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PREFACE

Almost all theories of fundamental interactions are nowadays based on the gauge concept. Starting with the historical example of quantum electrodynamics, we have been led to the successful unified gauge theory of weak and electromagnetic interactions, and finally to a non abelian gauge theory of strong interactions with the notion of permanently confined quarks. The early theoretical work on gauge theories was devoted to proofs of renormalizability, investigation of short distance behaviour, the discovery of asymptotic freedom, etc.., aspects which were accessible to tools extrapolated from renormalised perturbation theory. The second phase of the subject is concerned with the problem of quark confinement which necessitates a non-perturbative understanding of gauge theories. This phase has so far been marked by the introduction of ideas from geometry, topology and statistical mechanics in particular the theory of phase transitions. The 1979 Cargèse Institute on "Recent Developments on Gauge Theories" was devoted to a thorough discussion of these non-perturbative, global aspects of non-abelian gauge theories. In the lectures and seminars reproduced in this volume the reader will find detailed reports on most of the important developments of recent times on non perturbative gauge fields by some of the leading experts and innovators in this field. Aside from lectures on gauge fields proper, there were lectures on gauge field concepts in condensed matter physics and lectures by mathematicians on global aspects of the calculus of variations, its relation to geometry and topology, and related topics. The presence of mathematicians as enthusiastic participants and masterful lecturers in this school deserves special mention. We hope this trend will continue in the future and that, in the last quarter of this century, common concerns about the fundamental interactions will bring ever closer the physical and mathematical communities as in the days of yore.

We wish to express our gratitude to NATO whose generous financial contribution made it possible to organise this school. We also thank the Centre National de la Recherche Scientifique, the Délégation à la Recherche Scientifique et Technique, the

C.E.N. de Saclay, as well as the University of Hamburg for financial help. We thank the University of Nice for making available to us the facilities of the Institut d'Etudes Scientifiques de Cargèse. Grateful thanks are due to Marie-France Hanseler for much help with the material aspects of the organisation. Last but not least we thank the lecturers and participants for their enthusiastic involvement which contributed much to the scientific atmosphere of the school.

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