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Laser and Atom Interferometers as Dark Matter Detectors

We summarize recent developments in using gravitational wave (GW) detectors, specifically laser and atom interferometers, as probes of dark matter (DM). We first introduce the proper time observable—the proper time elapsed as measured by the beamsplitter between events—as an explicitly gauge-invariant construct of the real observable in an interferometer experiment. We explicitly demonstrate that the proper time observable is equivalent to the strain for a plane GW, as commonly used in the GW community, but it can now be readily generalized to any gravitational perturbations, including DM signals. Finally, we discuss the DM signal spectrum and the prospects for detection with existing and future interferometer experiments.

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