Rencontres des Jeunes Physicien·ne·s 2019

ID de Contribution: **22**

Type: **Oral presentation**

Reducing quantum noise in gravitational-wave detectors using squeezed states of light

vendredi 29 novembre 2019 16:30 (20 minutes)

Gravitational waves (GW) are ripples in the fabric of spacetime, emitted by compact accelerating objects. On September 2015, the first direct detection of GW from a binary black hole merger initiates the field of GW astronomy and opened a new window on the Universe. On August 17, 2017, Advanced LIGO and Advanced Virgo detectors jointly detected gravitational-waves resulting of the merger of two neutron stars, with the best localization precision ever obtained.
In order to increase the science reach of LIGO and Virgo, it is essential to reduce quantum noise (QN), one of the fundamental sensitivity limits of the detector. QN is originated by the quantum nature of light, and is attributed to the Heisenberg Uncertainty Principle, stating that it is not possible to know simultaneously and with an infinite precision the phase and the amplitude of the light. Since the quantum noise is generated by vacuum fluctuations entering from the dark port of the detector, the injection of non-classical vacuum states of light (or squeezed states) enables the reduction of quantum noise. This technique is now routinely used in LIGO and Virgo to increase the sensitivity in a fraction of their frequency spectrum.
Achieving a broadband reduction of quantum noise requires the use of "frequency-dependent squeezing (FDS)" techniques, where the squeezing ellipse rotates as a function of the frequency before entering the detector. After a general introduction about squeezing, I will present my work on the experimental demonstration of a FDS technique using entangled photons, and known as Einstein-Podolsky-Rosen (EPR) squeezing technique.

Field

GW/Squeezing

Language

English

Auteur principal: NGUYEN, Catherine (Laboratoire APC/ Université Paris-Diderot)

Orateur: NGUYEN, Catherine (Laboratoire APC/ Université Paris-Diderot)

Classification de Session: Oral presentations session

Classification de thématique: Physics