Protoplanetary disks population formation in massive clumps.

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Abstract

Protoplanetary disks are formed around protostars because of the angular momentum conservation during the protostellar collapse. Since they are the birthplace of the planets, understanding their initial conditions is essential to constrain exoplanets populations. Huge progress have been recently made in observing protoplanetary disks at the very early stages and we are now able to provide some constraints on the properties (dust mass, radius) of Class 0-I disks (Segura-Cox et al., 2018; Maury et al., 2019.; Tobin et al., 2020; Tychoniec et al., 2020). These studies suggest that young disks are compact (often $<$ 50 au) and massive enough for planet formation (as opposed to older Class II disks, see for e.g., Manara et al. 2018). However these properties are still quite uncertain and we lack theoretical studies that investigate disk formation as a population.
Recently, Bate (2018) investigated disk population formation in massive protostellar clumps with high resolution Smoothed particle hydrodynamics (SPH) calculations but without any magnetic field. Given the magnetic field role in redistributing the angular momentum during the protostellar collapse (see for e.g. Masson et al. 2016; Zhao et al. 2016; Wurster et al. 2016; Hennebelle et al. 2020b), it is extremely important to include it in future calculations.

During this presentation, I will present our recent study (Lebreuilly et al., 2021) where we proposed the first high resolution simulation of disk population formation from the collapse of massive protostellar clumps with non-ideal MHD using RAMSES (Teyssier 2002). I will show that the magnetic field and its treatment play a very important role in setting the initial disks properties. While hydrodynamical runs produce a population dominated by large disks, magnetized runs lead to half of the disks being smaller than

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