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# A MEASUREMENT OF THE GRAVITATIONAL ACCELERATION OF THE ANTIPROTON

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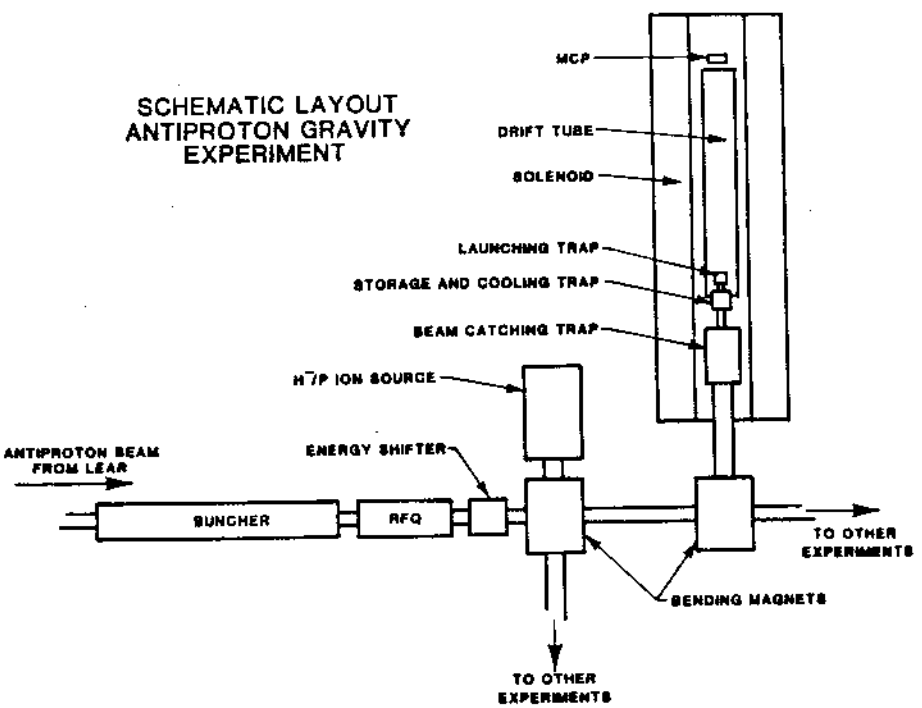
## ABSTRACT

Theoretical approaches to gravitation abound whereas experiments in gravity are few in number. A fundamental measurement in experimental gravity that has not yet been done is the measurement of the gravitational force on antimatter. In certain extended supergravity models, specific particles have different gravitational masses from their associated antiparticles. However, as yet there has been no direct test of this prediction. We propose to test directly the equality of particle and antiparticle gravitational masses in the baryon sector with protons and antiprotons. Experimentally, we plan to use the time of flight technique pioneered by Witteborn and Fairbank in their measurement of the gravitational force on the electron. In this approach the particles are launched vertically up a drift tube. The time of flight of the particle up the drift tube together with the initial velocity gives a measure of the gravitational force acting on the particle. To realize this measurement in sensibly dimensioned equipment and with reasonable timing precision requires ultra-low velocities for the antiprotons. We propose a staged deceleration approach to achieve these velocities. In our approach, low energy antiprotons from LEAR will be decelerated in an RFQ and cyclically injected into a series of specially designed pulsed ion traps. In this series of traps, adiabatic, resistive and electron cooling will be used to lower the antiproton energy to the required thermal level. When this is achieved the antiprotons will be transferred, a few at a time, into a launching trap at the base of the drift tube. After launch, the antiprotons will be detected at the top of the drift tube with a microchannel plate. An $H^-$ source will be used to calibrate the equipment.




Schematic view of the experimental setup indicating major equipment items