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The 30 micron sources in galaxies with different metallicities

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A broad emission dust feature peaking around 30 microns is seen in the spectra of some carbon-rich AGB stars, post AGBs, and PNe. Since the discovery by Forrest et al. (1981) this dust feature has been detected in plenty of carbon-rich objects. Magnesium sulphide (MgS) is now the most favoured candidate to be the carrier of this spectral feature, but its identification remains a matter of some debate.

Hony et. al (2002) have analysed in a uniform way a sample of 63 Galactic 30 micron sources observed by the Infrared Space Observatory (ISO). The Spitzer Space Telescope was able to detect distant sources in our Galaxy, but also in nearby galaxies such as the Small Magellanic Cloud, Large Magellanic Cloud (LMC), and the Sagittarius Dwarf Spheroidal galaxy. All of them are characterised by the different average metallicities.

We have analysed a sample of 207 Spitzer spectra from galaxies mentioned above showing the 30 micron dust feature, and we investigated if the formation of the 30 micron feature carrier may be a function of the metallicity. We obtained and compared the basic properties of the 30 micron feature in those galaxies such as a few colour indices (e.g. [6.4]-[9.3] colour), dust temperature (T), strength of the feature, central wavelength, and finally the profiles of the feature.

Our analysis has shown that the strength of the 30 micron feature is the highest among Galactic objects. Moreover, this feature show up at the highest dust temperature for the Galactic AGB stars. The first AGB objects with this feature in the LMC are visible below 900 K, whereas such objects in the SMC and Sgr dSph objects do not appear until T drops below 700 K. The strength of the feature increases until T drops to about 400 K, and then decreases to finally show again variety of values for post-AGB objects and PNe. The AGB objects with $T < 400$ K, seems to experience very large mass loss rates, which may be responsible for the drop in the strength of the 30 micron feature due to self-absorption. During post-AGB and PNe phase, the strength of the 30 micron feature seems to not depend on the metallicity of galaxy, but the Galactic post-AGB objects and PNe show rather smaller values of T.

Our analysis of central wavelengths of the 30 micron feature show that it is rather independent of T for AGB and post-AGB objects. In a case of PNe, the central wavelength is clearly shifted toward longer values. Hony et al. (2002) suggested that such shift is caused by the low temperature of the feature carrier, or change in shape of dust particles. However, we noticed several post-AGB objects with similar T, but much lower central wavelength than in planetary nebulae. Therefore, we expect that dust processing (due e.g. irradiation by UV photons from central stars of planetary nebulae) may be more important in shifting central wavelength of the 30 micron feature towards larger values. Finally, it seems that the Galactic PNe have rather smaller central wavelength than their Magellanic Clouds counterparts. If our suggestions are correct, this could mean that processing of the 30 micron feature carrier is more efficient in the MCs than in the Milky Way.

We have also searched for the median profiles of the 30 micron feature in different galaxies and/or dust temperature. We have shown that shapes of the 30 micron feature does not change as a function of metallicity in different galaxies (AGB and post-AGB objects) or dust temperature (AGB stars only). On the other hand, the shape of the feature in planetary nebulae is clearly different (not only central wavelength) than shape of the feature in AGB or post-AGB objects.

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