
The Disk Structure and the Planet in the Beta Pictoris System: An HST/STIS Study

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Abstract

We present new HST/STIS coronagraphic images of the Beta Pictoris disk, obtained at multiple coronagraphic wedge positions and rotation angles and using a color-matched PSF star. The combined image provides the yet highest-quality scattered light image of the inner regions of the Beta Pictoris disk and allows detailed studies of the disk structure between 0.35'' and 13''. Uniquely, our optical images cover the disk radius where Beta Pictoris b orbits.

We provide a detailed view of the disk's vertical structure and surface brightness profile as a function of separation, and describe previously known and new disk structures. Among other results we show that the disk morphology is not consistent with an inclined secondary disk and is caused by a warped inner disk instead.

We compare our images to high-quality near-infrared, mid-infrared, and submillimeter images of the disk and discuss the disk structure in the context of this unique multi-wavelength dataset. We also compare the new STIS images with the carefully re-reduced 1997 STIS images, allowing us to search for temporal evolution of the disk surface brightness on a 15-year baseline, which allows testing the orbital motions of some of the disk structures. We discuss the future potential of multi-epoch disk imaging for disentangling the dynamical interactions in debris disks. Finally, based on the new STIS data, we discuss the two outstanding open questions on the debris disk and the giant planet in the Beta Pic system, which will probably drive many studies in the coming years.

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