Controlling BEC Properties via Disorder and Driving

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The control of Bose-Einstein condensates (BEC) properties can be achieved using different experimental protocols. In this talk we will explore prospects of control via anisotropic disorder and driving of the trap.

We will investigate the effects of a weak anisotropic disorder at zero temperature on properties of a homogeneous dipolar BEC. We will present analytic results for the disorder ensemble averages of both the condensate and the superfluid depletion, the equation of state and the sound velocity. For a dipolar BEC with anisotropic disorder, we will find that the physical observables exhibit anisotropies due to the formation of fragmented condensates in the local minima of the disorder potential.

We will also study the emergence of Faraday (density) waves in a binary non-miscible BEC due to a modulation of the trap. We will show that the excited waves are of similar periods, emerge simultaneously, and do not impact the dynamics of the bulk. We will derive analytically their spatial periods and analyze the behavior of the system driven at resonant modulation frequencies, which turns the two components miscible.

Finally, we will investigate Faraday waves in single-component BECs with spatially inhomogeneous interactions. In the regime of weak inhomogeneity, we will show that the properties of generated Faraday waves are very similar to the case of homogeneous interactions, while in the strong inhomogeneity regime the periods of density waves strongly depend on the typical length scale of the inhomogeneity.