

# Special PHYSICAL MATHEMATICS SEMINAR

## SPINNING RODS: EXPERIMENTS & THEORY

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### ABSTRACT:

Cilia are slender, hair-like structures, which cover the cells of certain tissues. The cilia that line the lung reside in a thin lubricating layer that is then covered by mucus. The mucus traps bacteria, viruses, and dust. The cilia beat in a coordinated fashion pushing mucus toward the pharynx, out of the lung, and to the stomach. This muco-ciliary transport is the lung's main defense mechanism. The focus of this talk will be aimed at understanding how the motion of a slender body facilitates transport and mixing in a viscous fluid. I will show experiments of slender spinning rods attached to a flat plane which sweep out a cone as they rotate. These experiments are performed on the micro-scale where thermal fluctuations are present as well as on the tabletop where such Brownian effects are not observable. The length, velocity, and viscosity scales dictate that viscous forces dominate inertial forces in these experiments and the governing equations of motion are the Stokes equations. Singularity theory and slender body theory has been used to obtain approximate and exact solutions to the corresponding boundary value problems. By the principle of dynamic similarity, these theories are compared to both the small and the large-scale experiments. Besides experimental footage, I will show simulated particle trajectories and other fluid phenomenon.

**THURSDAY, MARCH 2, 2006**

**4:00 PM**

**Building 4, Room 231**

*Refreshments at 3:30 PM in Room 2-349.*



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