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FUDAN UNIVERSITY

# Applied Math Ph.D. Seminar

## An adaptive Hermite spectral method for the Boltzmann equation

**Speaker:** Jie Wu (Peking University)

**Time:** 2025-11-06, 16:10 to 17:00

**Location:** Rm 1801, Guanghai East Tower

**Advisor:** Sihong Shao (Peking University)

**Abstract:** In this talk, we will propose an adaptive Hermite spectral method for the three-dimensional velocity space of the Boltzmann equation guided by a newly developed frequency indicator. For the homogeneous problem, the indicator is defined by the contribution of high-order coefficients in the spectral expansion. For the non-homogeneous problem, a Fourier-Hermite scheme is employed, with the corresponding frequency indicator formulated based on distributions across the entire spatial domain. The adaptive Hermite method includes scaling and  $p$ -adaptive techniques to dynamically adjust the scaling factor and expansion order according to the indicator. Numerical experiments cover both homogeneous and non-homogeneous problems in up to three spatial dimensions. Results demonstrate that the adaptive method substantially reduces  $L^2$  errors at negligible computational cost, and the  $p$ -adaptive method achieves time savings of up to 74%.