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*Research Note*

# A New Southern Planetary Nebula

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**Summary.** A new southern planetary nebula of low surface brightness has been discovered on ESO Schmidt plates. Spectral characteristics, velocity, the central star, and estimates of the distance are discussed.

**Key words:** planetary nebula — spectra — distance — central star

## Introduction

A blue plate taken with the new ESO Schmidt telescope reveals a hitherto uncatalogued planetary nebula with coordinates $11^h50^m33^s$, $-50°34'$.
This nebula, shown in the enlarged section of the Schmidt plate of Fig. 1, is characterized by unusually smooth emissivity over the disk and circular symmetry, and a faint central star. The diameter of the disk is 82″.

## The Spectrum and the Radial Velocity of the Nebula

Two image-tube spectra of this object were obtained with the Boller and Chivens spectrograph on the 1.52 m telescope at La Silla.
These spectra, one having a dispersion of 90 Å/mm and the other 150 Å/mm, yield a heliocentric radial velocity of $-10\pm8$ km/s.
Correcting the heliocentric velocity to the local standard of rest by $-7$ km/s, gives a reduced radial velocity of $-17\pm8$ km/s.
The spectrum of the former is shown in Fig. 2 where some line identifications are given. A comparison of this spectrum with samples of different excitation classes provided by Aller (1956) suggests an excitation class 6, resulting from the strengths of the He II $\lambda$ 4686 line relative to H$\beta$.

## The Brightness of the Central Star

To estimate the apparent brightness of the central star, a photometric sequence was set up with the 1 m and the 50 cm telescopes. With the first, measurements using the Johnson B filter, so as to match the Schmidt IIa-0 system, were carried out on April 15, 1975 (in the course of an observing run planned largely for a different purpose). These measurements produced a sequence ranging from $B=9.7$ to 17.1. Subsequently, using the 50 cm telescope, this sequence was related to a number of bright stars of known photometry: HR 6188 ($V=5.66$, $B-V=-0.03$); HR 6192 ($V=5.87$, $B-V=+0.65$) and HR 6147 ($V=4.27$, $B-V=+0.92$, $U-V=+1.62$).
The resulting $B$, $B-V$ and approximate $U-B$ values in the Johnson system are given in Table 1, where the running numbers identify the stars as marked in Fig. 1.
The faintest star in this sequence, No. 2 with $B=17.05$, does not quite reach the magnitude of the central star of the planetary nebula, which was invisible in the field of the 1 m telescope. On the basis of an extrapolation of diameter measurements on the Schmidt plate, and taking into consideration the presumed limiting magnitude of this plate, $B=21.0$, we estimate the $B$ magnitude of the central star to be $B=18.0\pm0.3$ (p.e.).
The correction for interstellar absorption is probably small. From the available approximate $U-B$ and $B-V$

Table 1. Photometric sequence

| Star | $B$ | $B-V$ | $U-B$ |
|---|---|---|---|
| 1 | 11.06 | +1.57 | +1.8 |
| 2 | 17.05 | | |
| 3 | 15.07 | | |
| 4 | 14.50 | | |
| 5 | 12.95 | +0.66 | +0.1 |
| 6 | 10.31 | +1.13 | +1.0 |
| 7 | 15.62 | | |
| 8[a] | 9.72 | +1.12 | +1.1 |
| 9 | 11.42 | +1.08 | +0.9 |
| 10 | 11.00 | +1.19 | +1.3 |

[a]) Number 8 = SAO 239466.

* Now at Huijgens Laboratory, Leiden.

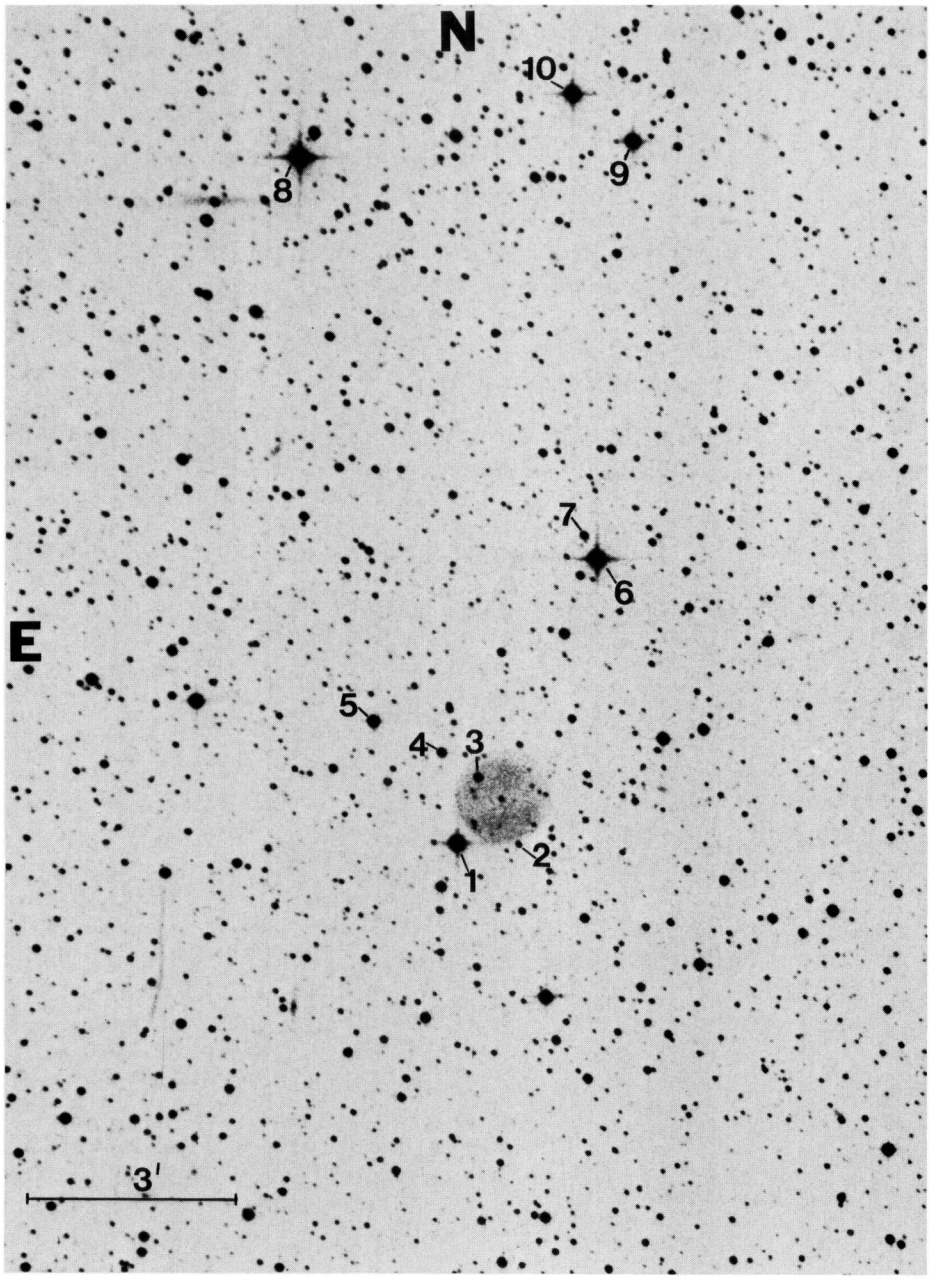


Fig. 1. An enlarged section of the Schmidt plate showing the planetary nebula, and stars referred to in the text. The exposure was made on a IIaO plate for 60 min through a GG 385 filter

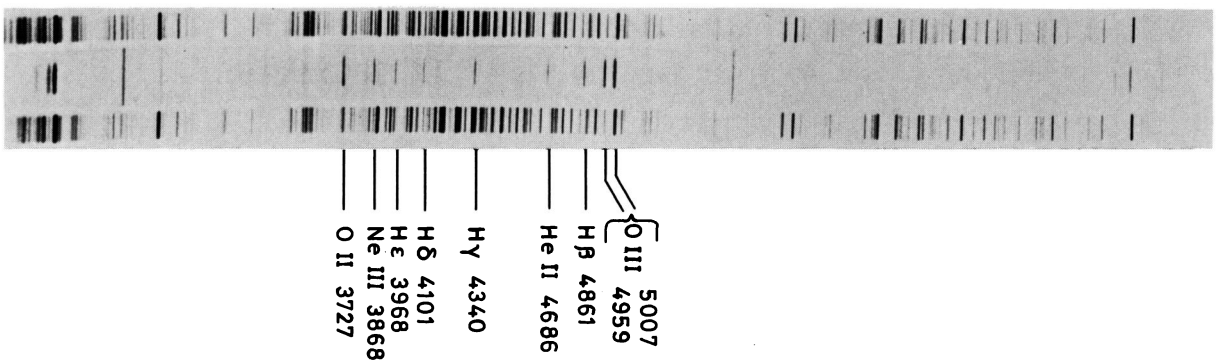


Fig. 2. An unwidened spectrum with original dispersion of 90 Å/mm resulting from a 120 min exposure. Strong lines are identified

values of the brighter stars in the photometric sequence, we infer that No. 5 is probably a late F or early G main sequence star with at most 0.2 mag reddening in $B-V$ at a distance of about 500 pc; No. 1 is probably a late K giant having similarly no more than 0.2 mag reddening in $B-V$, at a distance of 1000 pc. These two stars are nearest on the sky to the nebula. Numbers 7—10 should be either reddened K giants or late K main sequence stars with no more than a few tenths of a magnitude reddening.

### Distance, and Intrinsic Luminosity of the Central Star

At the galactic coordinates of the object, $\ell = 294°$, $b = +11°$, differential galactic rotation causes negative radial velocities which depend on the distance of the object in the following way:

at 1 kpc $V = -10$ km/s

at 3 kpc $V = -23$ km/s

at 5 kpc $V = -23$ km/s

at 7 kpc $V = -11$ km/s

at 9 kpc $V = +10$ km/s.

The moderately large velocity dispersion to be expected for objects of the present kind means that the observed radial velocity, while within the expected range, cannot be used as a measure of its distance.

Estimates of photographic absolute magnitudes of nuclei of planetary nebulae have been listed by O'Dell (1963, 1968); they range from about $+8$ to $-2$. If we ignore interstellar absorption, these extreme values would correspond to distance moduli of our object from 10 to 20, or distances of 1000 to $10^5$ pc. On the other hand, the observed apparent diameter of the nebula, 82″, corresponds to a linear diameter of 0.40 pc at a distance of $10^3$ pc, and this approximates the diameters of the largest known planetary nebulae. Accordingly, the distance will not be much in excess of $2 \times 10^3$ pc unless its dimensions are unusually large. We thus arrive at probable values of the photographic luminosity of the central star and of the distance of about $+8$ to $+6$ and 1000 to 2500 pc. The distance above the galactic plane is then about 200 to 480 pc.

Alternatively, we can use Abell's (1966) formula for old planetary nebulae using the photored magnitude $m_{pr}$ and the volume $v$ expressed in cubic seconds of arc, $\log r = 3.240 + 0.08\, m_{pr} - 0.2 \log v$.

Estimating $m_{pg} \sim 23.5$ mag/s$^2$ for this nebula by comparing it with Abell 84 ($m_{pg} = 23.7$ mag/s$^2$) on the Palomar Atlas, and assuming $m_{pg} - m_{pr} \sim +3$ mag, which is a mean value from 66 old nebulae given by Abell (1966), we obtain $r \sim 1100$ pc.

All the available evidence therefore suggests that it is an old object belonging to the galactic disk.

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