Physics 224: Paper Discussion 1
Spring 2018

Weingartner & Draine 2001:

- It isn't clear to me why the R_v values of 3.1, 4.0 and 5.5 were chosen for their modeling. R_v of 3.1 makes sense since it's the ratio for diffuse ISM according to the paper. The ratio increases as the density increases, but it isn't clear the acceptable range. Also, in their method, with case A, they use all three, but with case B they only use the latter two. Is this because they fix the volumes for the case R_v=3.1?
- What other dust composition models have still not been ruled out? Also, what exactly are "composite, fluffy grains"?
- Even though in 2001 there was no map of nearby ISM regions like Dr. Linsky showed us in his talk, it's interesting to see that this paper already suggests that the region we are passing through is not a true representative example of the ISM as a whole (Sec. 4.2, last paragraph). Based on the disparity of different models and observations, it's easy to see that bias can be picked up quickly and that there is no one model that covers all of the variation in the ISM.
- Does polarization by E and B fields effect the extinction?
- 1) I didn't quite understand how the 'observed' extinction was derived? 2) Section 2.5 mentioned that 'its highly unlikely that material is transferred from grain to gas phase', is this related to what we think could enable transition from diffuse atomic gas cloud to dense molecular gas cloud (introduced by the talk, where the middle phase involved both H and C+?) 3) Are there other possible candidates for very small grains?
- Why do they expect surface monolayer properties that are different from your bulk grain properties and the fact that your grain is not spherical to bias your model?

Sellgren 1984

- Why are dust grains with the size range 10-50 angstroms unexpected? I would expect that, if grains formed from joining molecules, then the lower radii grains would be more common, similar to other hierarchical formation (stars, galaxies, etc.). Is there some reason why these small grain populations would be considered unstable? (2)

- How accurate is the MRN grain size distribution? Can it be assumed that all dust grain populations follow the MRN distribution, even those in nebulae?

- This paper was written in 1984. Have there been stronger arguments for the cause of this near-IR emission since then? It is interesting to note that the near-IR emission is uncorrelated to the distance from the main star in each nebula. Sellgren suggests the emission comes from absorption of UV photons, which come from the stars within, right? So wouldn't there be some kind of distance dependence from the stars given how much UV light makes it to each small dust grain?

- Does gas or dust dominate the area around stars? Does this effect the extinction?

- Something that I never thought of but seems obvious now is how chemical reactions on a dust grain surface can generate energy. Usually I just think of collisions. Additionally, the idea of "chemical explosions" on the surface of a dust grain separates the dust size scale from the molecular size scale for me. Molecules are still much smaller than dust.

- How do we understand that the nebular energy distribution is independent from the position within the nebula? How can we be sure when fewer data points were available for NGC 2068?

- Is 10 angstroms a surprisingly small grain size? Why is a 9700 K BB normalization a good assumption for early-type standard stars for their spectroscopic calibration? What is the importance of the diaphragm size and source to sky positions with respect to systematics in their data/analysis?

- I don't quite understand that the differences in optical constants can affect surface phonon modes at far-IR wavelengths.