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Quenching a Bose-condensate to unitarity: transients, steady states, and novel singularities KADEN HAZZARD, ANDREW KOLLER, JOHN CORSON, ANDREW SYKES, JOSE D'INCAO, JILA, CU-Boulder, CHRIS GREENE, Purdue, ANA MARIA REY, JOHN BOHN, JILA, CU-Boulder — Motivated by recent experiments [1], we study the dynamics of a three-dimensional Bose gas following a sudden quench of the scattering length from zero to unitarity. We show that essential features of the time-evolution of the momentum distribution $n(k)$ can be captured with two simple approaches: an analytic two-body calculation and a numerical time-dependent variational ansatz for the many-body state. Although both approaches can capture the growth and oscillations of $n(k)$ as a function of time for short times and large k, only the variational approach predicts the formation of a steady state for large-momentum observables, where $n(k)$ approaches a time-independent function. We report the appearance of a short-distance (large-momentum) singularity that is absent in equilibrium. We incorporate the physics governing particle loss through a three-body calculation. Consistent with experiments, we predict lifetimes which are long compared to the dynamics of large momentum modes.

[1] Makotyn *et al.*, Nature Physics **10**, 116-119 (2014)

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