P218b Direct Imaging of the Transitional Disk around DM Tau

Yi Yang, Saeko Hayashi, Motohide Tamura, Daehyon Oh, HiCIAO/AO188/SEEDS team

Current theory states that circumstellar disks will experience a 'transitional' phase in their evolution and it is an essential period for planet formation. We report the first spatially resolved images of the transitional disk around the T Tauri star DM Tau in near infrared (NIR) band. These images were obtained using the HiCIAO camera mounted on the Subaru telescope, with adaptive optics AO188 and the polarized differential imaging (PDI) technique. We sucessfully resolve the disk in scattered light at H band for $r \leq 0''.35$ ($r \lesssim 50AU$), with an average inclination about $45.2 \pm 2.1°$ and position angle (PA) about $-27.7 \pm 3.1°$. However, we do not find any cavity or gap structure in the disk. To help uncover the unresolved structure in the disk, we use Whitney radiative transfer model to model the disk and compare it with observed spectral energy distribution (SED, derived from previous multi-wavelength observations) and NIR polarized intensity profile. After the comparison, we find out that to fit the observed SED and intensity profile, a central cavity and a gap in the disk is necessary. We determine that the central cavity has a radius of about 3 AU, the gap radius has a radius of about 14 AU, and the scale height of "wall" at the gap is about 0.2 AU or less to help fit the radial profile. This study shows the power of NIR high-resolution imaging, and is helpful for us to understand the evolution mechanism of circumstellar disks and planets.