Cavity-Assisted Quantum Sensing (EPSRC: EP/V027948/1)

University of Birmingham

We invite expressions of interest for a full-time postdoctoral positon in experimental atomic and optical physics in the Quantum Matter group at the University of Birmingham. The project will run from 1 April 2021 to 31 March 2024, with the formal advertisement and applications beginning in the next few weeks.

The project builds on our recent realisation of a millikelvin ring laser. A gas of magneto-optically trapped potassium atoms exhibits Raman lasing into the counter-propagating modes of a high-finesse ring resonator. The resulting laser exhibits random directional switching and controllable symmetry-breaking between modes.

The programme of work involves first setting up a cavity-enhanced optical dipole trap, to allow deeper cooling and quantum state preparation. The trapped gas will then be prepared in a coherent spin state which will be made to precess around an applied magnetic field. Spin precession will be monitored via non-destructive cavity probing or by 'superradiant' lasing from the collective spin.

Candidates should have a PhD in experimental atomic and optical physics, with specific expertise with laser cooling and trapping, quantum optics, optical cavities, and/or nonlinear optics. The successful applicant will be highly motivated, technically proficient, and theoretically sound. The post holder will benefit from the wide range of research within the Quantum Matter group at the University of Birmingham. Team members currently lead projects in quantum gases, quantum optics, and atomic magnetometry, with applications ranging from neuroscience to searches for physics beyond the Standard Model. The School of Physics & Astronomy is home to the lead of the UK National Quantum Technology Hub for Timing and Sensing, the Institute for Gravitational Wave Astronomy, and three separate projects within the new STFC-EPSRC initiative, *Quantum Technologies for Fundamental Physics*.

Interested candidates should contact Jon Goldwin (j.m.goldwin@bham.ac.uk) for more information.

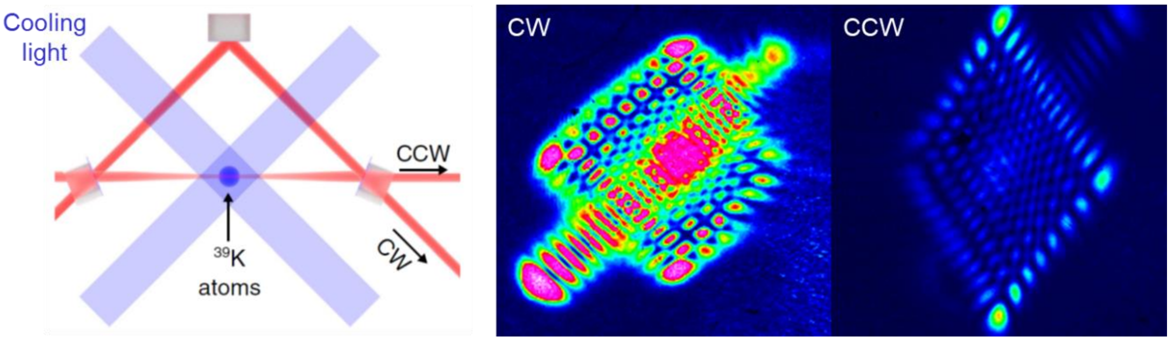

Figure 1: Birmingham cold-atom ring laser. Left: experiment schematic. Lasing light in the clockwise (CW) and counter-clockwise (CCW) modes is shown in red. Centre and right: simultaneous images of CW and CCW emission. The exposure time averages over the random directional switching; the CCW modes appear weaker due to magnetically-induced non-reciprocity, which leads to a greater probability for CW lasing.

Keywords: cold atoms; quantum optics; cavity quantum electrodynamics; optical magnetometry; optical trapping; four-wave mixing; slow light; optical non-reciprocity.

References

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