Sub-Arcsecond Optical Imaging of Proto-Planetary Nebulae

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Sub-arcsecond (0.7") V and I images have been obtained of 13 new proto-planetary nebulae (PPN). The observations were made with the image-stabilization camera (HRCam) on the 3.6 m Canada-France-Hawaii Telescope. The goal of the program is to study the mass-loss history of the stars and to determine when in the evolution the shaping seen in PN occurs.

Two of the PPN are clearly seen to possess bipolar nebulae, with sizes of 10"-15". For the remaining 11, we used a point-spread function subtraction to search for extended emission. We find 9 of the remaining PPN to be resolved, with sizes ranging from 2" to 6", and with the other 2 perhaps also extended. Of the 11 resolved images, 8 display elliptical or bipolar intensity contours. Thus an aspherical morphology is demonstrated to commonly exist early in the transition between the AGB and PN phases. Three of the objects display a changing morphology, indicating a variation with time of the shaping mechanism.