Abstract Submitted
for the DAMOP15 Meeting of
The American Physical Society

Cascade of Solitonic Excitations in a Superfluid Fermi Gas: From Solitons and Vortex Rings to Solitonic Vortices MARK KU, BISWAROOP MUKHERJEE, TARIK YEFSAH, MARTIN ZWIERLEIN, Massachusetts Institute of Technology — We follow the evolution of a superfluid Fermi gas of ^{6}Li atoms following a one-sided π phase imprint. Via tomographic imaging, we observe the formation of a planar dark soliton, and its subsequent snaking and decay into a vortex ring. The latter eventually breaks at the boundary of the superfluid, finally leaving behind a single, remnant solitonic vortex. The nodal surface is directly imaged and reveals its decay into a vortex ring via a puncture of the initial soliton plane. At intermediate stages we find evidence for more exotic structures resembling Φ-solitons. The observed evolution of the nodal surface represents dynamics that occurs at the length scale of the interparticle spacing, thus providing new experimental input for microscopic theories of strongly correlated fermions.

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Date submitted: 30 Jan 2015 Electronic form version 1.4