

The SUMO Speaker Series for Undergraduates

(food from Pizza Chicago)

Wednesday, May 27th

5:15-6:05, room 380C

Who Wants to be a Millionaire?

(the really hard math version)

Professor Gautam Iyer



ABSTRACT:

It is relatively elementary to show that reasonable ordinary differential equations have solutions. However, the story for partial differential equations (or PDE's) is quite different: Lewy produced an example of a *first order, linear* PDE which does not have a solution *anywhere*. Since one would expect linear, first order equations to be the easiest to deal with, this is rather unsettling.

Fortunately, mathematicians can prove that most *linear* equations that arise in physics have solutions. Non-linear equations are still a bit elusive. Many physically-motivated non-linear PDE have solutions for a short time, but proving that these PDE have solutions for all time is a very hard, often unsolved, problem.

I will discuss the example of the Navier-Stokes equations, which model fluid motion. Short-time existence was proved in 1934, but existence for all time is a million-dollar Clay problem. In non-technical terms, if we stir a glass of water can we prove it remains well-behaved for all time, or might it blow up in our face in finite time?

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