Mid-term change of dust formation activity of AGB stars

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Asymptotic Giant Branch (AGB) stars are one of the birth places of interstellar dust grains. The pulsation of AGB stars levitates stellar materials to the outer region. Dust grains will be formed from the levitated materials when they are sufficiently distant from the star. This cycle repeats on a timescale of a few years (~ pulsation timescale). Therefore, AGB stars can show a mid-infrared variability caused by the dust formation in a timescale relatively easy to observe, and they are useful to investigate real-time dust formation process.

However, such variability is often difficult to observe because of the contamination of the emission from the outer dust shell formed by a series of previous dust formation. To observe the sign of dust formation, the objects which recently activate dust formation and do not have a thick outer dust shell are suitable. Mid-term (100-yr scale) change of dust formation activity is suggested by some works (Mauron & Huggins 1999; Marengo et al. 2001), and it is possibly detected as a mid-infrared color change between IRAS and AKARI all-sky survey data, taken in a ~20 yr interval. In order to find such objects, we examined the IRAS and AKARI data and observed some objects to confirm their mid-infrared spectral change with our mid-infrared instrument MAX38 on miniTAO telescope in Chile.

The targets were selected from the Mira- and Semi-Regular-type variable stars listed on General Catalog of Variable Stars (GCVS) with high-quality photometric data of IRAS and AKARI, and mid-infrared spectra of Low Resolution Spectrometer (LRS) on IRAS. In addition, the objects with feature-less LRS spectra (class1n objects) were chosen because they are easy to judge the emergence of dust emission from recently formed dust. Their mid-infrared color was examined with the IRAS and AKARI data. So far 10 objects with a large mid-infrared color change, which indicates possible emergence of dust emission, were selected and observed with N-band imaging mode of MAX38. As a result, three objects showed clear spectroscopic change from the LRS spectrum. Especially, T Col showed clear emergence of dust feature.

T Col is a Mira variable star in a distance of 0.66 kpc (Whitelock et al. 2008). Its LRS spectrum does not show any dust feature. On the other hand, a 10-micron feature was clearly detected by our observation. It can be reproduced with emission bands of hot silicate and alumina dust. Its strength is about 10 Jy at 10-micron. The total mass of the silicate dust responsible for the emission is estimated at 7×10^{-10} solar-mass based on the feature strength and the distance. This amount of dust can be formed in a few decades with a usual mass-loss rate of AGB star. Therefore, T Col may have activated its dust formation in the last few decades and can be an interesting monitoring target.

In the workshop, these results and additional observation programmed in June will be reported.

References

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