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Limits of weak light phase measurements for inter-spacecraft laser interferometry and coherent optical communications (Conference Presentation)

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Abstract

Measuring the phase of low power optical signals is important for space-based gravitational wave detection, geodesy measurements and free-space optical communications. Phase measurements are required in heterodyne interferometry and are commonly implemented by phasemeters based on In-phase and Quadrature demodulation or phase-locked loops. Laser frequency noise and quantum noise set competing requirements on phasemeter design. Poor optimisation of the phase measurement system can lead to a breakdown of the measurement due to cycle slipping, an ungraceful degradation of phase measurement performance. This talk will explore the fundamental limitations of weak light phase measurements, highlight design considerations for such a phase measurement system and present recent experimental results for weak light phase measurements. These findings may expand the design parameter space for future inter-satellite laser interferometry and communication instruments.

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