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Dynamics of Vortex Lines in Turbulent 3D Stratified Flows
PHILIP MARCUS, UC Berkeley — Within the context of examining the flows within ProtoPlanetary Disks (PPDs), we have numerically computed long-lived, 3D, spatially-compact vortices. These vortices are robust; they last many turn-around times, and like-signed vortices interact with each other by stretching and merging. The vorticity in the mid-plane of each vortex is primarily aligned with the rotation axis of the nearly-Keplerian PPD. Because the vortices have limited vertical extent and because the vortex lines cannot terminate, an open question has been what is the geometry of the lines outside the region normally associated with the vortex. Do vortex lines pass through multiple vortices? Do they become chaotically tangled in the turbulence exterior to the vortex? When vortices merge, is there breaking and reconnection of the lines? We show that most of the lines form dipolar field and that entanglement is the exception rather than the rule in vortex merger.

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