

Current Status of Quantum Locking Experiment for Space Gravitational Wave Antenna DECIGO

Tuesday, 24 May 2022 13:30 (2 hours)

The DECI-hertz Interferometer Gravitational wave Observatory (DECIGO) is the future Japanese space mission with 1,000 km arm cavities. One of the main objectives of DECIGO is the detection of primordial gravitational waves (PGWs) produced in the inflation period. We should improve DECIGO's target sensitivity, which is limited by quantum noise, to enhance the possibility of the detection of PGWs.

The standard squeezing techniques to reduce the quantum noise are not effective because of the large diffraction loss in DECIGO due to the long arm length. Therefore, we proposed a new method, quantum locking with an optical spring, to reduce the quantum noise in a relatively broad frequency band. Quantum locking is the technique, in which each mirror of the long arm cavity (main cavity) is shared by two short-arm cavities (sub-cavities). Then the sub-cavities control the mirrors' motion of the main cavity. Interferometer signals obtained from the main cavity and the two sub-cavities can be combined to optimize the sensitivity of DECIGO.

In parallel with the theoretical analysis of the technique, we have been performing the experiment to verify the principle of the theory. In this poster session, we explain the current status of the quantum locking experiment.

Primary authors: ISHIKAWA, Tomohiro (Department of Physics, Nagoya University); Mr WATANABE, Izumi; IWAGUCHI, Shoki; WU, Bin (Department of Physics, Nagoya University); KAWASAKI, Yuki (Department of Physics, Nagoya University); SHIMIZU, Ryuma (Department of Physics, Nagoya University); Dr NAGANO, Koji (Institute of Space and Astronautical Science, Japan Aerospace Exploration Agency); Dr ENOMOTO, Yutaro (Department of Engineering, University of Tokyo); Dr KOMORI, Kentaro (Institute of Space and Astronautical Science, Japan Aerospace Exploration Agency); MICHIMURA, Yuta (Department of Physics, University of Tokyo); Prof. FURUSAWA, Akira (Department of Engineering, University of Tokyo); KAWAMURA, Seiji (Department of Physics, Nagoya University)

Session Classification: Poster session I

Track Classification: Instrument status: lessons and challenges for low frequencies