



Lothar-Collatz-Kolloquium für Angewandte Mathematik

Donnerstag, den 8. Dezember 2022, um 17:15 Uhr, im Hörsaal 5

Prof. Dr. Daniel Peterseim*
(Universität Augsburg, Institut für Mathematik)

Nonlinear eigenvector problems and the simulation of Bose-Einstein condensates

Zusammenfassung/Abstract:

Stationary states of Bose-Einstein condensates can be modelled by an eigenvalue problem for a nonlinear partial differential operator - the Gross-Pitaevskii or non-linear Schrödinger equation. It is a representative of the larger class of nonlinear eigenvector problems arising in computational physics but also in data analysis. The talk discusses the numerical solution of such nonlinear eigenvalue problems by adapting techniques from Riemannian optimization, computational PDEs and multiscale modelling and simulation.

For the special case of the Gross-Pitaevskii equation, the numerical analysis and a series of numerical experiments demonstrate the ability of the resulting simulation methods to capture relevant physical effects of Bose-Einstein condensates such as eigenstate localization under disorder potentials and the formation of vortex lattices in fast rotating potential traps. The talk is completed by an outlook to the robust and efficient simulation of the condensate's dynamics.

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