

Some recent developments in experimental positronium physics

D.B. Cassidy¹

¹*Department, of Physics and Astronomy, University College London, Gower Street, WC1E 6BT, London UK*

Presenting Author: d.cassidy@ucl.ac.uk

The use of a Surko-type buffer gas trap [1] has made it possible to turn ordinary neon-moderated d.c. positron beams [2] into devices that can deliver pulses containing millions of particles in a few ns burst [3]. These can be used to make a “gas” of positronium which, despite its 142 ns annihilation lifetime, can be probed with pulsed lasers in much the same way as any other atomic species [4]. The ability to create such a Ps gas makes feasible an array of hitherto impractical or impossible experiments, such as the production of molecular positronium [5]. In this talk I will discuss some experiments that can be carried out in this way that are related to the production of long-lived Rydberg positronium states, and their possible manipulation with inhomogeneous electric fields [6]. This work has many possible applications, including precision spectroscopy, scattering and even matter-antimatter gravity measurements [7].

References

- [1] C. M. Surko, M. Leventhal, and A. Passner, *Phys. Rev. Lett.* **62**, 901 (1989)
- [2] *Positron Beams and Their Applications*, edited by P. G. Coleman (World Scientific, Singapore, 2000)
- [3] D. B. Cassidy, S. H. M. Deng, R. G. Greaves, and A. P. Mills Jr. *Rev. Sci. Instrum.* **77**, 073106 (2006)
- [4] D. B. Cassidy, T. H. Hisakado, H. W. K. Tom, and A. P. Mills, Jr. *Phys. Rev. Lett.* **109**, 073401(2012).
- [5] D. B. Cassidy, T. H. Hisakado, H. W. K. Tom, and A. P. Mills, Jr. *Phys. Rev. Lett.* **108**, 133402 (2012)
- [6] S. D. Hogan and F. Merkt *Phys. Rev. Lett.* **100**, 043001 (2008)
- [7] A. P. Mills, Jr. and M. Leventhal, *Nucl. Instrum.Methods in Phys. Res. B***192**, 102-106 (2002).