Very Large Interstellar Grains as Evidenced by the Mid-Infrared Extinction

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Interstellar grains span a wide range of sizes from a few angstroms to a few micrometers. The ultraviolet (UV) and optical extinction constrains the dust in the size range of a couple hundredth micrometers to several submicrometers. The near and mid infrared (IR) emission including the IRAS and COBE/DIRBE broadband photometry and the PAH emission spectroscopy constrains the nanometer-sized grains and angstrom-sized very large molecules. However, the quantity and size distribution of micrometer-sized grains remain unknown as they are gray in the UV/optical extinction and they are too cold and emit too little in the IR to be detected by IRAS or Spitzer. In this talk, we employ the ~3-8 micrometer mid-IR extinction which is flat in both diffuse and dense regions to constrain the quantity, size, and composition of the micrometer-sized grain component. We find that, together with nano- and submicron-sized silicate and graphite (as well as PAHs), micrometer-sized graphite grains with C/H ~ 137 ppm and a mean size of ~1.2 micrometer closely reproduce the observed interstellar extinction from the far-UV to the mid-IR as well as the near-IR to millimeter thermal emission obtained by COBE/DIRBE, COBE/FIRAS, and Planck. The micrometer-sized graphite component accounts for ~14.6% of the total dust mass and ~2.5% of the total IR emission.