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Opportunities for Maturing Precision Metrology with Ultracold Gas Studies Aboard the ISS[1] JASON WILLIAMS, Jet Propulsion Lab, JOSE D'INCAO, JILA, NIST and University of Colorado, Boulder — Precision atom interferometers (AI) in space are expected to become an enabling technology for future fundamental physics research, with proposals including unprecedented tests of the validity of the weak equivalence principle, measurements of the fine structure and gravitational constants, and detection of gravity waves and dark matter/dark energy. We will discuss our preparation at JPL to use NASA's Cold Atom Lab facility (CAL) to mature the technology of precision, space-based, AIs. The focus of our flight project is three-fold: a) study the controlled dynamics of heteronuclear Feshbach molecules, at temperatures of nano-Kelvins or below, as a means to overcome uncontrolled density-profile-dependent shifts in differential AIs, b) demonstrate unprecedented atom-photon coherence times with spatially constrained AIs, c) use the imaging capabilities of CAL to detect and analyze spatial fringe patterns written onto the clouds after AI and thereby measure the rotational noise of the ISS. The impact from this work, and potential for follow-on studies, will also be reviewed in the context of future space-based fundamental physics missions.

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