OH0739-14: An old star blowing bubbles

Bo Reipurth
European Southern Observatory
Casilla 19001, Santiago 19
Chile

ABSTRACT. Two large bipolar bubbles emanating from the OH/IR star OH0739-14 have been discovered. Interference filter images show that the bubbles are emission-line objects, and longslit spectra reveal that the bubbles are expanding, with a radial velocity-difference between the bubblefronts of over 200 km/sec.

The OH/IR star OH0739-14, also known as OH231.8+4.2, has a faint optical counterpart, a small elongated nebula, which reflects the light of an embedded M9 giant or supergiant (J.Cohen and Frogel 1977,M.Cohen 1981). A bright near-infrared nebulosity is oriented along the same axis (Allen et al.1980). Furthermore, a detailed spatial and velocity mapping of the 1667 MHz OH maser emission shows a bipolar velocity gradient also along this axis (Bowers and Morris 1984,Morris et al.1982). Recently, Cohen et al.(1985) made longslit spectroscopy along the flow axis, and discovered blue- and red-shifted shock-excited regions outside the optical nebula.

Deep CCD images of OH0739-14 through various interference filters have been carried out at the Danish 1.5m telescope at ESO,La Silla. Fig.1 shows an H-alpha image, on which three basic features of the object can be identified. Firstly, the optical reflection nebulosity is seen as two bright, rather narrow lanes. Secondly, an obscuring disk cuts across these two lanes, and thirdly, two large shock-excited bubbles surround the reflection lanes. An image taken through a continuum-filter, otherwise identical to the H-alpha filter, shows only the reflection lobes and the obscuring disk, while yet another image, through a filter transmitting the [SII] 6717/6731 lines, again shows the bubbles, although weaker than in H-alpha.The total extent of the bubble-system is 50 arcseconds.

Longslit spectroscopy obtained with the ESO 2.2m telescope yield a heliocentric radial velocity for the

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northern bubblefront of -42 km/sec, and +180 km/sec for the southern front, both with a standard deviation of 27 km/sec. The inclination of the system is about 47 degrees to the plane of the sky, on the basis of near-infrared polarimetry (Tielens,Werner and Capps, cited in Cohen et al.1985). The space velocities of the northern and southern bubblefronts relative to the central maser are then about 110 and 190 km/sec. At a distance of 1.2 kpc and with this inclination, the physical extent of the system is around 0.42 pc (0.17 and 0.25 pc for the northern and southern part). A lower limit to the dynamical age of the bubbles is thus 1500 years.

The outflow is probably generated by the wind from a hot accretion-disk surrounding a companion white dwarf. The companion accretes matter from the mass-losing red giant, which is at the very end of AGB evolution. We are most likely here witnessing the rapid evolution immediately preceding the formation of a bipolar planetary nebula.

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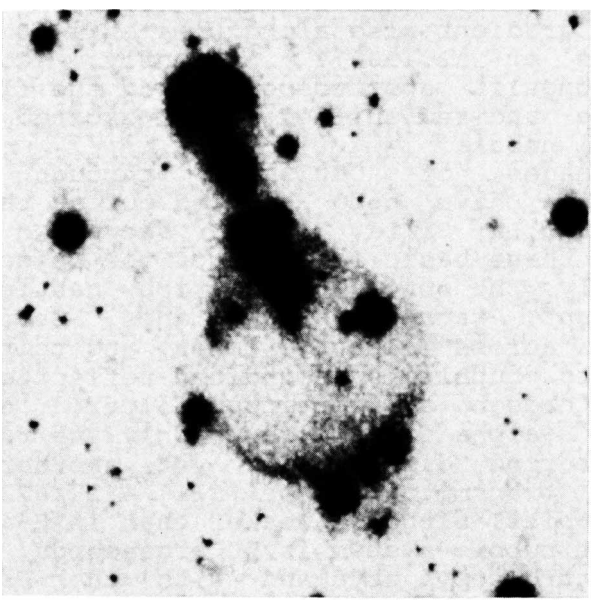

Fig.1. A deep H-alpha CCD image of OH0739-14.

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