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Current status of experiments to verify the principle of quantum locking for DECIGO

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The DECI-hertz Interferometer Gravitational-Wave Observatory (DECIGO) is a space gravitational wave (GW) detector. One of the most important DECIGO's goals is the observation of the primordial GW background (PGW). To increase the possibility of PGW observation, we need to improve the sensitivity of DECIGO, which is limited by quantum noise.

Standard squeezing used in ground-based detectors cannot be used for DECIGO because the effect of diffraction loss is significant in DECIGO's main cavity with a long arm length of 1000km. Therefore, quantum locking technology has been proposed as a new method for quantum noise reduction. Quantum locking is a technique to improve the sensitivity of DECIGO using signals obtained from the sub-cavity, which shares one mirror with the main cavity.

"Ponderomotive squeezing" and "Homodyne detection" are applied to the sub-cavity. By combining the signals from the main cavity (that contains the GW signals) and sub-cavity, we can achieve sensitivity beyond the limit due to quantum noise in a certain range of frequencies.

Currently, we are conducting experiments to verify this method. In this poster session, we explain the status of the quantum locking experiment.

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