

## 2nd Terrestrial Very-Long-Baseline Atom Interferometry Workshop



Contribution ID: 19

Type: **not specified**

### Alice Josset

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

The Atom Interferometer Observatory and Network (AION) detector is subject to a standard limit on its phase resolution due to quantum projection noise when the atomic superposition is collapsed. This limit needs to be overcome for the instrument to be sensitive to gravitational waves and ultra-light dark matter with reasonable atomic cloud sizes, requiring the creation of quantum correlations in the atom cloud. Squeezed states of the atomic ensemble can be generated by performing a quantum nondemolition measurement of the atom number. At Imperial College, we are working towards an atom-cavity system where an atomic transition is strongly coupled to a high-finesse ( $F=200\ 000$ ) cavity mode. Homogeneous coupling will be achieved by trapping the atoms in an optical lattice formed by a cavity mode oscillating at twice the wavelength of the probe. An entangled state will be created by taking a non-destructive measurement of the atom number with a sweep of the probe field over the vacuum Rabi splitting of the system. In this poster, we present experimental progress towards the creation of the atom-cavity system. This includes the design and characterization of the high-finesse optical cavity and the demonstration of an optical dipole trap in the cavity.

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