PHYSIK

THEORETISCH PHYSIKALISCHES KOLLOQUIUM

Donnerstag, den 08.06.2017 um 15:30 Uhr in Raum 46-576

Droplets in a dipolar Bose-Einstein condensate

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A recent experiment found that a dilute Bose-Einstein condensate (BEC) of highly-magnetic dysprosium atoms may spontaneously break up into a crystal of droplets, a process reminiscent of the Rosensweig instability [1,2]. Dynamic simulations show that the standard dipolar Gross-Pitaevskii equation cannot explain these long-lived droplets. Recently it was proposed that quantum fluctuations, in the form of a dipolar Lee-Huang-Yang-type correction to the energy, are able to provide the necessary stabilization. We investigate the ground state properties of of these droplets and find a first-order phase transition between a low-density BEC and a high-density droplet phase. Remarkably, once formed, these droplets become self-bound and continue to exist even in the absence of any trapping potential. A self-bound droplet-formation simulation is illustrated in Fig. 1.

[1] H. Kadau et al., Nature **530**, 194 (2016)
[2] Schmitt et al., Nature **539**, 259 (2016)

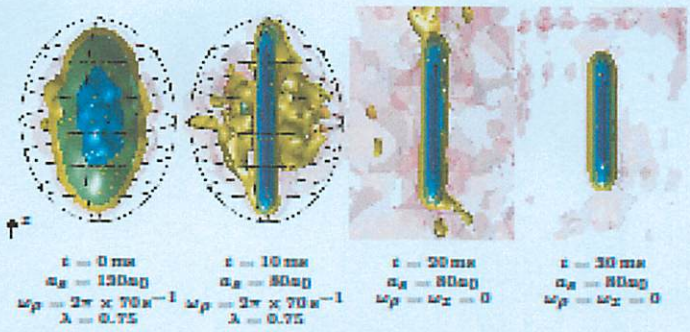

FIG. 1. Density isosurfaces illustrating the dynamical production of a self-bound droplet starting from a ^{164}Dy condensate with $a_s = 130a_0$ and 10^4 atoms. In the dynamics, a_s is quenched to $80a_0$ over 10 ms, and then the trapping potential is turned off over 10ms. Contours are for a density slice in the $y = 0$ plane. Each adjacent contour has a density differing by a factor of 10. See Fig. 5 for other simulation parameters and details.

Gäste sind herzlich willkommen.

Die Dozenten der Theoretischen Physik

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