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Optical Refrigeration for an Optomechanical Amplifier

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Radiative cooling is a contact-free cooling technique that allows cooling of 100kg scale mirrors to cryogenic temperatures. However, future optomechanical applications require lightweight mirrors, for which radiative cooling is inefficient. In this talk, I will present optical refrigeration as a low-vibration cooling method for a phase-sensitive optomechanical amplifier, proposed to improve the sensitivity of future gravitational wave detectors (*Physical Review A 102.2 (2020): 023507*). With moderate improvements on coolants currently available, optical refrigeration can improve the amplifier gain by a factor of 2-10, relative to what is possible with radiative cooling. I will also show that the technique does not add significant noise to the amplifier.

Primary author: Mr SCHULZ, Samuel (Department of Physics and Astronomy, Amherst College, Amherst, Massachusetts 01002)

Co-authors: DRORI, Yehonathan (Department of Physics and Astronomy, Amherst College, Amherst, Massachusetts 01002); Prof. ADHIKARI, Rana (LIGO Laboratory, California Institute of Technology, Pasadena, California 91125)

Presenter: DRORI, Yehonathan (Department of Physics and Astronomy, Amherst College, Amherst, Massachusetts 01002)

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