QED TESTS AND SEARCH FOR NEW PHYSICS IN MOLECULAR HYDROGEN

E. J. SALUMBIDES, M. L. NIU, G. D. DICKENSON, K. S. E. EIKEMA, *Department of Physics and Astronomy, and LaserLaB, VU University, De Boelelaan 1081, 1081 HV Amsterdam, The Netherlands*; J. KOMASA, *Faculty of Chemistry, A. Mickiewicz University, Grunwaldzka 6, 60-780 Poznań, Poland*; K. PACHUCKI, *Faculty of Physics, University of Warsaw, Hoża 69, 00-681 Warsaw, Poland*; and W. UBACHS, *Department of Physics and Astronomy, and LaserLaB, VU University, De Boelelaan 1081, 1081 HV Amsterdam, The Netherlands*.

The hydrogen molecule has been the benchmark system for quantum chemistry, and may provide a test ground for new physics. We present our high-resolution spectroscopic studies on the $X\,^1\Sigma_g^+$ electronic ground state rotational series[a] and fundamenal vibrational tones in molecular hydrogen. In combination with recent accurate *ab initio* calculations, we demonstrate systematic tests of quantum electrodynamical (QED) effects in molecules. Moreover, the precise comparison between theory and experiment can provide stringent constraints on possible new interactions that extend beyond the Standard Model.

[a] E. J. Salumbides, G. D. Dickenson, T. I. Ivanov and W. Ubachs, Phys. Rev. Lett. **107**, 043005 (2011).