

B

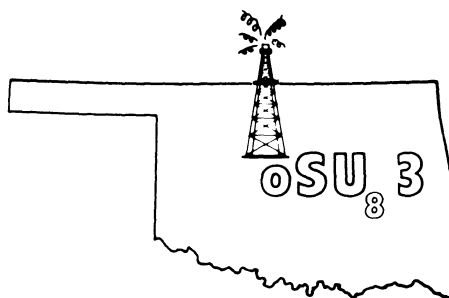
Progress in Physics
Vol. 8

Edited by
A. Jaffe, G. Parisi,
and D. Ruelle

Birkhäuser
Boston · Basel · Stuttgart

Workshop on Non-Perturbative Quantum Chromodynamics

Kimball A. Milton,
Mark A. Samuel, editors



1983

Birkhäuser
Boston • Basel • Stuttgart

Editors:

Kimball A. Milton
Mark A. Samuel
Department of Physics
Oklahoma State University
Stillwater, OK 74078

Library of Congress Cataloging in Publication Data

Workshop on Non-perturbative Quantum Chromodynamics
(1983 : Oklahoma State University)
Workshop on Non-perturbative Quantum Chromodynamics.

(Progress in physics ; vol. 8)

I. Quantum chromodynamics—Congresses. I. Milton,
K. A. II. Samuel, Mark A. III. Title. IV. Series:
Progress in physics (Birkhäuser Boston) ; vol. 8.
QC793.3.Q35W67 1983 539.7'21 83-22521
ISBN-13: 978-0-8176-3127-7 e-ISBN-13: 978-1-4612-5619-9
DOI:10.1007/978-1-4612-5619-9

CIP-Kurztitelaufnahme der Deutschen Bibliothek

**Workshop on Non-Perturbative Quantum Chromo-
dynamics (1983, Stillwater, Okla.):**

Workshop on Non-Perturbative Quantum Chromo-
dynamics / Kimball A. Milton ; Mark A.
Samuel, ed. - Basel ; Stuttgart ; Boston :
Birkhäuser, 1983.

(Progress in physics ; Vol. 8)

NE: Milton, Kimball A. [Hrsg.]; HST; GT

All rights reserved. No part of this publication may be reproduced, stored in a retrieval system, or transmitted, in any form or by any means, electronic, mechanical, photocopying, recording or otherwise, without prior permission of the copyright owner.

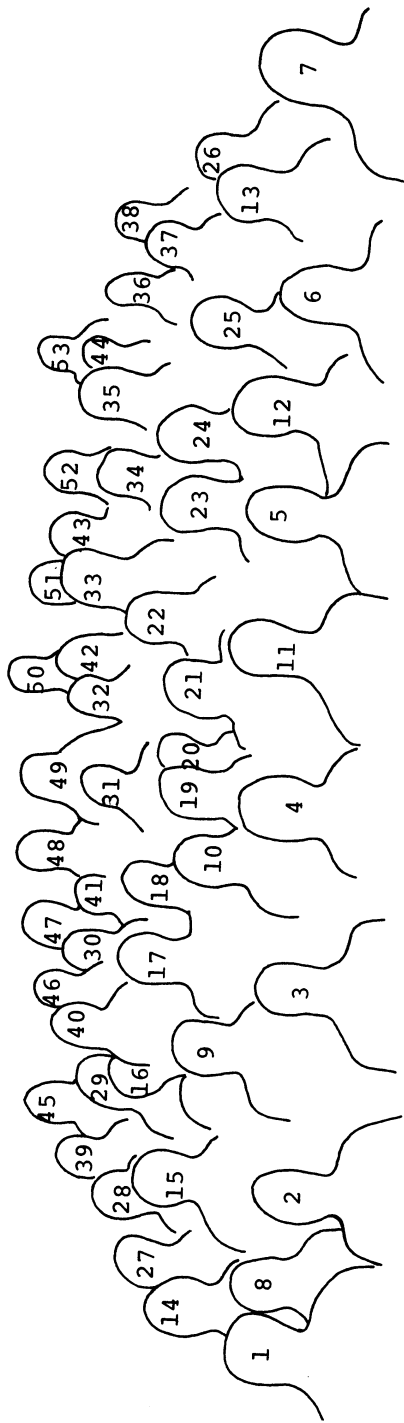
© Birkhäuser Boston, Inc., 1983

9 8 7 6 5 4 3 2 1

"A scientist is a man that can find out anything, and nobody in the world has any way of proving whether he ever found it out or not, and the more things he can think of that nobody can find out about...why, the bigger the scientist he is."

Will Rogers





- | | | |
|---|------------------------------------|-----------------------------------|
| 1. Doug McKay, Kansas | 20. Achin Sen, OSU | 39. Michael Creutz, Brookhaven |
| 2. Louise Dolan, Rockefeller | 21. Jung Rno, Cincinnati | 40. Carl Shakin, Brooklyn College |
| 3. Dennis Sivers, Argonne | 22. Janos Polonyi, Illinois | 41. Sue Willis, Oklahoma |
| 4. Wally Greenberg, Maryland | 23. Yoichi Kazama, Kyoto | 42. Adolpho Nimirowsky, Kansas |
| 5. Thomas Morgan, Nebraska | 24. Pahol Sanganetra, Kansas | 43. Ted Grose, OSU |
| 6. Pat Skubic, Oklahoma | 25. Thomas Kruecken, Nebraska | 44. Unidentified |
| 7. Gordon Lasher, IBM | 26. Q. Hokim, Laval University | 45. Richard Haymaker, LSU |
| 8. Bindu Bambah, Chicago | 27. Porter Johnson, IIT | 46. Herman Munczek, Kansas |
| 9. Ronald Kantowski, Oklahoma | 28. Mike Cornwall, UCLA | 47. Thomas Koppel, Chalk River |
| 10. Kim Milton, OSU | 29. Ken Johnson, MIT | 48. Gerrit Schierholz, Hamburg |
| 11. Gary Köhler, Oklahoma | 30. Jim Ball, Utah | 49. Gary Tupper, OSU |
| 12. Mark Samuel, OSU | 31. Amarjit Soni, UCLA | 50. Walter Wilcox, OSU |
| 13. Keith Andrew, Arkansas | 32. Steve Pinsky, Ohio State | 51. Morten Laursen, OSU |
| 14. Richard Woloshyn, TRIUMF | 33. James Reid, Simon Fraser | 52. H.C. Lee, Chalk River |
| 15. Mike Lieber, Arkansas | 34. Bruce Hudson, Oklahoma | 53. Garrett Sylvester, OSU |
| 16. Carl Bender, Washington U. | 35. Stan Brodsky, SLAC | |
| 17. P.K. Williams, DOE | 36. Sejjuk Saritepe, OSU | |
| 18. Charles Nelson, SUNY at Binghamton | 37. F.C. Chang, St. John's | |
| 19. Steve Adler, Institute for Advanced Study | 38. Maria Teresa Thomaz, Wisconsin | |

(OSU = Oklahoma State University)

" FORWARD "

The workshop on Non-Perturbative Quantum Chromodynamics took place over a three-day period, March 7-9, 1983 on the campus of Oklahoma State University in Stillwater. Some 65 participants and 28 talks represented diverse institutions and a broad spectrum of approaches to the central problems of strong interaction physics. Many subjects were discussed, including lattice gauge theory, infrared behavior, confinement, chromostatics and glueballs, as well as the interface with perturbative QCD. The excellent talks and the lively discussions which took place at the sessions, as well as during the various social events, ensured the success of the workshop.

We would like to summarize some of the highlights of those 3 days not represented by the technical papers included here. The workshop opened with a champagne reception at the Student Union Hotel and a party was held at the Samuel's residence Monday evening. A reception and banquet took place Tuesday evening followed by 3 significant events:

- (1) A unique feature of this workshop was the contest held for the best interpretation of the workshop logo. The entries were extremely creative and imaginative. After some difficulty, a winner was chosen and Steve Adler became the very proud owner of a brand new OSU orange cowboy hat. (See appendix for some of the entries.)
- (2) P.K. Williams of the Department of Energy gave us an up-to-the-minute review of the Federal funding situation especially in regard to CBA. His after dinner talk "Potomac Fever" was both amusing and informative.
- (3) The participants enjoyed a taste of the old west in the entertainment provided by the Prairie Dance Theatre Company of Oklahoma City. They presented a private performance of "All Our Yesterdays - Belle Starr", a modern dance look at a portion of early Oklahoma history not too far removed from us in time.

We are indebted to many people who helped assure the smooth functioning and success of the workshop: Smith Holt, Dean of the College

of Arts and Sciences who gave the opening welcome; Stan Green and Stan Dunham of Arts and Sciences Extension; Jeff Carroll, Said Ghnein, Ted Grose, Morten Laursen, Michele Plunkett, Seljuk Saritepe, Achin Sen, Geoff Summers, N.V.V.J. Swamy, Gary Tupper, Walter Wilcox, Tim Wilson and Laura Woodward of the Department of Physics; Beth Shumway of the Prairie Dance Theatre Company; and the efficient staffs of Arts and Sciences Extension, the Student Union and the Student Union Hotel. Special thanks go to our wives Margarita Barros-Milton and Carol Samuel for help and moral support.

We are also indebted to the U.S. Department of Energy, the National Science Foundation and the College of Arts and Sciences of Oklahoma State University for financial support.

Kim Milton
Mark Samuel
Editors

TABLE OF CONTENTS

S.Brodsky, PROBLEMS AT THE INTERFACE BETWEEN PERTURBATIVE AND NONPERTURBATIVE QUANTUM CHROMODYNAMICS..... 1

J.Reid, DO THE QCD CORRECTIONS DESTROY THE AMPLITUDE ZERO IN $q\bar{q} \rightarrow W\gamma$?..... 27

K.Johnson, THE M.I.T. BAG MODEL IN THE CONTEXT OF QCD..... 35

J.Breit, SELF ENERGY IN MASSLESS QUARKS IN THE M.I.T. BAG.... 45

C.Shakin, QUARK MODEL CALCULATIONS OF NUCLEON STRUCTURE FUNCTIONS..... 52

S.Pinsky, WHERE HAVE ALL THE PSEUDOSCALAR GLUEBALLS GONE ?..... 59

A.Soni, GLUONIUM PHENOMENOLOGY IN MASSIVE QCD..... 73

H.Munczek, D.McKay, SCALARS AND PSEUDOSCALARS IN NON-LINEAR CHIRAL DYNAMICS BASED ON QCD..... 83

S.Adler, QUARK STATICS..... 87

D.Sivers, POLARIZABLE MEDIA IN CLASSICAL GLUODYNAMICS AND THE SU_2 VACUUM..... 106

H.Munczek, A.M.Nemirovsky, EFFECTIVE QUARK PROPAGATOR AND $Q\bar{Q}$ STATES IN QCD..... 113

J.M.Cornwall, FINDING DYNAMICAL MASSES IN CONTINUUM QCD..... 119

H.C.Lee, ANALYTIC REGULARIZATION AND RENORMALIZATION OF NONPERTURBATION THEORIES..... 136

M.Creutz, LATTICE GAUGE THEORIES..... 145

G.Schierholz, THE SPECTRUM OF $SU(2)$ AND $SU(3)$ NON-ABELIAN LATTICE GAUGE THEORIES.....**

C.Bender, FINITE ELEMENT APPROXIMATION IN QUANTUM THEORY..... 155

J.Polonyi, TOPOLOGICAL CHARGE IN LATTICE GAUGE THEORY..... 168

W.Greenberg, LOCALLY GAUGE-INVARIANT FORMULATION OF PARASTATISTICS..... 181

** manuscript not available

L.Dolan, AFFINE ALGEBRAS AND STRONG INTERACTION THEORIES....191

Y.Kazama, GLUON CONDENSATION IN QCD AND SUPERSYMMETRIC
QCD.....197

R.Haymaker, STABILITY OF A CHIRAL BREAKING VACUUM.....223

J.Ball, INFRARED BEHAVIOR OF QCD.....231

P.Johnson, INFRARED BEHAVIOR OF THE GLUON PROPAGATOR IN
QCD.....249

C.Nelson, INFRARED PROPERTIES OF UNUSUAL INITIAL STATE
INTERACTIONS.....255

APPENDIX - Some Sample Contest Entries.....262

LIST OF PARTICIPANTS.....263