

COLLOQUIUM
UNIVERSITY OF PITTSBURGH
FRIDAY, MARCH 4, 2016
704 THACKERAY HALL
3:30 P.M.

WILLIAM LAYTON
UNIVERSITY OF PITTSBURGH

TURBULENT FLUCTUATIONS ARE
DISSIPATIVE IN THE MEAN

ABSTRACT: One fundamental barrier in predictive simulation is the conflict in resources and time between sufficient resolution to see what is true and the need to account for uncertain data by ensemble simulations. This talk will begin by giving a third way path through this barrier. Some applications of ensemble simulations to predictability and self organization will be shown as well as new models of turbulence.

These new models led to reconsideration and a proof for the 1877 conjecture of Boussinesq that underpins all turbulent flow simulations used in practice.

In 1877 Boussinesq conjectured, based on an analogy with the kinetic theory of gasses, that turbulent fluctuations are dissipative on the mean flow. This has been widely viewed as a fundamentally false engineering approximation. This talk will present a new and rigorous proof of the Boussinesq conjecture. The proof also reveals the terms swept under the rug in the proof. These terms are the key to a correct model of: **Backscatter** which is an intermittent flow of energy from fluctuations back to means. As time permits and from the proof, the talk will present joint work with Nan Jiang (FSU) giving mathematically correct and physically lucid extensions of eddy viscosity models to incorporate backscatter without absurdities like negative viscosities.

<https://people.sc.fsu.edu/~njiang/research.html>

The talk should be **completely understandable** by those who know the standard energy equality for the Navier-Stokes equations and including most grad students in applied math.

Refreshments served at 3:00 p.m.
in the Math Dept. COMMON ROOM, Thackeray 705