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The φ4 oscillons in a ball: numerical approach and parallel implementation

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Spherically symmetric localized long-lived pulsating states (oscillons) in the three-dimensional φ^4 theory are numerically investigated in a ball of finite radius. These structures are of interest in a number of physical and mathematical applications including several cosmological contexts. Numerical approach is based on numerical continuation of solutions of a boundary value problem for the respective nonlinear PDE on the rectangle [0,T]×[0,R] where T is period of oscillations and R is the finite radius. Stability analysis is based on the Floquet theory and reduces to multiple solution of the Cauchy problem and subsequent solution of the eigenvalue problem for the matrix formed using these solutions. Details of numerical approach are presented including parallel implementation of the respective MATLAB code. Numerical results on the spatio-temporal structure and bifurcation of the oscillons are presented as well as the results of test calculations demonstrating effect on parallel implementation at resources of the JINR Multifunctional Information and Computing Complex.

Summary

Primary author: ZEMLYANAYA, Elena (Joint Institute for Nuclear Research, Dubna State University)

Co-authors: BOGOLUBSKAYA, Alla (Joint Institute for Nuclear Research, Dubna State University); BASHASHIN, Maxim (JINR); ALEXEEVA, Nora (Centre for Theoretical and Mathematical Physics, University of Cape Town, South Africa); BARASHENKOV, Igor (Joint Institute for Nuclear Research, Centre for Theoretical and Mathematical Physics, University of Cape Town, South Africa)

Presenter: ZEMLYANAYA, Elena (Joint Institute for Nuclear Research, Dubna State University)

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