ALPEN-ADRIA UNIVERSITÄT KLAGENFURT

Invitation to the Doctoral Seminar

Prof. Dr. Mechthild Thalhammer
Universität Innsbruck

"Modified operator splitting methods for nonlinear evolution equations of parabolic and Schrödinger type"

N.1.44 | Wednesday, 15 May 2024 | 3:00 p.m.

Abstract

This talk is based on a recent joint work with Sergio Blanes, Fernando Casas, and Cesáreo González.

Our main objective is the extension of modified potential operator splitting methods to specific classes of nonlinear evolution equations. The considered partial differential equations of Schrödinger and parabolic type comprise the Laplacian, a potential acting as multiplication operator, and a cubic nonlinearity.

Moreover, we deduce an invariance principle that has a significant impact on the efficient realisation of the resulting modified operator splitting methods for the Schrödinger case.

Our numerical experiments for the time-dependent Gross–Pitaevskii equation in the physically most relevant case of three space dimensions and for its parabolic counterpart related to ground state and excited state computations confirm the benefits of the proposed fourth-order modified operator splitting method in comparison with standard splitting methods.

To the best of our knowledge, the presented results are novel and of particular interest from both, a theoretical perspective to inspire future investiga-

tions of modified operator splitting methods for other classes of nonlinear evolution equations and a practical perspective to advance the reliable and efficient simulation of Gross–Pitaevskii systems in real and imaginary time.

Barbara Kaltenbacher and the Department of Mathematics look forward to seeing you at the talk!