

Vibration Analysis of KAGRA Cryostat at Cryogenic Temperature

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Large-scale Cryogenic Gravitational-Wave Telescope, KAGRA is a second-generation gravitational-wave detector (GWD) located in Japan. The features that distinguish KAGRA from other GWDs are its underground location and cryogenic operation of the four main mirrors. The underground location provides a quiet site with low seismic noise, while the cryogenic operation cools the mirrors down to 20 K, reducing the thermal noises. However, cryocooler vibration and structural resonances of the cryostat can contaminate detector sensitivity as they couple to test mass through the heat-links. Monitoring and characterization of the vibration inside the cryostat is critical for the optimum noise performance of KAGRA.

In April, 2020 KAGRA conducted an international observation run, “O3GK” along with GEO600. During this run several noise sources were identified and a noise budget was prepared. However, as the mirrors were not cooled the noise transfer via heat-links was estimated based on room temperature, in vacuum vibration measurement performed 2.5 years before O3GK. During the upcoming observation run the mirrors will be cooled down, so we performed vibration analysis of the cooling system at cryogenic temperature to study its impact on detector sensitivity. In this poster, we describe the KAGRA cooling system and discuss the results of vibration analysis.

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