Abstract Submitted
for the DFD20 Meeting of
The American Physical Society

"Vortex Bursting": its initiation and dynamics ERIC STOUT, FAZLE HUSSAIN, Texas Tech Univ — Vortex bursting – an abrupt expansion of the core radius of a slender vortex column, but distinct from vortex breakdown – occurs when a vortex ring dipole forms within the column, advects radially outward, and erupts as a detached structure. The ring dipole forms when an initial perturbation to the column's core radius generates azimuthal vorticity, ω_θ, that then mutually interacts to increase the radius. Via DNS, we find that eruption of the dipole can be arrested due to the dipole's interaction with the column. The meridional velocity of each ring of the dipole generates opposite ω_θ at the column's surface via tilting of the column's initially axial vortex lines; this tilting, hence coiling, forms a counter-dipole at the column's surface, outside the first dipole; this counter-dipole advects radially inward, arresting the erupting dipole's outward motion and decimating it via uncoiling of vortex lines. We model the generation of ω_θ at the column's surface due to the meridional velocity of each ring of the erupting dipole and find quadratic growth, confirmed by DNS. Then, by assuming the ω_θ in the dipole rings is generated at the initial core perturbation, we find that bursting occurs for a minimum axial variation of the core radius, $\Delta r_0/\Delta z$, of 0.49 – this occurs when the erupting dipole's ω_θ is larger than the counter-dipole's ω_θ. This criterion should enable seeding radius variations on a column to control or induce vortex bursting in various applications.

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Date submitted: 10 Aug 2020 Electronic form version 1.4