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Atom interferometer searches for spin-2 ultra-light dark matter

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Atom interferometers are a new class of quantum sensors capable of making precision measurements in many areas of fundamental physics including gravitational wave and ultra-light dark matter (ULDM) searches. While the sensitivity of atom interferometers to scalar ULDM has been established [arXiv: 1911.11755; arXiv: 2308.10731], spin-2 ULDM models are also well motivated but have yet to be fully explored. In this talk I will outline the phenomenology of spin-2 ULDM in atom interferometers and discuss how best to optimise searches by operating multiple experiments in a network. Existing laser interferometer searches for spin-2 ULDM will be complemented by atom interferometers by probing different mass parameter space and offering a distinct method of detection. Not only will spin-2 ULDM induce a change in the laser phase measured in the interferometer but will additionally couple directly to the internal energy states of the atoms. Atom interferometers are uniquely sensitive to both effects, which will enhance the limits these experiments will place on spin-2 ULDM and help distinguish these signals from scalar candidates. Work in collaboration with Diego Blas and Christopher McCabe.

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