Resolved Line Profiles of PNe in NGC 6822

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ABSTRACT

BACKGROUND:

The kinematics of Planetary Nebulae (PNe) in galaxies is a clue to understand the behavior of LIMS and their relation with other components of the galaxies.

OBJECTIVE:

Measure precise radial velocities of PNe (intermediate-old age population), HII regions and A-type supergiant stars (young population) in NGC 6822, we aim to determine if both types of population share the kinematics of the HI disk found in this galaxy.

METHODS:

The heliocentric radial velocities (RV) of the different objects were compared to the velocities of the HI disk at the same position.

The RV were measured with a precision better than 5-6 km/s.

METHODS

Observations

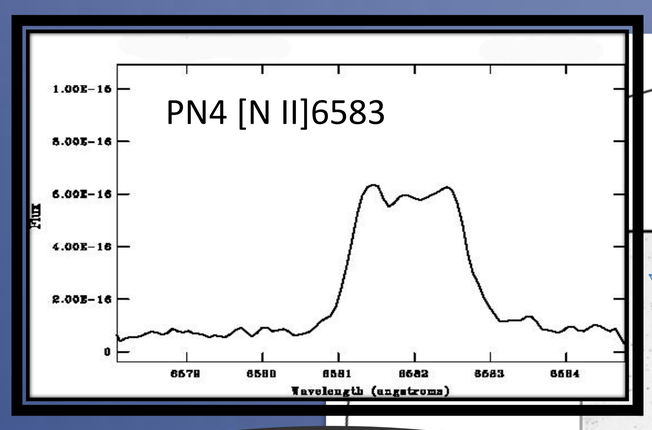
- High res of four PNe obtained with MIKE-Clay goes from 3350 Å to 5050 Å and from 4950 Å to 9400 Å. A binning of 2x2 was used, with a spacial scale of 0.2608''/pix, spectral res varied from 0.14 Å to 0.17 Å (about 10.8 km/s) in the blue and from 0.23 Å to 0.27 Å (about 12.8 km/s) in the red.
- Other 4 PNe high res was obtained with the MES-SPM, 3 of the them were retrieved from the database SPM-KINCATPN (http://kincatpn.astrosen.unam.mx/, for details see Richer et al. (2010).
- High res for the bright HII regions HV and HX (Hubble 1925), were provided by A. Peimbert (Peimbert et al. 2005). Data for HII 18 was extracted from the SPM-KINCATPN, and a low res spectrum for HII 08 was obtained from Hernández-Martínez et al. (2009)]
- High res spectra of two A-type supergiant stars (near the center of the galaxy) were deeply analyzed by Venn et al. (2001)

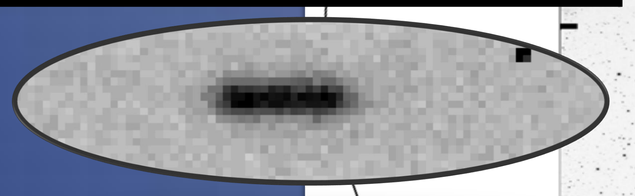
Data Reduction

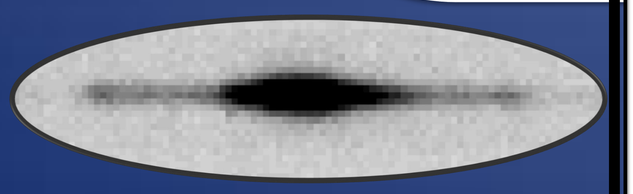
- Data reduction of LCO Clay-MIKE's and SPM-MES spectra was carried out by using standard IRAF routines.

RESULTS

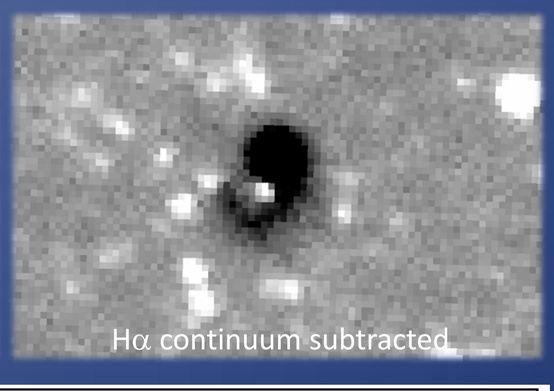
- HV, HX and HII 08, their RV are very close to those of the HI disk, differences in velocity relative to the HI gas (Δ) are smaller than 9 km/s. HII 18 presents a large Δ of -24.2 km/s.
- The two A-stars seem to share the movement of the HI disk. Their Δ are 2.3 km/s and -11.2 km/s.
- Most PNe are approaching faster than the HI gas, with Δ from -60 km/s to -12 km/s, except for the cases of PN1, PN2 and PN7 whose Δ are +12.1 km/s, +9.5 km/s and +21.2 km/s respectively.
- The PN4 [NII] 6583 line profile shows a central component surrounded by what appears to be a shell with an expansion velocity of 25 km/s.
- The PN7 [NII] 6583 line profile shows a central component surrounded by what appears to be a double-shell with an expansion velocity of 140 km/s.

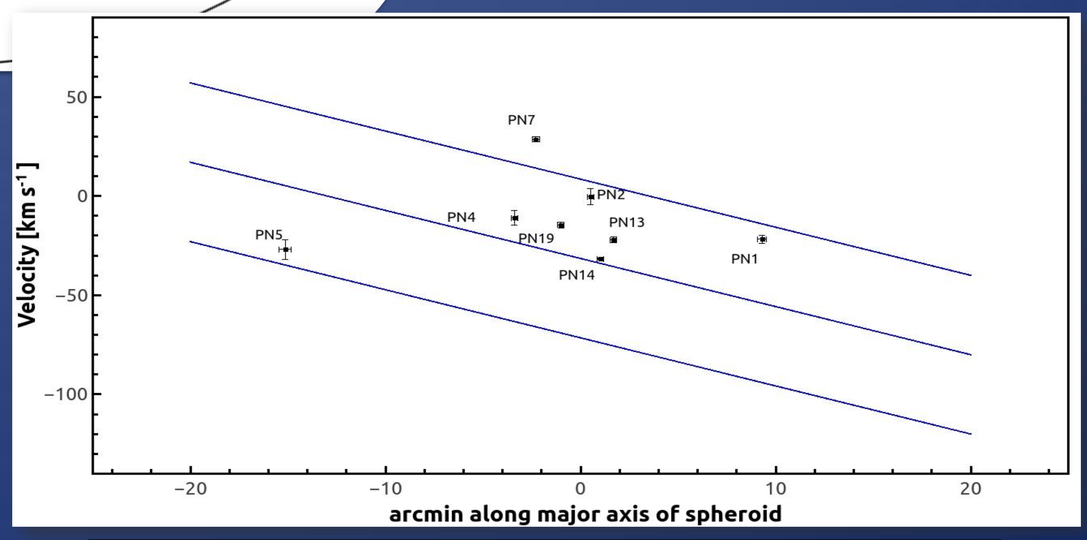






Object	Vhelio [km/s]	Δ = Vhelio – VHI [km/s]	Vhelio – Vsys [km/s]
PN1	-76.8±2.1	12.1	-21.8
PN2	-55.4±4.6	9.5	-0.4
PN4	-66.5±3.8	-12.2	-11.5
PN5	-84.1±1.7	-60.1	-29.1
PN7	-26.3±1.1	21.2	28.7
PN13	-77.1±4.7	-16.6	-22.1
PN14	-86.7±4.9	-20.9	-31.7
PN19	-68.6±3.2	-15.6	-13.6
HV	-62.7±2.1	-4.5	-7.7
HX	-57.3±2.5	-8.6	-12.3
HII 18	-87.4±1.8	-24.4	-32.4
HII 08	-63.6±44.3	-2.3	-8.2
A 13	-55.0±2.0	2.3	0.0
A 101	-65.0±2.0	-11.2	-10.0





CONCLUSIONS

- From the analysis of RV it is found that HII regions and A-type supergiants do share the kinematics of the HI disk at the same position, as expected for these young objects.
- The compact HII 18 shows a kinematics closer to the PNe and C stars, with a Δ of -24.2 km/s. This nebula could be a true PNe located near a faint and extended HII region.
- The studied PNe are not moving along with the HI gas and their kinematics is closer to the one presented by the C stars of the stellar spheroid. However, the analysis of a much large number of PNe is needed to confirm this result.
- The expansion velocities shown by PN4 is 25 km/s, which is a range similar to the one found in other galaxies (Richer et al. 2010). PN7 is a Type I PN located near the galactic center, however it is receding away from the galaxy at more than 30 km/s and it shows a double-shell with a velocity of about 140 km/s.

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