## Q40a Characterization of the Unidentified Infrared Emission Bands

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Using the Mid-Infrared Spectrometer on board the Infrared Telescope in Space and the low-resolution grating spectrometer (PHT-S) on board the Infrared Space Observatory, we obtained 850 mid-infrared (5 - 12 $\mu$m) spectra of the diffuse interstellar medium in the Galactic center, W51, and Carina nebular regions. These spectra indicate that the emission is largely due to the unidentified infrared emission bands at 6.2, 7.7, 8.6, and 11.2 $\mu$m. The relative band intensities (6.2/7.7, 8.6/7.7, and 11.2/7.7 $\mu$m) were derived from these spectra, and no systematic variation in these ratios was found in our observed regions, in spite of the fact that the total far infrared intensities differ by a factor of 100 (or $G_0 \approx 5 - 10^4$, where $G_0$ is the integrated radiation intensity in units of the Habing interstellar radiation field). Our results imply constant physical and chemical properties of the carriers of the unidentified infrared emission bands in the diffuse interstellar medium. Comparing our results with the polycyclic aromatic hydrocarbon molecules (PAHs) model, we found that the candidate PAH carriers are mostly or completely hydrogenated and ionized in the diffuse interstellar medium. The finding that diffuse interstellar PAHs are mostly ionized is inconsistent with past theoretical studies, in which a large fraction of neutral PAHs is expected in the diffuse interstellar medium. One likely explanation is that the recombination coefficients for electron-PAH ion interactions are at least an order of magnitude less than those adopted in the past theoretical studies. Because of the very low or zero abundance of neutral state molecules, the interstellar PAHs cannot be the dominant source of heating of the diffuse interstellar gas by photoelectric emission.