



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

# First Galaxies in Cold, Warm, and Fuzzy Dark Matter Cosmologies

by



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*Date: November 3, 2020 (Tuesday)*

*Time: 10:30 - 11:30 a.m.*

*Join ZOOM Meeting: <https://cuhk.zoom.us/j/94744937941>*



ALL INTERESTED ARE WELCOME

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## Abstract

The near-century-old dark matter (DM) problem is one of the most intriguing mysteries in modern physics. I discuss how the first galaxies that form in the Universe are a unique probe for the nature of dark matter. These first objects form in low-mass DM potential wells, probing the behavior of DM on kiloparsec (kpc) scales. I present pioneering simulations of what the young Universe would look like if DM were ultra-light, in the so-called 'fuzzy dark matter' (FDM) limit where DM is a  $\sim 10^{-22}$  eV boson, and contrast this against Warm and Cold DM models. The simulations highlight the interplay between baryonic physics and unique wavelike features inherent to FDM, including a new nonlinear formation channel for solitons. Future telescopes like the James Webb will soon offer an observational window into this emergent world. I will further discuss a variety of other small-scale astrophysical consequences of FDM due to its unique substructure, which place independent constraints on the FDM particle mass. I present prospects to validate or rule out FDM.