Discovery of a localized excess in the millimeter emission of the protoplanetary disk around TW Hya

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Planets are formed from dust and gas in circumstellar disks around young stars.
Observations of dust and gas in circumstellar disks can provide fundamental information on planet formation processes, and high-resolution (sub-)millimeter imaging is now revealing the dust substructure likely generated by forming planets in disks.
Here we report the detection of an excess in dust continuum emission at 233 GHz (1.3 mm in wavelength) in the circumstellar disk around TW Hya, the closest such system to Earth, revealed through high-sensitivity observations with the Atacama Large Millimeter/submillimeter Array (ALMA).

We have carried out 3 au resolution continuum observations at 233 GHz (Band6) toward the protoplanetary disk (PPD) around TW Hya using ALMA in 2016 and 2017.
The sensitivity has been improved by a factor of 3 than that of our previous cycle 3 observations.
The overall structure is axisymmetric, and there are apparent gaps at 25 and 41 au as previously reported.
The most remarkable new finding is a few au scale excess emission at the south-west part of the PPD.
The excess emission is located at 52 au from the disk center and is 1.5 times brighter than the surrounding PPD.
The extracted emission after subtracting the axisymmetric PPD emission has a size of 4.4x1.0 au and a total flux density of 250 micro-Jy, corresponding to a dust mass of 0.03 earth masses.
Since the excess emission can also be marginally identified in the Band 7 image at almost the same position, the blob is unlikely a background source.
The excess emission can be explained by a massive CPD around a Neptune mass forming-planet or a dust clump accumulated in a small elongated vortex.

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