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Title: *Vortex Instabilities*

Summary: In this talk, I will discuss instabilities affecting vortices without axial flow in an open domain. I will focus on instabilities that develop in the core of the vortex and consider linear perturbations that grow exponentially in time.

The case of a 2D axisymmetric vortex is considered first. I will review the inviscid instability criteria for shear instability and centrifugal instability. Next, I will examine a stable vortex (such as the Lamb-Oseen vortex) and analyze the characteristics of its 3D neutral waves (in the inviscid limit) to introduce the effect of critical layer damping (Landau damping).

I will demonstrate how these waves can be resonantly coupled when such a vortex is placed in a non-axisymmetric environment. I will analyze three different configurations: a vortex ring (without swirl), a pair of counter-rotating vortices, and a vortex surrounded by three satellite vortices. In each case, I will show that in the limit of small core size, the vortex can be considered as a 2D axisymmetric vortex plus a small non-axisymmetric correction of azimuthal wavenumber $m = 1$ (vortex ring), $m = 2$ (vortex pair) or $m = 3$ (vortex surrounded by 3 satellites). This will allow me to show that a phenomenon of wave resonance mediated by the non-axisymmetric correction is possible. I will explain how the growth rate associated with each resonance can be calculated. Theoretical predictions for the Lamb-Oseen vortex will be given and compared to numerical and experimental results.