Debris Disks - The Heritage of Herschel

A.V. Krivov

AIU/FSU, Jena, Germany

Debris disks, belts of invisible planetesimals and their observable dust, are thought to be remnants of the planet formation process. These disks have been observed at far-infrared wavelengths in various large- and small-scale programs of the Herschel Space Observatory. Herschel observations have revealed the presence of debris disks around at least 20% of stars across the main sequence, which is comparable to the detection rate of extrasolar planets, and discovered disks around subgiants. More exotic systems found by Herschel include, for instance, circumbinary and circumpolar disks, as well as ultracold disk candidates. The disks are typically aligned with the stellar equator and, in systems with known planets, also with their orbital planes. Statistical correlations between the presence of planets, disks, and stellar metallicity have been identified. Another merit of Herschel has been an impressive increase in the number of spatially resolved disks. Analyses of Herschel-resolved disks suggest a two-component structure, i.e. a Kuiper-like belt plus an asteroid-like belt, to be common. This, together with the disk asymmetries seen in the resolved images, reinforces the view that the cavities in debris disks are populated by as yet undiscovered planets. The radii of the Kuiper-belt analogs exhibit a large scatter and do not appear to correlate with the stellar luminosity. This shows that the disk dimensions are not directly related to ice lines. Finally, previously unknown trends in the dust grain sizes with the host star luminosity have been identified. Collisional modeling suggests them to possibly derive from systematic differences between the planetesimals and/or planets around earlier- and later-type stars.