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Quench Dynamics of a Superfluid Fermi Gas[1] GEOFFREY WARNER, ANTHONY LEGGETT, University of Illinois at Urbana-Champaign — With an eye toward the interpretation of so-called 'cosmological' experiments performed on the low temperature phases of ^{3}He, in which regions of the superfluid are destroyed by local heating with neutron radiation, we have studied the behavior of a Fermi gas subjected to uniform variations of an attractive BCS interaction parameter λ. In ^{3}He the quenches induced by the rapid cooling of the hot spots back through the transition may lead to the formation of vortex loops via the Kibble-Zurek mechanism. A consideration of the free energy available in the quenched region for the production of such vortices reveals that the Kibble-Zurek scaling law gives at best a lower bound on the defect spacing. Further, for quenches which fall far outside the Ginzburg-Landau regime, the dynamics on the pair subspace, as initiated by quantum fluctuations, tends irreversibly to a self-driven steady-state with a gap $\Delta_\infty = \epsilon_C(e^{2/N(0)\lambda} - 1)^{-1/2}$. In weak coupling this is only half the BCS gap, the extra energy being taken up by residual collective motion of the pairs.

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