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Since the internal structure of atoms is possibly sensitive to dark matter (DM), atomic clocks may serve as suitable DM detectors and provide a platform for detecting violations of the Einstein equivalence principle (EEP). These features are not exclusive to atomic clocks, as atom interferometers can detect EEP violations as well, for example via gravimetry. The atomic diffraction processes envisioned for gravitational-wave detectors also drive internal transitions, which connects clocks and atom interferometers in a natural fashion. Furthermore, the atoms'centre-of-mass motion is potentially affected by DM as well, making atom interferometers susceptible to DM even without internal transitions. In this contribution we present a unified treatment of internal and centre-of-mass dynamics for atom interferometers, in which relativistic effects, mass defects, and violation parameters (due to DM and EEP) are included. Based on this formalism, we investigate the leading-order effects for atom interferometers with and without internal transitions. Overall, we identify the effects of DM in atom interferometers and discuss the difference between the ones induced by the atom's clock properties and centre-of-mass effects. See AVS Quantum Sci. 5, 044404 (2023).

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