Search for emission–line objects in external galaxies

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We are carrying on several surveys in nearby galaxies aiming to find, catalogue and study old and young emission–line objects as HII regions, Planetary Nebulae, Symbiotics stars, SNRs to unprecedent levels. In particular, we are intersted in the study of extragalactic PNe and also of HII regions and Symbiotic stars. PNe are outstanding components of the intermediate stellar population and are present in galaxies of different morphological types and different chemical environements. They are the best tracers of kinematic properties of basic morphological components of galaxies (disks, bulges, haloes). We show in this poster a study of the PNe of three nearby galaxies: the spiral galaxies M33 and M81 (Magrini et al. 2000, 2001; Magrini et al. 2001A) and the dwarf irregular galaxy Sextans B (Magrini et al. 2002).
Large area belonging to these galaxies have been searched for emission–line objects , using the prime focus Wide Field Camera of the 2.54 m Isaac Newton Telescope (La Palma, Spain).

WFC image of Sex B (composition of [OIII], Halpha and Str.Y filters).

Five planetary nebulae have been discovered in the nearby dwarf irregular galaxy. The candidate PNe were identified by their point–like appearance and relatively strong [OIII] emission–line fluxes. The are located within a galactocentric distance of 2.8 arcmin, corresponding to 1.1 kpc.
This is a notable result considering the limited number of PNe know in the other dwarf galaxies of the Local Group. The total number of PNe found in Sextans B is consistent with the expected population size for this galaxy. The Fig. 1 shows the number of PNe vs the V–band luminosity of the galaxy, in solar units. The dashed line gives the expected total number of PNe fitted to the know number in LMC, where the survey has been most complete.The PN census in SexB may be expected to be less deep than that in LMC. The position of Sex B in Fig.1 implies a large portion of of intermediate–age stars with a significant fraction of star formation over the past 5 Gys. (Magrini et al. 2002 astro–ph–0202561)

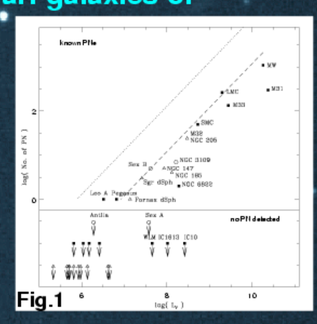


Fig.1

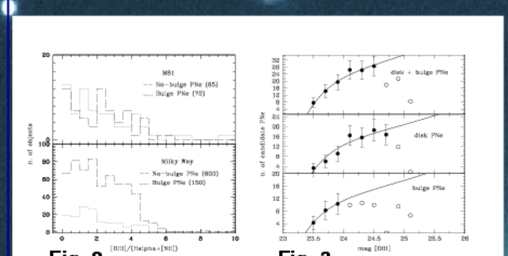


Fig. 2

Fig. 3

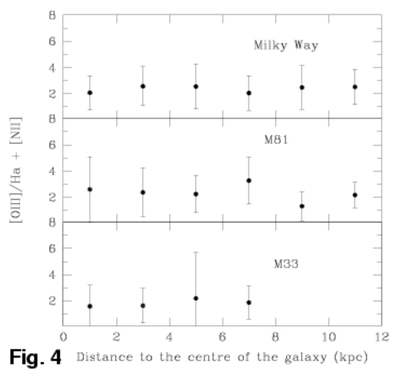
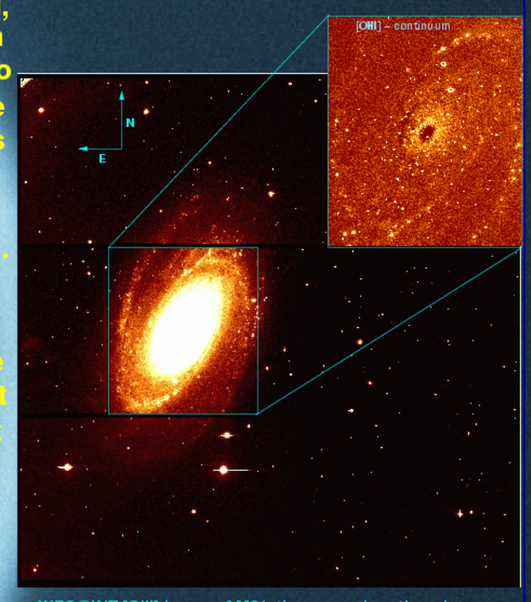
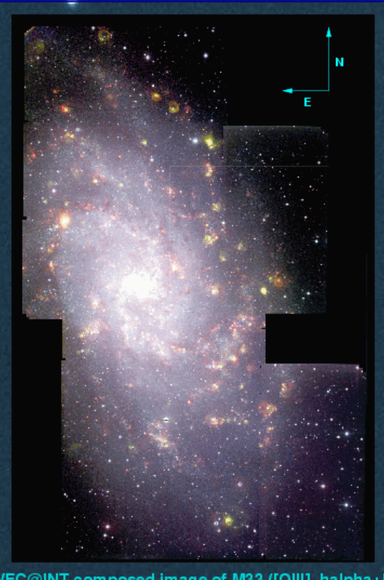


Fig. 4

In total, 171 candidate PNe were found in M81, 117 of which are new while 54 coincide with those discovered by Jacoby et al. (1989) in the central 4'x4' bulge.
The behaviour of the PNe excitation across the galaxy was examined, finding no evidence for substantial differences in excitation between bulge and disk PNe, nor variations along the galaxian disk. The ratio R=[OIII]/Halpha+[NII] is a good indicator of the temperature of the central star but also depend on the properties of the nebula like its geometry , electron density and temperature.
Fig.2 shows that there is not any significant variation between the excitation of the bulge and disk PNe in the Milky Way and in M81.
In Fig. 4 the radial behaviour of R is presented in three cases: PNe in M33, M81 and the Galaxy.
The distance of M81 has been extimated using the bright cutoff of the planetary nebulae luminosity function (Fig. 3), built for three different samples. The resulting distance is 3.84 ±0.41 Mpc in good agreement with previous determination using Cepheids.
(Magrini et al. 2001, A&A 379, 90)



WFC@INT [OIII] image of M81, the zoomed section shows the detection of several PNe.



WFC@INT composed image of M33 ([OIII]. halpha+[NII], continuum) (Magrini et al. 2000, ING Newslwtter 2, 17)

In november 1998, we observed M33 at the INT and using the on–band off–band techinques we discovered 131 new planetary nebulae(Magrini et al. 2000, A&A 355, 713, Magrini et al. 2001, A&A 367, 498). We are now investigating with spectroscopy their nature (observations October 2001 @WHT4.2m, La Palma).
Our aim is to quantify the degree of contaminations with compact HII regions due to our detection criteria. We observed 39 PNe and we could have useful spectra from 36 of them. We have constructed an up–to–date version of the Canto's diagnostic diagram, using essentialy recent extragalactic data(Fig.5). In our previous work, we extimated a contamination of the 10%. We analyze the position of our PNe in the Canto diagram, finding that 34 among the 36 observed are bona fide PNe and only two were misidentified with compact HII regions.
We can conclude that the criteria we used to search for PNe are reliable (point–like source, no continuum emission, Halpha+[NII]. and/or [OIII] 5007emission).
At the moment we are investigating the possibility to have chemical abundances and electron temperature and density determinations from the spectra we collected (see as example Fig. 6).

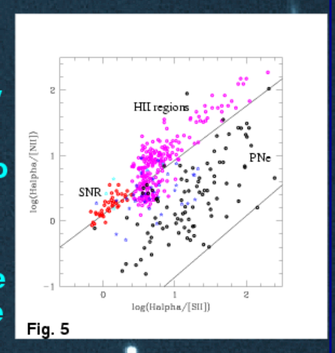


Fig. 5

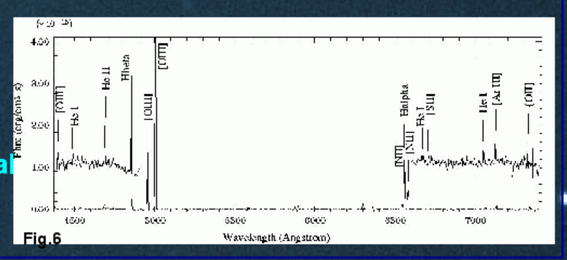


Fig.6

Background: Abell 39 galactic PN, from NOAO/AURA/NSF