A STUDY OF COSMIC DUST IN THE GALACTIC ENVIRONMENT

Ajay Mishra

Dr. Aigen Li, Dissertation Supervisor

ABSTRACT

We explore the interrelations among the mysterious 21μm , 30 μm , and UIR features of the 21 μm sources in the short-lived protoplanetary nebula phase of stellar evolution . We find that none of these spectral features correlate with each other. This argues against a common carrier (e.g., thiourea) for both the 21 and 30 μm feature. This also does not support large PAH clusters as a possible carrier for the 21 μm feature. We also examine the correlation between mass loss rate of the AGB phase or the superwind phase with that of fluxes emitted from the 21 and 30 μm features. We find that both features tend to correlate with AGB phase not with Superwind, suggesting that their carriers are probably formed in the AGB phase.

In addition, we probe the role of carbon in the ultraviolet (UV) extinction by examining the relations between the amount of carbon required to be locked up in dust with the 2175 Å bump, and the far-UV extinction rise. We find that the carbon depletion tends to correlate with the strength of the 2175 Å indicating graphite or PAH molecules as the possible carrier of the 2175 Å bump. Carbon depletion shows a trend of correlating with $1/R_V$, suggesting that the far-UV extinction is more likely produced by small carbon dust than by small silicate dust.

Finally, we model the infrared emission of 120 Galactic high latitude clouds and 81 Diffuse Infrared (DIR) excess clouds using silicate-graphite-PAH model. We find that hydrogen column density strongly correlates with the far-infrared emission, this indicates the presence of large grains of similar properties and abundances. Also, we find that all clouds are rich in PAHs as traced by the IRAS 12 μm data. They are heated by the local interstellar radiation field, but with the radiation intensity reduced by a factor of about 2 to 3.