

# Imaging and Spectroscopy of Ejected Common Envelopes

D.L. Pollacco<sup>1</sup> and S.A. Bell<sup>2</sup>

<sup>1</sup>Isaac Newton Group, La Palma, Canary Islands;

<sup>2</sup>Royal Greenwich Observatory, Cambridge, UK

Imaging and spectroscopy are presented for four planetary nebulae known to contain close binary central stars resulting from a recent phase of common envelope evolution. These objects are Abell 41, Abell 46, Abell 63 and Abell 65. Determinations of the nebula abundances show that He is significantly enhanced in all of the objects. These results are in agreement with theoretical expectations. Uncertainties in the nebular electron temperature constrain other abundances less well. The line fluxes indicate that N is unexpectedly under-abundant. This effect is probably not real and may be an artifact of electron temperature fluctuations within the nebulae.

All the objects appear to exhibit axisymmetric nebulae which may be interpreted as inclined bipolar nebulae. Narrow-band imaging of Abell 41 shows that the bar of material passing through the centre of the nebula is split and appears as an ellipse. If this can be interpreted as an inclined circle of material then this would indicate an orbital inclination of approximately  $66^\circ$ . The inner nebula of Abell 46 can also be visualised as an inclined bipolar nebula. Deep imaging of Abell 63 reveals the presence of bipolar caps for the first time while the degree of collimation is amongst the most extreme for any bipolar planetary nebula having an aspect ratio of  $\sim 7$ . As the orbital inclination of this object is nearly  $90^\circ$ , we are confident that we are observing this object in cross-section. Imaging of Abell 65 does reveal the object to be elliptical in shape with a constriction at the waist.

These observations will be discussed further in a forthcoming paper in *Monthly Notices of the Royal Astronomical Society*.