

Spanish and Portuguese Relativity Meeting



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Archimedes Experiment: the Weight of Quantum Vacuum

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The Archimedes experiment investigates the interaction between zero-point quantum fluctuations of the electromagnetic field and gravity, placing itself into one of the most longstanding discussions in physics: the Cosmological Constant problem.

Using a highly sensitive suitably designed beam balance, Archimedes will measure the force exerted by the gravitational field on special samples suspended from the balance arms in which the vacuum energy is modulated in time by exploiting superconducting transition; the transition turns them into a stack of Casimir cavities, expelling not-allowed EM modes.

If the vacuum energy does interact with gravity, an upward force acts on the cavity and can be interpreted as the lack of weight of the expelled EM modes. The expected torque generated by this modulation is of the order of $10^{-13} Nm/\sqrt{Hz}$, therefore a very sensitive beam balance has been designed.

The final setup of the Archimedes experiment is now fully installed, and the first sensitivity measurement in vacuum is expected by the end of 2024, while the final measurement of the weight of the vacuum fluctuations weight is expected within 2026.

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