Contribution ID: **23** Type: **"Rapid fire" talk**

Einstein-Podolsky-Rosen quantum entanglement for future gravitational-wave detectors

Monday, 17 March 2025 17:45 (7 minutes)

In the last years, gravitational-wave (GW) Earth-based detectors have seen a great improvement in sensitivity, leading to the detection of more than 100 events during the joint observing runs of the LIGO-Virgo-KAGRA (LVK) Collaboration. This has opened the way to a completely new field of study, i.e. multimessenger astrophysics.
The contribution presented here is about taming quantum noise to further enhance the sensitivity of GW detectors, in view of next-generation detectors such as the Einstein Telescope.
Excluding technical noises, quantum noise dominates the high-frequency band (300 Hz - 10 kHz) and it will become limiting also in the other bands (10 - 300 Hz), with the expected improvements of other noise sources. Therefore, we are developing a table-top optical prototype to validate a novel technique for quantum noise reduction via Einstein-Podolsky-Rosen (EPR) entangled squeezed states of light. The quantum entanglement allows to attain a broadband noise reduction and it drastically simplifies the state-of-the-art optical setup needed to achieve similar performances, being also much cheaper.
The talk will give an overview of the current status of the experiment both in simulations and experimental design of the EPR project. This experiment is hosted by the EGO (European Gravitational Observatory, Cascina, PI) consortium and counts members from several INFN groups (Roma1, Napoli, Genova, Perugia) and from KASI (Korea Astronomy and Space Science Institute) and South Korean institutions.

Primary author: DE MARCO, Francesco (Sapienza University of Rome & Istituto Nazionale di Fisica Nucleare, Sezione di Roma1)

Presenter: DE MARCO, Francesco (Sapienza University of Rome & Istituto Nazionale di Fisica Nucleare, Sezione di Roma1)

Session Classification: Quantum sensors and technologies

Track Classification: Quantum sensors and technologies