The Reincarnation of Interstellar Dust in Cometary Comae and Debris Disks: Its Evidence in Their Infrared Spectra

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An accumulation of interstellar dust is often believed to have formed planetesimals, which are the predecessor of comets and asteroids in our solar system. At the present time, dust particles are ejected from comets and asteroids when the former is heated by solar radiation or the latter collides the others. The same mechanisms for releasing dust particles from their parent bodies are expected to work in debris disks around main-sequence stars. It is, therefore, natural that infrared spectra of dust in cometary comae and debris disks have shown similar features of minerals that are common in Interplanetary Dust Particles (IDPs) collected in the stratosphere of the earth.

By taking into account coagulation growth in molecular clouds and depletion of dust-forming elementals in the gas phase of the interstellar medium, we model interstellar dust as aggregates of submicron-sized silicate core, organic mantle grains[1,2]. Infrared spectra of such an aggregate are computed along with thermal and collisional processes of the dust that would take place during the formation of planetary systems[3,4]. We find that infrared spectra of processed interstellar dust reproduce all the emission peaks at the correct wavelengths where the peaks were observed in cometary comae and debris disks. We will discuss material processing of interstellar dust by putting special emphasize on the importance of organic refractory material.

Keywords: interstellar dust; comets; debris disks; infrared spectra; silicates; organics.

References

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