

## S E M I N A R



**Prof Gonzalo J. Olmo**  
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Spanish Society of Gravitation and  
Relativity)

**Date:**  
Friday, 12 June 2026

**Time:**  
11h00-12h00 SAST

- Venues:**
- **NITheCS Seminar Room**  
University of KwaZulu-Natal  
Westville Campus  
3rd Floor, H-Block,  
School of Chemistry and Physics
  - **Online**

**WHO SHOULD ATTEND?**  
All are welcome.

**ENQUIRIES:**  
Email Dr Cerene Rathilal:  
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# Platypus Stars: self-gravitating vacuum compact objects

## ABSTRACT

Black holes are one of the most impressive predictions of General Relativity, but they also establish the limits of the theory. The unavoidable existence of singularities and the emergence of event horizons pose critical challenges that call for a deep reformulation of the theory to find a solution. Nonsingular black holes and gravastars (stellar objects supported by the energy and pressure of a cosmological constant) are often presented as alternative compact objects that can solve or alleviate some of these problems.

In this talk, I will show that, if vacuum energy is treated as truly empty space (rather than as a cosmological constant), it is also possible to construct a new type of ultracompact stellar object (using the standard Tolman–Oppenheimer–Volkoff (TOV) equations) that is free of singularities and able to (at least partially) confine photons without the need for horizons. I will describe the structural properties of these objects, discuss aspects of the matching conditions involved in their construction, and analyse their compactness, as well as the behaviour of null geodesics in these geometries.

*Prof Gonzalo J. Olmo is Head of the Department of Theoretical Physics at the University of Valencia, Spain. His research focuses on physics beyond General Relativity, including quantum cosmology, black holes, and alternative theories of gravitation with applications in cosmology and astrophysics.*

*He has published more than 170 research papers, received approximately 10,000 citations and has an h-index of 52. Since 2019, he has served as Vice-President of the Spanish Society of Gravitation and Relativity (SEGRE). He maintains active collaborations with institutions in Brazil and South Africa, including North-West University and the University of Cape Town.*

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