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PAHs and star formation in the HII regions of M83 and M33

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IR emission features at 3.3, 6.2, 7.7, 8.6 and 11.3 μm are usually attributed to IR fluorescence from FUV pumped polycyclic aromatic hydrocarbons (PAHs). These features thus trace the FUV stellar flux and are a measure of star formation in the Universe. Here, we present results from a detailed study on the mid-IR emission features of HII regions in M83 and M33, with the aim to investigate the IR spatial characteristics in star-forming regions from Milky Way (MW) HII regions, to star-forming complexes in nearby galaxies, and star-forming galaxies as a whole. As such, we build a control sample to compare our results, including star-forming regions in the MW, LMC, M101, starburst nuclei, and nearby galaxies. We find that the PAH intensity ratios in M83 and M33 HII regions have similar correlations as those in individual HII regions within galaxies, starburst nuclei, and AGN host galaxies. We find that the strength of the 17.0 μm PAH band is enhanced relative to the other PAH bands compared to galactic star-forming regions, similar as in other galaxies. In comparison with other emission components we find that: **1)** the PAH/VSG intensity ratio presents a decrease with galactocentric radius for both M83 and M33 as well as the Milky Way, and **2)** the $L_{TIR}/L_{6.2\mu m}$ luminosity ratio in M83 and M33 HII regions ranges in between the values measured in Galactic and LMC HII regions, and those in normal star-forming galaxies and starburst nuclei. The extragalactic HII regions appear as a linking component between the spectral properties of local HII regions and star-forming galaxies, and can be used as better templates than Galactic HII regions when interpreting the properties of star-forming galaxies.

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