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*Thursday 4 April 2024 16:50 (2 hours)*

We propose the nuclear interferometer - a single photon interferometry experiment based upon the nuclear clock transition in neutral thorium atoms - as a novel detector for ultra-light dark matter (ULDM). Thanks to the enhanced sensitivity of this transition to the variation of fundamental constants, we find that modest scale experiments have the potential to match or even improve the discovery potential of advanced very long-baseline terrestrial clock atom interferometers to ultra-light dark matter with scalar couplings to photons. A nuclear interferometer would also offer an unparalleled window to new physics possessing scalar couplings to quarks or gluons, with a reach exceeding other existing and proposed experiments by orders of magnitude over a range of frequencies. We find such a search to be complementary to nuclear-atomic optical clock frequency comparisons, moving in the direction of well-motivated parameter space.

**Session Classification:** Poster Session & Wine & Coffee