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New Measurement of the Neutral Pion Life Time as a Precision Test of the Chiral Anomaly[1]

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Symmetries and their spontaneous breaking effects play a fundamental role in our understanding of Nature. In particular, the three neutral light mesons, π^0, η and η', contain fundamental information about chiral symmetry breaking, and their radiative decays are primarily defined by the chiral anomaly. Theoretical activities in this domain for the past several years resulted in a high precision (1% level) prediction for the decay rate of the π^0 into two photons. The present experimental uncertainty of this decay rate, according to the Particle Data Group average, is an order of magnitude greater than the theoretical uncertainties. In the past several years, the PrimEx collaboration at Jefferson Lab has developed and performed a new experiment to measure the π^0 lifetime with high precision, using the small angle coherent photoproduction of π^0's in the Coulomb field of a nucleus, *i.e.*, the Primakoff effect. The new level of experimental precision has been reached by implementing the new high intensity and resolution photon tagging facility in Hall B at Jefferson Lab and by developing a novel high resolution electromagnetic hybrid calorimeter (HYCAL). Two well known electromagnetic processes, the Compton scattering and the e^+e^- pair production have been used to check the precision, as well as to control the long term stability of this experiment. The preliminary results of this new measurement at the few percent level will be presented and compared with the recent predictions of chiral perturbation theory.

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