Title:
On the hierarchical fragmentation of the Orion Molecular Cloud 1 northern filament

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It is well established that filamentary molecular cloud structures are ubiquitous within star forming regions. This has been known since Schneider & Elmegreen 1979, and recent Herschel observations have generated an intense revival in the star formation community's interest in these structures (André et al. 2010). By analyzing how such structures evolve and fragment to form cores and stars, we may gain insight into the connection between the core mass function and the initial mass function. The Orion Molecular Cloud (OMC) 1 is an ideal target for such a study, for it is part of the nearest giant molecular cloud. We report on Submillimeter Array (SMA) 1.3mm observations of the OMC1 northern filaments that were previously identified from SCUBA JCMT 850 micron continuum and VLA ammonia observations. We discovered 24 new compact sources along an extent of ~3' within the filaments. The sources range in mass from 0.5 to 3 MSun and several of them are driving CO molecular outflows. The millimeter emission is arising from the inner part of the envelope and circumstellar disk; these compact sources are therefore in the Class 0/I evolutionary phase. The fragmentation of the OMC1n filamentary structure is probed by analyzing the spatial distribution of these protostars. Due to their youth, the young protostars cores have not yet had enough time to move away from their birthsites and as such their spatial distribution is a fossil signature of the fragmentation scale of their parental filament. The spatial analysis of the protostars show that they are divided into small groups (clumps), and that these groups are separated by a quasi-equidistant length of ~30' (~0.06pc). This separation is consistent with the Jeans length of the filament, suggesting that the main physical process in the filament's evolution was thermal fragmentation. Within these protostellar groups, the typical separation between the protostars is ~7" (~2800au), which is again consistent with the Jeans length of the parental clumps within which the protostars are embedded. Our results point to a hierarchical (2-level) thermal fragmentation process of the OMC1-n filament. We also discuss how these findings compare with those of OMC3 (Takahashi et al., 2013), and how it connects with the hierarchical fragmentation of the larger scale Orion molecular cloud.