

**Electroweak Coupling Measurements from Polarized Bhabha Scattering at  
the Z<sup>0</sup> Resonance<sup>\*</sup>**

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SLAC-Report-688  
March 1994

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.

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<sup>\*</sup> Ph.D. thesis, University of Oregon, Eugene, OR 97403

ELECTROWEAK COUPLING MEASUREMENTS FROM POLARIZED  
BHABHA SCATTERING AT THE  $Z^0$  RESONANCE

by

KEVIN T. PITTS

A DISSERTATION

Presented to the Department of Physics  
and the Graduate School of the University of Oregon  
in partial fulfillment of the requirements  
for the degree of  
Doctor of Philosophy

March 1994

"Electroweak Coupling Measurements From Polarized Bhabha Scattering at the  $Z^0$  Resonance," a dissertation prepared by Kevin T. Pitts in partial fulfillment of the requirements for the Doctor of Philosophy degree in the Department of Physics. This dissertation has been approved and accepted by:

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Title: ELECTROWEAK COUPLING MEASUREMENTS FROM POLARIZED  
BHABHA SCATTERING AT THE  $Z^0$  RESONANCE

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The cross section for Bhabha scattering ( $e^+e^- \rightarrow e^+e^-$ ) with polarized electrons at the center of mass energy of the  $Z^0$  resonance has been measured with the SLD experiment at the Stanford Linear Accelerator Center during the 1992 and 1993 runs. The electroweak couplings of the electron are extracted.

At small angles the measurement is done in the SLD Silicon/Tungsten Luminosity Monitor (LMSAT). A detailed description of the design, construction, commissioning and operation of the LMSAT is provided. The integrated luminosity for 1992 is measured to be  $\mathcal{L} = 420.86 \pm 2.56$  (stat)  $\pm 4.23$  (sys)  $\text{nb}^{-1}$ . The luminosity asymmetry for polarized beams is measured to be  $A_{LR}(LUM) = (1.7 \pm 6.4) \cdot 10^{-4}$ .

The large angle polarized Bhabha scattering reveals the effective electron vector and axial vector couplings to the  $Z^0$  through the measurement of the  $Z^0 \rightarrow e^+e^-$  partial width,  $\Gamma_{ee}$ , and the parity violation parameter,  $A_e$ . From the combined 1992

and 1993 data the effective electron vector and axial vector couplings are measured to

$\bar{g}_v^e = -0.0495 \pm 0.0096 \pm 0.0030$ , and  $\bar{g}_a^e = -0.4977 \pm 0.0035 \pm 0.0064$  respectively.

The effective weak mixing angle is measured to be  $\sin^2\theta_W^{eff} = 0.2251 \pm 0.0019 \pm 0.0015$ .

These results are compared with other experiments.

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## ACKNOWLEDGMENTS

First and foremost, thanks to my parents, William and Beverley Pitts, without whom none of this would have been possible. I will forever be in your debt. I am also very grateful to my brother, Rick, his wife Kathy and daughter Sarah for all their love and support. I would also like to acknowledge my grandparents, Howard and Thelma Miller and Gene and Bea Pitts.

Thanks very much to my advisor, Jim Brau, for his guidance, encouragement and friendship. I appreciate the friendship and support of my good friend and co-worker, Jenny Huber. Thanks also to Cary Zeitlin for his friendship and for his tremendous effort in making it all work.

Thanks to all of the physicists and support personnel of the SLD collaboration. This experiment is truly a team effort.

I would especially like to thank:

- the University of Oregon group: Ray Frey, David Strom, Koichiro Furuno, Hyun Hwang, Matt Langston, Anatoli Arodzero, Xiao Qing Yang, Hwanbae Park and David Mason for their contributions to the luminosity monitor and thoughtful discussions regarding my analysis.
- Bill Bugg and the University of Tennessee group: Steve Berridge, Achim Weidemann, Rob Kroeger, Peter Du, Joe Hargis and Sharon White for their contribu-

tions to the LMSAT/MASC.

- Iris Abt, Tony Waite, Eric Vella and Richard Dubois for their work on the calorimeter as well as their contribution and support to the luminosity monitor.
- John Yamartino and Saul González for their thoughtful insights and ideas, as well as their excellent work on calorimetry software.
- Peter Rowson, Morris Swartz and the Electroweak Physics group for their contribution and support of this analysis.
- Phil Seward and Behzad Sanii for their help, ideas and advice on the luminosity monitor hardware, as well as some stimulating conversations.

We are all grateful to the accelerator physicists and support personnel working on the SLC. Without luminosity and polarization, there would be no physics.

On behalf of the entire luminosity group, thanks to Bernie Wendring and the University of Oregon machine shop for a tremendous job on the luminosity monitor hardware.

Last, but not least, special thanks to the members of the Jack Miller Roundtable: Jack Miller (the founder), Cary Zeitlin, Peter Rowson, Jim Grubb and the great John McGraw for their incredible insights into a plethora of topics.

This work was supported in part by U.S. Department of Energy grant number DE-FG06-85ER40224.

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