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The Precision Measurement of the Neutron Spin Structure Function Using Polarized He-3 Target*

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THE PRECISION MEASUREMENT OF THE NEUTRON SPIN STRUCTURE FUNCTION USING POLARIZED HELIUM-3 TARGET

A DISSERTATION
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AND THE COMMITTEE ON GRADUATE STUDIES
OF SYRACUSE UNIVERSITY
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DOCTOR OF PHILOSOPHY

By
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Abstract

Using a 48.6 GeV polarized electron beam scattering off a polarized ^3He target at Stanford Linear Accelerator Centre (SLAC), we measured the neutron spin structure functure g_1^n over kinematic(x) ranging $0.014 < x < 0.7$ and $1 < Q^2 < 17\text{GeV}^2$. Our measurement give the integral result over the neutron spin structure function $\int_{0.014}^{0.7} g_1^n(x)dx = -0.036 \pm 0.004(\text{stat}) \pm 0.005(\text{syst})$ at an average $Q^2 = 5\text{GeV}^2$. Along with the proton results from SLAC E143 experiment($0.03 < x$) and SMC experiment ($0.014 < x < 0.03$), we find the Bjorken sum rule appears to be largely saturated by the data integrated down to x of 0.014. However, we observe relatively large values for g_1^n at low x. The result calls into question the usual methods (Regge theory)for extrapolating to $x = 0$ to find the full neutron integral $\int_0^1 g_1^n(x)dx$, needed for testing the Quark-Parton Model(QMP).

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