Measurement of the Weak Pion-Nucleon Coupling Constant, h_π^1, from Backward Pion Photo-Production near Threshold on the Proton

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The nucleon-nucleon (NN) weak interaction is the last sector of the weak interaction where the main aspects of the electroweak theory have not been verified. In the presence of the nuclear interaction, the weak NN interaction can be isolated via parity violation. The longest range weak pion-nucleon coupling constant, h_π^1, is important for nuclear parity violation. However, after considerable effort in the past two decades, its value is still poorly known largely due to many-body theoretical uncertainties. Prospects of a new measurement of h_π^1 in a theoretically clean process [1] will be presented. A measurement of the parity-violating asymmetry in pion photo-production off the proton is related to h_π^1 in a low-energy theorem for the photon polarization asymmetry at threshold in the chiral limit. At present two completed experiments - photon circular polarization for ^{18}F and the anapole moment of ^{133}Cs - have been interpreted to give very different values of h_π^1. This experiment will be the first attempt to measure h_π^1 in the single nucleon system. A reliable measurement of h_π^1 provides a crucial test of the meson-exchange picture of the weak NN interaction. Such a test of the meson-exchange picture will shed light on low energy QCD.

References

[1] J. W. Chen and X. Ji, Phys. Rev. Lett. **86**, 4239 (2001).