DEPARTMENT OF MATHEMATICAL SCIENCES
Colloquium

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Title: Stable configurations with unbounded vorticity in 2d Ginzburg-Landau

Abstract: In mathematical physics, Ginzburg-Landau theory is a successful framework to describe many features of superconductors. In the theory, the presence of a strong magnetic field allows for the existence of stable vortex states. The study of global minimizers of the Ginzburg-Landau energy in 2d and a characterization of their vorticities is the focus of a series of works by Sandier and Serfaty in the $\varepsilon \to 0$ limit (ε is the inverse of the Ginzburg-Landau parameter), corresponding to extreme type II superconductors. However, it is known that superconductors possess hysteretic properties that yield vortex configurations, that can be observed in experiments and numerically, with a number of vortices N much different from that present in a global minimizer. It is a famous open problem to establish the existence of local minimizers of the Ginzburg-Landau energy with prescribed vorticity (in a range determined by the strength of the applied field). Treating very large vorticities has been a great challenge from the hard-analysis standpoint, in this and other related problems, and thus the best partial results until recently could only cover very slowly diverging ($N \lesssim |\log \varepsilon|$ as $\varepsilon \to 0$) numbers of vortices. In recent work with R. L. Jerrard, we prove the existence of the conjectured local minimizers with prescribed vorticity for a wide range of external fields and treat for the first time $N \gtrsim 1/\varepsilon^{\alpha}$ vortices, for some $\alpha > 0$. Our results also provide the best characterization of the vorticity of local (and global) minimizers, in the regimes considered, known to date.

Tuesday, December 10, 2019
11:00AM to 12:00PM
Stratton Hall, room 203