Submillimeter multi-wavelength observations for the protoplanetary disk around a young star TW Hya with ALMA

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We present the results of our ~3 au resolution imaging observations of the protoplanetary disk around TW Hya at 145 and 233 GHz with the Atacama Large Millimeter/submillimeter Array. Our observations revealed two deep gaps at 22 and 37 au and shallower gaps at 6, 28, and 44 au, as reported by Andrews et al. (2016). The central hole with a radius of ~3 au was also marginally resolved. The most remarkable finding is that the spectral index between bands 4 and 6 peaks at the 22 au gap. The derived power-law index of the dust opacity beta is ~1.7 at the 22 au gap and decreases toward the disk center to 0. The most prominent gap at 22 au could be caused by the gravitational interaction between the disk and an unseen Neptune-mass planet, although other origins may be possible. The planet-induced gap is supported by the fact that beta is enhanced at the 22 au gap, indicating a deficit of millimeter-sized grains within the gap due to dust filtration by a planet.

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