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Black holes and nilmanifolds: quasinormal modes as the fingerprints of extra dimensions?

Prof Alan Cornell (University of Johannesburg)

Monday, 26 June 2023 | 16h00 – 17h00 SAST

Venue: in person* and online

** Neelsie Cinema, Stellenbosch University*

--- Cheese and wine will be served at the venue ---

ABSTRACT

We investigate whether quasinormal modes (QNMs) can be used in the search for signatures of extra dimensions. To address a gap in the Beyond the Standard Model literature, we focus here on higher dimensions characterised by negative Ricci curvature. As a first step, we consider a product space comprised of a four-dimensional Schwarzschild black hole space-time and a three-dimensional nilmanifold (twisted torus); we model the black hole perturbations as a scalar test field. We suggest that the extra-dimensional geometry can be stylised in the QNM effective potential as a squared mass-like term representing the Kaluza–Klein (KK) spectrum. We then compute the corresponding QNM spectrum using three different numerical methods, and determine a possible "detectability bound" beyond which KK masses cannot be detected using QNMs.

BIOGRAPHY

Alan is a professor of theoretical physics at the University of Johannesburg, having obtained his PhD from the University of Melbourne, Australia.

He has previously worked at the Korean Institute for Advanced Studies (Seoul, Korea), the Yukawa Institute for Theoretical Physics (Kyoto, Japan), the Institut de Physique Nucléaire de Lyon (France) and the University of the Witwatersrand.

He is a member of ASSAf, the SA-CERN programme, the Inter-experimental Machine Learning working group at CERN, the Future Circular Collider collaboration, and the chair of the Theoretical and Computational Physics division at the SAIP.

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