

# 数学与系统科学研究院

## 计算数学所学术报告

报告人: Dr.Yong Zhang

*(Wolfgang Pauli Institute, University of Vienna)*

报告题目:

**Fast convolution-type nonlocal potential solvers in Nonlinear Schrödinger equation and Lightning simulation**

邀请人: 刘歆副研究员

报告时间: 2017年11月16日(周四)

下午 14:00-15:00

报告地点: 数学院南楼七层

702 教室

报告摘要:

Convolution-type potential are common and important in many

science and engineering fields. Efficient and accurate evaluation of such nonlocal potentials are essential in practical simulations. In this talk, I will focus on those arising from quantum physics/chemistry and lightning-shield protection, including Coulomb, dipolar and Yukawa potential that are generated by isotropic and anisotropic smooth and fast-decaying density, as well as convolutions defined on a one-dimensional adaptive finite difference grid. The convolution kernel is usually singular or discontinuous at the origin and/or at the far field, and density might be anisotropic, which together present great challenges for numerics in both accuracy and efficiency. The state-of-art fast algorithms include Wavelet based Method (WavM), kernel truncation method (KTM), NonUniform-FFT based method (NUFFT) and Gaussian-Sum based method (GSM). Gaussian-sum/exponential-sum approximation and kernel truncation technique, combined with finite Fourier series and Taylor expansion, finally lead to a  $O(N \log N)$  fast algorithm achieving spectral accuracy. Applications to NLSE are reviewed. Tree-algorithm to compute the onedimensional convolutions in lightning-shield simulation is also covered in the last section.

**欢迎大家参加！**