SHOCK MODELLING AND HIGH RESOLUTION SPECTROSCOPY OF NGC 6905

L. CUESTA and J. P. PHILLIPS
Instituto de Astrofísica de Canarias, E-38200 La Laguna, Tenerife, Spain

NGC 6905 appears to be an unusual source in displaying conical outflow lobes superimposed upon a spheroidal inner shell.

We have recently undertaken high resolution spectroscopy of this nebula using the 2.5 m Isaac Newton Telescope (Observatorio del Roque de los Muchachos), and our results may be briefly summarised as follows:

a) The principal shell is expanding at velocities $\Delta V \sim 100$ km sec^{-1}, whilst spectra taken along the major axis reveal intense [NII] emission at the nebular limits, suggestive of ansae.

b) There is evidence to favour a change in extinction over the interior shell of $\Delta A_v \sim 1$ mag; presumably indicative of local extinction.

c) The spectral lines are well resolved, and yield 2D velocity maps which are well explained in terms of a tilted spheroidal inner shell, providing we assume velocity to be proportional to radius. The kinematics of the exterior cones appear to be radically different.

We have adopted a model similar to those of Canto (1980) in attempting to replicate the overall source morphology, whereby stellar winds are assumed to shock interact with ambient material, leading to distinct hour-glass configurations where the flow is collimated. In the present case, we suppose that either a) symmetrically disposed holes in the inner shell enable a stellar wind to interact with an exterior halo, or b) that the entire nebula is a consequence of such shock interaction, with the internal nebulosity constrained by a higher density disk.

The consequences are in both cases similar, and it is apparent that such models match the observed source morphology extremely closely. Comparison between observed line of sight velocities and model results are also reasonably good, whilst we find that structures of this kind would require wind velocities $V_w \sim 430$ km sec^{-1}, and typical mass-loss rates $\sim 10^{-7}$ $M_\odot$ yr^{-1}.

Finally, we note that such a model is not only capable of explaining the peculiar morphology of this source, and the observed kinematics, but also provides a ready explanation for the presence of ansae. In this case, we suppose such features to derive from the collision of opposing shock refracted streams, leading to the shock enhancement of lower excitation ionic species.