Dust Disks around Pulsars

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The possible presence of a dust disk around pulsars has been suggested by the detection of planets first around PSR B1257+12 and then around PSR B1620-26 and PSR J1719-1438. Such a disk could be formed from the fallback of supernova ejecta, i.e., the ejecta from a core-collapse supernova could be captured by the gravitational field of the newly formed neutron star and therefore fall back onto the star and form an orbiting disk, provided that the angular momentum of the fallback material is sufficiently large so as to prevent direct infall onto the star. Heated by the ultraviolet and X-ray photons converted from the spin-down energy of the pulsar, the dust in the disk is expected to radiate thermally in the infrared (IR). However, the search for dust thermal emission from the near-IR to millimeter (mm) so far has mostly been unsuccessful, except the *Spitzer*/IRAC detection of the 4.5 and 8μm dust emission in two magnetars.

We perform a thorough examination of the IR-to-mm observational data reported for pulsars in the literature and present a physical dust model for the disks around pulsars, with reasonable dust compositions, size distributions, dynamics, and heating and cooling mechanisms taken into account. We place upper limits on the dust masses of pulsar disks and discuss their implications for the formation of planets around pulsars.