Intensity Variations of the 3.3 μm Complex Feature in AKARI Data with Galactic Environment

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The study of carbon in our galaxy is an important pursuit in astronomy, remaining relevant to a number of astronomical fields, including the study of interstellar dust, spectroscopic puzzles such as the diffuse interstellar bands, and newer fields such as astrobiology. A considerable fraction of carbon in the galaxy is expected to exist as polycyclic aromatic hydrocarbon (PAH) molecules, emphasizing the importance of studying these and other hydrocarbons to further our understanding.

In particular, the many sub-features of the 3.3 μm complex are highly specific to the type of emitting molecule, making the respective intensities of these emission bands of great use in determining the variety of PAHs being observed. The work presented here incorporates and corroborates the recent proposal that the main emission band at 3.3 μm is caused by two underlying sub-features at 3.28 μm and 3.3 μm, arising from different chemical environments within the carrier molecules. We include these two features in modeling work performed on high resolution AKARI NIR data and find a good fit with the observational data.

The ratios of intensities between sub-features of the 3.3 μm complex are discussed in terms of the morphology and stability of the molecular carriers. Implications regarding PAH growth and destruction mechanisms are addressed with respect to galactic environment. Spatial variations in emission band intensity ratios within specific astronomical objects such as HII regions and supernova remnants are also discussed.