THE CHINESE UNIVERSITY OF HONG KONG
Department of Physics
SEMINAR

Resolved Simulations of Cosmic Ray Hydrodynamics in CGM and ICM Contexts

by

Mr. Navin TSUNG
Department of Physics
The University of California, Santa Barbara, USA

Date: August 03, 2022 (Wednesday)
Time: 1:30 - 2:15 p.m.
Zoom link:
https://cuhk.zoom.us/j/98585178076?pwd=V2FLRTRWQjY2N2MyMlUvQ05KNVlVQT09

ALL INTERESTED ARE WELCOME
****

Abstract

Recently there is a surge of interest in understanding what role cosmic rays (CR) play in regulating the structure of galaxies and clusters. From observations researchers are certain CRs account for a significant fraction of the energy budget and are interacting with the thermal gas, but with limited resolving power it is difficult to pinpoint what CR physics are at play. Cosmological simulations have opened more doors, robustly agreeing CRs can be a strong source of feedback shaping the CGM and ICM environments. In my research I focus on simulating small scale CR driven phenomena at high resolution, complementary to the larger scale but more coarsely resolved cosmological simulations, by first testing the numerical schemes utilized to model CR physics, and then applying it to study the CR driven acoustic instability and how CRs modifies thermal instability. It is found that CR driven unstable sound waves steepen nonlinearly into shocks, at the same time generating a curious "staircase" phenomenon. The staircase can lead to stronger mass outflows, and suppress the ability of CR in maintaining global thermal balance (the latter contrary to what's suggested by the literature). Connections with existing cosmological simulations and observations of the CGM and ICM will be made. All in all, the rich dynamics involved with CR plasma physics should not be overlooked when studying the evolution of galaxies and their environs.