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research highlights

CIRCUMSTELLAR MATERIAL

Bottling it up

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Stars undergoing formation are often less luminous than expected from theoretical models that assume a constant, smooth accretion of material from their circumstellar disks. This 'luminosity problem' could be partially solved if protostars accrete episodically instead. Gas and dust from a protostar's natal envelope accrete onto a rotating disk around the central star, and then from the disk onto the protostar itself. This second step generates the majority of the luminosity of the protostellar system, and the mass of accreting material can be estimated from luminosity measurements. Using the Atacama Large Millimeter/submillimeter Array (ALMA), Ágnes Kóspál and collaborators have constrained the rate of mass transfer in the first step, in a young, low-mass protostar, V346 Nor. They find that the accretion rate is a few times greater in the envelope–disk step than in the disk–star step, meaning that material must build up in the disk and accrete sporadically, in bursts, presumably following gravitational instability. Typically, protostars are observed in their low accretion rate state, whereas the more intense, short period, and thus rarer, high accretion rate episodes are missed.

Kóspál *et al.* observed 1.3 mm continuum emission and ^{12}CO, ^{13}CO and C^{18}O rotational lines from the envelope of V346 Nor, a known member of a class of eruptive stars called FU Orionis objects. The emission traces different components of the envelope, and through analysis of channel maps and position–velocity diagrams, the authors obtained a dynamical picture of the accretion flow from the envelope to the disk. The mass infall rate from envelope to disk was quantified using an empirical relation between the calculated mass and radius of the envelope and the current mass of the protostar.

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