

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

Xue-jun Wang

Stanford Linear Accelerator Center
Stanford University
Stanford, CA 94309

SLAC-Report-683
July 1997

Prepared for the Department of Energy
under contract number DE-AC03-76SF00515

Printed in the United States of America. Available from the National Technical Information Service, U.S. Department of Commerce, 5285 Port Royal Road, Springfield, VA 22161.

* Ph.D. thesis, Syracuse University, Syracuse, NY 13244.

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

A DISSERTATION
SUBMITTED TO THE DEPARTMENT OF PHYSICS
AND THE COMMITTEE ON GRADUATE STUDIES
OF SYRACUSE UNIVERSITY
IN PARTIAL FULFILLMENT OF THE REQUIREMENTS
FOR THE DEGREE OF
DOCTOR OF PHILOSOPHY

By
XUEJUN WANG
August 1997

Approved Paul Souder
Professor Paul Souder

Date 7/9/97

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 function 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).

Acknowledgment

Becoming a physicist has been my dream since I knew the great name like Newton and Einstein from middle school text book. As a result, I spent a large part of my life to pursuing this child dream. No matter the dream is realized or not, the people I met and the knowledge I learned during the dream pursuing time will certainly benefit my whole life.

There are many people I have to thank. First of all, I would express my gratitude to my advisor Paul Souder, who gave me the opportunities to participate in world class experiments like E154 and guided me with his deep insight in physics. Working with Paul is my lifetime rewarding. Next, I thank Richard Holmes for his substantial help during my whole graduate research period. I thank Emlyn Hughes, Charlie Young for their many supports during my stay at SLAC. I will never forget my friend James Xu, who shared all his valuable experience with me.

This experiment is a joint effort of many physicist and students. It's a tremendous learning experience to work in the collaboration. I spent very pleasant time with Micheal Olson in Syracuse to finish the hodoscope project and we enjoy a good friendship. I am indebted to Takashi Akagi for his help to set up and test the hodoscope system. It's my great pleasure to know my colleague student Ball Kahl and work with him. I would like to thank my fellow graduate students Mikhail Romalis, Piotr Zyla, Yury Kolomensky, Franck Sabatie, Sebastien Incerti, Todd Smith, Steve Churchwell, Gregory Mitchell and Dave Reyna for sharing their experiences and ideas with me. I thank Lou Buda, Lester Schmutzler and John Barden for their help during the hodoscope project. Many thanks to Gordon Cates, Krishna Kumar, Makis Petrotos, Ray Aronad, Peter boster, Zein-Eddine Meziani, Cristina Berisso, Linda Stuart, Lee Sorrell, Roger Gearhart and Friench Group for there help when I was in SLAC.

I have to thank my parents, they raised me with all their love and then were happy to let their only son to be far away from them to pursue his own dream. Finally, the most gratitude is due to my dearest wife, Yuxiang(DeeDee) Zhang. To support my

research in SLAC, she sacrificed her own Ph.D degree in Syracuse University and endured many ways of hardship in her life, while her unconditional love is always with me. For all those reasons, I dedicate this thesis to her.

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