# Apocenter glow in eccentric debris disks

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**Abstract**

Resolved eccentric ring-shaped debris disks have now been observed in multiple systems; they are of special interest because the measured disk eccentricity constrains the mass of the planetary perturber needed to produce it. The pericenter glow model of Wyatt et al. (1999) predicts that eccentric debris disks should be brighter at pericenter than at apocenter simply because disk particles at pericenter are closer to and receive more radiation from the central star. However, this model assumes a uniform dust density and focuses on near- to mid-infrared wavelength bands. Here we use analytic modeling and numerical simulations to incorporate collisions into a new model for eccentric debris rings, allowing azimuthal changes in the dust production rate due to variations in velocity or optical depth in the eccentric disk. We find that the collision frequency and dust production rate are largest at apocenter, increasing the apocenter optical depth and partially offsetting the pericenter glow. Also, we find that at far-IR and submillimeter wavelengths, eccentric disks display apocenter glow: these long wavelengths lie closer to the apocenter than to the pericenter blackbody peak for ~100 AU disks, and the larger per-particle flux at apocenter reinforces the effects of the higher optical depth. This result is particularly suggestive in view of recent observations of Fomalhaut's disk showing enhanced submillimeter flux near apocenter (Marsh et al. 2005, Ricci et al. 2012) despite its enhanced optical flux near pericenter (Kalas et al. 2005).

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