McGill Computational Science and Engineering Seminar

Friday March 2nd at 14:00 in Burnside Hall room 1205

Breathing behavior of coupled Bose-Einstein condensates: from multi-soliton interactions to homoclinic tangles

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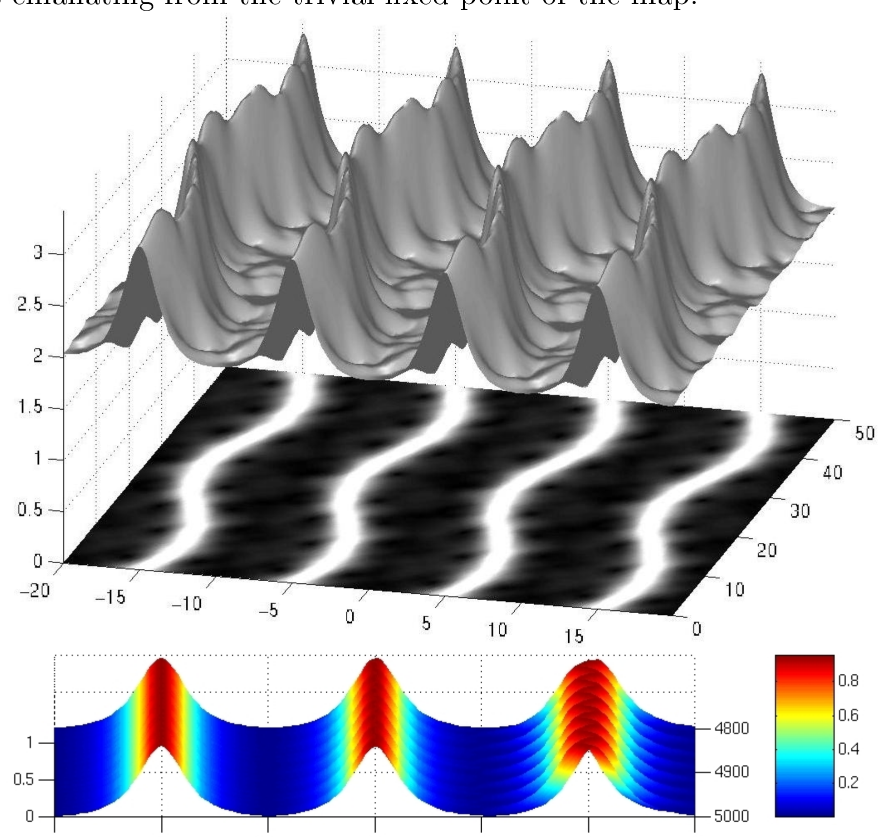
I present a treatment for the interaction of coupled Bose-Einstein condensates trapped in periodic potentials. Under certain physical conditions, the condensates dynamics may be described by the cubic nonlinear Schrödinger equation with a potential term. The corresponding multi-soliton solution is treated using variational techniques to reduce the infinite-dimensional dynamics to a lattice differential equation on the soliton's parameters (position, width, height, phase, ...). By introducing a position-oscillating ansatz for the lattice dynamics it is possible to further reduce the system to a discrete map. This map corresponds to a recurrence relation between neighboring amplitudes for the position-oscillation. A wide range of oscillatory behavior is then obtained by following different orbits of the map. In particular, non-trivial fixed and periodic points give rise to extended homogeneous and modulated oscillations on the condensates positions. More interesting, however, is the realization of exponentially localized oscillations corresponding to homoclinic connections between the stable and unstable manifolds emanating from the trivial fixed point of the map.



Coupled Bose-Einstein condensates. Top: extended oscillation in position and amplitude. Bottom: exponentially localized —breather— oscillation.

Coffee and desserts are served after the seminar at 15:00 in the lounge, Burnside Hall 1024