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IMAGING POLARIMETRY OF THE POTENTIALLY PLANET-FORMING CIRCUMSTELLAR DISK HD 142527: THE NACO VIEW

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HD 142527 is a unique protoplanetary disk in terms of planet formation. Its high accretion rate combined with its huge inner gap and short age make of it an ideal candidate for harboring forming planets. ALMA cycle-0 observations revealed gap crossing gas streams and showed that the millimeter-sized dust particles are distributed in a horse-shoe shape. Here we present our recent H- and Ks-band imaging polarimetry data of HD 142527 obtained with VLT/NaCo. By means of polarimetry, we remove most of the stellar light, directly imaging the disk's inner regions. Our observations allow us to constrain the dust properties (size and porosity) on the surface of the outer disk. We also detect two regions of the disk with low emission ("nulls") both in polarized and unpolarized light. Intriguingly, one of these nulls is azimuthally coincident with the maximum of the horse-shoe shape detected by ALMA.

The light scattered by dust particles on the surface of the protoplanetary disks becomes linearly polarized, while the stellar light remains largely unpolarized. Because of this, imaging polarimetry is a powerful tool to directly image the faint protoplanetary disks around young (bright) stars. In addition, polarized images can be used to constrain the properties (size, composition and shape) of the dust particles that scatter the light on the surface of the disk.

We have applied this technique, together with PSF-subtraction, to directly image the protoplanetary disk around the Herbig Ae star HD 142527 (Canovas et al. 2013). Previous studies of this target, using different techniques, have shown a large ($\approx$ 130 AUs) gap, spiral features, and gas flows connecting the outer disk with the inner disk (Verhoeff et al. 2011, Casassus et al. 2012, 2013).

Our images clearly show a large, dust-devoid inner gap (see Fig. 1). Applying an edge detection filter we discover a spiral feature on the eastern side of the disk, an confirm the presence of two spiral features on the western side. We derive the polarization degree at H-band, which ranges from 10% to 25%. This is consistent with μm-sized, compact (non-porous) grains on the surface of the disk. Furthermore, we clearly detect two regions of the disk at 0° and 160° that show less emission ("nulls") both in the polarized intensity and PSF-subtracted images. In particular, the null at $\approx$ 0° is roughly spatially coincident with the maximum of the continuum image obtained by ALMA at 345 GHz (Casassus et al. 2013). This suggest a link between both features, with the ALMA images tracing the mm-sized grains on the disk's mid-plane and our H- and K_s- band images tracing μm-sized grains on the disk's surface. We did not detect polarized features caused by the inner disk or the gap-crossing HCO^+ streams previously observed.

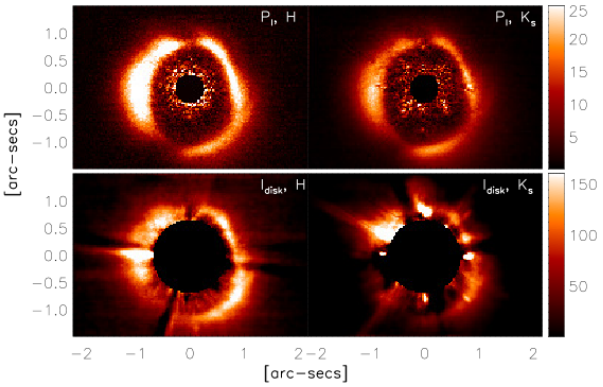

Fig. 1. **Top.** Polarized intensity images at H-band (left) and Ks-band (right). **Bottom.** PSF-subtracted images at H-band (left) and Ks-band (right). In all figures, the central regions dominated by noise and artifacts are masked out. North is up and east is left.

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