Abstract Submitted
for the DAMOP13 Meeting of
The American Physical Society

A Superheated Bose-Condensed Gas RICHARD FLETCHER, ALEXANDER GAUNT, ROBERT SMITH, ZORAN HADZIBABIC, University of Cambridge, UK — Our understanding of various states of matter usually relies on the assumption of thermodynamic equilibrium. However, the transitions between different phases of matter can be strongly affected by non-equilibrium phenomena. Here we demonstrate and explain an example of non-equilibrium stalling of a continuous, second-order phase transition. We create a superheated atomic Bose gas, in which a Bose-Einstein condensate (BEC) persists above the equilibrium critical temperature, Tc, if its coupling to the surrounding thermal bath is reduced by tuning interatomic interactions. For vanishing interactions the BEC persists in the superheated regime for a minute. However, if strong interactions are suddenly turned on, it rapidly "boils" away. Our observations can be understood within a two-fluid picture, treating the condensed and thermal components of the gas as separate equilibrium systems with a tuneable inter-component coupling. We experimentally reconstruct a non-equilibrium phase diagram of our gas, and theoretically reproduce its main features.

Richard Fletcher
University of Cambridge, UK

Date submitted: 30 Jan 2013 Electronic form version 1.4