武汉物数所理论交叉学术交流系列报告

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Stealth for Atoms: Precision measurement in ultracold metastable helium atoms to test QED

Prof. Ken Baldwin

The Australian National University

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频标楼4楼报告厅

About the speaker:

Professor Ken Baldwin is Deputy Director of the Research School of Physics and Engineering at the Australian National University, where he is also the Director of the Energy Change Institute. Professor Baldwin is an inaugural ANU Public Policy Fellow, and winner of the 2004 Australian Government Eureka Prize for Promoting Understanding of Science, for his role in initiating and championing "Science meets Parliament". In 2007, Professor Baldwin was awarded the W.H. Beattie Steele Medal, the highest honour of the Australian Optical Society, and in 2010 he was awarded the Barry Inglis Medal by the National Measurement Institute for excellence in precision measurement. Professor Baldwin is a Fellow of the American Physical Society, the Institute of Physics (UK), the Optical Society of America and the Australian Institute of Physics.

Abstract:

Helium is a favoured test bed for validating quantum electrodynamic theory through precision spectroscopic measurements. We have previously measured transition rates in ultracold metastable helium atoms in order to test QED.

More recently we have measured the first tune-out wavelength for metastable helium (*PRL* **115**, 043004 (2015)). This is the wavelength at which the atomic polarizability vanishes – effectively creating 'stealth' for atoms. We utilise a novel, highly sensitive technique for precisely measuring the effect of perturbations in the trapping potential of magnetically confined atoms illuminated by an external laser light field. At a wavelength of 413.0938($9_{stat.}$)($20_{syst.}$) nm we detect no effect on the trapping potential for atoms output-coupled from the trap. This compares well with the theoretical value of 413.02(9) nm predicted by our colleagues at Wuhan (J. Mitroy and L.-Y. Tang, *PRA* **88**, 052515 (2013)), but with two orders of magnitude greater precision. This tune-out wavelength is very sensitive to non-relativistic QED effects, thereby providing motivation for more detailed theoretical investigations in order to test QED.

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