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NITheCS COLLOQUIUM:

Cosmology with viscous dark matter

Dr Anslyn John (Stellenbosch University)

DATE: Monday, 29 April 2024 | 16h00 – 17h00 SAST

VENUES:
- Neelsie Cinema, Stellenbosch University
- Online

ABSTRACT

In the standard model of cosmology most of the matter of the universe is comprised of cold dark matter of as-yet unknown form. While this model is extremely successful a number of persistent conflicts between numerical simulations and astronomical observations have emerged. This has been dubbed the "small-scale crisis" in cosmology. Dark matter is usually modelled as a pressure-less fluid that only interacts with the rest of the universe via its gravitational field. If this fluid also experiences energy or momentum dissipation then its clustering properties would change and this could have observable effects on the formation of large-scale structures. The presence of viscosity in dark matter could potentially alleviate the tension between theory and experiment. In this talk I will review aspects of the standard cosmological model, dark matter and classical fluid mechanics. I will discuss dissipative hydrodynamics in the context of general relativity where a number of distinct alternatives have been proposed. The Eckart theory and the Israel-Stewart theory are among the more prominent examples. I highlight the strengths and deficiencies of these theories before discussing recent applications.

BIOGRAPHY

I am a theoretical physicist specialising in general relativity, cosmology and astrophysics. My current research interests include black hole accretion, modified theories of gravity, and cosmological structure formation. Since August, 2020 I am permanently based at the Physics Department of Stellenbosch University. I was a lecturer at the Mathematics Department of Rhodes University from 2017 to 2020. Prior to this I held a joint postdoctoral fellowship at the National Institute for Theoretical Physics and the Physics Department at Stellenbosch University. My PhD was completed via the Astrophysics and Cosmology Research Unit at the University of KwaZulu-Natal. I was selected as an African Presidential Scholar at the University of Michigan, USA, in 2022. I was one of the founders of Science Cafe in Grahamstown and maintain an active interest in science popularization having delivered numerous public lectures and interviews. I am a member of the executive committee of the South African Gravity Society as well as a member of the National Multiwavelength Astronomy Strategy working group.

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