

Plasma Physics Seminar

UCLA College | Physical Sciences
Physics & Astronomy

Physics & Astronomy Building (PAB) Room 4-330

Friday November 14th at 12:30 PM

Via Zoom: <https://ucla.zoom.us/j/92785449357?pwd=SVBTSko3bTdEUW03dzQwNks1Q2lKZz09>

Understanding the anomalous transport properties of weakly collisional plasmas

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There is a pressing need for new theories of the transport properties — thermal conductivity, viscosity, and electrical resistivity — of the magnetised, weakly collisional plasmas found in both laser-plasma experiments and astrophysical systems. Astronomical observations and measurements of laser-produced plasmas have shown that classical models of transport properties, which only consider the effect of Coulomb collisions between a plasma's constituent particles, often fail when applied to such plasmas. This finding, which is most plausibly due to neglecting collective plasma interactions, presents a serious challenge to accurate fluid modeling of these plasma environments. It is also particularly unfortunate for inertial-confinement-fusion (ICF) research because reliable modeling of heat transport is crucial for optimised target designs. Addressing this challenge requires re-examining the foundations of plasma transport theory.



In this talk, I will discuss the research my group and collaborators have conducted to meet this challenge. This includes establishing a comprehensive theoretical framework for assessing when classical transport theory fails; constructing revised transport models based on first-principles kinetic simulations; proposing the novel thermodynamic forcing method for determining transport in plasmas in full generality; characterising the suppression of heat transport in new laser-plasma experiments; and demonstrating that anomalous transport has significant implications for the dynamics of both ICF and astrophysical plasmas. Together, these efforts are helping to build a new, experimentally grounded framework for understanding transport in weakly collisional plasmas.