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High Precision Measurement of the π^0 Radiative Decay Width¹

LIPING GAN, University of North Carolina, Wilmington

As the lightest particle in the hadron spectrum, the π^0 plays an important role in understanding the fundamental symmetries of QCD. The $\pi^0 \rightarrow \gamma\gamma$ decay provides a key process for test of the chiral anomaly, and at the same time a test of the Nambu-Goldstone nature of the π^0 meson due to spontaneous chiral symmetry breaking. Theoretical activities over the last decade have resulted in high precision (1% level) predictions for the decay amplitude of the π^0 into two photons. The experimental measurement of this parameter with a comparable precision will be critical to test these important QCD predictions. The PrimEx collaboration at Jefferson Lab has developed and performed new experiments to measure the π^0 radiative decay width via the Primakoff effect. A new level of experimental precision has been achieved by implementing the high intensity and high resolution photon tagging facility and by developing a novel, high resolution, electromagnetic hybrid calorimeter (HYCAL). A recently published result from the first experimental data (PrimEx-I) with a 2.8% total uncertainty is a factor of 2.5 more precise than the current Particle Data Group average. The second experiment (PrimEx-II) was carried out in fall 2010 with the final goal of 1.4% precision. The result of PrimEx-I and the status of PrimEx-II will be presented.

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