

Cryogenic Mirror System in KAGRA

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KAGRA is a gravitational wave telescope under construction in Japan. An unique feature of KAGRA is to be in deep underground to reduce seismic vibration and to introduce cryogenic mirror system. Cryogenic mirror system is a very simple solution to reduce thermal noises of main mirror and suspension wires, but technology to achieve both cooling mirror and seismic vibration isolation is difficult. In KAGRA, four stage mirror suspension system is cooled down to below 20K, which is named as Cryogenic Payload, and this cryogenic payload is suspended from low frequency vibration isolation system at room temperature. Total height of this mirror suspension system including cryogenic part is about 14m, and this tall suspension is realized without suspension tower by excavating vertical tunnel in underground. KAGRA cryogenic payload equips tilting control system by moving mass, local position system and coil-magnet actuators. And it has non-magnetism black coating to reduce optical scattering noise and to increase thermal radiation cooling.

We have already done some of cooling down test and operation test of cryogenic payload at cryogenic temperature. And we did cryogenic test of Michelson interferometer operation in 2018. Cooling down time of a cryogenic payload was about 23 days, and successful control even at cryogenic temperature was demonstrated. Now all of four cryogenic payloads have been installed into KAGRA cryostats.

In this presentation, we will report test results of a KAGRA cryogenic payload and latest status of KAGRA cryogenic system.