Planetary Nebulae: An Eye to the Future
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Planetary nebulae as tracers of the kinematic structure of the starburst galaxy IC 10

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Abstract. The Local Group dwarf irregular galaxy IC 10 is the nearest starburst galaxy (at 725 kpc) and presents extended and complex HI kinematics. It is believed that IC 10 is still experiencing an intense and very recent burst of star formation, likely triggered by infalling gas from an extended envelope which is counter-rotating with respect to the galaxy proper rotation. In this contribution we summarize our preliminary results (Gonçalves *et al.* 2011, in prep.) obtained by performing a kinematic analysis of the PN population of IC 10. Our aim is to explore the kinematic connection of its intermediate to old stellar populations with that obtained from HI observations. Some PNe were found at large galactocentric distances and could therefore represent a trace of past tidal interactions.

Keywords. galaxies: dwarf, galaxies: kinematics and dynamics, galaxies: individual (IC 10), Local Group, planetary nebulae: general

1. PNe vs. H I Radial Velocities in IC 10

We have studied about 35 PNe in IC 10, including newly discovered objects plus some PNe studied in Magrini *et al.* (2003). We used an [OIII]λ5007 on-band/off-band technique with the FOCAS camera, at Subaru. The radial velocities (RVs) were measured for most of the detected sources, using a slit-less method (Méndez *et al.* 2009) by means of images taken through both the on-band filter and an echelle grism in three fields of 6.5 arcmin (Fig. 1a). The bins of PN RVs (black circles) are shown in Fig. 1b. In Fig. 1b we show our PNe radial velocities (black circles), whose average value of -335 ± 28 km s^{-1} agrees well with IC 10's radial velocity (-348 km s^{-1}, NED).

Wilcots & Miller (1998) (WM98) studied the H I kinematics of IC 10. By fitting a tilted ring model to the velocity field of IC 10 disk these authors found a rotation curve (their Fig. 5) that suggests a V_{rot} of 30 km s^{-1}. In Fig. 1b we compare the PN radial velocities with those obtained by WM98 from HI observations. In these velocity maps, the grey scale is indicative of the HI column density. The sense of the rotation is that the West side of the disk is approaching. WM98 conclude that IC 10 has a normal rotating disk, but with an abnormal counter rotation of its external envelope. Thus, Fig. 1b suggests that the PN kinematics follow that given by the H I gas. It is worth emphasising that,

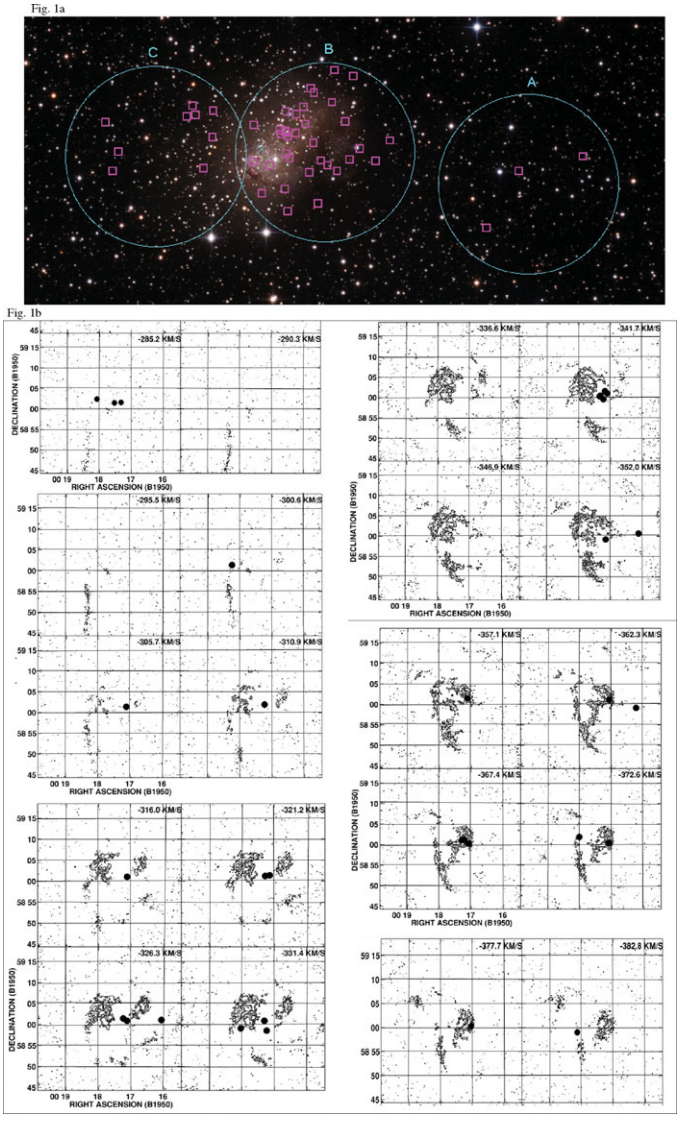

Figure 1. a) The three 6.5 arcmin FOCAS fields with the PNe we observed. b) IC 10's position fields per velocity bin with our PNe (black circles) superposed to the HI results of WM98.

while our study covers ∼3 kpc from the galaxy's centre, the results based on H I are confined within less than 1 kpc from the IC 10's centre. Our and the H I results suggest a galaxy formation and evolution scenario that might account for an inner normal rotating disk and with counter rotating gas further out. Interestingly, the IC 10 stellar population traced by PNe has a much larger extent than its present-time optical disk. The three kinematically confirmed PNe in IC 10's Field A tell us that the star formation in the past was extending towards larger radii than at present.

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