ZEPLER INSTITUTE

UNIVERSITY OF Southampton

Quantum Technology Lecture Series

Magneto optical trapping and sub-Doppler cooling of molecules

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Abstract

Atomic physics has been revolutionised by the introduction of laser techniques to cool atoms far below the Doppler limit. Now, it has become possible to laser cool molecules, to collect them in a magneto-optical trap, to cool them below the Doppler limit [1] and to trap them with modest magnetic fields.

These ultracold molecules open up a wide vista of future applications. To give a few examples, they can be optically or magnetically trapped to form arrays for quantum simulation, they can make a molecular fountain for testing fundamental physics at unprecedented levels of sensitivity, and they open a new energy range for the study of ultracold collisions and quantum chemistry. I will review the current status of this field.

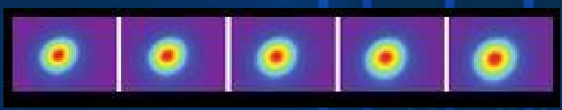

Fig. 1 Images of a CaF cloud expanding freely after cooling to 52(2) μK [1].

[1] S. Truppe et al. arXiv:1703.00580v1

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Biography

Edward Hinds is a physicist who has conducted pioneering research into the behaviour of matter at temperatures approaching absolute zero. His many contributions to the study of ultracold atoms include accurate measurements of the electron's electric dipole moment — an elusive property of great physical consequence. A world leader in the development of new techniques to study atomic systems at low temperatures, he constructed optical cavities small enough to fit on a tiny chip, where they can be used to study individual particles at will. Edward also conducted the first measurement of the Casimir–Polder force, which arises between an atom and a surface within a vacuum. Edward is currently a Royal Society Research Professor and Director of the Centre for Cold Matter at Imperial College London. A Fellow of numerous international learned societies, in 2008 he received both the Thomson Medal and Prize of the Institute of Physics and the Rumford Medal of the Royal Society.

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