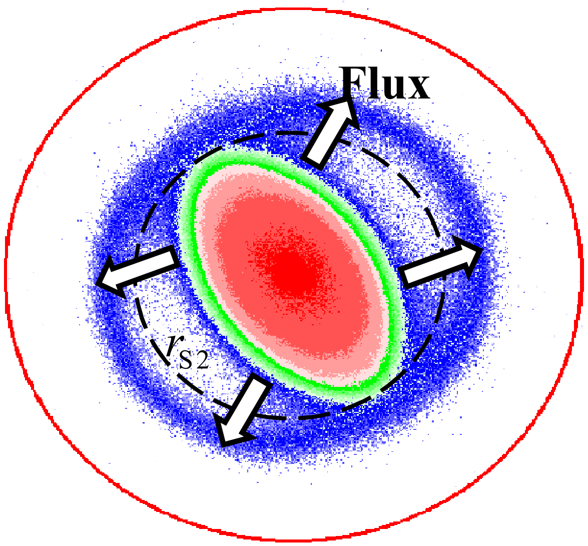
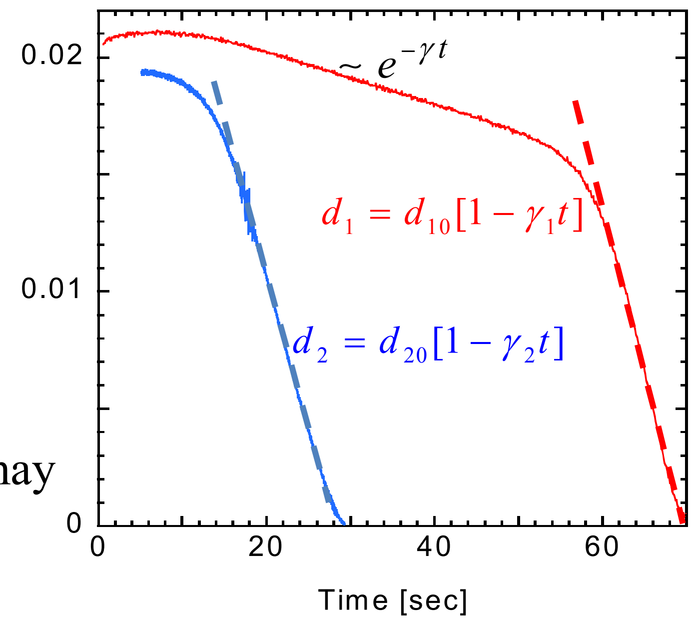
O'Neil /Driscoll /Dubin NSF-0903877

Algebraic Diocotron Mode Damping, aka Vortex Symmetrization



Diocotron modes are **E**×**B**-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 $m_\theta = 2$ (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 elucidate a new *algebraic* damping process caused by a weak *flux of vorticity* through the resonant radius r_S. This occurs for the "displacement" $m_\theta = 1$ mode also. The plot shows measured wave amplitudes d_1 and 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 amplitudes. 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.



A.A. Kabantsev et al., *Phys. Rev. Lett.*, **112**, 115003 (2014)