



Contribution ID: 22

Type: **Poster**

Thermal modulation of YBCO samples through radiation heat transfer for the Archimedes experiment

Wednesday, 10 November 2021 19:00 (1 hour)

The main scientific goal of Archimedes experiment, installed in the SarGrav laboratory in Sardinia (one of the quietest places in Europe and candidate site for the third generation GW detector Einstein Telescope), is to investigate whether and how vacuum fluctuations interact with gravity.

A high sensitive balance will measure the small weight variations of two YBCO superconducting disks (type II high T_c), suspended at the ends of its arm. By modulating the temperature of these disks around their critical temperature (91 K) with a modulation frequency of a few mHz, the vacuum energy contained in them will be modulated and, if it gravitates, its weight. This modulation can only occur through the radiative heat exchange mechanism: the system must be isolated from any external interaction that could add energies other than that of vacuum.

With this objective in mind, a first small-scale prototype was developed by the INFN Roma 1 division to study temperature variation of a YBCO sample through radiation heat transfer alone. The first cryogenics tests have already started, and the data is being analysed.

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Session Classification: Poster Session @ Sos Enattos Mine