



Innsbruck Physics Colloquium

FWF

Der Wissenschaftsfonds

Spontaneous creation, dynamics and interaction of vortices in Bose-Einstein condensates

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When a system crosses a second-order phase transition on a finite timescale spontaneous symmetry breaking can cause the development of domains with independent order parameters, which then grow and approach each other creating boundary defects. This is known as Kibble-Zurek mechanism [1,2]. Originally introduced in cosmology, it applies both to classical and quantum phase transitions, in a wide variety of physical systems. We will discuss the conditions for the spontaneous creation of defects in Bose-Einstein condensates via the Kibble-Zurek mechanism and we will show that its typical signatures, such as the power-law scaling of the defects density on the quench time, can be recovered [3]. These defects are identified as quantum vortices orthogonally oriented to the symmetry axis of the confining trap, as expected for solitonic vortices in a highly anisotropic condensate [4]. The real-time dynamics of vortices can be followed in the condensate using a weakly destructive stroboscopic technique, hence allowing for an accurate comparison between experimental data and theoretical models of dynamics of vortices in superfluids [5]. In configurations with two vortex lines simultaneously present in the condensate signatures of interaction are observed in the form reconnections, rebounds and annihilation [6]. This opens a new perspective to studies in the domain of quantum turbulence.

**Colloquium: Tuesday, 16.05.2017
17:15 h in lecture hall C**

DK-ALM Pre-Talk: 16:30 h

Malcolm Simpson

Photodetachment spectroscopy of molecular anions in a 22-pole ion trap

Snacks will be provided in between the pre-talk and the colloquium

Innsbruck Physics Colloquium, Organisation: M. Beyer, R. Kissmann, H.-C. Nägerl, A. Reimer