

SOME OBSERVATIONS OF STEPHENSON'S PLANETARY NEBULA

RONALD WEINBERGER

Institut für Astronomie der Universität, Innsbruck, Austria

AND

ALOIS PURGATHOFER

Institut für Astronomie der Universität, Wien, Austria

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A new planetary nebula detected by Stephenson (1978) has been observed in the optical, near infrared, and radio range; its appearance on the POSS is described and its position is determined.

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A hitherto unreported planetary nebula (PN) at $\alpha = 07^{\text{h}}04^{\text{m}}3$, $\delta = -03^{\circ}00'$ (1950) was very recently found by Stephenson (1978) on objective-prism plates. It has for some time been included in our lists of PN which we intended to observe in different wavelength regions. We present here the observations of this object which have already been carried out.

The PN was noted by us when examining Palomar Observatory Sky Survey (POSS) prints in 1976 for strongly reddened galaxies at low galactic latitudes. Though it had at that time been suspected as possibly being a PN, our suspicion was too weakly established as to put it in our lists of new PN candidates (Weinberger 1977*a,b*). Only when we photographed the object about one year later did its nature become obvious.

Appearance on the POSS

The PN is visible in both colors on four prints (nos. 653, 1346, 1488, 1491) as a circular black spot and lies in a region of rather uniform star density. The mean value of the four diameters of the object in the red is 17 arc sec, in the blue 15 arc sec. If it were a star, the diameters would correspond to $10^{\text{m}}1$ (red) and $12^{\text{m}}2$ (blue) $\pm 0^{\text{m}}8$, employing one of the magnitude-diameter relations in use (Dorschner et al. 1966); therefore these numbers represent lower limits of the integrated nebular magnitude. Surface brightnesses were estimated by comparison with those Abell (1966) determined for the brightest portions of his nebulae. The darkest, namely blackish portions of them have up to about 19.5 (red) and 20.5 (blue) mag arc sec⁻², our black-looking object therefore being of approximately equal or stronger surface brightness. Since the nebula has a rather uniform surface brightness (see next paragraph), upper limits of the integrated nebular magnitudes can be found as $13^{\text{m}}6$ (red) and $14^{\text{m}}9$ (blue). When the PN is assumed to be a sphere, the application of Abell's

(1966) equation (4) yields distances of 2300 pc and 4400 pc for the two red magnitude limits. The position has been calculated by use of five SAO reference stars as $\alpha = 07^{\text{h}}04^{\text{m}}20^{\text{s}}8$, $\delta = -03^{\circ}00'30''$ (1950.0) with $\pm 5''$ to $10''$ error in both coordinates; correspondingly $l = 217^{\circ}44$, $b = +02^{\circ}02$. The rectangular coordinates, measured from the lower left corner of the POSS (E) print no. 1491 are $x = 338$, $y = 19$ mm.

Photographs in the Near Infrared

In November 1977, the nebula was photographed with a cooled image-tube camera at the 1.2-m telescope on the Calar Alto in Spain in the colors R ($\lambda_{\text{eff}} \simeq 0.7 \mu$) and I ($\lambda \simeq 0.9 \mu$), closely resembling the Johnson R and I passbands. Details of the camera system, which has an S1 cathode and a P11 phosphor, are given by Beetz, Elsässer, and Weinberger (1974). These plates clearly demonstrated the typical characteristics of a planetary nebula. The R plate (Fig. 1) shows a disk of nearly uniform surface brightness with a diame-

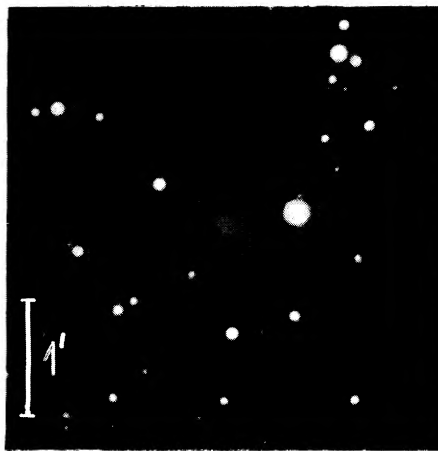


FIG. 1— R photograph of the PN (1.2-m telescope, exposure time 35 min). North is at top, east to the left.

ter of $d \sim 15$ arc sec. No central star is visible; the limiting magnitude for stars on this R plate is $19^m \pm 1^m$. The PN is marginally visible on the I plate which has a limiting star magnitude of $16^m.5 \pm 1^m$ (exposure time 45 min).

Optical Spectrum

A spectrum of the object was obtained in November 1977 with the spectrograph (equipped with a Carnegie image tube) on the 1.5-m telescope of the Leopold Figl Observatory near Vienna. This 60-min slit spectrum covers the spectral range $4300 \text{ \AA} - 5100 \text{ \AA}$ with a reciprocal dispersion of 26 \AA mm^{-1} and was calibrated with a tube sensitometer. The following lines can be seen: $[\text{O III}] \lambda 4959 + \lambda 5007$; $\text{H}\beta$; $\text{He II } \lambda 4686$; $\text{H}\gamma$. Uncorrected line ratios for $[\text{O III}]/\text{H}\beta = 8.0$, for $\text{He II}/\text{H}\beta = 0.3$; accordingly, the excitation class is medium, in agreement with Stephenson's determination. The spectrum also yields a provisional heliocentric radial velocity of $+57 \text{ km s}^{-1}$.

Radio Observation

Six-centimeter observations of several new PN were carried out, in March 1978, with the Effelsberg 100-m

radiotelescope of the Max-Planck-Institute for Radio Astronomy. Results for Stephenson's PN: Flux density $S = 10 \pm 3 \text{ mJy}$ (s.d.): $\alpha_{\text{opt}} + \alpha_{\text{radio}} = 0'.3$, $\delta_{\text{opt}} - \delta_{\text{radio}} = 0'.9$. The positional uncertainty is about $1'.0$ in both coordinates. The coincidence of PN and radio source can therefore be assumed.

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