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High-Speed 3D Visualization of the Head-on Collision of Vortex Rings RYAN MCKEOWN, SHMUEL RUBINSTEIN, Harvard University — The head-on collision between two laminar vortex rings results in a complex dynamic pattern that has been previously observed, though never fully explained. During their initial interaction, the laminar vortex rings elongate radially along the collision plane, while the two vortex cores approach one another. When the distance between the vortex cores reaches a critical length scale, they either reconnect into secondary vortex rings or break down and dissipate into a turbulent cloud, depending on their initial Reynolds number. By filming this collision at high speeds, while illuminating it with a scanning laser sheet, we can reconstruct the intricate three-dimensional flow structure at the collision plane. We find that the onset of the vortex ring breakdown is triggered by a sequential cascade of instabilities that interact with the vortex cores. Understanding the role of these instabilities in the breakdown of vortex rings could provide new insight into the evolution and stabilization of vortices.

Ryan McKeown
Harvard University

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