

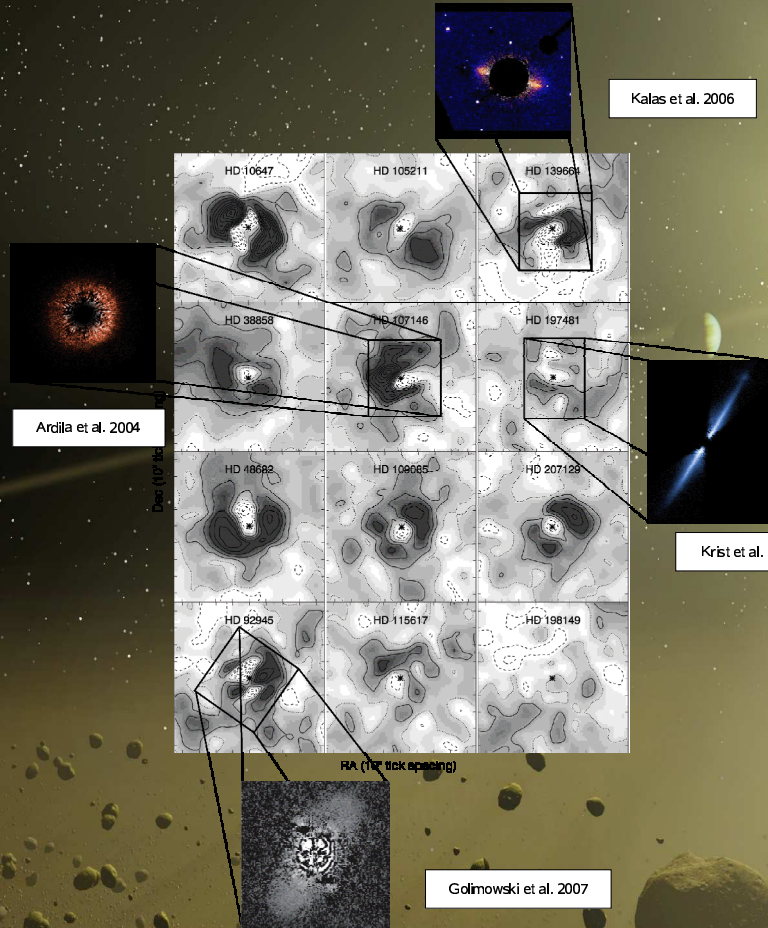


Spitzer-Resolved Debris Disks around Late-Type Stars



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Spitzer has surveyed ~300 nearby solar-type stars for IR excess, with a detection rate of ~15%. Among these stars with circumstellar dust emission, we identify 11 as marginally resolved in their MIPS 70um images. Several have independent evidence for disk extension, most notably the four disks previously resolved with the Hubble Space Telescope; the thermal emission observed by Spitzer matches these scattered light images in both size and position angle. For two additional systems, the Spitzer observations correctly predict these disk parameters, as confirmed by subsequent HST imaging. By resolving the thermal emission, we place constraints on the dust properties and on the orbital location of larger colliding planetesimals.

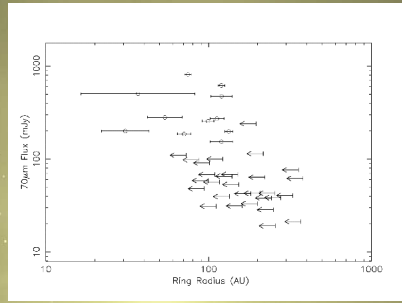


Kalas et al. 2006

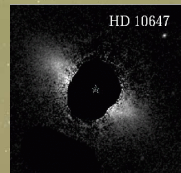
Arcilla et al. 2004

Krist et al. 2005

Golimowski et al. 2007

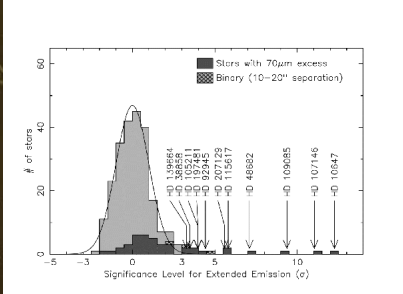


Limits on emission extent for the 41 sources with IR excess at 70um. For the 11 sources with resolved emission, open circles show the best fit emission radius, assuming face-on ring-like emission. For the remaining sources, upper limits are shown.



Of the 11 Spitzer-resolved disks, four were previously imaged with HST (shown to left) while two have been confirmed with follow-up HST/ACS imaging (one shown above; Stapelfeldt et al. 2009).

In all six systems with HST images, the scattered-light images are consistent with the disk parameters derived from the Spitzer images.



Significance of extended emission for the 245 stars in our sample. The histogram is divided between stars with excess emission at 70um (dark fill) and the bulk of the sample without IR excess (light fill). The three stars with known binary companions within 20" are marked in the histogram with cross-hatching. A Gaussian distribution is shown for comparison (solid line), with several stars showing extended emission with 3-sigma significance. The 11 stars with resolved 70um emission are individually labeled.

MIPS 70um images for 12 stars after subtraction of a point spread function (PSF) centered on the star location. Each image is 90" x 90" centered on the stellar position (marked with an asterisk) with North up. The median brightness level is shown as dotted contours, with solid contours for emission above the median and dashed contours for emission below. Contours are equally spaced in intervals of the background noise level within each field. The gray-scale background is redundant with the contours; the maximum darkness level is set at 3-sigma (the third solid contour). Eleven stars show clear evidence for extended emission beyond the instrument point response function. The lower right panel shows a PSF-subtracted reference star for comparison.

Summary

Typical orbital location of the dust is ~100 AU, often in a ring-like configuration.

Typical dust temperature is twice the blackbody temperature --> small grains (1-10um).