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Supercritical superfluid and vortex unbinding following a quantum quench LUDWIG MATHEY, JQI, NIST and UMD, ANATOLI POLKOVNIKOV, Boston University — We study the dynamics of the relative phase of a bilayer of two-dimensional superfluids after the two superfluids have been decoupled. We find that on short time scales the relative phase shows 'light cone' like thermalization and creates a metastable superfluid state, which can be supercritical. On longer time scales this state relaxes to a disordered state due to dynamical vortex unbinding. We study this effect both numerically using truncated Wigner approximation and analytically within a newly suggested time dependent renormalization group approach (RG). In particular, within RG we show that there are two possible fixed points for the real time evolution corresponding to the superfluid and normal steady states. So depending on the initial conditions and the microscopic parameters of the Hamiltonian the system undergoes a non-equilibrium phase transition of the Kosterlitz-Thouless type. The time scales for the vortex unbinding near the critical point are exponentially divergent, similar to the equilibrium case.

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