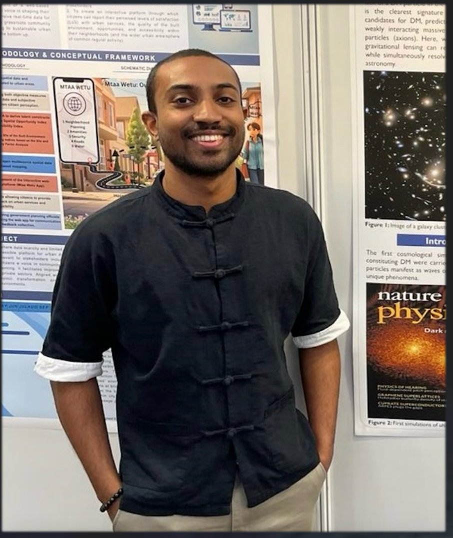
北 京 师 范 大 学
引力波与宇宙学实验室

讲座预告

Revealing Dark Matter under the Lens

Dr. Amruth Alfred (Univ. of Hong Kong)



Amruth Alfred, originally from the island of Sri Lanka, is an astrophysicist at the University of Hong Kong and currently holds a Dissertation Year Fellowship which allows for an additional year of research after successfully completing his PhD defense. Amruth is also the recipient of the 2023 Hong Kong Young Scientist Award which is given annually to the best PhD research in Hong Kong within Physics, Chemistry and Mathematics. His work was featured on the front cover for the June 2023 issue of Nature Astronomy, and has been rated as within the top 1% among all research articles across all journals for how much attention it created.

Abstract

Unveiling the true nature of Dark Matter (DM), which manifests itself only through gravity, is one of the principal quests in physics. Leading candidates for DM are weakly interacting massive particles (WIMPs) or ultralight bosons (axions), at opposite extremes in mass scales, that have been postulated by competing theories to solve deficiencies in the Standard Model of particle physics. Whereas DM WIMPs behave like discrete particles (ρDM), quantum interference between DM axions is manifested as waves (ψDM). Here, we show (Amruth et al. Nature Astronomy, 2023) that gravitational lensing leaves signatures in multiply-lensed images of background galaxies that reveal whether the foreground lensing galaxy inhabits a ρDM or ψDM halo. Whereas ρDM lens models leave well documented anomalies between the predicted and observed brightnesses and positions of multiply-lensed images, we show for the first time that ψDM lens models are remarkably able to correctly predict the level of observed anomalies. More challengingly, when subjected to a battery of tests for reproducing very high angular resolution observations of quadruply-lensed triplet images in the system HS 0810+2554, ψDM is able to reproduce all aspects of this system whereas ρDM often fails. The ability of ψDM to resolve lensing anomalies even in demanding cases like HS 0810+2554, together with its success in reproducing other astrophysical observations, tilts the balance towards new physics invoking axions.

时间：　2024年6月25日 (星期二) 10:00

地点：　北京师范大学物理楼402