**Breaking Degeneracies in Radiative Transfer Codes**

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**MOTIVATION: PAHs/VSGs are a realistic, but confusing, component to dust radiative transfer**

**Stochastic emission** from polycyclic aromatic hydrocarbons (PAHs) and very small grains (VSGs) varies according to the energy density in photons.

The PAH spectrum changes very little for $U < 10^4$. $U$ is the radiation field energy density relative to local ISRF. These PAH templates are from Draine & Li (2007), and have been used previously by Wood et al. (2008) on Gomez' Hamburger. An important update to this code will involve a PAH/VSG template that includes ionised PAHs, so that individual features can be seen to change more drastically, and red sources, to model the PAH/VSG emission deep in the clouds realistically.

**Where the PAHs/VSGs are confined to matters**

Putting PAHs/VSGs throughout a cloud, rather than in the PDR only, changes the infrared colors. This difference is small up to high optical depths. Since PAHs/VSGs are considered to be confined to the PDR, restricting the small grains to $A_v=1.5$, while an estimate, is probably more realistic.

Diamonds are for small grains throughout, triangles for PDR only.

**THE IMPORTANCE OF INCLUDING PAH/VSG EMISSION**

This 'evolutionary sequence' considers a point source with a varying inner dust envelope radius (outer dust radius shown in the figure). Increasing radius is indicated by the arrows. (From Whelan et al. in preparation)

These mid-infrared (Spitzer) color-color diagrams show that models that do not utilise PAHs/VSGs (the yellow lines) are far from matching those that do. This could lead to a serious mis-interpretation of one's data.

Using Herschel photometry with PACS and SPIRE will break some of the model degeneracies, such as those created by dust clumpiness, while being negligibly dependent on the small grain emission.

The different dust distributions (completely smooth = black; 99% clumpy = red) are well-separated in these PACS and SPIRE color-magnitude diagrams, unlike for the Spitzer diagrams.