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Optical Absorption and Birefringence correlation in KAGRA Sapphire Test Masses

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To reduce the impact of thermal noises in the sensitivity of gravitational wave detectors, cryogenic operation is planned for future 3G detectors such as Einstein Telescope and it is already implemented in the 2.5G detector KAGRA. To benefit from cryogenic operations, test masses substrate material needs to be changed from amorphous fused silica to crystalline material. The choice of KAGRA for the substrate of its test masses was sapphire. Crystalline materials have very different optical behavior with respect to glasses and the study and characterization of such properties is crucial to ensure the high performances necessary for gravitational wave detectors.

In this presentation, we are presenting the results on the characterization of KAGRA sapphire test masses in terms of optical absorption and birefringence and present our interpretation of a common source for both optical properties. This study, although performed solely on sapphire, has great impact on the choice and fabrication process of any crystalline material for future detectors which will make use of crystalline test masses.

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