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Probing the morphological evolution of circumstellar disks around solar-type stars with near-infrared direct imaging

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Circumstellar disks are considered to be the
birthplace of planets. In theory, planets
can open gaps when they form in a disk
(e.g., Zhu et al. 2011). Recently, a deficit of near- and mid-infrared excess in a spectral energy distribution of a object has been observed
so far (e.g., Strom et al. 1989), and disks with an inner hole have been also detected with a radio interferometry (e.g., Andrews et al. 2011).
These objects, so-called transitional disk, might be a signature of recent planet formation in these system.

As mentioned above, the inner resion (r $<$ 100 AU) of the circumstellar disks are considered to be deeply related to planet formation. Thus, there have been many observational investigations of protoplanetary disks.
However, for optical and near-infrared observations, it is quite difficult to observaed such inner regions due to bright central star (e.g., Grady et al. 1999).
Also, for radio interferometry observations, its spatial resolution is limited to 40 AU, and thus, it is difficult to conduct detailed direct observations (Andrews et al. 2011).

In order to observe planet-forming region (r$<$100AU) in protoplanetary disks with higher spatial resolution ($<$10AU), we developed a new high contrast instrument HiCIAO (Tamura et al. 2006).
HiCIAO employs dual-beam polarimetry, which suppress speckle noise of the central star. In addition, combining with adaptive optics, HiCIAO acheives higher resolution of less than 10 AU.

Using HiCIAO, we have observed protoplanetary disks as a strategic project in Subary Telescope (SEEDS; Tamura 2009). As a result of high-resolution near-infrared polarimetric observations, we achieved a spatial resolution of less than 10 AU, and accessed planet-forming regions (r$<$100AU) of protoplanetary disks. We divided observed ˜20 disks into three categories;
(1) disks with double-ring structures,
(2) disks with cavities,
(3) disks without cavities in the near-infrared.
In the talk, I would like to review the SEEDS disk observations, and discuss a disk evolution to a planetary system.