THE PINCH TECHNIQUE AND ITS APPLICATIONS TO NON-ABELIAN GAUGE THEORIES

Non-Abelian gauge theories, such as quantum chromodynamics (QCD) or electroweak theory, are best studied with the aid of Green's functions that are gauge invariant off-shell, but unlike for the photon in quantum electrodynamics, conventional graphical constructions fail. The pinch technique provides a systematic framework for constructing such Green's functions and has many useful applications.

Beginning with elementary one-loop examples, this book goes on to extend the method to all orders, showing that the pinch technique is equivalent to calculations in the background-field Feynman gauge. The pinch technique Schwinger-Dyson equations are derived and used to show how a dynamical gluon mass arises in QCD. Applications are given to the center vortex picture of confinement, the gauge-invariant treatment of resonant amplitudes, the definition of non-Abelian effective charges, high-temperature effects, and even supersymmetry. This book is ideal for elementary particle theorists and graduate students. This title, first published in 2011, has been reissued as an Open Access publication Cambridge Core.

JOHN M. CORNWALL is Distinguished Professor of Physics Emeritus in the Department of Physics and Astronomy, University of California, Los Angeles. Inventor of the pinch technique, he has made many other contributions to the formalism and applications of quantum field theory, as well as to space plasma physics. He has contributed to the technical analysis of many public policy issues, ranging from ballistic missile defense to the human genome.

JOANNIS PAPAVASSILIOU is a researcher in the Department of Theoretical Physics and IFIC, the University of Valencia–CSIC. A large part of his work has been devoted to the development of the pinch technique, both its formal foundation and its many applications, and he has published articles on quantum field theory and particle phenomenology.

DANIELE BINOSI is a researcher at the European Centre for Theoretical Studies in Nuclear Physics and Related Areas (ECT*) and Fondazione Bruno Kessler. In addition to his work on extending the pinch technique and its applications, he leads several policy-related European projects on the development of the vision and sustainability of quantum information foundations and technologies.

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JOHN M. CORNWALL
University of California at Los Angeles, USA

JOANNIS PAPAVASSILIOU
University of Valencia–CSIC, Spain

DANIELE BINOSI
European Centre for Theoretical Studies in Nuclear Physics and Related Areas, Italy

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