ЛАБОРАТОРИЯ ИНФОРМАЦИОННЫХ ТЕХНОЛОГИЙ

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UNIVERSITÄT HEIDELBERG

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Novel time-dependent phenomena in attractive and repulsive Bose-systems

The density of the many-particle quantum system is the main observable routinely detected in modern experiments with trapped ultra-cold atomic clouds. Hence, the evolution of quantum many-particle system can be monitored and compared with theoretical (numerical) solutions of the respective many-particle Schrödinger equation governing this dynamics.
In this talk, we look at novel phenomena which can directly be observed and identified in the densities of the evolving many-particle systems and connect them with respective numerical simulations on the many-body level.

We start from Bose systems with attractive inter-particle interactions supporting “solitonic” solutions – dynamically-stable localized coherent wave-packets propagating without dispersion. We show that together with the “solitons” there are new classes of localized objects which are not coherent, but rather fragmented. As an example we discuss dynamical formations of many-body Schrödinger-cat like states which we have termed “Catons”.

In the second part of we have a look over trapped Bose systems with strong repulsive inter-particle interactions of finite ranges. We demonstrate that the ground state of these systems can indeed be fragmented in localized structures which are very stable dynamically with respects to strong external perturbations. The physics behind is identified and explained.