



## The Hong Kong Polytechnic University Department of Applied Mathematics

## Seminar

# On the computation of ground states of the Gross-Pitaevskii equation By

### Prof. Patrick HENNING Ruhr University Bochum

#### Abstract

In this talk we discuss two different aspects of computing the ground states of Bose-Einstein condensates by solving the Gross-Pitaevskii equation: 1. an iterative scheme for finding the ground states in a given discrete space and 2. the construction of suitable discrete spaces with superapproximation properties. For the iterative scheme, we propose a generalized Riemannian gradient method with provable global convergence. Furthermore, we show how the method can be interpreted as an inverse iteration for eigenvalue problems and how we can recover explicit convergence rates depending on spectral gaps of the Gross-Pitaevskii operator. For the discrete space, we propose a multiscale finite element construction that is based on the concept of the Localized Orthogonal Decomposition (LOD). Here we achieve high approximation properties even in regimes with low regularity (as often faced for optical lattice potentials). Combining the iterative approach with the LOD spaces yields an efficient numerical multiscale method.



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Date: 3 March 2023 (Friday) Time: 16:00-17:00 (Hong Kong Standard Time GMT +8) Venue: Online Talk via Zoom (Meeting ID: 929 3292 1605; Passcode: 0303) Speaker: Prof. Patrick Henning, Ruhr University Bochum Host: Dr. Buyang Li, The Hong Kong Polytechnic University Click to join: <u>https://polyu.zoom.us/j/92932921605?pwd=b0ljb1JIMzFONHZsRkl0anRXc2FCdz09</u>

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