HST/ACS Coronagraphic Images of a Debris Disk around HD 92945

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Introduction

HD 92945 is a nearby (22 pc) K1V star with an age of ~100 Myr (Song, Zuckerman, & Bessell 2004). It was classified as a significant IR excess source by the Spitzer/MIPS Science Team, confirming the Silverstone (2000) identification based on IRAS measurements. As part of a collaborative effort between the MIPS and HST/ACS Science Teams, the star was observed with the ACS coronagraph to search for the scattered light counterpart to the IR emission. We present preliminary results here.

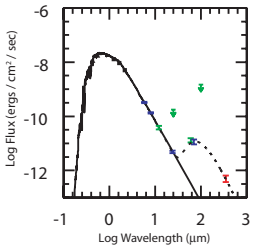

Figure 1. HD 92945 SED from Chen et al. (2005). The blue points are from Spitzer, green from IRAS, and red from SHARC II 350 micron observations. Visible and near-IR photometry are also plotted along with a best-fit stellar atmosphere model and IR excess blackbody. The double-hump profile suggests a central clearing in the disk, like those in Beta Pic, AU Mic, HR 4796A, HD 107146, and HD 141569A. The dust fractional IR luminosity (L_{ir}/L_*=7.7 x 10^{-4}) is a couple of times less than that of Beta Pic.

Observations

HD 92945 was observed with the ACS HRC (0.025"/pix) coronagraph using the r=0.9" occulting spot. A 2200 s exposure was taken through F606W (wide V band) . A similar exposure of another star was taken in the following orbit for use in subracting the residual scattered light. After confirmation of a disk around the star, another visit with 2 orbits (4800 s) in F606W and 3 (7800 s) in F814W (I band) was made (along with reference PSF observations).

The coronagraph supresses the wings of the telescope PSF by 7x-10x. Subtraction reduces the wing brightness by another 100x-500x. Only by using PSF subtraction is the HD 92945 disk apparent.

HD 92945 was observed with the HST/NICMOS coronagraph in another program (10177, PI=Schneider) but was not detected.

Figure j2. (Left) ACS coronagraph observation of HD 92945 in filter F606W using the r=0.9" occulting spot. The center of the spot is filled with light due to the aberrated HST optics. The streak running from the upper left to lower right is instrumental scattered light. (Middle) Observation of HD 100623 used as a reference PSF. (Right) Subtraction from HD 100623 from HD 92945. Residuals caused by mismatches between the two images are evident. All images are logarithmically scaled.

Disk Characteristics

The HD 92945 disk seen in the PSF-subtracted images appears inclined by about 25° from edge-on with the projected major axis aligned along PA=100°. Within ~3" of the star the subtraction residuals caused by PSF mismatches prevent reliable measurement of the disk, which is seen extending out to ~6.5" (146 AU). The disk has a mean surface brightness of V=22.8 mag/arcsec^2. Because the forward edge along the line of sight is hidden under the residuals, it is not possible to estimate the amount of foward scattering by the dust grains. The disk appears generally featureless.

The surface brightness profiles along the apparent major axis shows the "broken power law" shape seen in the Beta Pic and AU Mic disks. Within 5" the disk has a $r^{-1.5}$ profile which then falls off by r^{-8} beyond. This is more drastic than the drop-offs seen in the other disks. The profiles appear similar at both colors, indicating that the disk is largely neutrally scattering, indicating larger-than-ISM grains. It is the most neutrally-colored debris disk known to date (the Beta Pic disk is slightly red in recent ACS coronagraphic observations (Golimowksi et al., in prep)).

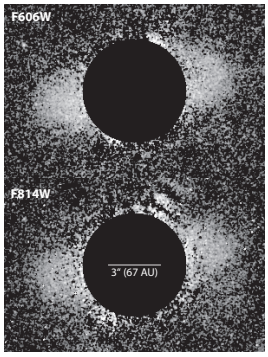

Figure 3. ACS coronagraph images of the HD 92945 disk after PSF subtraction in filters F606W and F814W. The central region where subtraction residuals dominate has been masked. North is up.

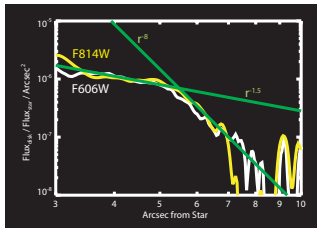

Figure 4. Surface brightness profiles (smoothed) along the apparent major axis of the disk (average of both sides). Beyond 7" noise dominates. Power law profiles are overplotted in green.

References

Chen, C., et al. (2005), Ap.J. (in press)
Silverstone, M. (2000) Ph.D. thesis
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