

综合报告会

Lecture

国家数学与交叉科学中心

时间：2013年12月20日，下午4:00-5:00

地点：蓝白楼311

Recent Progress on the Search of 3D Euler Singularities



报告人：侯一钊

美国加州理工大学讲座教授，美国艺术与科学院院士

报告摘要：

Whether the 3D incompressible Euler equations can develop a singularity in finite time from smooth initial data is one of the most challenging problems in mathematical fluid dynamics. This is closely related to the Clay Millennium Problem on 3D Navier-Stokes Equations. In this talk, we will present strong numerical evidence that the 3D Euler equations develop finite time singularities. To resolve the nearly singular solution, we develop specially designed adaptive (moving) meshes that are dynamically adjusted to the evolving solutions. With a maximum effective resolution of order 10^{12} in each dimension near the point of the singularity, we are able to advance the solution up to 10^{-6} distance from the predicted singularity time while maintaining a pointwise relative error of $O(10^{-4})$ in vorticity. We have applied all major blowup (non-blowup) criteria, including Beale-Kato-Majda, Constantin-Fefferman-Majda, and Deng-Hou-Yu to confirm the validity of the singularity. A careful local analysis also suggests that the blowing-up solution is highly anisotropic and is not of Leray type. However, the solution develops a self-similar structure near the point of the singularity in the radial and axial directions as the singularity time is approached. This is a joint work with Dr. Guo Luo from Caltech.

个人介绍：

侯一钊，美国加州理工大学讲座教授，美国艺术与科学院院士。侯一钊教授在科学计算领域的多个方面获得杰出成果，曾获得冯康科学计算奖、美国工业与应用数学学会 Wilkinson 数值分析与科学计算奖、美国计算力学会计算与应用科学奖、晨兴应用数学金奖、国际数学家大会45分钟邀请报告等荣誉和奖项。