P205a Cloudlet Capture Model for the Streamer Associated with DG Tau

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DG Tau is a well-known Class II source associated with jets and a residual envelope. Recently, Garufi et al. (2022, A&Ap, 658, A104) found an extended streamer feature in the envelope and a bright spot of SO and SO_2 near where the streamer joins the disk, possibly tracing the impact of the streamer on the disk. If so, the streamer is an ongoing and direct gas flow from the envelope ($r > 400$ au) to the disk ($r \simeq 60$ au). To confirm this, we constructed hydrodynamic simulations of a cold gas cloudlet falls onto the rotating gas disk of DG Tau. Our model can reproduce the morphology and line-of-sight velocity of the streamer and the impact position. We report the hydrodynamic simulations and compare with ALMA observations.

Our model assumes that DG Tau is surrounded by a warm atomic gas, while the gas disk and accreting cloudlet consist of cold molecular gas. At the initial stage, the cloudlet is located at an elliptical orbit periastron (600 au from DG Tau). The orbit is tilted 10° with respect to the disk and has the eccentricity of 0.9. The cloudlet has the initial radius of 90 au but is highly elongated by the tidal force and the warm atomic gas. The warm gas is invisible in molecular emission but is key in channeling the cloudlet into a narrow streamer as it approaches the disk. The streamer is transient and has a lifetime of $\simeq 1000$ years in our model.