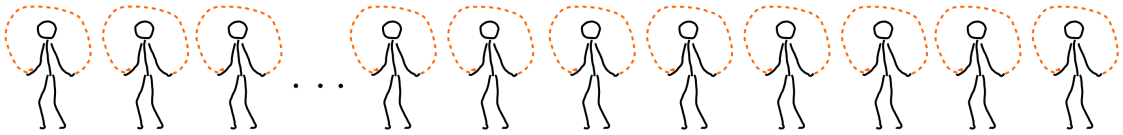
Phase dynamics and time coherence of a condensate: Simple picture



In a monochromatic wave, the phase oscillates in time periodically, indefinitely. To give a simple picture, one can imagine a child jumping rope very regularly, with no interruptions. In the case of a Bose-Einstein condensate, which is a state of matter where many atoms share the same quantum state, coherence is macroscopic. It is as if thousands of children were jumping rope together in a perfectly synchronized fashion. However, interactions among atoms can perturb the evolution of the condensate phase, so a question arises: *what is the coherence time in the presence of non-trivial inter-atomic interactions ?*

For atoms with strong magnetic moment, it is possible to reach the regime where the N-body physics of the gas is dominated by dipolar interactions rather than short-range ones. That interactions are particular, can be attractive or repulsive depending on the system geometry, allow one to obtain nontrivial states where quantum self-bounded droplets and quantum ferrofluid are excellent examples. In the project, we will perform an accurate theoretical study of time coherence of ultra-cold atomic gases with dipolar interactions, as we see potential for the appearance of its exotic behavior. We will take into account nonzero temperatures and also consider the role of reduced spatial dimensions.