

数学与系统科学研究院

计算数学所学术报告

报告人: **Dr. Jun Luo**

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报告题目:

**A Symplectic-preserving Gas-kinetic
Scheme for Hydrodynamic
Equations under Gravitational Field**

邀请人: 袁礼研究员

报告时间: **2010年6月17日(周四)**

下午 4:00~5:00

报告地点: **科技综合楼三层 301**

计算数学所小报告厅

Abstract:

Based on the Liouville's theorem and symplectic preserving property of a Hamiltonian flow, an accurate gas-kinetic scheme for the gravitational hydrodynamic system with well-balanced property, such as keeping precise isothermal hydrostatic state, has been developed. In order to construct such a scheme, the physical process of particles penetration and reflection through a potential barrier at a cell interface is considered, and the variation of gas distribution function is evaluated explicitly according to the incident particle velocity. At the same time, the use of the symplectic property of a Hamiltonian system is crucial in evaluating high-order moment of the same gas distribution function on both sides of a potential jump in order to develop an accurate Navier-Stokes flow solver under gravitational field. In this talk, we are going to present a symplectic preserving BGK (SP-BGK) scheme and the symplectic preserving kinetic flux vector splitting (SP-KFVS) scheme. When both schemes are applied to an isolated system with time-independent

gravitational field , a precise isothermal hydrostatic solution, i.e., the so-called well-balanced solution, can be obtained. In the general case, both SP-BGK and SP-KFVS schemes are accurate shock-capturing schemes for gravitational hydrodynamic system with precise conservation for the total energy, i.e., the sum of kinetic, thermal, and gravitational ones. The SP-BGK is the first second-order accurate flow solver for gravitational NS equations with the well-balanced property. A few theoretical proofs will be presented, such as the necessity to use an exact Maxwellian for keeping the hydrostatic state and the total mass, and energy conservation. Many numerical examples will be used to validate the SP-BGK and SP-KFVS schemes.

欢迎大家参加!