Turbulence in Star Formation

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Modern theory and observations suggest that molecular clouds are assembled, form stars and disperse, on a dynamical timescale. The finding of super- sonic turbulence within molecular clouds strongly supports this idea. In this paradigm the turbulent energy delivered by the assembly of the molecular cloud is dissipated as it cascades to smaller scales. Thus the larger structures within molecular clouds, those that form star clusters, have super-sonic turbulence. Conversely, the smaller, denser prestellar cores, which form single stars and small stellar systems, display trans-sonic or sub-sonic turbulence.

In this review talk, I will first lay out the context of turbulence in star-forming molecular clouds and how it is related to the formation of filamentary structures within them. Then I will focus on smaller, prestellar core scales and show that the scale of the largest turbulent perturbation strongly influences the mode of star formation within the core. Turbulence on scales larger than the core size leads to disk formation and fragmentation, while small scale turbulence promotes the formation of single stars with small, AU-sized disks. For intermediate scales the cores collapse in a filamentary fashion and a small number of stars forms from fragmenting filaments. These results are discussed in the context of a mapping between the core mass function and the initial stellar mass function.