

# Gravitational Geometry and Dynamics Group Seminar

Tue., Jul. 16<sup>th</sup>, 2024, at 11h00.

Room: 11.2.21 and Zoom ID: 989 6252 0928

(Password: contact [graposo@ua.pt](mailto:graposo@ua.pt))

## Boson stars and their relatives in semiclassical gravity

In this talk we will discuss boson star configurations in quantum field theory using the semiclassical gravity approximation. Restricting our attention to the static case, we show that the semiclassical Einstein- Klein-Gordon system for a single real quantum scalar field whose state describes the excitation of  $N$  identical particles, each one corresponding to a given energy level, can be reduced to the Einstein- Klein-Gordon system for  $N$  complex classical scalar fields. Particular consideration is given to the spherically symmetric static scenario, where energy levels are labeled by quantum numbers  $n$ ,  $l$  and  $m$ . When all particles are accommodated in the ground state  $n = l = m = 0$ , one recovers the standard static boson star solutions. On the other hand, for the case where all particles have fixed radial and total angular momentum numbers  $n$  and  $l$ , but are homogeneously distributed with respect to their magnetic number  $m$ , one obtains the  $l$ -boson stars, whereas when  $l = m = 0$  and  $n$  takes multiple values, the multi-state boson star solutions are obtained. Thus, we have shown that in semiclassical gravity, Boson Stars relatives arise naturally as the quantum fluctuations associated with the state of a single field describing a many-body system.

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