Dust and Gas in Protoplanetary Disks

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The internal physical and chemical structure of protoplanetary disks is fundamentally important to understand how planets form. To infer this structure from observations, new 'holistic' disk models have been developed which include detailed 2D dust and PAH radiative transfer, thermo-chemical gas and ice modeling, and 3D diagnostic radiative transfer to consistently predict all kinds of line and continuum observations from optical to centimeter wavelengths.

The dust size and opacity parameters applied in the models are found to have a decisive influence on most predicted observations, not only on the continuum observations (as expected), but also on the resulting gas temperatures, chemical composition, and line observations. More evolved dust properties (larger grains) and stronger dust settling are generally found to amplify gas emission lines at optical to far-IR wavelengths, because the heating UV radiation can penetrate deeper into the disk gas in these cases. This could possibly imply that the observation of gas emission lines can help to determine dust properties in protoplanetary disks. We are proposing new dust opacities for protoplanetary disk models, which account for the properties of evolved dust, aiming at setting new disk modeling standards.

[(1)]: European FP7 project about the *Analysis and Modelling of Multi-wavelength Observational Data from Protoplanetary Discs*, see `http://www.diana-project.com`.