Observations of dust continuum emission at 1.3mm from the protoplanetary disk around DG Tau

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We report the ALMA long-baseline observations of dust continuum emission at 1.3mm from the protoplanetary disk around DG Tau. DG Tau is a young T Tauri star in Taurus molecular clouds. It exhibits features such as a circumstellar envelope ~1000au in size, ionized jets, and vigorous mass accretion (> 10^{-6} M_{sun} /yr) onto the star. These are common to HL Tau whose protoplanetary disk was nicely imaged in the long-baseline campaign, making DG Tau an ideal object for examining the origin and universality of the ring-like features found in the HL Tau's disk. Based on the jet kinematics and gas rotation in r < 400au, the inclination and stellar mass were estimated to be 38deg and 0.67M_{sun}. Our present observations at the wavelength of 1.3mm have provided us with a image of dust continuum emission at the beam size of ~36 milli-arcseconds, or 5au. The overall structure of the disk is axisymmetric, and the surface brightness distribution is radially smooth, approximately following power-laws of $r^{-0.55}$ in r< 12.5au and $r^{-1.22}$ in 12.5au < r < 50au, respectively, with steep tapering beyond r = 50au. Though the inner regions (r< 12.5au) seems optically thick at 1.3mm, the surface density distribution in r > 15au suggested from these results agrees with a classical accretion disk model. Other intriguing features are several gaps seen in 12.5au < r < 50au, with their relative decrements of ~ 7% from the power-law distribution. These are reminiscent of spectacular concentric rings around HL Tau, and their nature should be explored further by multi-band observations with ALMA in near future.

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