DEPARTMENT OF PHYSICS
THE UNIVERSITY OF HONG KONG

香港天文與天體物理研究所
THE HONG KONG INSTITUTE FOR ASTRONOMY AND ASTROPHYSICS

HKIAA SEMINAR

Higgs inflation:
Connecting Particle Physics, Gravity, and Cosmology

SPEAKER

Dr. Minxi He

NATIONAL ASTRONOMICAL OBSERVATORY OF JAPAN



Minxi He is a Project Assistant Professor at the National Astronomical Observatory of Japan. He received his PhD from the University of Tokyo, and previously worked as a researcher at KEK in Japan and Institute for Basic Science in South Korea. His research focuses on early-Universe cosmology and astrophysical probes of fundamental physics. He studies inflation and reheating, with particular emphasis on how their dynamics shape predictions for the cosmic microwave background. He explores astrophysics including primordial black holes, the effects of Hawking radiation on surrounding plasma, and dark matter effects on stellar evolution. He also investigates gravitational waves as probes of dark environment around black holes and fundamental physics.

ABSTRACT

Cosmic inflation provides an explanation for the primordial fluctuations that seeded galaxies and large-scale structure, but its underlying physical mechanism remains unknown. One intriguing candidate is the Higgs field, which gives mass to elementary particles such as electrons. With a suitable coupling to gravity, this same field could also drive the accelerated expansion of the early Universe.

In this talk, I will present selected results connecting the theoretical foundations of Higgs inflation to its cosmological predictions. A central question is whether we can reliably describe the evolution of the Universe throughout inflation and its subsequent reheating. I will introduce a geometric perspective on the interactions between the Higgs field and gravity, which helps identify the energy range in which our calculations remain reliable, independently of how the theory is written. I will also discuss the Higgs–(R^2) model, in which an additional scalar degree of freedom associated with gravity can extend this range. Its inflationary and reheating dynamics illustrate how addressing questions of theoretical consistency can affect our understanding of the early Universe, including the connection between its thermal history and predictions for the cosmic microwave background.

17 November 2026 (Tuesday)

4:00 – 5:00 PM

Venue: Room 522, 5/F · Chong Yuet Ming Physics Building

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