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Electrostatic manipulation of Rydberg positronium atoms

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Experiments using positronium (Ps) atoms are often complicated by low numbers of atoms, and the fact that they self-annihilate in around 142 ns (for the "long-lived" states). The latter problem can be avoided if the atoms are optically excited to long-lived Rydberg states, which don't annihilate to any significant degree. This has become much easier to accomplish in recent years using positron bugger gas trapping technology [1], allowing the efficient production of Rydberg Ps atoms [2]. As well as increasing their lifetime, exciting Ps atoms to Rydberg levels also makes it possible to manipulate them using electric fields because of their large dipole moments [3]. Here I will report the first demonstration of such manipulation of Ps atoms [4], and discuss future applications, including precision spectroscopy of Rydberg Ps levels. If it can be performed with sufficiently high precision, this may be of relevance to the proton radius problem [5], since Ps is composed only of leptons.

References

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