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PNs and H II regions in NGC 300

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Abstract. From a survey of PNs in NGC 300 we obtain its PNLF. We use it to derive a distance estimate, and briefly discuss the PNLF shape.

Keywords. planetary nebulae: general; galaxies: individual (NGC 300), distances and redshifts

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1. Introduction and observations

We report a survey of PNs and H II regions covering the full extent of the face-on, late-type Sculptor spiral galaxy NGC 300. We have used a three-filter technique, with narrow-band filters centered at 5012, 5180 and 6584 Å. The images were obtained by RHM and WG in September 2000 with the MPG/ESO 2.2m telescope at La Silla, Chile, using the Wide Field Imager (WFI). We obtained a total of 14 images through each of the filters, with total added exposure times of 27985, 8280 and 15360 seconds, respectively. The seeing was typically between 0.9 and 1.3 arcsec.

2. Reduction

Reduction was performed within the IRAF environment. Images were bias-subtracted and flat-fielded using the **mscred** package. Astrometric and photometric calibration were performed using the **wfpred** package developed at the Padova Astronomical Observatory by Enrico Held and Luca Rizzi. A full astrometric solution was generated for the WFI camera in the three filters, with a final absolute precision of 0.3 arcsec rms (the error is mostly due to the precision of external reference catalogs). The photometric calibration was achieved in two steps. First, relative zero points of the 8 CCDs were measured and corrected. Second, the absolute zero point of one of the CCDs was measured using spectrophotometric standard stars.

Photometry was performed using Daophot II. Raw photometry results were tied to the absolute scale by computing aperture correction on a set of bright isolated stars. The final error of the absolute calibration is 0.05 mag rms.

The transformation from instrumental to Jacoby magnitudes was obtained from observations of the spectrophotometric standard star LTT 7379 and the following filter parameters: equivalent widths 23.4, 149 and 68.1 Å, and filter transmission at the relevant wavelength 0.76, 0.85 and 0.75 respectively.

3. PNLF, distance and extinction

We present the [O III] 5007 PN luminosity function in Fig. 1. It is compared with a simulation produced by Méndez and Soffner (1997) assuming a distance modulus of 26.8 mag and no reddening. This confirms an earlier PNLF distance based on a smaller sample (Soffner *et al.* 1996). There is good agreement with Cepheid distances, as usual.

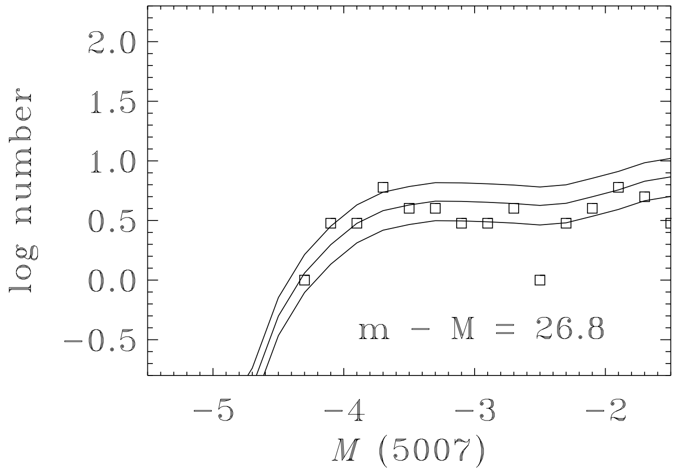

Figure 1. Open squares represent the observed 5007 PNLF of NGC 300 (98 PNs), assumed to be at a distance modulus of 26.8 and assuming no reddening. The full lines are numerical simulations of the PNLF (Méndez and Soffner 1997) for three different PN population sizes: 240, 350, and 500. These simulations reproduce very well the shape of the observed PNLF, in particular the deficit of PNs between $M(5007) = -3.5$ and -2.0.

Recent work (Gieren *et al.* 2005) has suggested a higher reddening internal to NGC 300, the average $E(B-V)$ being 0.09 mag. If we apply this reddening correction, the absorption at 5007 Å becomes 0.35 mag, and the distance modulus is reduced to 26.45. The agreement with the Cepheid distance is conserved if the reddenings are the same, on average, for Cepheids and PNs. Whatever uncertainty remains in the distance estimate is dominated by the uncertainty in the reddening correction to be applied.

4. The shape of the PNLF

There is a certain lack of PNs, starting at $M(5007)$ fainter than -3.5. This has been reported in other galaxies too, in particular the SMC (Jacoby and DeMarco 2002). See e.g. Ciardullo's review in these Proceedings. NGC 300 provides another example. The shape of its PNLF is well reproduced by the Méndez and Soffner PNLF simulation. The physical reason for this shape is not entirely clear, but it can be most probably related to a preponderance of H-burners among PN central stars (see in particular the shape predicted in Fig. 4 of Méndez and Soffner 1997).

References

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