

数学与系统科学研究院

计算数学所学术报告

报告人: **Prof. Qian Jianliang**

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报告题目:

**Fast Huygens sweeping methods for  
Helmholtz equations in  
inhomogeneous media in the high  
frequency regime**

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报告时间: 2016年7月26日(周二)

上午 10:00~11:00

报告地点: 数学院南楼六层

602 会议室

## **Abstract:**

In some applications, it is reasonable to assume that geodesics (rays) have a consistent orientation so that the Helmholtz equation may be viewed as an evolution equation in one of the spatial directions. With such applications in mind, we propose a new Eulerian computational geometrical-optics method, dubbed the fast Huygens sweeping method, for computing Green's functions of the Helmholtz equations in inhomogeneous media in the high-frequency regime and in the presence of caustics. The first novelty of the new method is that the Huygens-Kirchhoff secondary source principle is used to integrate many locally valid asymptotic solutions to yield a globally valid asymptotic solution so that caustics associated with the usual geometrical-optics ansatz can be treated automatically. The second novelty is that a butterfly algorithm is adapted to carry out the matrix-vector products induced by the Huygens-Kirchhoff integration in  $O(N \log N)$  operations, where  $N$  is the total number of mesh points, and the proportionality constant depends on the desired accuracy and is independent of the frequency parameter. Both two-dimensional (2-D) and three-dimensional (3-D) numerical experiments are presented to demonstrate the performance and accuracy of the new method.

This is a joint work with Wangtao Lu, Songting Luo and Robert Burridge.

**欢迎大家参加！**