THE UNIVERSITY OF CHICAGO | THE COMMITTEE ON COMPUTATIONAL AND APPLIED MATHEMATICS

COLLOQUIUM

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Numerical methods for nonlinear Schrödinger equations with low regularity or singularity

THURSDAY, February 5th at 4:00 PM
Jones 303, 5747 S. Ellis Ave. Chicago, IL 60637

ABSTRACT

The (nonlinear) Schrödinger equation (NLSE) is a fundamental model in quantum physics and chemistry, laser beam propagation, plasma physics, and Bose–Einstein condensates. In many realistic settings, the NLSE involves non-smooth or singular features arising from the potential, the nonlinearity, the initial data, or from rescaling in space and/or time. Typical examples include discontinuous and Coulomb-type singular potentials, as well as nonlinearities with Lee–Huang–Yang terms (fractional power) or logarithmic terms. Such low-regularity and singularity pose significant challenges in the rigorous analysis of standard numerical methods and the development of accurate, efficient and structure-preserving numerical schemes.

In this talk, I will present new analysis tools that establish optimal error bounds under minimal regularity assumptions for several widely used time integrators. Based on the analysis, we also propose novel efficient structure-preserving temporal and spatial discretizations to handle the low regularity and singularity more effectively.

Organizers:
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