

Techniques for Cryogenic Sensing and Actuation

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With increasing sensitivity in the low-frequency region, thermal noise is a growing problem. Cooling the optical parts is one of the essential mitigation techniques, but it has consequences for all components inside the cryostat system. Thus displacement sensors and actuators have to work at the foreseen temperatures below 20 Kelvin. Additionally, they should dissipate as little heat as possible. At cryogenic temperatures, we can use superconductivity to eliminate resistive heating of actuator coils. We present a technique for additive manufacturing of superconductors and their applicability for actuators in gravitational wave detectors. Furthermore, due to changes in the band structure, care has to be taken in the selection of photodiodes and LEDs for cryogenic sensing. We present measurements of the diode behavior at low temperatures.

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