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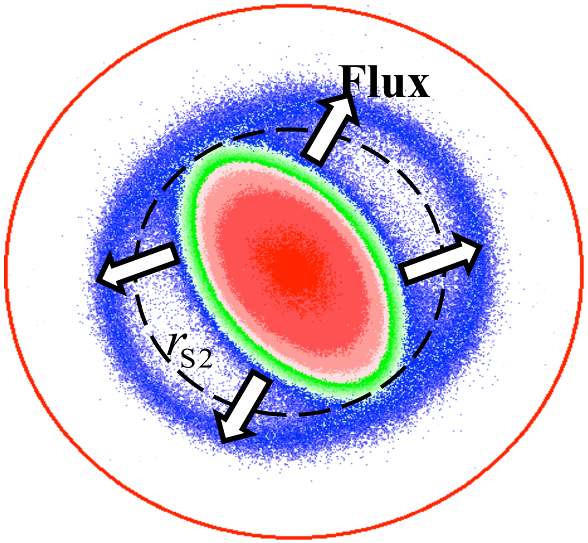
Algebraic Diocotron Mode Damping, aka Vortex Symmetrization



Diocotron modes are ExB-drift surface waves on magnetized electron plasma columns, and are isomorphic to Kelvin waves on vortices in 2D Euler flows. The image at left shows the measured vorticity (colors) in a large m_θ=2 (elliptical) wave. *Exponential* Landau damping (inviscid vortex symmetrization) occurs when vorticity interacts with the wave at the resonant radius r_{s2}, typically ceasing when a nonlinear "cat's eye" structure (blue) forms.

Recent experiments and theory (Kabantsev 2013) elucidate a new *algebraic* damping process caused by a weak *flux of vorticity* through the resonant radius r_s. This occurs for the "displacement" m_θ=1 mode also.

The plot shows measured wave amplitudes d_1, d_2, each damping algebraically (as $1-\gamma_m t$) once the (controlled) flux reaches r_s. This damping is fast, and it continues to zero amplitude. Thus, even weak viscosity (causing negligible direct damping) may generate a weak outward *flux* and thus cause *strong algebraic damping.* This may contribute to vortex symmetrization in 2D geophysical flows.