Coupled blind signal separation and spectroscopic database fitting of the mid-infrared PAH features[★] (Corrigendum)

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1. Erratum

The original paper contained erroneous data in Fig. 10. The correct figure is presented here. None of the conclusions are substantially affected.

Figure 10 displays a linear correlation between the $[11.0]/[11.2]$ μm PAH emission line ratio and the $[6.2]/[11.2]$ μm ratio. To measure the $[6.2]/[11.2]$ μm ratio, the low-resolution IRS spectra were used to measure the flux of the $6.2 \mu\text{m}$ feature, and the high-resolution spectra to measure the $11.2 \mu\text{m}$ band flux. As noted in the text, this was chosen because the $[11.0] \mu\text{m}$ contribution cannot be differentiated from the $[11.2] \mu\text{m}$ emission using the low-resolution module. However, upon inspection, we have found that the low-resolution and high-resolution IRS modules are not calibrated correctly with respect to each other. There is on average a factor of ~ 2 difference in the absolute intensity between low and high-resolution spectra in the $9\text{--}14 \mu\text{m}$ range.

Although the exact origin of this calibration problem is beyond the scope of this paper, we believe it comes from the extended nature of the emission in NGC 7023-NW. This PDR has many bright filaments and complex spatial structures that are unresolved by the IRS instrument. The difference in aperture size between the low and high-resolution modes, namely $(1.8'')^2$ for high and $(2.3'')^2$ for low, could account for this factor of two difference between the modules. Comparing IRS low-resolution spectral mapping with IRAC $8 \mu\text{m}$ image also shows a large discrepancy in the observed integrated intensities.

Once this cross-calibration problem between the high and low resolution modules of IRS is apparent, we must alter our method of measuring the ratios. For the $[6.2]/[11.2] \mu\text{m}$ ratio, it is necessary to measure both the $[6.2]$ and $[11.2] \mu\text{m}$ bands with the same module (i.e. IRS-SL), so the calibration offset is normalized. However, this presents the problem of the $11.0 \mu\text{m}$ PAH⁺ contamination, since the $11.0 \mu\text{m}$ contribution cannot be resolved in the low-resolution mode. This can be corrected for using the high-resolution $[11.0]/[11.2] \mu\text{m}$ ratio. The integrated intensity in the 11.2 band, $I_{11.2}$, can be expressed independently of the SH/SL calibration by

$$I_{11.2} = I_{11.2}^{\text{SL}} \times \left(1 - I_{11.0}^{\text{SH}}/I_{11.2}^{\text{SH}}\right). \quad (1)$$

A new plot has been created using the new $I_{11.2}$ and is shown in Fig. 1. The low signal-to-noise ratio points ($\leq 25\%$ of maximum flux) were removed and the remaining points were fit with a least squares linear regression. The revised empirical relation is

$$\frac{[11.0 \mu\text{m}]}{[11.2 \mu\text{m}]} = 0.084 \times \left(\frac{[6.2 \mu\text{m}]}{[11.2 \mu\text{m}]}\right) - 0.06. \quad (2)$$

We note that this relation does not go through $(0, 0)$. This implies that there is $6.2 \mu\text{m}$ emission even if there is no $11.0 \mu\text{m}$ band. Recalling that the $6.2 \mu\text{m}$ band may have a (weak) contribution from neutral PAHs, while the $11.0 \mu\text{m}$ band is “pure” cation, we suggest that the $11.0 \mu\text{m}$ band may be a better tracer of the presence of PAH cations in space. Further studies will have to validate this statement.

[★] This work is based on observations made with the Spitzer Space Telescope, which is operated by the Jet Propulsion Laboratory, California Institute of Technology under a contract with NASA.

Fig. 1. The $[6.2]/[11.2] \mu\text{m}$ vs. the $[11.0]/[11.2] \mu\text{m}$ PAH band integrated intensity ratio in NGC 7023-NW. The $11.2 \mu\text{m}$ and $11.0 \mu\text{m}$ measurements were made using the IRS-SH observations, while the $[6.2]/[11.2] \mu\text{m}$ ratio was measured using the IRS-SL observations (see text for details). The instrumental error is comparable to the symbol size.