Subaru + FOCAS observations of PNs in NGC 821

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Abstract. We present preliminary photometry of 122 PNs discovered in the elliptical galaxy NGC 821. We build the PN luminosity function (PNLF), which gives a distance modulus m - M = 31.9±0.3, in good agreement, within the uncertainties, with the SBF distance modulus 31.91±0.17 obtained by Tonry *et al.* (2001).

Keywords. planetary nebulae: general; galaxies: individual (NGC 821), distances and redshifts, elliptical and lenticular

1. Introduction

Planetary nebulae (PNs) in elliptical galaxies are preferentially detected in the outskirts of their galaxies and for this reason they can be used as tools for dark matter studies. Hui *et al.* (1995) and Teodorescu *et al.* (2005) found evidence of dark matter around two ellipticals: NGC 5128 and NGC 1344. On the other hand, by studying the line-of-sight velocity dispersion profile of 4 normal ellipticals, NGC 4697, 3379, 4494 and 821, Méndez *et al.* (2001) and Romanowsky *et al.* (2003) could not find evidence of dark matter in the halos of these galaxies (see also the contributions by Romanowsky and Méndez *et al.* in these Proceedings). This tells us that the more information is collected, the larger is the variety in the amount and distribution of dark matter, and the only way to get a clearer picture is to obtain data for many other elliptical galaxies. As mentioned above, NGC 821 was previously studied by Romanowsky *et al.* (2003) who reported detection of 104 PNs. Using Subaru we have increased the sample to 122 PNs, and we plan in the near future to further increase it to about 200 PNs. We hope this will help us to give a better diagnostic for the dark matter problem in the case of NGC 821.

2. Observations and Reductions

The initial observations were made by RHM with the Faint Object Camera and Spectrograph (FOCAS) attached to the Cassegrain focus of the 8.2 m Subaru telescope, Mauna Kea, Hawaii, on three nights, 2004 November 07/08/09. The field of view of FOCAS is 6' and is covered by two CCDs of 2k × 4k (pixel size 15 μm) with an unexposed gap of 5" between them. The image scale is 0.104 arcsec pixel^{-1}. The purpose of this project is to measure the brightness and also radial velocities of the discovered sources; the radial velocities are measured using a slitless method involving images taken through an echelle grism. The slitless method is described by Méndez, Teodorescu & Kudritzki in these Proceedings. The on-band filter has a central wavelength of 5010 Å, and a FWHM of 60 Å. In total, 15 off-band images (exp. time 140 s), 16 on-band images (exp. time
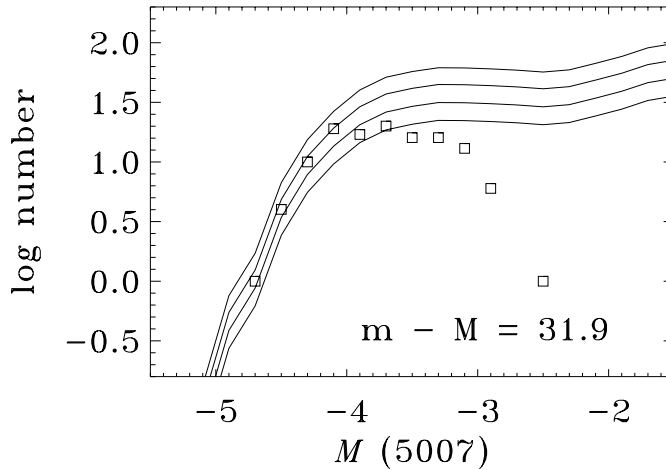
Figure 1. Observed [O III] $\lambda5007$ PNLF of NGC 821 (squares). The apparent magnitudes $m(5007)$ have been transformed into absolute magnitudes by adopting an extinction correction of 0.4 mag and a distance modulus $m - M = 31.9$. The 4 lines are PNLF simulations for 4 different total PN population sizes: 1700, 2400, 3400 and 4700 PNs (Méndez & Soffner 1997).

1400 s) and 16 grism images (exp. time 2100s) were taken on each of the two half-field CCD chips.

The photometry was made relative to the spectrophotometric standard star LTT 9491, using the IRAF tasks 'phot', 'psf' and 'allstar'. For a description of the procedure see e.g. Méndez *et al.* (2001).

3. PNLF, extinction, distance, conclusions

Having measured the apparent Jacoby magnitudes $m(5007)$, the PN luminosity function (PNLF) was built (Fig. 1). The absolute magnitudes $M(5007)$ were derived using an extinction correction of 0.4 mag (from data listed in NED, NASA/IPAC Extragalactic Database) and a distance modulus $m - M = 31.9$. There is good agreement with the SBF distance of Tonry *et al.* (2001). However, at $M(5007)$ fainter than -3.8 the PNLF is probably affected by incompleteness, and we expect to improve the accuracy of the PNLF distance by increasing the total exposure time, which we need anyway to detect more PNs in this galaxy. We have postponed the radial velocity measurements until we collect additional images and combine them with the earlier ones.

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