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Beyond Advanced Gravitational Wave Detectors: Beating the Quantum Limit with Squeezed States of Light

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After two decades of technology development, the first direct observation of gravitational waves appears to be imminent. Ground-based interferometric gravitational wave detectors world-wide are about to come back on-line after a major upgrade aimed to significantly improve their sensitivity. As these advanced detectors become a reality, the gravitational wave community is looking at new ways of further expanding their astrophysical reach. The quantum nature of light imposes a fundamental limit to the sensitivity that gravitational wave detectors can achieve, due to statistical fluctuations in the arrival time of photons at the interferometer output (shot noise) and the recoil of the mirrors due to radiation pressure noise. In this talk I will show how mature technology can be used to push interferometric precision measurement beyond the standard quantum limit by means of squeezed states of light, and current ideas on how to integrate this technology into the Advanced detectors of the Laser Interferometer Gravitational wave Observatory (LIGO).