Possible inclined inner protoplanetary disk

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A young embedded planet in the protoplanetary disk is expected to interact with a parent disk. When the planet is inclined and massive enough (> 1 Jupiter mass), the disk-planet interaction theory predicts the disk inside the planetary orbit breaks from the outer disk. Such a misaligned inner disk can both warp gas velocity structures observed by ALMA and cast the shadows in the outer disk in the near-infrared image. By analyzing the position of the shadows in the outer disk, one can estimate the inclination of the inner disk relative to the outer disk. Furthermore such systems with shadows should be promising targets for searching young inclined planets in the disks, and would help understanding of planetary orbital evolution.

As a part of our survey in archival data obtained with VLT/SPHERE which is the high contrast instrument in near-infrared, we reduced LkHa 330. LkHa 330 is a T Tauri star with a mass of 2.2 solar mass and known to possess gap and spiral structures. By reducing VLT/SPHERE archival data at H band (1.6 micron), we found shadow structures at PA of 85 and 280 degree in the outer disk at 38 AU in radius. We also found a possible bright blob at PA of 160 degree with a separation of 23 AU from the central star. In the poster, we discuss the inclination of the inner disk by comparing our Monte Carlo radiative transfer calculations for the inclined disks and mention future ALMA proposal plan.

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