Semiclassical stellar hydrostatic equilibrium

Julio Arrechea Rodríguez,[1] Carlos Barceló,[1] Raúl Carballo-Rubio,[2,3] and Luis J. Garay[4,5]

[1]*Institute of Astrophysics of Andalusia (IAA-CSIC),*
Glorieta de la Astronomía, 18008 Granada, Spain
[2]*SISSA, International School for Advanced Studies, Via Bonomea 265, 34136 Trieste, Italy*
[3]*INFN Sezione di Trieste, Via Valerio 2, 34127 Trieste, Italy*
[4]*Department of Theoretical Physics, Complutense University of Madrid, 28040 Madrid, España*
[5]*Institute for the Structure of Matter (IEM-CSIC), Serrano 121, 28006 Madrid, Spain*

Theoretical assumptions about the behaviour of gravitational collapse motivate the search for new forms of stellar equilibrium beyond classical general relativity [1]. In this talk we delve into the semiclassical regime, where the vacuum energy contribution to spacetime curvature gives rise to a plethora of scenarios, all of them avoiding the formation of a horizon. We will start reviewing classical hydrostatic equilibrium for stars composed by a perfect fluid of constant density. Such considerations will guide us in the exploration of the solutions to the semiclassical hydrostatic equilibrium equations [2]. We will describe and explain the various situations one encounters as a function of the compactness of the resulting structure. Although the model here considered is the simplest one can think of, it can serve as a cornerstone for the study of semiclassical stellar models with more realistic equations of state.

[1] Carlos Barceló, Raúl Carballo-Rubio, and Luis J. Garay. Where does the physics of extreme gravitational collapse reside? *Universe*, 2(2):7, 2016.

[2] Raúl Carballo-Rubio. Stellar equilibrium in semiclassical gravity. *Phys. Rev. Lett.*, 120(6):061102, 2018.