## GWADW2023 - Gravitational-Wave Advanced Detector Workshop



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## Alignment Sensing and Control of Laser Interferometer for DECIGO and B-DECIGO

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DECIGO(DECi-hertz Interferometer Gravitational-wave Observatory) is a space-based gravitational wave detector that has a good sensitivity at low frequencies from 0.1 Hz to 10 Hz. DECIGO can detect gravitational waves from intermediate-mass black hole binary mergers and gravitational wave background. It leads to the verification of the formation scenario of supermassive black holes and inflation theories in the early universe.DECIGO is a triangular-shaped laser interferometer consisting of 3 satellites that are in a precise formation flight. By controlling and measuring the distance between each satellite, the interferometer detects distortion of space caused by gravitational waves. Each side of the triangular laser interferometer is an optical cavity, and its length is designed to be 1000 km for DECIGO and 100 km for B-DECIGO. This cavity is called Dual-Pass Fabry-Perot cavity because the laser beams from satellites on both sides are incident on it. It is necessary to protect the interferometer from disturbances such as solar wind in space, and to control the position and alignment of the mirrors that consist of Dual-Pass Fabry-Perot cavity. In this presentation, we introduce the methods to sense and control these mirrors (WaveFront Sensor and Beam Pointing Control for alignment control), and an experiment for demonstration and verification of them. As the result, we succeeded in a simultaneous control 2 dofs of length and 12dofs of alignment which are all dofs of Dual-Pass Fabry-Perot cavity.

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