NONLINEAR PARTIAL DIFFERENTIAL EQUATIONS. MAY 28TH 2019. TITLES AND ABSTRACTS OF THE TALKS

Thierry Cazenave: **Finite-time blowup for a Schrödinger equation with a nonlinear source term**.

Abstract: In this joint work with Zheng Han, Yvan Martel and Lifeng Zhao, we consider the nonlinear Schrödinger equation $u_t = i\Delta u + |u|^\alpha u$ on $\mathbb{R}^N$, for H^1-subcritical or critical nonlinearities: $\alpha > 0$ and $(N-2)\alpha \leq 4$. This equation combines two important properties: the associated ODE $u' = |u|^\alpha u$ produces finite-time blowup; and the equation can be solved backwards in time. Using these properties we prove that, given any compact set $E \subset \mathbb{R}^N$, there exist finite-energy solutions which are defined on some time interval $(-T, 0)$ and blow up at $t = 0$ exactly on E. The construction is based on an appropriate ansatz. The initial ansatz (which is sufficient when $\alpha > 1$) is simply $U_0(t,x) = \kappa(t + A(x))^{-\frac{1}{\alpha}}$, where $A \geq 0$ vanishes exactly on E, which is a solution of the ODE $u' = |u|^\alpha u$. If $\alpha \leq 1$, we need to refine this ansatz, and we proceed inductively, using only ODE techniques. We complete the proof by energy estimates and a compactness argument. We prove similar results for the nonlinear wave equation, which has a comparable structure (finite-time blowup for the associated ODE, and time-reversibility).

Mahir Hadzic: **On gravitational collapse of Newtonian stars**.

Abstract: We prove the existence of an infinite-dimensional family of radial collapsing star solutions of the gravitational Euler-Poisson system, with a prescribed space-time collapse curve. If time permits we also discuss the question of stable collapse. This is a joint work with Y. Guo and J. Jang.

Jérémie Szeftel: **The nonlinear stability of Swartzchild**.

Abstract: I will discuss a joint work with Sergiu Klainerman on the stability of Schwarzschild as a solution to the Einstein vacuum equations with initial data subject to a certain symmetry class.