Exploring the dependence of PAH emission on metallicity and starlight spectrum in M101

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Polycyclic aromatic hydrocarbon (PAH) molecules are abundant and widespread throughout the Universe, as revealed by their distinctive set of emission bands at 3.3, 6.2, 7.7, 8.6, and 11.3 micron. The excitation of PAH emission depends on the spectrum or “hardness” and intensity of the illuminating starlight. Exposed to a harder radiation field, PAHs are transiently heated to higher temperatures and therefore emit more at 3.3, 6.2 and 7.7 micron than at 11.3 micron. On the other hand, "hard" photons could potentially also photo-dissociate PAH molecules. Observationally, it is also well recognized that PAH emission is also affected by metallicity: PAH emission is deficient or lacks in low-metallicity galaxies, although the exact reason is not clear. The giant, face-on spiral galaxy M101, also known as the Pinwheel galaxy, is ideal for exploring the dependence of PAH emission on metallicity and starlight "hardness" and intensity. At a distance of 6.7 Mpc, M101 has one of the largest metallicity gradients as well as starlight hardness and intensity gradients among SINGS member. Spatially-resolved PAH emission obtained by Spitzer/IRS revealed considerable variations M101 from the nucleus to outer regions. We have modeled the PAH excitation and emission in M101, revealing the dependence of PAH emission on metallicity, starlight "hardness" and intensity.