

OKC Day Spring 2025

Wednesday 28 May 2025 - Wednesday 28 May 2025

National Museum of Science and Technology

Scientific Programme

Mark Pearce: Progress in X-ray polarimetry

Since the 1960's, X-ray astronomy has been steadily driven forward by the development of instruments which measure X-ray images, light-curves, and energy spectra. Recently, instruments capable of discerning the linear polarisation of X-rays have been developed and flown on satellites and stratospheric balloons. I will review developments, focussing on the IXPE satellite mission (2-8 keV) and the balloon-borne XL-Calibur mission (15-80 keV). A possible scenario for future developments will also be discussed.

Helena Faustino Vieira: Local Universe galaxies: the key to unlocking star formation

Current facilities such as ALMA, the Hubble Space Telescope and the James Webb Space Telescope are revolutionizing Astronomy, allowing us to image the Local Universe (<20 Mpc) at spatial scales comparable to Milky Way observations. Nearby galaxies are fantastic laboratories for star formation, and provide important theoretical benchmarks. The FEAST project (lead by Angela Adamo at Stockholm University) is spearheading this effort to understand what happens once stars form and begin to emerge from their parent cloud.

Stephen Thorp; Pop-cosmos: Insights from generative modelling of the galaxy population

Projects such as the imminent Vera C. Rubin Observatory are critical tools for understanding cosmological questions like the nature of dark energy. By observing huge numbers of galaxies, they enable us to map the large scale structure of the Universe. However, this is only possible if we are able to accurately model our photometric observations of the galaxies, and thus infer their redshifts and other properties. This has motivated the development of data-driven generative models, that aim to coherently forward simulate the galaxy catalogs from photometric surveys, going from physical parameters to observables. I'll give an overview of this approach, and will present some new results from the pop-cosmos generative model that we have been developing here at the OKC to tackle this challenge.

Marcus Högbås: The Hubble tension

The Hubble tension is an ongoing 5σ discrepancy between early- and late-universe measurements of the Hubble constant and has become one of the most significant puzzles in contemporary cosmology.

In this talk, I'll outline the history behind the tension and walk through the main possible resolutions, including both systematic uncertainties and new physics. I'll also highlight some underexplored ideas, including recent work on how a fifth force could influence the local measurement of the Hubble constant.

Aleksandr Chatrchyan: Phase transitions in cosmology

Phase transitions in the early universe can provide a unique window into fundamental physics, combining rich dynamics with potential observational signatures. In this talk I will discuss transitions in a range of scales: from the electroweak scale, which may generate gravitational wave signals detectable by future experiments, down to the eV scale, where new physics could help resolving the Hubble tension.

Stephen Stopyra: Cosmology with voids

Cosmological voids - vast underdense regions which occupy most of the Universe's volume - are a vital piece of the puzzle that is the cosmic web. While seemingly cold and empty, their structure can reveal aspects of cosmology not easily accessible by other means, and their simple, pristine environment relative to more complicated galaxy clusters and filaments makes them an ideal testbed for fundamental physics. In this talk, I will give an overview of void cosmology and discuss my work on constructing void catalogues with Field-Level Inference using the Bayesian Origin Reconstruction from Galaxies (BORG) framework.

Ivan Esteban: Milky Way satellite velocities reveal Dark Matter properties

Abstract: Dark Matter (DM) properties at small (\sim kpc) scales remain uncertain. Recent theoretical and observational advances have provided the tools to narrow them down. In this talk, I will discuss how the correlation between internal velocities and sizes of dwarf galaxies is a sharp probe of small-scale DM properties.

I will introduce the relevant tools that allow to go from DM properties to dwarf galaxy properties, showing that —despite baryonic uncertainties— Milky Way satellite galaxy data can be used to probe how DM clusters at small scales with unprecedented precision.