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The Atom Interferometer Observatory and Network (AION) project aims to develop a next-generation differential atom interferometer for the detection of ultra-light dark matter and mid-frequency range gravitational waves, complementing the peak sensitivities of other experiments i.e., LISA, LIGO, and Virgo. The project is comprised of various stages, starting with a 10 m baseline atom interferometer paving the way to a 100 m detector and eventually a km-scale terrestrial detector with the final stage being the development of a satellite-based detector. The project is a multidisciplinary initiative bringing together researchers from seven institutions from all over the UK. In this work, I present the role of my team at Imperial College London in this collaboration which is to improve the sensitivity of the detector by performing spin-squeezing on the atoms. Spin squeezing involves the entanglement of many atoms to reduce the spin measurement noise (which obeys Heisenberg's uncertainty principle) in one direction (i.e. J_y) while increasing the noise in the other direction (i.e. J_z) and allows measurements below the standard quantum limit. As a consequence, the resolution of the interferometer increases as the noise in the differential phase measurement is reduced.

Poster Abstract

Session Classification: Poster Session

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