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Demonstrating optical cavity functionality and 40 dB of straylight suppression with tunable coherence in a Michelson

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As straylight is an important limitation for the sensitivity of gravitational wave detectors, we investigate new laser operation concepts and interferometer topologies for a more straylight-resilient detector configuration. Our main focus is the use of tunable coherence realized by phase modulation following a pseudo-random-sequence on the interferometer laser. This breaks the coherence of the delayed straylight reducing its intrusive impact with the remaining coherence length only depending on the modulation frequency. Thus, effectively realizing a pseudo white-light interferometer with tunable coherence length. We demonstrate this in a Michelson and a Sagnac-topology with a remaining coherence length of roughly 30 cm. Additionally, we investigate the use of tunable coherence in optical resonators, demonstrating the functionality of cavities with the PRN-modulated laser.
Here, we present our recent results, achieving more than 40 dB of straylight suppression in a table top Michelson-interferometer using tunable coherence and the full functionality of an optical cavity with a matched PRN-sequence.

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