DETECTION OF AN EXTENDED OPTICAL HALO AROUND IC 418

D.J. Monk, M.J. Barlow, and R.E.S. Clegg
Dept. of Physics and Astronomy
University College London

ABSTRACT. Two-dimensional long slit AAT IPCS spectra of IC 418 (in the 3400-4400 A wavelength region) show faint extensions in the [O II] 3726, 3729 A and Hγ emission lines out to at least 60 arcsec south and 50 arcsec north of the central star, compared to the angular radius of only 6 arcsec for the bright nebula.

The [O II]:Hγ flux ratio is constant throughout the nebula and halo, although both lines show a 200-fold decrease in intensity in the halo compared to the nebula. The mean [O II] 3726:3729 A (density sensitive) ratio in the halo is 1.66±0.40, compared to 2.15±0.10 in the nebula. The errors allow the two ratios to be interpreted as equal, in which case all the data are consistent with a dust halo reflecting the nebular emission lines. However, the apparent difference in electron density between the halo and nebula could be real.

IPCS spectra in the 6400-7400 A wavelength range show a smaller extension in the Hα and [N II] 6584 A emission lines, out to radii of ∿ 21 and ∿ 28 arcsec respectively. The Hα:[N II] 6584 A ratio is constant throughout the nebula and halo, but there is a 2000-fold drop in line intensity from nebula to halo, an order of magnitude larger than that observed for the [O II] and Hγ lines.

Taking the [O II] 3726:3729 A ratio as constant, the observations are consistent with an extended reflection halo at least 110 arcsec in diameter. To explain the fact that the scattering optical depth at 6563 A is a factor of ten lower than that at ∿ 4000 A, we find that the scattering grains must be small, ≦ 0.03 μm for carbon or silicate particles. The existence of small dust grains around IC 418 is consistent with the presence of the unidentified infrared emission features in its spectrum (Willner *et al.*, 1979), since these features have often been attributed to very small carbon-rich particles. Very small dust grains have also been invoked in the past to explain an excess 2 μm continuum observed around IC 418 (Willner *et al.*, 1979, Phillips *et al.*, 1984).

Finally the flat profile of the [O II] line intensity through the halo is interpreted as being due to a second density peak in the outer nebula, and it is proposed that IC 418 is a double-shell nebula.

S. Torres-Peimbert (ed.), Planetary Nebulae, 197.