Discovery of a Disk Gap Candidate at 20 AU in TW Hya

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Explorations and studies of protoplanetary disks reveal important physical processes that are fundamental to the formation and evolution of planetary systems.

As part of the Strategic Explorations of Exoplanets and Disks with Subaru (SEEDS) project for exploring the circumstellar disk structure, TW Hya, an analog of the early solar nebula, was selected because it is particularly accommodating to investigations of its geometrical structure with high spatial resolution and sensitivity due to its close distance of 54 pc.

As results of the observations, the scattered light from the disk was detected from 0.2 to 1.5 asec (11–81 AU) from the central star and the polarized image shows a ring-like depression, probably a gap at ~20 AU from the central star as shown in Fig. 1 [1], similar to the 80 AU gap previously reported from the Hubble Space Telescope (HST) images [2]. Several gap formation mechanisms, such as disk–planet interaction, photoevapolation, grain growth, or dust filtration, has been proposed. Our observation suggests the possibilities of planet formation and grain growth because the observed radial profile can well be explained by the gap formation model by a planet [3] and the observed depression can also be reproduced by a change in dust scale height due to grain growth.

In addition to the HST result, our observation revealed the multiple ring-like gap structure in TW Hya, implying that multiple planets are forming as a planetary system. In near future, ALMA and next-generation astronomical telescope, TMT, will provide convincing information about the origin of gaps and shed new light on planet formation.

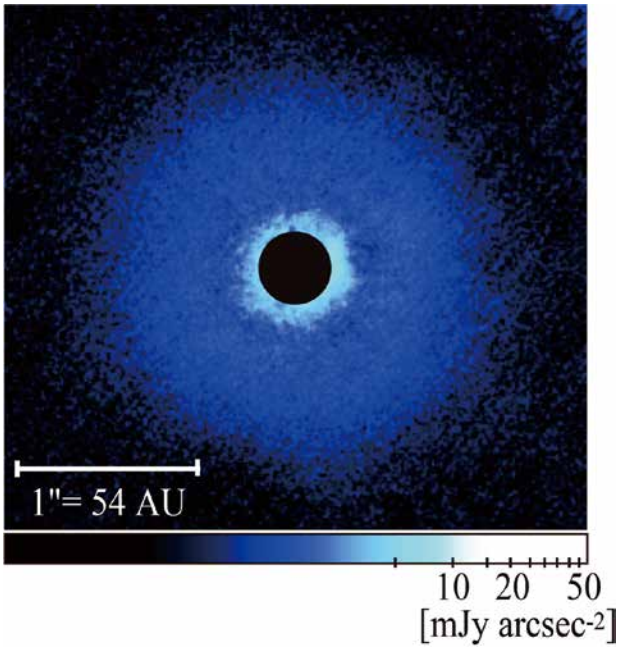

Figure 1: *H*-band polarized intensity image of TW Hya. The dark filled circle at the center indicates a software mask with $r = 0.2$ asec.

References

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