CFEL SCIENCE

SEMINAR

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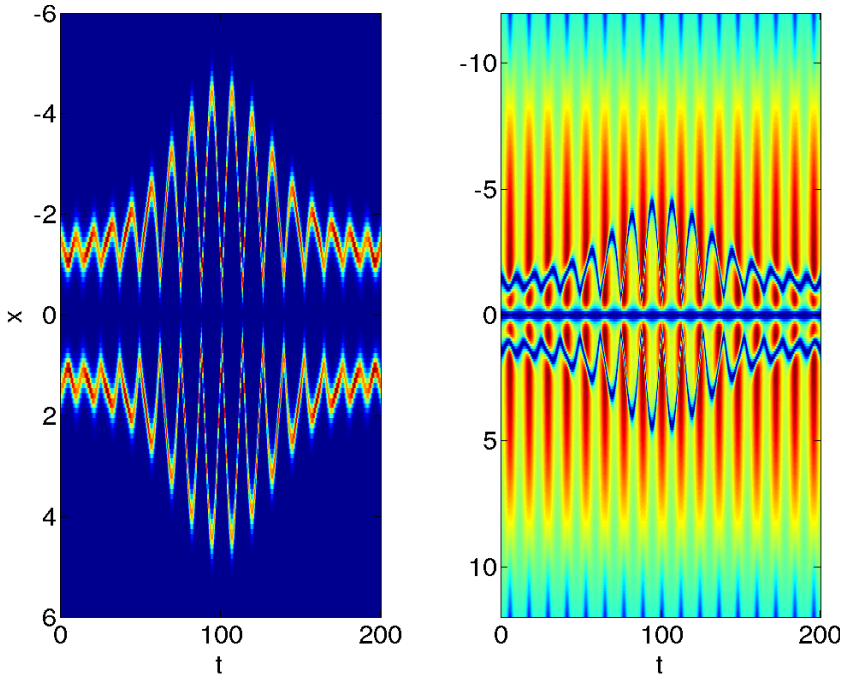
CFEL – Building 99, seminar room I (ground floor)

Evangelos Kamaratskos

Zentrum für Optische Quantentechnologien, Universität Hamburg, Hamburg, Germany

Ultracold and ultrafast dynamics of nonlinear excitations

In this talk I will give a brief overview over recent results in two different research topics.
The first topic deals with nonlinear excitations in Bose-Einstein condensates and in particular with a system composed of two interacting Dark-Bright solitons in ^{87}Rb confined in a harmonic trap. It can be shown that there exist two different stationary solutions characterized by their phase difference in the bright component, whereas after a critical particle number a symmetry breaking bifurcation of the pitchfork type occurs leading to a third, asymmetric solution. These solutions when subject to perturbations show in their time evolution for a large class of parameters characteristic tunneling oscillations that can be indentified with the typical plasma-, pi- and self-trapped oscillations of the Bosonic Josephson Junction (BJJ). However in contrast to the BJJ, for large perturbations the interaction between the solitons leads to aperiodic and seemingly chaotic soliton trajectories and tunneling currents.
In the second part of the talk I will focus on recent results of a combined theoretical and experimental work, where atomic Argon was exposed to very intense radiation of a FEL laser source and multiply ionized. Ions up to Ar^{7+} have been observed with an unexpectedly large Ar^{7+} signal. The ionization steps for the creation of ions up to Ar^{6+} can be explained through sequential single photon ionization processes but for the last step in the sequence a two-photon transition is needed to ionize the ground state of Ar^{6+} further. This nonlinear process is calculated with high accuracy and it is shown that it cannot account for the experimental results. I will discuss a possible resolution of this discrepancy in terms of electron-electron correlation effects in the ionization procedure.



Left figure shows two bright- and right figure three dark matter wave solitons performing a breathing mode oscillation in a harmonic trap after a quench in the trap strength

Host: Jochen Küpper/CMI seminar