Planetary Nebula Evolution from a Detached Binary System

Siek Hyung and Woo-Baik Lee
Korea Astronomy Observatory Hwaam-dong, Yusong-Ku, Taejon 305-348

Seong-Jae Lee
Chungnam National University, Gung-dong, Yusong-Ku, Taejon

Nikos Mastrodemos and Mark Morris
Division of Astronomy and Astrophysics, UCLA (JPL), CA 90095, U. S. A.

The dust grains from cool Asymptotic giant branch (AGB) stars are subject to radiation pressure and collisional drag from their drifting through the gas (Baines et al 1965), which leads to an acceleration of dust, and finally to produce the escape wind terminal velocity or mass loss from the AGB stars. In the later stage of its evolution, the hot central star could be exposed, forming a hot interior bubble around it. This bubble would be energized by the central star and expands into the RGE (or the forgoing molecules), eventually developing a bright H II region, i.e. planetary nebula (PN). AGB stars lose their mass spherically, but their descendants display the diversified morphologies, i.e. ellipticals, butterflies, circulars. Most recent HST/NICMOS H2 images indicate that the elliptical ring appearance of the pre- and young PN, which had been interpreted as projection effect of an enshrouded ellipsoidal envelope, is indeed a toroidal ring detached from the bright inner ionized gas (Hyung et al 1999). We investigate how spherically symmetric AGB stars evolve into the bilaterally symmetric PNe, especially Rings, based on a hypothesis that these result from the influence of a detached binary companion and possible pulsation of a mass-losing primary star. Disk formation in a constant environment, i.e. constant mass loss and circular orbit, had been investigated elsewhere (SPH simulation by Mastrodemos and Morris 1998). We carry out the SPH simulation of an asymmetric ring formation from mass losing AGB stars due to an eccentric orbital motion in addition to the pulsation effect.