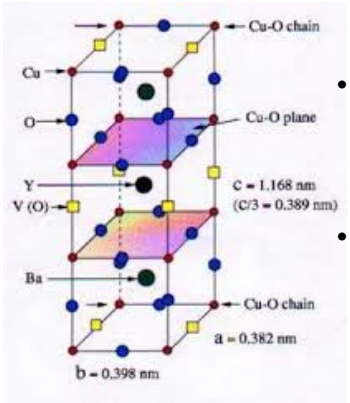
The Archimedes Experiment

P. Puppo[3] for Archimedes' collaboration

From the cosmological constant problem:

why does vacuum energy exibit a gravitational contribution enormously lower than the predicted one? Does vacuum gravitate or not?

Cuprates are «natural» stacks of Casimir cavity



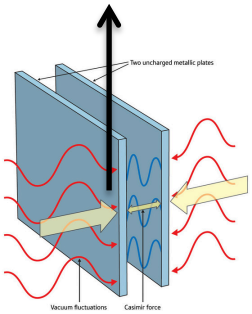
- The cuprate, when makes the transition, has parallel superconducting planes separated by dielectric planes.
- These planes expel part of the vacuum energy due to the increased reflectivity.

How to measure it?

- **The idea is to weigh a <u>rigid Casimir</u> 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**

The Vacuum Weight

- **The Casimir effect is a <u>macroscopic</u> 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.**



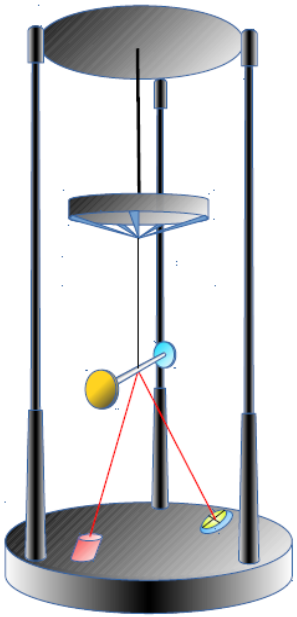
$$\vec{F}_{tot} = \frac{|E_C|}{c^2} g\ \hat{z}$$

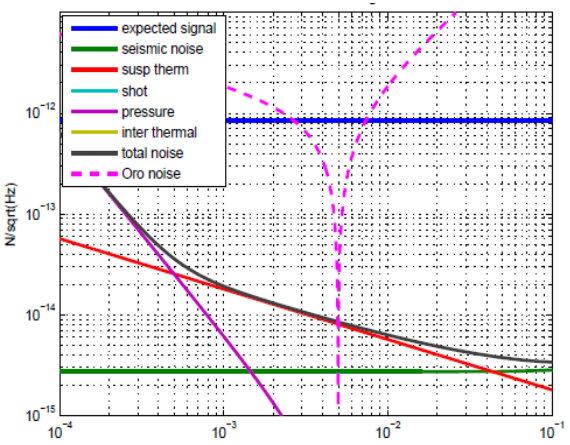
E_c :Casimir Energy

Expected force 10^{-16} N

The Experiment

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





Signal and Sensitivity for Archimedes)