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SEMINAR ZAVODA ZA TEORIJSKU FIZIKU

(Zajednički seminari Zavoda za teorijsku fiziku,
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**A time-dependent tour with novel highly non-equilibrium
quantum many-body phenomena in attractive and repulsive
Bose-systems**

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Abstract:

Quantum dynamics of trapped ultracold atomic clouds is governed by the time-dependent Schrödinger equation (TDSE). In this talk I introduce the Multi-Configurational Time-Dependent Hartree for Bosons (MCTDHB) method capable of solving the many-boson TDSE numerically exactly. We start our tour from attractive BECs and see that together with famous coherent solitonic solutions there are other dynamically stable localized wave-packets propagating without dispersion fragmentons. In the second part of our tour 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 have multi-hump densities with well-localized humps. Moreover, we show that they are very dynamically stable with respect to strong external perturbations. We discuss the origin of the multi-hump structures in the density and the physics behind outstanding dynamical stability of these systems. Finally, I would like to announce the release of the MCTDHB-Laboratory a FREE-for-download, cross-platform (Mac-Win-Linux) solver of the TDSE with a simple graphical mouse-click interface (<http://www.mctdhb-lab.com>).

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