Dressed atom potentials for matter-wave interference

G. Sinuco & B.M.Garraway
email: b.m.garraway@sussex.ac.uk,
Department of Physics and Astronomy, University of Sussex, Falmer,
Brighton, BN1 9QH, United Kingdom

Dressing atoms with radio-frequency and microwave radiation opens up new possibilities for ultra-cold atoms, or a BEC, in new types of atom trap and in new topologies of waveguides [1,2]. This is because of the flexibility inherent in the vector coupling of a magnetic dipole moment to electromagnetic fields which can be varied in time, frequency, orientation and space. This may in turn result in quantum technology applications to sensing (with ring traps and gyroscopes [3,4]), metrology, interferometry and atomtronics as well as applications to atomic lattice physics [5,6].
In this talk we give three recently developed applications of dressed atom theory which are relevant to experiments in interferometry and quantum technology: the first shows how microwaves can be used to make symmetric ringtraps [4], and the second shows how "double-dressing" with radiofrequency *and* microwave fields can be used to optimise realistic field inhomogeneities in matter-wave bubbles. The third application analyses the microwave spectroscopy of radio-frequency dressed states: this is relevant to experiments developing rotation sensors based on the Sagnac effect with matter-waves [7].

References:

[1] Topical Review: *Recent developments in trapping and manipulation of atoms with adiabatic potentials*, B.M. Garraway and H. Perrin, J. Phys. B **49**, 172001 (2016).
[2] T*rapping atoms with radio-frequency adiabatic potentials*, H. Perrin and B.M. Garraway, in Advances in Atomic, Molecular and Optical Physics, vol. **66**, pp 181-262 (2017).
[3] *Ring trap for ultracold atoms*, O.Morizot, Y.Colombe, V.Lorent, H.Perrin, and B.M.Garraway, Phys. Rev. A **74**, 023617 (2006).
[4] *Inductively guided circuits for ultracold dressed atoms*, G. Sinuco-León, K. Burrows, A.S. Arnold, and B.M. Garraway, Nat. Commun. **5**, 5289 (2014).
[5] *Radio-frequency dressed lattices for ultracold alkali atoms*, G.A. Sinuco-León and B.M. Garraway, New J. Phys. **17**, 053037 (2015); *Addressed qubit manipulation in radio-frequency dressed lattices*, New J. Phys. **18**, 035009 (2016).
[6] *Addressed qubit manipulation in radio-frequency dressed lattices*, G.A. Sinuco-León and B.M. Garraway, New J. Phys. **18**, 035009 (2016).
[7] W. von Klitzing, et al. in preparation (2019).