

NITheCS COLLOQUIUM:

Our Universe, the Movie! (Based on a True Story)

Prof Romeel Davé (University of Edinburgh and University of the Western Cape)

Monday, 27 May 2024 | 16h00 – 17h00 SAST

Venues: Neelsie Cinema, Stellenbosch University and online

ABSTRACT

The question of our cosmic origins is as old as humanity. Today, numerical cosmologists are trying to answer this question by simulating universes on a computer, allowing us to run numerical experiments to test the input physics, interpret observations from our latest telescopes, and develop a holistic framework for understanding the evolution of our Universe from the Big Bang until today. Creating such scientifically-motivated movies of our universe's evolution is an area that has reached new levels of maturity within the past decade, where we can now simulate the beautiful diversity of objects seen from the earliest cosmic epochs to today. This has revolutionised our understanding of how galaxies like our own Milky Way grow and evolve, regulated by a complex interplay between dark matter establishing the Cosmic Web, the formation of stars that go supernova and drive powerful winds, and supermassive black holes that drive a continual exchange of matter and energy within large-scale cosmic ecosystems. In this talk I will explain the motivation, ingredients, and methodologies that go into simulating the formation and evolution of galaxies, and highlight some fascinating and unexpected emergent phenomena that arise from putting all the relevant science we know into a computer. Finally, I will mention the role that radio observations such as from South Africa's world-leading MeerKAT radio telescope are playing in elucidating our cosmic origins story. So grab some popcorn and sit back as I take you on a wild ride of how we numerical cosmologists are producing Our Universe, the Movie!

BIOGRAPHY



Romeel Davé is currently a Professor at the University of Edinburgh holding the Chair of Physics, as well as an Extraordinary Professor of Physics and Astronomy at the University of the Western Cape. From 2013-2017 he held the SARCHI Chair in Cosmology in Cape Town, split between UWC, South African Astronomical Observatories, and the AIMS Institute.

Prior to that he was tenured faculty in the Department of Astronomy at the University of Arizona.

Romeel obtained his PhD in Astronomy and Astrophysics from the University of California in 1998. His postdoctoral work consisted of a Lyman J. Spitzer Fellowship at Princeton University, followed by a NASA Hubble Fellowship at Steward Observatory. He has been a distinguished visiting scholar at the Max Planck Institute for Astronomy, Cambridge's Institute of Astronomy, Carnegie Observatories of Washington, the Raman Research Institute in Bangalore, the Simons Foundation's Center for Computational Astrophysics, and NASA's Space Telescope Science Institute. He is currently on sabbatical as a Fellow at STIAS.

His research focuses on using high-performance supercomputers to study galaxies, black holes, the intergalactic medium, the epoch of reionization, and the nature of dark matter and dark energy. He has published over 300 articles spanning a diverse range of topics, has an h-index of over 100, and perennially appears on Clarivate's Highly Cited List of the top-1% most cited researchers in the world.

His accolades include the US National Science Foundation's CAREER Award and a Wolfson Research Merit Award from the UK Royal Society. He holds an A1 researcher rating from the NRF. While his work is primarily theoretical, he has also chaired telescope time allocation committees including one for the James Webb Space Telescope, and regularly serves on high-level committees such as the UK's STFC National Astronomy Grants Panel.

Romeel is also a science populariser and writer. He has helped produce two award-winning documentaries highlighting the contributions of underrepresented minorities in astrophysics called *Hubble's Diverse Universe* and *Black Suns*, as well as an award-winning family YouTube series called *The Science Tourist*. His popular-level science book called *Simulating the Cosmos: Why the Universe Looks the Way It Does* appeared on bookshelves last summer.

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