SHOCK EXCITED EMISSION KNOTS IN COMETARY REFLECTION NEBULA

Th. Neckel and H.J. Staude
Max-Planck-Institut für Astronomie
Königstuhl 17
D-6900 Heidelberg
FRG

ABSTRACT. Near infrared and Hα CCD images of the newly found cometary reflection nebula GN 20.18.3. led to the discovery of its illuminating star and of a bright Hα knot located on its axis of symmetry. The knot has a Herbig-Haro spectrum indicating the presence of a collimated outflow from the central star. Also in the Bok globule L 810 a red CCD image reveals a cometary reflection nebula surrounding the central star, from which a shock excited filament is emanating. These observations emphasize the common origin of cometary nebulae and collimated high velocity flows.

INTRODUCTION. Staude et al. (this volume) have presented observations of collimated outflows in two bipolar reflection nebulae. On the basis of CCD photographs and longslit spectrograms here we show the existence of collimated high velocity flows in two cometary reflection nebulae.

THE COMETARY NEBULA GN 20.18.3 (α=20h $18\overset{m}{.}3$, δ=+37° 00') is associated with a small elongated dust cloud. An infrared CCD picture (Figure 1), taken with the 2.2 m telescope on Calar Alto, makes visible the fairly bright star #3 at the apex of the parabolic rim of the nebula. From this configuration and from its strong reddening (R-I ~ 2.6 mag) we argue that the nebula is illuminated by this star. A rough estimate of its distance yields d = 1 kpc. At this distance the R and I magnitudes of an early A star reddened by A_V = 11 mag equal those which we have observed.

The cometary nebula coincides with an IRAS point source. Integrating the IRAS fluxes between 12 and 100 μm and assuming a distance of 1 kpc, we obtain a contribution of 50 $L_\odot$ to the bolometric luminosity from this spectral range. This value agrees quite well with the assumption that the nebula is powered by an early A star.

An Hα frame of the nebula is shown in Figure 2. In its brightest part a nearly stellar knot becomes visible; here the ratio between Hα and Gunn r intensities is three times higher than throughout the nebula. From this we conclude that the radiation of the Hα knot is mainly emission.

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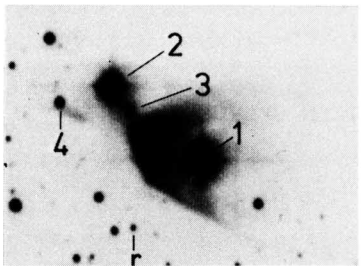

Figure 1. The cometary nebula GN 20.18.3 in the infrared. Star 3 illuminates the nebula, stars 1 and 2 are foreground objects.

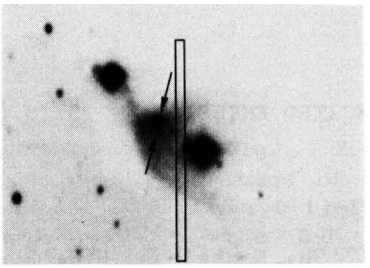

Figure 2. An Hα photograph of GN 20.18.3 shows the bright Hα knot near its center (arrows).

A spectrogram of the nebula taken with the slit oriented in N-S direction about 4 arcsec west of the Hα knot shows besides Hα the forbidden lines of [OI] $\lambda\lambda$6300, 6363 Å. Both Hα and [OI] λ6300 Å exhibit a component blueshifted by about 8 Å. Thus, it seems likely that an emission feature at 6724 Å must be identified as blueshifted [SII] 6731 Å line. The radial velocity of the blueshifted components turns out to be ~350 km/s. Together with the intensity ratio of the forbidden lines relative to Hα, which are typical for shock excitation, we interprete our observations in terms of a collimated high velocity flow emanating from the central star and colliding with the ambient material at the position of the Hα knot.

THE CASE OF L 810. Neckel et al. (1985) have shown that in the centre of the Bok globule L 810 a recently formed late B star is present. A shock excited filament is emanating from this star and points towards a nearby H_2O maser. A new CCD picture (Figure 3), taken under excellent seeing conditions, reveils interesting new details. First, it shows that the central star of L 810, #7 in Figure 3, is embedded in a cometary nebula with star #7 beeing located at its apex, the usual configuration in cometary nebulae. Further, also the nearby nebulous patch #8 exhibits a cometary shape. Possibly, this is a second cometary nebula with an additional young star in L 810. In conclusion, our observations substantiate the tight connection between collimated high velocity flows and bipolar or cometary morphology.

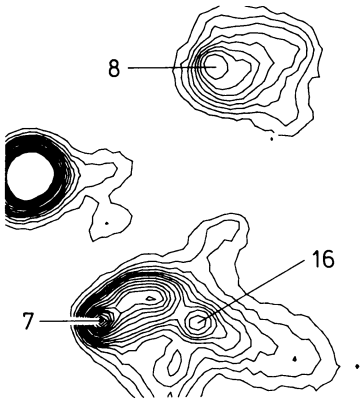

Figure 3. The central part of the nebulae embedded in the Bok globule L 810 with the two cometary reflection nebulae. The isophotes are constructed from a Gunn r CCD frame taken with the 2.2 m telescope.

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