Debris disks:

Seeing dust, thinking of asteroids, comets, and planets

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Dust is seen to orbit many main-sequence stars, and in many cases is thought to originate from ongoing collisions with a mass reservoir of larger objects. Thus, these populations of circumstellar dust are generically known as “debris disks”. The large bodies that supply the dust can be the leftovers of planet formation (asteroids and comets) or planetary embryos that are still growing and will reach planet status in the future. As shown by the cometary contribution to our Zodiacal cloud, the bodies that supply the dust may not originate where the dust is observed. Because relatively small masses of dust can be detected by scattered light and thermal emission, debris disks provide a unique window into the formation and evolution of planetary systems.

The dust has been detected at all possible locations around other stars, in some cases residing at a few stellar radii and in others extending to thousands of astronomical units. Generally, the closer any detected dust is to the star, the more poorly it is understood. The cool belts seen beyond tens o AU are thought to be analogues of our Edgeworth-Kuiper belt, but the warm “exo-Zodi” may be Asteroid belt analogues, the aftermath of planetary-scale collisions, or extreme versions of our own Zodiacal cloud supplied by comets scattered in from elsewhere. The “hot dust” phenomenon seen towards 30% of nearby stars is currently being treated as a debris disk problem, but could in fact be more relevant to stellar astrophysics.

I will discuss the debris disks in general, and talk about their strengths and weaknesses as a probe of the properties of extra-Solar planetary systems. I will focus on the current challenges, and areas where a better of understanding of the dust is needed for progress.