LMU LUDWIG-MAXIMILIANS-UNIVERSITÄT MÜNCHEN

ARNOLD SOMMERFELD CENTER FOR THEORETICAL PHYSICS

Sommerfeld Theory Colloquium

Prof. Ulrich Schneider

LMU

Negative absolute temperatures for mobile particles

Absolute temperature, that is the fundamental temperature scale in thermodynamics, is usually bound to be positive. Under special conditions, however, negative temperatures - where high-energy states are more occupied than low-energy states - are also possible. In this talk, I will present a negative temperature state for motional degrees of freedom: By tailoring the Bose-Hubbard Hamiltonian we experimentally created an attractively interacting ensemble of ultracold bosons, which is stable against collapse for arbitrary atom numbers. In this negative temperature state, the quasi-momentum distribution develops sharp peaks at the upper band edge, revealing thermal equilibrium and bosonic coherence over several lattice sites. Negative temperatures imply negative pressures and open up new parameter regimes for cold atoms, enabling fundamentally new many-body states and counterintuitive effects such as Carnot engines above unity efficiency. In addition, this system enabled us to study the dynamics of the phase transition from Mott insulator to superfluid and to experimentally investigate how fast phase coherence can spread.

Wednesday, 10 July 2013, 16:15h, Room A348/349, Theresienstr. 37/III

Prof. J. von Delft