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Rotation and angular momentum transport mechanisms in molecular clouds and filaments

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For many years, evidence of large-scale velocity gradients has been found in molecular clouds and filaments, which are commonly associated with rotation. It is known that during the collapse and fragmentation of these structures, a process of redistribution and loss of angular momentum is involved, such that the fragments possess less angular momentum per unit of mass than their parent structures. The mechanisms responsible for transporting angular momentum out of the fragments are still a matter of debate. Therefore, studying this redistribution process is essential to understand both the star formation process and (since at some point the mechanism responsible for transporting angular momentum at cloud scales should be inefficient on small scales) disks formation.

In this work we focus on the study of the residual angular momentum and the 3D velocity field in and around molecular clouds and filaments. We analyze numerical simulations including turbulence, gravity, and magnetic fiel, and define numerical samples of clumps and filaments. In particular, we address the following issues:

1. Turbulent viscosity: dominant mechanism for transferring angular momentum at molecular cloud scales? Are gravity and magnetic field necessary to reproduce angular momentum scaling in clumps and cores?
2. Angular momentum measurements in filaments: what is the best way to measure it? Do filaments follow the same angular momentum scaling as clumps and cores? And more importantly, do filaments rotate?
3. Filament dynamics: what is the 3D velocity and magnetic field around and inside filaments? Properties of turbulence in filaments? Is the angular momentum of clumps and cores determined by these properties?

Work in progress with openness to discussion and collaboration.

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