



合肥微尺度物质科学国家研究中心
HEFEI NATIONAL LABORATORY FOR PHYSICAL SCIENCES AT THE MICROSACLE

学术报告

Precision measurements on molecular hydrogen in search for new physics

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摘要:

Modern laser spectroscopic and metrology methods, involving atomic clocks and frequency comb lasers, allow for ever more refined and accurate determination of the quantum level structure of the smallest molecules, the hydrogen molecule. At the same time advanced quantum calculations, including non-adiabatic, relativistic and QED-effects on these small systems have become possible at a high level of accuracy. A comparison between experiment and theory for the benchmark dissociation energy reveals that both are in agreement at the sub-MHz level. This result can be interpreted as a test of QED in molecules, but also constraints on possible 5th forces or higher dimensions can be deduced. The abundance and observation of H_2 in quasar radiation can be used for searching possible variations of the proton-electron mass ratio, a phenomenon that surpasses known physics. Currently the focus of research is shifting to the measurement of vibrational transitions in hydrogen; in view of the long lifetimes of those quantum states, that opens up a new avenue for precision metrology on molecules and the search for new physics.

个人简介:

Wim Ubachs received his PhD degree in 1986 from Nijmegen University on "High resolution spectroscopy on diatomic hydrides". Since 1988 he is affiliated with Vrije Universiteit Amsterdam, as Lecturer, Senior Lecturer and Full professor. During 2000-2010 he was the director of the Laser Centre at VUA, and 2010-2014 the head of the Physics Department. At VUA he was involved in different aspect of laser spectroscopy, in particular precision metrology, focusing on the hydrogen molecule and isotopologues. In 2014 he was one of the co-founders of the Advanced Research Center for Nanolithography in Amsterdam with support from the ASML company.

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