

Chez Pierre

Presents ...

Monday, October 4, 2021

12:00pm Noon

Virtual Chez Pierre Seminar

Brad Ramshaw – Cornell University

"The Planckian Limit: a Fundamental Bound on Electron Scattering."

Certain quantities in Nature are bounded at a fundamental level: nothing can travel faster than the speed of light, for example, and Heisenberg's uncertainty principle sets how precisely an object's position and momentum can be specified. These bounds motivate new discoveries and serve as guardrails when making predictions. Recently, it was conjectured that there is a fundamental bound on how often electrons can collide with each other in a metal, with the collision rate set by Planck's constant. This "Planckian" bound, if it were shown to be true, would unify our understanding of a host of seemingly-disparate systems, including high-temperature superconductors and twisted bilayer graphene, and even connect their properties to the physics of black holes. The difficulty has been finding experimental proof for this conjecture. We recently developed a new technique for measuring electron scattering rates and found that the Planckian bound not only holds, but it holds in a way that was entirely unexpected: it is independent of the electron's momentum. I will review the history of how this bound came to be proposed, what we have learned so far, and what still needs to be resolved to establish the Planckian bound as a fact grounded both in experiment and in theory.

G. Grissonnanche et al. Linear-in temperature resistivity from an isotropic Planckian scattering rate, Nature 595, 667-672 (2021)"

