An HST/Spitzer Study of the HD 10647 Debris Disk

The first disk detected in scattered light around an RV planet host star

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About the Star and RV Planet

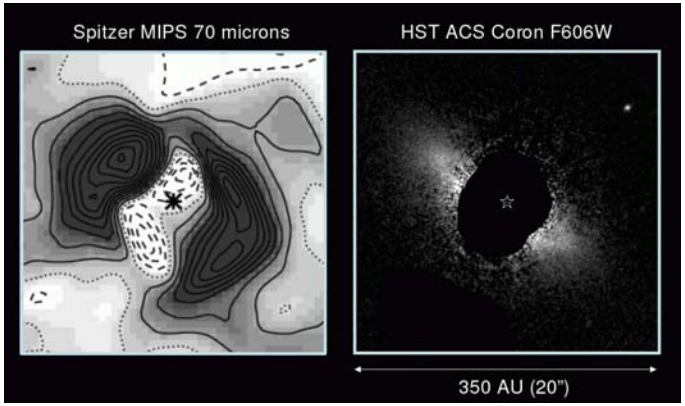
HD 10647 (HR 506) is an F8 V star located at a distance of 17 pc. The star is chromospherically active, has solar metallicity, and an uncertain age. The star has a radial velocity planet discovered by Mayor (2003). The planet's orbital period is 1003 days, semi−major axis 2.03 AU,, eccentricity of 0.16 +/− 0.22, and Msini= 0.93 Jupiter masses (Butler et al. 2006).

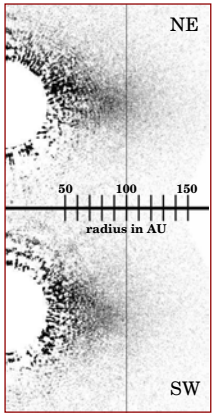
The Infrared Excess

A 60 micron excess was found by IRAS (PSC 01405−5359). The star was studied with Spitzer/IRS by Jura et al. (2004), who found a continuously increasing excess from 25−37 microns. Bryden et al. (2007) report Spitzer/MIPS 24 and 70 micron photometry confirming the IRAS excess, and finding Ld/Lstar= 0.0004. They also marginally resolved the 70 micron source along PA 56 degrees. The implied disk radius is 106 AU and inclination of 14 degrees.

HST/ACS Coronagraphy of the Disk

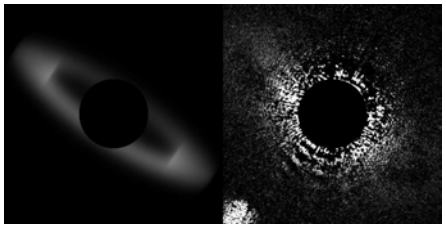
We observed the star in the F606W filter in two HST orbits separated by a roll angle of 10 degrees, followed by a PSF refererence star. Nebulosity is is detected out to radii of 120−140 AU along the position angle indicated by the Spitzer/MIPS data. The disk appears as a diffuse, highly inclined ring. The ring has an asymmetrically greater extension to the NE than the SW. It is quite faint: 21.1 mag per square arcsec on the ansae.





Above left: PSF−subtracted Spitzer/MIPS 70 micron image showing extended thermal emission.
Above right: PSF−subtracted HST/ACS optical image.

Left: Comparison of the two disk ansae. The disk is brighter and/or more extended to the NE.



References:
Butler, P. et al. 2006 Ap.J. 646 505
Bryden, G. et al. 2007 in preparation
Jura, M. et al. 2004 Ap.J.S. 154 453

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Modeling the Scattered Light and SED

Symmetric scattered light disk models were calculated and convolved with the instrumental PSF. Model parameters were adjusted by hand until a rough match was achieved. At upper right, the best current model is shown along with the model subtracted from the data. Slightly forward scattering grains are indicated. Using the dust spatial distribution defined by the HST image, a model SED fitting the Spitzer data was found and is shown at right.