Abstract Submitted
for the MAR16 Meeting of
The American Physical Society

Instability of Driven Josephson Vortices in Long Underdamped Junctions[1] AHMAD SHEIKHZADA, ALEX GUREVICH, Department of Physics and Center for Accelerator Science, Old Dominion University — We show that a Josephson vortex driven by a dc current can become unstable due to strong Cherenkov radiation resulting from intrinsic nonlocal electrodynamics of long underdamped Josephson junctions. This instability is not captured by the conventional sine-Gordon equation but is described by a more general integro-differential equation for the phase difference, $\theta(x,t)$. Our numerical simulations of this nonlinear dynamic equation for different junction geometries have shown that, as the vortex reaches a critical velocity, it triggers a cascade of expanding vortex-antivortex pairs. As a result, vortices and antivortices become spatially separated and accumulate continuously on the opposite sides of expanding dissipative domain. This effect is most pronounced in thin film edge Josephson junctions at low temperatures where a single vortex can switch the whole junction into a resistive state at currents well below the Josephson critical current. Our results suggest that a rapidly moving Josephson vortex can destroy the superconducting long-range order in a way that is similar to the crack propagation in solids.

[1]This work was supported by DOE under grant No. DE-SC0010081.

ahmad sheikhzada
Department of Physics and Center for Accelerator Science, Old Dominion University

Date submitted: 05 Nov 2015 Electronic form version 1.4