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Nonlinear dynamics of antihydrogen in magnetostatic traps: gravitational measurements and laser cooling

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Advancements in trapping and cooling antihydrogen pave a way to accurate spectral and gravitational measurements. Analysis of experiments require detailed knowledge and understanding of the nonlinear dynamics of antihydrogen atoms in magnetostatic traps in the presence of gravity. Perturbation theory yields insights and detailed simulations used to evaluate various techniques for measuring the ratio of the gravitational mass to the inertial mass of antihydrogen. These techniques are discussed and compared. Theoretical considerations and numerical simulations suggest that stochasticity may play a crucial role in some experimental techniques. Chaotic particle motion is also shown to facilitate laser cooling of trapped antiatoms. Different approaches to inducing orbit stochasticity are discussed.

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