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Precise Measurement of Muon Capture on the Proton FREDERICK GRAY, University of California, Berkeley, MUCAP COLLABORATION — The μCap experiment is measuring the rate of muon capture on the proton in hydrogen. Muons are stopped in a time projection chamber (TPC) filled with isotopically pure protium gas that contains of order 10^{-6} deuterium and 10^{-8} higher-Z impurity contamination. This active target allows the muon to be tracked to its stopping point so that only those stopping within the chamber, well away from the walls, are included in the data set. The effective lifetime of the negative muon is measured in this environment from the time spectrum of decay electrons. It is compared with the positive muon lifetime to determine the capture rate, which in turn gives g_p, the induced weak pseudoscalar form factor of the proton. Precise theoretical predictions of g_p have been made using heavy baryon chiral perturbation theory, with uncertainties at the level of 3%. The current experimental situation is controversial and inconsistent, with significant ambiguity introduced by the formation of $p\mu p$ molecular states in the liquid hydrogen targets that were used in these experiments, a difficulty that is avoided with the present gas target of 100 times lower density. A precise measurement to compare with theory will provide a sensitive test of the chiral symmetry of QCD. A "blind" analysis of the data collected in fall 2004 (a $\sim 15\%$ measurement of g_p) is in progress. Data collection will continue in 2005 and 2006, with an eventual precision goal of 1% in the capture rate corresponding to 7% in g_p. The support of DOE and NSF is gratefully acknowledged.

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