TDLI Astronomy Seminar

Title: Impact of Different Haze Types on the Atmosphere and Observations of a Hot-Jupiter WASP-39b using a 3D General Circulation Model

Time: 21:30-22:00, 20 February (Thursday), Shanghai time

Host: Dong Lai

Location: Online

Mei Ting Mak

(University of Exeter)

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Abstract:

Hazes are defined as small solid-state particles formed through photochemistry, suspended in an atmosphere. It is found on Earth and are expected to be common in exoplanets (i.e., planets outside of the Solar System). However, our limited knowledge of haze and the lack of studies are presenting a significant barrier in our understanding of its impact on the atmospheric dynamics, as well as interpreting observations. In this talk, I will present results from 3D simulations of photochemical haze in the atmosphere of a hot-Jupiter, namely WASP-39b (a gas giant exoplanet orbiting very close to its host star) using the 3D general circulation model - the Met Office Unified Model. I find that haze can drastically alter the thermal structure and atmospheric circulation, but the haze distribution is largely determined by the superrotating jet and the eddies under all circumstances. Our results also suggest that the radiative impact of haze can result a larger transit depth over the morning terminator than the evening terminator, providing a new indicator in determining the presence of haze in the atmosphere through such observational limb asymmetry.

Biography:

Mei Ting Mak is an astrophysicist specialising in aerosols in planetary atmospheres and exoplanetary climate modelling. She is currently completing her PhD at the University of Exeter, where she develops and applies cutting-edge haze schemes in a state-of-the-art 3D model to study the radiative impact of haze on habitability and observability.

Originally from Hong Kong, Mei Ting pursued her high education in the UK, earning a First-Class MPhys (Hons) in Physics from the University of Exeter. During her undergraduate studies, she conducted computational fluid dynamics research on circumstellar disc dynamics. She has also received multiple awards, including Dean's Commendation for Exceptional Performance and Physics Prize. She later secured the prestigious Bell Burnell Graduate Scholarship Fund by independently developing a research proposal to investigate the role of haze in exoplanetary atmospheres for her PhD.

Mei Ting has pioneered the study of haze on rocky planets using 3D modelling, demonstrating for the first time in the exoplanet community that thin layer of haze can increase create a temperate environment conducive to life. Her work on haze in hot-Jupiter atmospheres has provided critical insight for future observing missions, suggesting that limb asymmetry in transmission spectra could serve as a strong diagnostic for haze detection. After finishing her PhD, Mei Ting aims to continue her work of haze while exploring the dynamic interplay between planetary atmospheres and observational techniques, advancing the frontiers of exoplanetary research.