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A Study of the Spin Structure on the Neutron in Deep Inelastic Scattering of Polarized Electrons on Polarized Neutrons*

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A STUDY OF THE SPIN STRUCTURE OF THE NEUTRON IN DEEP INELASTIC SCATTERING OF POLARIZED ELECTRONS ON POLARIZED NEUTRONS

by

Michael S Spengos

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A STUDY OF THE SPIN STRUCTURE OF THE NEUTRON IN DEEP INELASTIC SCATTERING OF POLARIZED ELECTRONS ON POLARIZED NEUTRONS

BY

Michael S Spengos

ABSTRACT

The internal spin structure of the neutron, was studied in deep inelastic scattering of longitudinally polarized electrons from a polarized ^{3}He target in the End Station A of the Stanford Linear Accelerator Center (SLAC). The spin asymmetry of the neutron was measured at energies between 19 and 26 GeV in the range $0.03 \leq x \leq 0.06$ at an average Q^2 of 2 $(GeV/c)^2$. The results are in agreement with a new measurement of the asymmetry by SMC within their six times larger uncertainties. The spin dependent structure function $g_1(x)$ for the neutron was determined from the asymmetry measurement and, its integral over x is found to be $\int g_1^n(x)dx = -0.038 \pm 0.009$. This result is 2.7 standard deviations from the Ellis-Jaffe Sum Rule and combined with the EMC results from the proton in very good agreement with the Bjorken Sum Rule. In the Quark Parton Model (QPM), in conjunction with the weak coupling constants F and D, from baryon decay, the result implies that the quarks contribute approximately 32% of the nucleon helicity. Finally, different ways of evolving the data, based on various theoretical models, is attempted and future aspects for spin physics, with emphasis at spin physics at SLAC, are discussed.

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Getting a Ph.D. in High Energy Physics, is considered by many people in the field as a big milestone, after which someone becomes a professional physicist and enters the "real world". My point of view is somewhat different. I would like to think of the professional life of a High Energy Physicist as a continuous learning process, which starts in graduate school and ends whenever someone looses interest. The first years of this process, the graduate school years, (not only in High Energy Physics but pretty much in every field) are the years were other people can have a decisive influence, positive or negative, and shape someone 's career. There are many people who have influenced me in a positive way since I started graduate school and I am pleased that I have here an opportunity to thank them.

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To thank my family in a foreign to them language would be meaningless, therefore the reader of the next paragraph can either learn Greek or view the whole paragraph as a very complicated equation which can also be used as a huge "fudge" factor to modify the final answer in chapter 4 according to their taste.

Το να ευχαριστει κανεις αγαπημενα του προσωπα ειναι και συνηθισμενο και σωστο. Το να ευχαριστει ομως κανεις τον ιδιο του τον εαυτο θα μπορουσε να χαρακτηριστει σαν ανοητο. Για μενα τα αρχικα των ονοματων Ε.Α.Σ εναι και θα ειναι παντοτε μερος του ιδιου μου του εαυτου. Κωστα αν και ποτε δεν σου το εχω πει, σε σενα χροσταω την αποφαση μου να ασχοληθω με την Φυσικη.

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