The Role of Environment in the Formation and Evolution of ISM Filaments

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The observed association of filaments with prestellar and protostellar objects has made these structures a priority target in the investigation of the earliest stages of core and star formation. Recent studies point towards a scenario in which these cores are formed by gravitational fragmentation of supercritical filaments (linear mass $M_{line} > 16.5\ M_o$/pc; e.g., [1]) with quasi-universal widths of ~0.1 pc [2][3]. In this work we have aimed to constrain the role of environment in filament formation and a possible evolution to supercritical filaments. The Herschel datasets of the Galactic Cold Cores Key Programme, covering a range of Galactic locations and distances, allows for a statistical study of filamentary properties in a range of environmental conditions.

Filaments were extracted from these fields with the *getfilaments* algorithm. Their column density structure was characterized based on the relative contributions from a 'core' component, represented by a Gaussian, and a 'wing' component, dominated by the power-law behaviour of the Plummer-like function. In the context of gravitationally-dominated evolution, we find that (sub)critical filaments could increase their total linear mass by increasing that of their core and wing components while decreasing their M_{line} (core) /M_{line} (wing) ratio. Both filament components appear to be linked to local environment, with filaments at higher background levels systematically reaching higher core and wing masses. The distribution of core and wing-dominated filaments suggests a wing origin probably linked to accretion, which is dependent on the mass of the core component and the availability of material.

Results are in good agreement with previous Herschel observations and theoretical models of filament formation ([4], [5], [6]), supporting an accretion-based evolutionary process. Supercritical filaments are formed from subcritical, contracting, self-gravitating filaments with a minimum core component close to criticality (M_{line} (core) $>6M_o$/ pc). Formation of such star-forming filaments would be aided by a dense environment with $A_V \gtrsim$ 3 mag. This emphasizes the need for triggering, or an alternative (dynamical) external event, in order to bypass the limitations of gravity in the most extreme conditions: star-formation in diffuse high-galactic latitude environments, and high-mass star formation.

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