QUANTUM DECAY OF SOLITIONS

Oscillons are spherically symmetric, oscillatory, long-lived solitonic solutions to classical field equations [1]. They arise naturally in many inflationary models by the nonlinear dynamics during reheating [2]. In fact, their observational signatures might provide very relevant information about the physics driving inflation. Even though they are quasi-stable classically, quantum effects may affect substantially their decay and lifetime [3,4], ultimately altering cosmological predictions. In order to begin exploring these avenues, we propose this research line in which the candidate will investigate the decay of realistic oscillons including quantum effects. To this end, we will perform simulations of classical field theories in 3+1 dimensions, from which the candidate will extract oscillon profiles and, in isolation, analyze their stability under quantum corrections.

Refs:
[1] Oscillons After Inflation; Mustafa A. Amin, Richard Easther, Hal Finkel, Raphael Flauger, Mark P. Hertzberg; e-Print: 1106.3335 [astro-ph.CO]; DOI: 10.1103/PhysRevLett.108.241302; Published in: Phys.Rev.Lett. 108 (2012), 241302
[2] Self-resonance after inflation: oscillons, transients and radiation domination; Kaloian D. Lozanov, Mustafa A. Amin; e-Print: 1710.06851 [astro-ph.CO]; DOI: 10.1103/PhysRevD.97.023533; Published in: Phys.Rev.D 97 (2018) 2, 023533
[3] Quantum Radiation of Oscillons, Mark P. Hertzberg; e-Print: 1003.3459 [hep-th]; DOI: 10.1103/PhysRevD.82.045022; Published in: Phys.Rev.D 82 (2010), 045022
[4] Quantum Oscillons are Long-Lived, Jarah Evslin, Katarzyna Slawińska, Tomasz Romańczukiewicz, Andrzej Wereszczyński; e-Print: 2512.17193 [hep-th]

Profile of the candidate:

Required background in field theory and quantum mechanics. Computing skills: parallel C++ and Python.

Supervisor:

Dr. Joanes Lizarraga, (EHU), Early Universe Cosmology Group.
Department of Physics, Leioa.
The work will be carried out in the same department, and the candidate will meet with the supervisor every week.