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Tracing charge amongst the 10-20 µm PAH emission bands

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Polycyclic aromatic hydrocarbons (PAHs) are observed throughout the universe and play important roles in many astrophysical processes. In order to examine the effects of varying charge states on the PAH populations emitting the 10-20 µm PAH bands, we analyze low- and high-resolution Spitzer/IRS observations of Galactic and Large Magellanic Cloud sources and nearby galaxies. We specifically introduce a Gaussian-based decomposition of the 11.2 and 12.7 µm bands. The respective components exhibit different spatial origins in the maps of reflection nebulae NGC 7023 and NGC 2023, suggestive of cations, neutrals and possibly very small grains. Extending this analysis to the weaker 15-20 µm PAH bands, the 16.4 and 17.8 µm bands are morphologically similar to the 12.7 µm band and are well-correlated in band intensities, suggesting a similar combined charge origin for these bands. The 17.4 µm band generally traces the traditional 11.0 µm emission, suggesting a cationic origin, and the 15.8 µm and plateau emission follows the traditional 11.2 µm emission, associated with neutrals. These results emphasize the role of charge in tracing the general properties of the weaker PAH bands and how examination of high-resolution spectral profiles reveal subtle morphological variations in the spatial maps.

REFERENCES