Week 6 Abstracts

Speaker: Michael Kiessling

Abstract: By the end of the 19th century the atomistic explanation of the material universe had reached such a widespread acceptance among physicists that Hilbert, in 1900 at the International Congress of Mathematicians, proposed as his 6th problem to lay the rigorous mathematical foundations of the macroscopic continuum laws of physics in terms of the Newtonian dynamics of a huge number of atoms. (Obviously this is an open-ended project, not a clearly limited problem like Hilbert's problem 8a: The Riemann Hypothesis.) In the 125 years hence, in particular most recently, mathematical physicists have made impressive progress on Hilbert's 6th problem with hard-sphere atoms by deriving the Maxwell-Boltzmann kinetic equation for dilute gases, and from it the Navier–Stokes equations of fluids! The spirit of Hilbert's 6th problem is not limited to its pre-relativistic formulation, and in this presentation I argue that the relativistic version of Hilbert's 6th problem is an underappreciated frontier of mathematical physics research.

Speaker:Shah Faisal

Abstract: The symplectic area of a Lagrangian submanifold L in a symplectic manifold is defined as the minimal positive symplectic area of a smooth 2-disk with boundary on L. The Lagrangian capacity of a symplectic manifold is defined as the supremum of these minimal areas taken over all embedded Lagrangian tori. In this talk, I will describe several conjectures concerning Lagrangian capacity and report on the progress we have made so far. This talk is partially based on ongoing joint work with Yin Li.

Speaker: Peter Cameron

Abstract: It has been shown that the interior of a dynamical black hole spacetime (of the sort believed to occur in nature) contains a horizon to which the spacetime metric extends continuously. However, Penrose's strong cosmic censorship conjecture states that in any such extension, the Christoffel symbols should fail to be locally square integrable (and consequently evolution via the Einstein equations must break down, thus preserving the deterministic nature of the theory). Motivated by proving such an inextendibility statement, I will discuss recent work with Jan Sbierski where we study the uniqueness of continuous spacetime extensions in 1+1 dimensions.