Cloudlet capture model for the origin of asymmetry in the molecular emission in TMC-1A

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Protostars are associated with protoplanetary disks and are surrounded by infalling envelopes. The gas accretion from the envelope is thought to be more or less symmetric around the rotation axis of the disk. However, some young protostars show highly asymmetric features in the molecular emission lines. Blue-shifted component is much stronger than red-shited one in the CS emission line in TMC-1A harboringIRAS 04365+2535, Class I protostar in Taurus. The asymmetry may indicate that we are observing the capture of a cloudlet. We examine this possibility based on hydrodynamical simulations in which a cloudlet accretes and collides the pre-existing disk. The orbital plane of the cloudlet is inclined to the disk. This model explains several features such as (1) the asymmetry in the infalling gas, (2) a partial lack in the disk, and (3) apparently slow infall velocity. We discuss the implications of our hypothesis that the gas accretion onto protostar may be successive but sporadic captures of cloudlets rather than continuous flow.