_{23}, Pagel et al. 1979) and sulfur (S_{23}; Díaz & Pérez-Montero, 2000) are affected by aperture effects in knot A, while N2 (Denicoló et al. 2000), which involves low excitation nitrogen lines, gives more homogeneous values.

The analysis of heliocentric velocity along the slit using Hα and [S II]λ6717 Å emission lines is shown in lower right panel of Fig. 1. We find an asymmetric rotation possibly affected by the expanding velocities of the bubbles of ionized gas surrounding the knots of star formation, in the case of knot C, reaching 60 km s^{-1}. Assuming that we see the polar ring edge-on, with a radial velocity of 85 km s^{-1} and an optical radius of 20$''$, which is where we can measure the emission lines with good S/N, we calculate a dynamical mass of $(2.8 \pm 0.2) \times 10^9$ solar masses, giving $M/L_B = 5$.

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