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NITheCS COLLOQUIUM
Observations and the Damping of Gravitational Waves by Matter
Prof Nigel Bishop (Rhodes University)

Monday, 22 May 2023 | 16h00 – 17h00 SAST

Attend in person (Neelsie Cinema, Stellenbosch University) or online

ABSTRACT

Using linearized perturbations within the Bondi-Sachs formalism in general relativity, we consider the problem of a gravitational wave (GW) source surrounded by a spherical dust shell. It is shown that the shell causes the GWs to be modified both in magnitude and phase; and that if the shell is viscous, then the shear induced in the velocity field results in an energy transfer so damping the magnitude of the GWs. Both effects can be significant if the shell radius is much smaller than the GW wavelength, and there are astrophysical scenarios for which the modification to the GW signal is large enough to be measurable. These scenarios include core collapse supernovae (CCSNe), quasinormal mode emission from the remnant of a binary neutron star merger, and primordial GWs. Importantly, there are feasible values of the CCSNe parameters for which viscous damping of the GW signal would be almost complete, implying that the detection of GWs from a CCSNe is unlikely.

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BIOGRAPHY

Nigel Bishop studied at the University of Cambridge. He was tutored by Stephen Hawking, who would become one of the most famous relativists of our time. He obtained a BA Honours degree in mathematics and moved to the University of Southampton, obtaining a PhD degree in 1976. At the same time was elected a Fellow of the Royal Astronomical Society.

He was appointed as a lecturer at WITS, and his first appointment as full Professor was at UNISA in 1992. In 2009 he moved to Rhodes University as Professor and Head of Department of Mathematics. He retired in 2016, and is currently Emeritus Professor.

He has held several visiting appointments: England: University of Cambridge, University of Southampton; Germany: Max-Planck Institute for Gravitational Physics; India: Inter-University Centre for Astronomy and Astrophysics; Turkey: Sabanci University, USA: University of Pittsburgh, Louisiana State University, California Institute of Technology.

He has served as President of the South African Gravity Society. For many years he has been on the Council of the South African Mathematical Society, serving two terms as President. Internationally, he serves on the Council of the International Society on General Relativity and Gravitation.

He is the author or co-author of over 70 scientific publications, and 3 books. The subjects of this work range from mathematical analysis to computer programming, from quantum gravity to discoveries about the horizons of black holes, and from cosmology to the theory of travel faster than light. However, for about the last 30 years the focus of his work has been on gravitational waves, and in particular how they are calculated.

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