Abstract Submitted
for the DAMOP19 Meeting of
The American Physical Society

Matter-wave interferometry with atoms in high Rydberg states

STEPHEN HOGAN, JAMES PALMER, University College London — Rydberg states of atoms and molecules can possess large static electric dipole moments which allow forces to be exerted on them using inhomogeneous electric fields [1]. For samples prepared in coherent superpositions of Rydberg states with different electric dipole moments, these forces can be exploited to generate superpositions of momentum states for atom interferometry. Here, we report the experimental realization of such a Rydberg-atom interferometer - an electric analogue of the longitudinal Stern-Gerlach interferometer [2]. The experiments were performed with helium atoms in pulsed supersonic beams. Sequences of microwave and inhomogeneous electric field pulses were applied to implement the interferometry scheme. The results presented open new possibilities for measurements of the acceleration of Rydberg positronium or antihydrogen atoms in the Earth's gravitational field. The Rydberg states used in the experiments had sizes of 320 nm. Matter-wave interferometry with such giant atoms is also of interest for the study of spatial decoherence in large quantum systems. [1] S. D. Hogan, EPJ Techniques and Instrumentation 3, 1 (2016) [2] S Nic Chormaic et al., J. Phys. B 26, 1271 (1993)

Stephen Hogan
University College London

Date submitted: 01 Feb 2019 Electronic form version 1.4