The Archimedes Experiment

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From the cosmological constant problem:

*why does vacuum energy exhibit a gravitational contribution enormously lower than the predicted one? Does vacuum gravitate or not?*
The Casimir effect is a macroscopic manifestation of vacuum fluctuations. If the vacuum «weights» then there is a force, directed upward, equal to the weight of the modes expelled from the cavity when it becomes superconducting.

\[ \mathbf{F}_{\text{tot}} = \frac{E_C}{c^2} g \hat{z} \]

\( E_C \) : Casimir Energy

**Expected force** \( 10^{-16} \) N

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**How to measure it?**
- The idea is to weigh a rigid Casimir cavity when the vacuum energy is modulated by changing the reflectivity of the plates.
- High Tc layered superconductors as natural multi Casimir-cavities
- High variation of Casimir energy at the transition → Taking advantage from the fact that in normal state the plane (that will become superconducting) is a very poor conductor

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**The Experiment**
- Seismically isolated balance
- Temperature modulation around Tc
- Balance tilt possibly read with an optical lever