Gas and dust of asymptotic giant branch (AGB) stars and planetary nebulae (PNe)

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Recent infrared observations using the Spitzer Space Telescope, the Subaru Telescope and the AKARI provided good opportunities to understand the mass and gas formed in evolved stars. We first present the estimation of the total mass-loss rate from all carbon-rich AGB stars in the Large Magellanic Cloud (LMC). AGB stars are one of the important dust sources in the ISM of the LMC. Gas injection from supernovae is more important in the Bar region, than AGB stars. AGB stars are an important gas contributor in the Disk. We show some of the representative spectra of AGB stars and PNe in the Galaxies in the Local Group, including the LMC, and Galactic Globular Clusters (GC). Their spectra show a wide range and varieties of molecular and dust features. The strength of this molecular band tends to be stronger towards the AGB stars at low metallicity. This can be explained, because at low metallicity, the initial oxygen abundance is low, resulting in chemical processes being more sensitive to carbon synthesized in AGB stars [1]. It appears that the dust composition depends on both the stellar evolution stage and the metallicities of the galaxies. Finally, we show a wide-field-of-view (4'x7') image of the Helix Nebula in the molecular hydrogen lines. The Helix Nebula is one of the closest PNe (219 pc), and detailed studies within the nebula are possible. Molecular hydrogen is found only in association with globules in the nebula. PDR models suggest that these hydrogen molecules were formed during the AGB phase, and they survived over the UV radiation field from the PN central star.

References

[1] Matsuura M., Zijlstra A.A., van Loon J.Th., et al., 2005, A&A, 434, 691