



**THE CHINESE UNIVERSITY OF HONG KONG**  
**Department of Physics**  
**SEMINAR**

# **The Variability Crisis of Modelling Sagittarius A\***

*by*

**Mr. Ho Sang Leon CHAN (陳灝生先生)**  
**JILA &**  
**Department of Astrophysical and Planetary Sciences**  
**University of Colorado, USA**

*Date: May 24, 2024 (Friday)*

*Time: 1:30 - 2:15 p.m.*

*Place: Rm 311, Science Centre North Block, CUHK*

**ALL INTERESTED ARE WELCOME**

\*\*\*\*\*

---

## **Abstract**

The Event Horizon Telescope Collaboration has successfully observed the galactic centre black hole - Sagittarius A\* in 2022. Comparing theoretical models, which are derived from general relativistic magnetohydrodynamics (GRMHD) simulations and general relativistic ray-tracing (GRRT) post-processing, with observational data is vital in interpreting these observations. They offer us valuable constraints on the black hole, such as the spin parameter, mass accretion rate, accretion mode, and the nature of the surrounding plasmas. However, current theoretical models are inconsistent with the 3-hour 230 GHz flux variability constraint. This inconsistency presents a 'variability crisis' for modelling Sagittarius A\* and calls into question our understanding of the underlying plasma physics, accretion and radiative processes. We address this problem by adjusting the ion-to-electron temperature ratios under strongly magnetised conditions, which were previously fixed in modelling the 230 GHz emission from Sagittarius A\*. By performing large parameter surveys via the Open Science Grid (OSG), we explored parameter spaces that have not been studied before. We show that we can reduce the 3-hour 230 GHz flux variability of Sagittarius A\*, bringing simulations into closer alignment with observational data. By analysing GRRT images and GRMHD simulation snapshots, we will examine the reason behind our success and reveal some possible causes for the unexpectedly high variability.