



UNIVERSITÄT
BAYREUTH



Mathematisches Institut

Einladung zum Mathematischen Kolloquium

Am Donnerstag, **dem 8. Mai 2025**, spricht

Frau Prof. Dr. Tatjana Stykel von der Universität Augsburg,

Gast am Lehrstuhl Mathematik V / Angewandte Mathematik bei Herrn Prof. Dr. Anton Schiela,

über das Thema

Riemannian optimization methods for ground state computations

Abstract

In this talk, we address the computation of ground states of multicomponent Bose-Einstein condensates by solving the energy minimization problem on an infinite-dimensional generalized oblique manifold. First, we discuss the existence and uniqueness of a ground state with non-negative components and characterize it as the solution to a coupled Gross-Pitaevskii eigenvalue problem.

We then study the geometric structure of the generalized oblique manifold by introducing several Riemannian metrics and computing the corresponding Riemannian gradients and Hessians. This allows us to develop the Riemannian gradient descent and Riemannian Newton methods based on different metrics. The use of first- and second-order information of the energy functional to construct appropriate metrics is particularly advantageous, effectively preconditioning the resulting optimization schemes.

For the energy-adaptive Riemannian gradient descent method, we provide a qualitative global and quantitative local convergence analysis. Numerical experiments demonstrate the computational efficiency of the proposed optimization methods.

(Joint work with R. Altmann, M. Hermann, and D. Peterseim)

Beginn: 16.30 Uhr (Kaffee/Tee ab 16 Uhr im S 748)

Ort: Hörsaal H 19, Gebäude Naturwissenschaften II, Universitätsgelände