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Models of Polarized Emission from Interstellar Dust Grains

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Nonspherical aligned dust grains produce strong linearly-polarized thermal emission at submm and microwave frequencies, with polarized fractions exceeding 20% in some parts of the high-latitude sky. Observations of emission, absorption, and scattering by dust, together with our knowledge of the abundances of elements out of which dust grains can be formed, impose many constraints on dust modelers. The dust is in large part composed of amorphous silicates, but with a substantial component of carbonaceous materials, including nanoparticles of polycyclic aromatic hydrocarbons. The smallest particles radiate thermally in the mid-IR following single-photon heating, and also produce rotational emission at microwave frequencies. This rotational emission may account for the so-called Anomalous Microwave Emission. Iron contributes about 25% of the total mass of interstellar dust, but what form the Fe is in is largely unknown; much of the Fe could be in ferromagnetic or ferrimagnetic materials that could emit magnetic dipole radiation at microwave frequencies. I will review the observational constraints on dust models, the current state of our physical models, and prospects for further progress.