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WERNER, Michael (Institut für theoretische Physik, Leibniz Universität Hannover)

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We present a systematic approach to calculate all relativistic phase shift effects in Bragg-type light-pulse matter wave interferometer (MWI) experiments up to (and including) order $\mathcal{O}(\epsilon^2)$, placed in a weak gravitational field. The whole analysis is derived from first principles and even admits test of General Relativity (GR) apart from the usual Einstein Equivalence Principle (EEP) tests, consisting of universality of free fall (UFF) and local position invariance (LPI) deviations, by using the more general „parameterized post-Newtonian“ (PPN) formalism. We collect general phase shift formulas for a variety of well-known MWI schemes and present how modern experimental setups could measure PPN induced deviations from GR without the use of macroscopic test masses. This procedure should be seen as a way to easily calculate certain phase contributions, without having to redo all relativistic calculations in new MWI setups and come up with possibly new measurement strategies.

Poster Abstract

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