Mass Assembly of Stellar Systems and their Evolution with the SMA (MASSES)

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Motivating Questions

1. **When, where, and how do cores and disks fragment into multiple systems?**
2. **What role do disks play in the transfer of mass from cores to stars?**
3. **To what extent do outflows regulate the protostellar mass accretion process?**
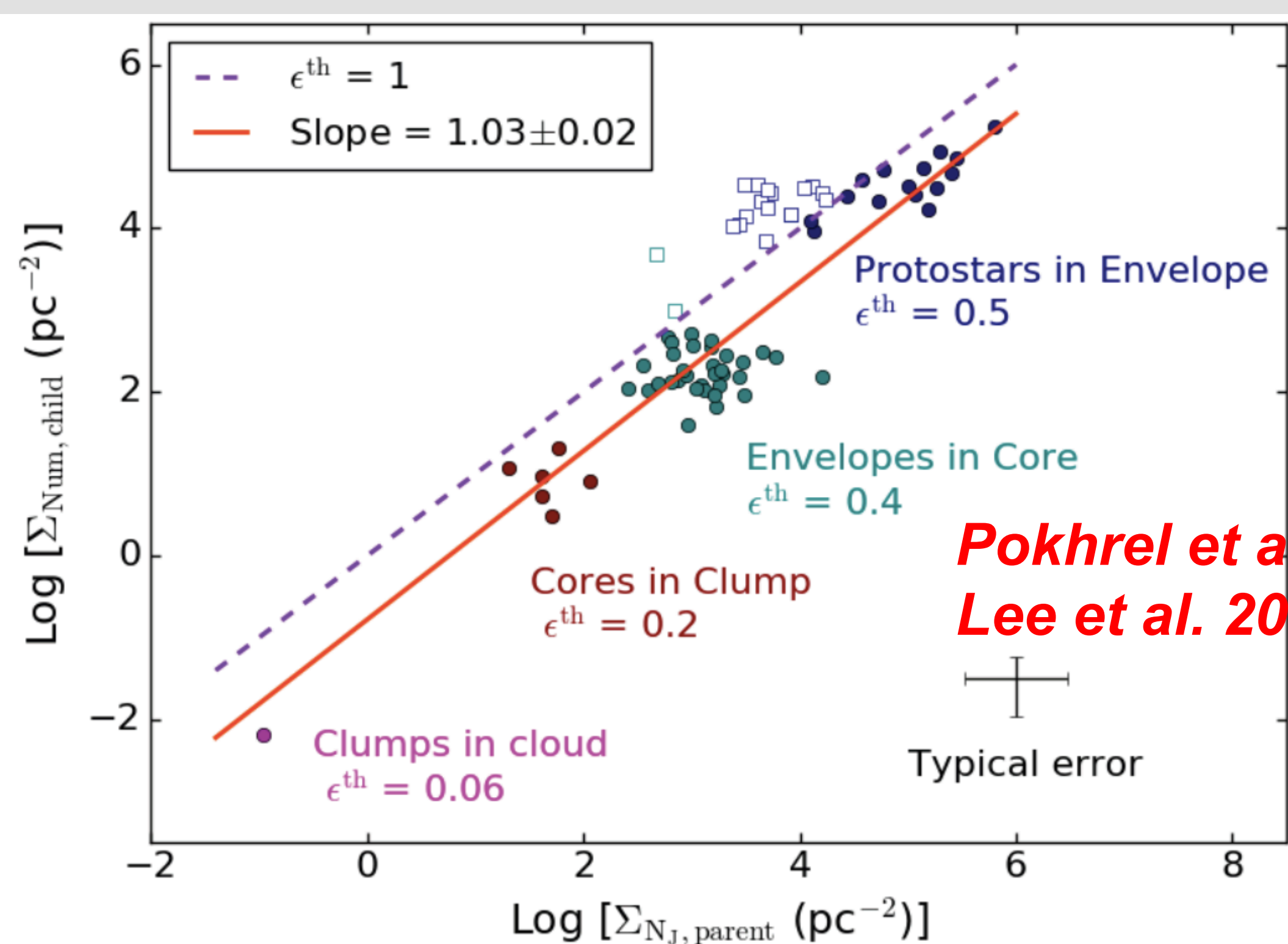
Some outflows imaged by MASSES in ^{12}CO (2-1). Data released by Stephens et al. (2018), ApJS, in press.
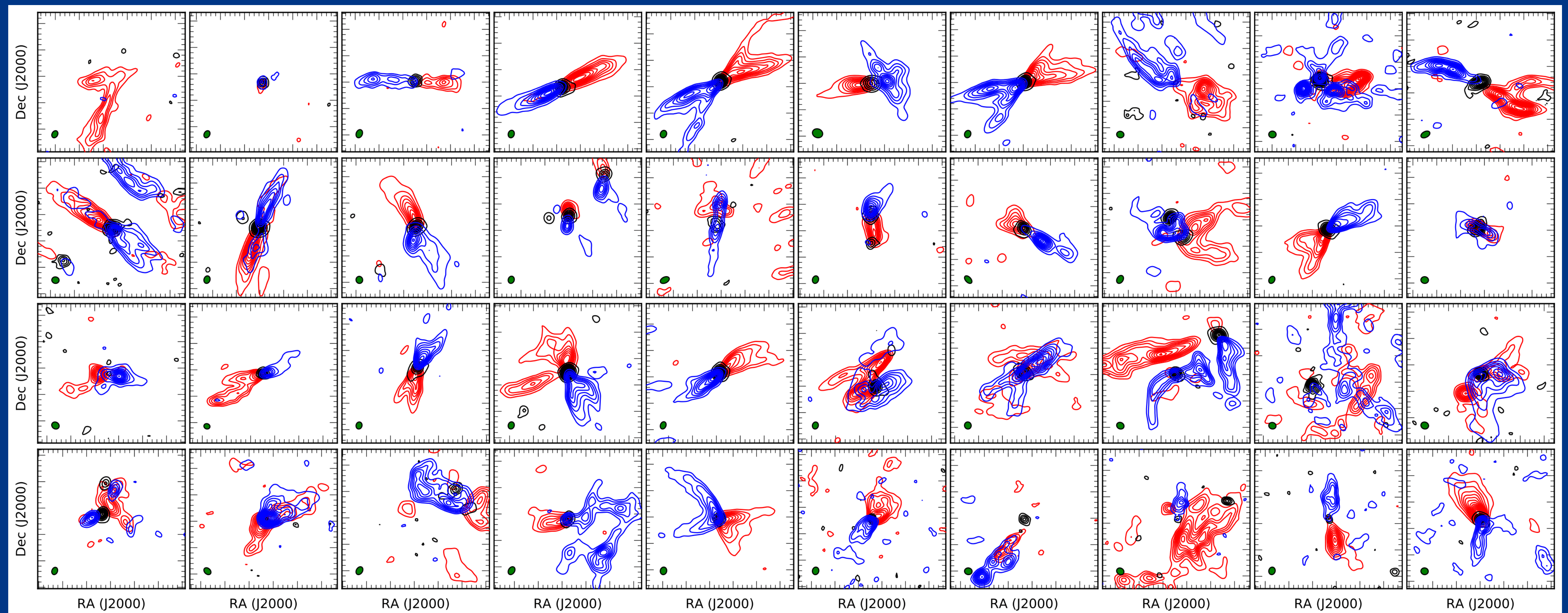
Survey Details

- **600 hr survey of all (~70) protostars in Perseus (d = 230 pc)**
- **230+345 GHz SUB+EXT observations tracing scales from 200-4000 AU**
- **230+345 GHz continuum and 7 lines tracing outflows & dense gas**
- **Calibrated visibilities & images publicly delivered**

Key Survey Results

Fragmentation is a multi-scale, hierarchical process

Pokhrel et al. 2018, ApJ, 853, 5
Lee et al. 2015, ApJ, 814, 114

Fragmentation is best described as "inefficient thermal Jeans fragmentation," meaning the number of fragments in a parent structure correlates linearly with the parent's thermal Jeans number, but is lower than expected
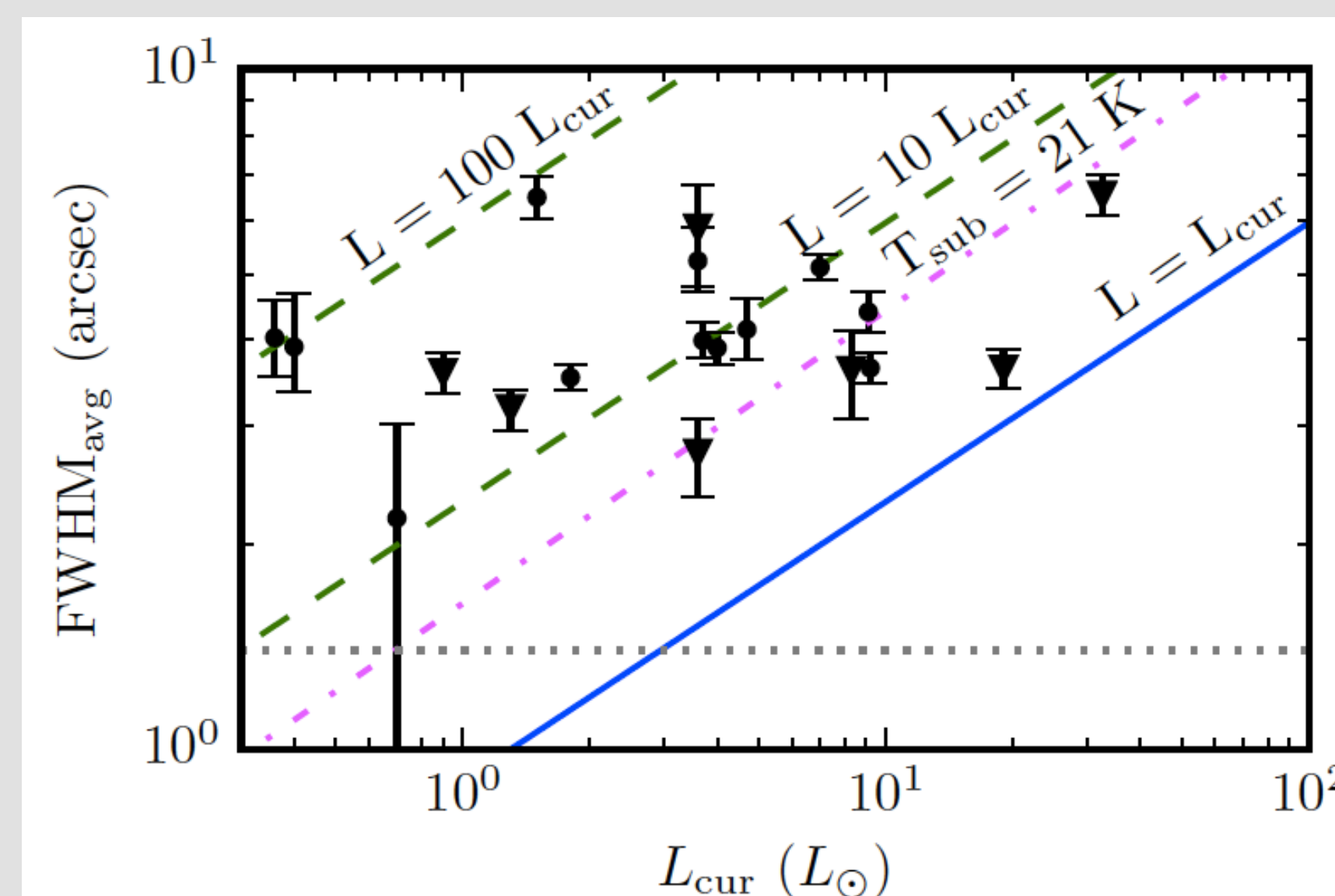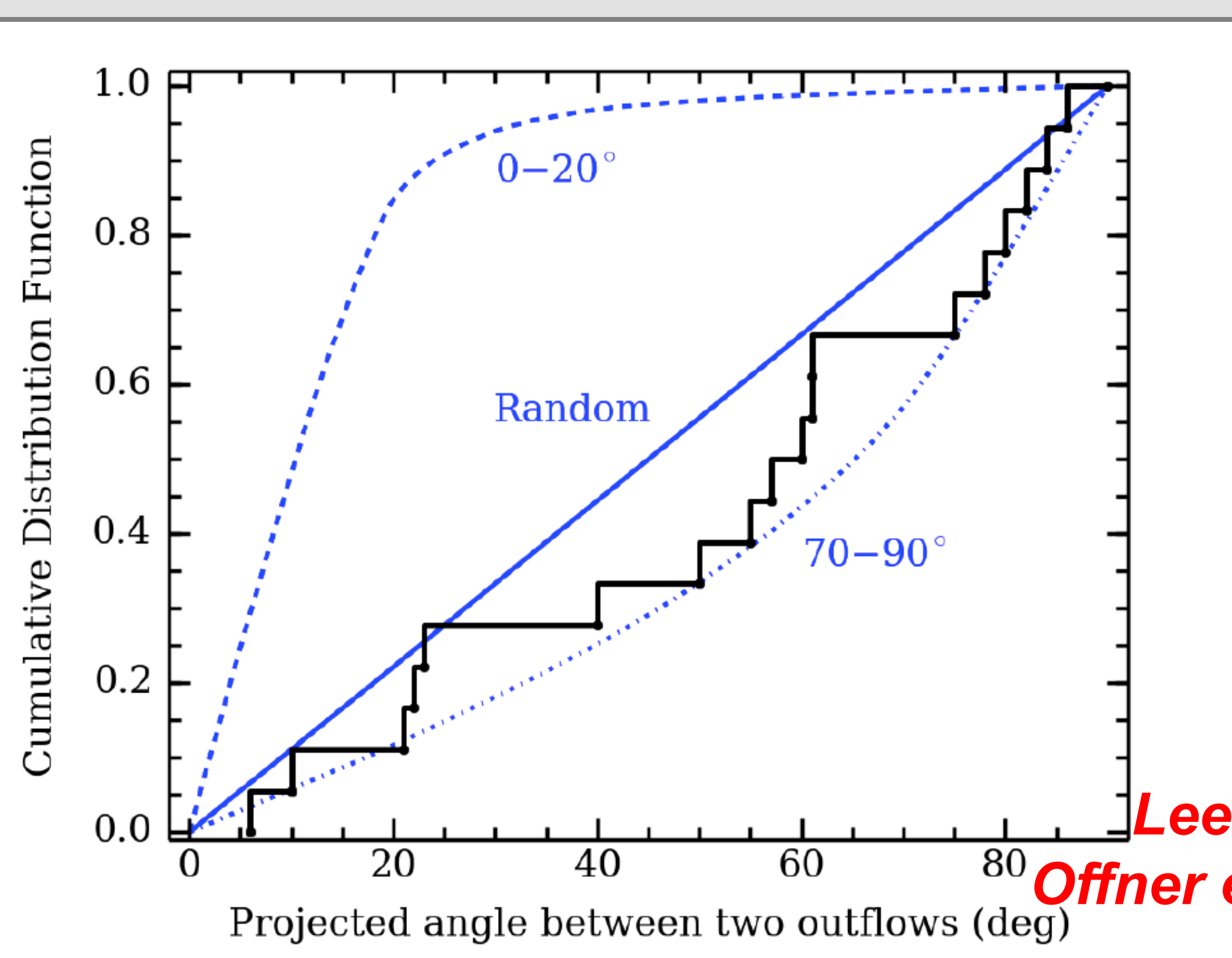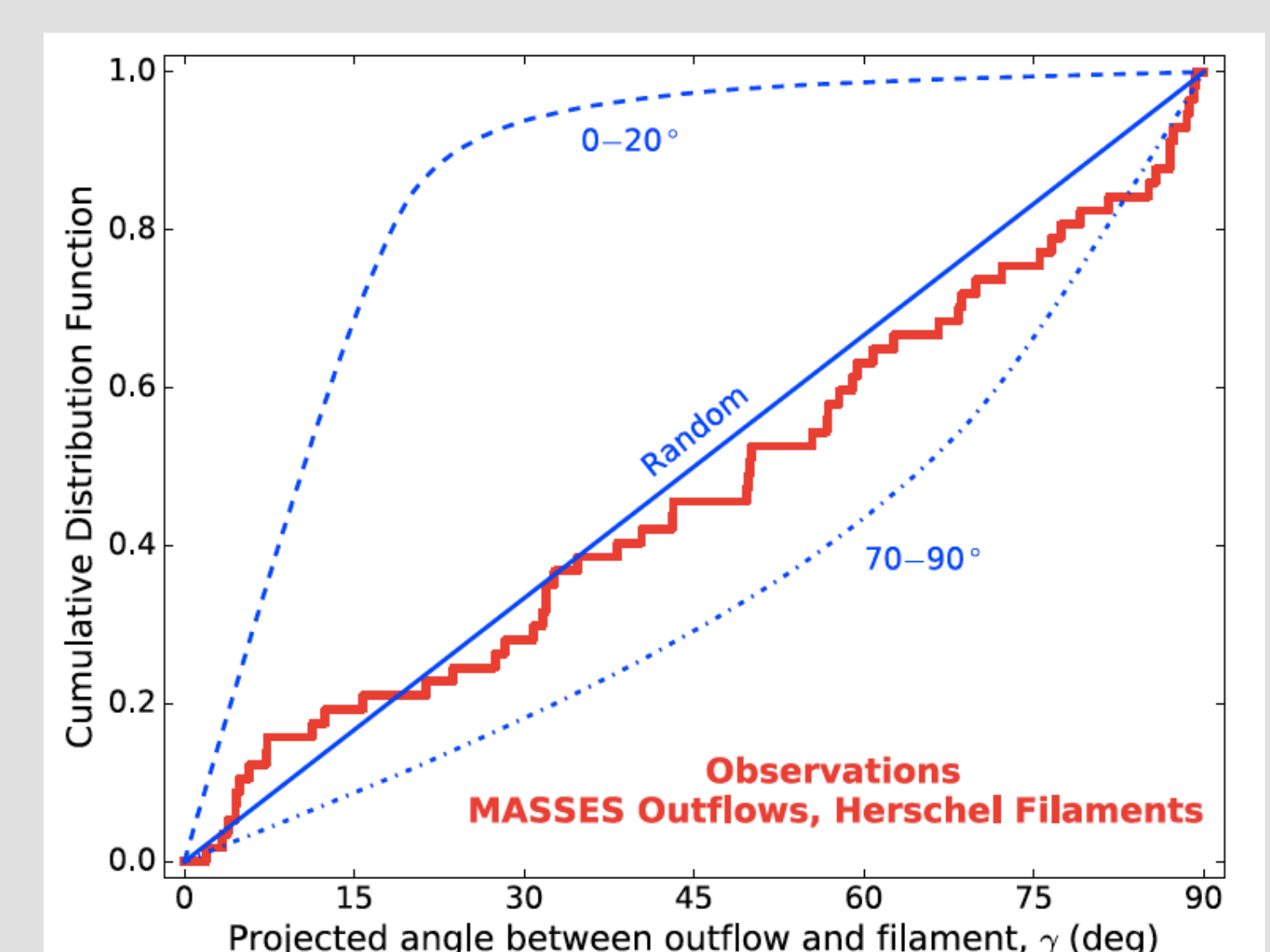

Protostellar chemistry is indicative of variable accretion histories in at least half of all protostars

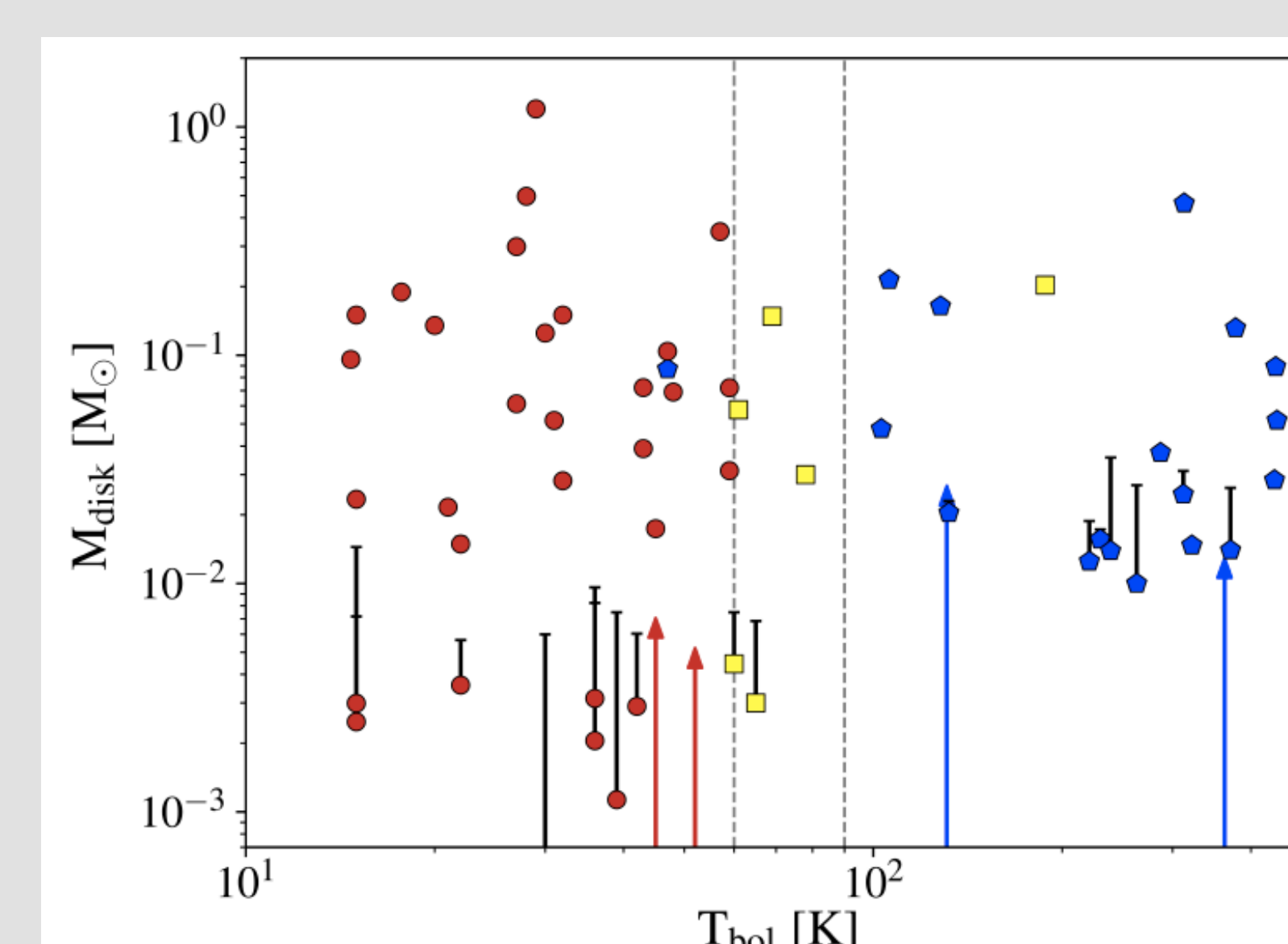*Frimann et al. 2017, A&A, 602, 120*

Outflows driven by protostars are randomly aligned relative to the filaments inside which the protostars are embedded

Stephens et al. 2017, ApJ, 846, 16

Outflows from wide binaries are randomly aligned, in agreement with theoretical predictions of turbulent fragmentation

Lee et al. 2016, ApJ, 820, 2
Offner et al. 2016, ApJ, 827, 11

Protostellar disks form early in the Class 0 stage, and do not evolve significantly in mass after formation

Andersen et al. 2018, in preparation

MASSES enables key progress on open questions requiring a statistical approach
Seven papers are published, with several additional papers currently in preparation