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The UKST Survey of Planetary Nebulae in the Small Magellanic Cloud

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Abstract. This paper describes the results of searches for planetary nebulae on seven objective prism plates which were taken with the UK 1.2m Schmidt Telescope and cover the entire Small Magellanic Cloud. A total of 62 objects were detected; their spatial distribution is discussed.

1. Introduction

Schmidt telescopes have provided the means of identification for most of the known planetary nebulae in the Magellanic Clouds. In most instances the telescopes were used with objective prisms. Early work was based on the smaller Schmidt telescopes principally towards the centres of these galaxies; but latterly the wide $6.5° \times 6.5°$ field of the UK 1.2m Schmidt Telescope (UKST) has been used to observe the entire Large Magellanic Cloud (LMC) and thereby construct a catalogue of 265 planetary nebula candidates (Morgan 1994a). Even the Small Magellanic Cloud (SMC) is known to extend over an area at least $\sim 11.5°$ across (Morgan and Hatzidimitriou 1994) which is large enough to require the wide field of the UKST for complete easy coverage. Consequently, a set of deep UKST objective prism plates covering the entire SMC area was obtained and searched for planetary nebula candidates.

The identifications of new planetary nebula candidates found during scans of these plates will be presented elsewhere, but the present paper describes the overall distribution of planetary nebulae in the SMC as seen on the UKST plates.

2. Observations and Reductions

The seven UKST objective prism plates used for this work are of the same type as those used for the LMC study (Morgan 1994a). That is, they all employ a GG455 filter, the IIIa-J emulsion and the UKST 800Å/mm dispersion objective prism, and are ideal for identifying faint planetary nebulae. The plates typically reach a continuum magnitude of $b_J \sim 19.5$ and allow the detection of planetary nebulae with [OIII]λ5007 fluxes $\gtrsim 5 \times 10^{-14}$ erg s^{-1} cm^{-2} (see Morgan & Good 1990).

The plates were searched by systematic, visual scanning and new planetary nebula candidates were checked following the procedures described by Morgan (1994a) in connection with the LMC Survey. These procedures allowed the elimination of faint M and C stars, compact emission-line galaxies and variables such as novae: contaminating objects should be rare. The most crowded areas

TABLE I Summary of Planetary Nebulae in the UKST Survey

Catalogue	No. of Objects	Catalogue Entry Numbers	Reference
SMP	28	1-28	Sanduleak *et al.* (1978)
SP	2	32,34	Sanduleak & Pesch (1981)
MG	13	1-13	Morgan & Good (1985)
J	7	2, 4	Jacoby (1980)
MA	8	14, 44, 406, 891, 1357, 1714, 1762, 1796	Meysonnier & Azzopardi (1993)
M	9	1-9	Morgan (1994b)

Total number of objects detected in UKST survey is 62
Each line in the Table includes only those objects which have not appeared in the Catalogues higher in the Table.

of the Bar were excluded from the UKST searches because they had been well covered by Jacoby (1980) from deep, on-band, off-band [OIII] imaging, and by Meysonnier and Azzopardi (1993) from deep objective prism searches in the Hα line. Instead, the planetary nebulae identified in these two catalogues were sought on the UKST plates; many were seen, but others were too faint to be detected or were obscured in very crowded regions.

3. The Planetary Nebula Distribution

Table I provides a brief summary of the planetary nebulae detected on the UKST objective prism plates. In the central regions not scanned for this work, Table I includes only those planetary nebulae already identified in the literature which are clearly visible on the UKST objective prism plates.

Clearly, not all the objects in the papers listed in Table I were seen on the UKST plates. In particular, many of the planetary nebulae found by Jacoby (1980) are excluded because they are are too faint to be seen with the UKST. Also, some of the Meysonnier and Azzopardi (1993) Hα-emission objects are omitted because they too are fainter in [OIII]λ5007 than the UKST limit. Nor does Table I include the VLE (very low excitation) objects because these either have too strong a blue continuum or are too weak in [OIII]λ5007 to be detected.

The positions of the 62 SMC planetary nebulae are plotted in Fig 1: superimposed are four carbon star surface density contours taken from Morgan and Hatzidimitriou (1994). Three planetary nebulae are found at large distances from the centre of the SMC; and, being located near the boundary of the SMC carbon stars, these objects could easily be SMC members. The shape of the planetary nebula surface density distribution within distances $\sim 2°$ from the centre of the SMC is the same as that of the Bar (as reported in earlier papers)

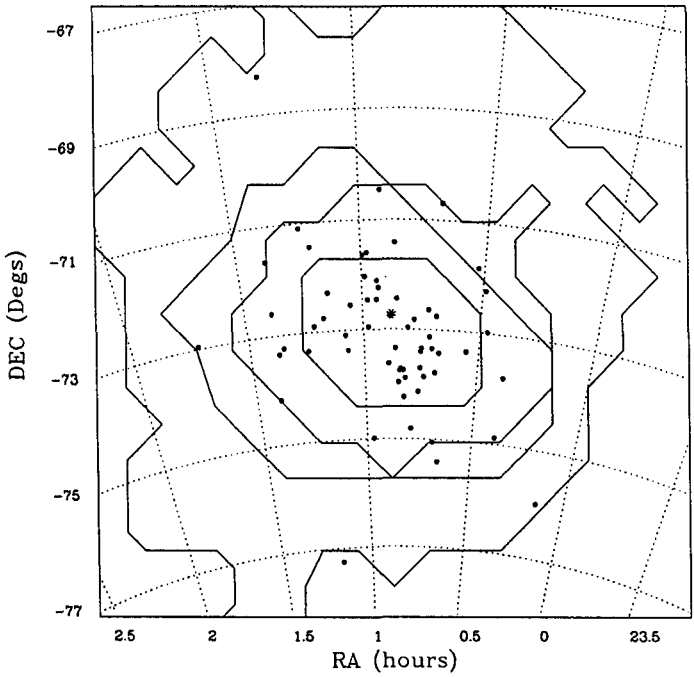

Figure 1. The 62 SMC Planetary Nebulae seen on deep UKST objective prism plates. The contours are those of the SMC carbon stars (Morgan & Hatzidimitriou 1994) at 1, 5, 20 and 50 stars per unit area. The optical centre of the Bar is marked with an asterisk.

and matches the innermost contours of the carbon star distribution; but farther from the SMC centre it is insufficiently well delineated to depict the different shape shown by the outermost carbon stars.

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