Joint Theory Seminar
European XFEL, CFEL & University of Hamburg

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via Zoom

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Strong suppression of heat conduction in laboratory and astrophysical plasmas

Galaxy clusters are filled with hot, diffuse X-ray emitting plasma, with a stochastically tangled magnetic field whose energy is close to equipartition with the energy of the turbulent motions In the cluster cores, the temperatures remain anomalously high compared to what might be expected considering that the radiative cooling time is short relative to the Hubble time. While feedback from the central active galactic nuclei is believed to provide most of the heating, there has been a long debate as to whether conduction of heat from the bulk to the core can help the core to reach the observed temperatures, given the presence of tangled magnetic fields. Interestingly, evidence of very sharp temperature gradients in structures like cold fronts implies a high degree of suppression of thermal conduction. To address the problem of thermal conduction in a magnetized and turbulent plasma, we have created a replica of such a system in a laser laboratory experiment. Our data show a reduction of local heat transport by two orders of magnitude or more, leading to strong temperature variations on small spatial scales. The problem of heat conduction suppression is also common in many laser-produced plasmas. We conclude the talk by presenting a new machine learning approach that is in principle able to retrieve the latent form of heat transport from either experimental data or high-fidelity simulations.

Reading material: https://arxiv.org/abs/2105.08461

Hosts: Beata Ziaja-Motyka (CFEL) and Nils Brouwer (EuXFEL)

https://xfel.zoom.us/j/97845913859?pwd=UWFkMEVEZXF0Ny9hZUhjeGNDVTUyQT09
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