

Special PHYSICAL MATHEMATICS SEMINAR

VISCOUS HORIZONTAL CONVECTION

SUNNY CHIU-WEBSTER

University of Bristol
(United Kingdom)

ABSTRACT:

'Horizontal convection' arises when a temperature variation is imposed along a horizontal boundary of a finite fluid volume. It has attracted recent interest from researchers in both industrial fluid mechanics and oceanography. Here we study the infinite-Prandtl-number limit relevant to very viscous fluids, motivated by our studies of glass furnaces. At large Rayleigh number, the top boundary-layer thickness scales as $Ra^{-1/5}$, with the circulation and heat flux scaling as $Ra^{1/5}$. These scalings hold for both rigid and shear-free boundary conditions, which is initially surprising, but is true because the return flow is dominated by a horizontal intrusion immediately beneath the top boundary layer. We also consider the influence of temperature-dependent viscosity and coupling with radiative heat transfer, and the implications for the glass industry.

TUESDAY, FEBRUARY 19, 2008

2:30 PM

Building 2, Room 190

*Refreshments at 3:30 PM in Building 2, Room 349
(Applied Math Common Room)*

