

Preface

Results from LHC, the Large Hadron Collider at CERN, relativistic heavy-ion collision experiments as well as various cosmological observations are expected to shed much light on several aspects of particle physics in the years to come. Study of the formation of the Quark Gluon Plasma in high temperature and high density environments can, for example, lead to a better understanding of strong interactions. In turn, QCD effects have to be understood well to correctly interpret collider results at the electroweak scale. Higher energy processes can be studied in the laboratory of the Universe and particle cosmology can teach us much about issues such as the number of light neutrinos and the effective Lagrangian on GUT scales.

This volume includes reviews that cover various topics in strong interaction physics, anomalies and particle cosmology and are based on lectures that were delivered at the XXI and XXII SERC Main School in Theoretical High Energy Physics held at the Physical Research Laboratory, Ahmedabad and the University of Hyderabad from February 11 - March 3, 2006 and January 18 - February 7, 2007 respectively. We believe that these reviews will be of value to any student of particle physics who is keen on understanding issues in these important areas.

The SERC Schools in Theoretical High Energy Physics have been held regularly since 1985 and provide Ph.D. students with an introduction to important topics in High Energy Physics. The Ahmedabad School covered courses on Cosmology for Particle Physicists, Quark Gluon Plasma, Black Hole Physics and Flavour Physics. Each course consisted of nine lectures, and nine tutorial sessions in which certain concepts and problems were discussed. The lecturers and the tutors for the courses were Urjit A. Yajnik (Indian Institute of Technology Bombay, Mumbai) and L. Sriramkumar (then at Harish-Chandra Research Institute (HRI), Allahabad), Ajit M. Srivastava (Institute of Physics, Bhubaneswar) and (late) Abhee K. Dutt-Mazumder (Saha Institute of Nuclear Physics (SINP), Kolkata), Soumitra Sengupta (Indian Association for the Cultivation of Science, Kolkata) and Sumati Surya (Raman Research Institute, Bangalore), and Sreerup Raychaudhuri (then at Indian Institute of Technol-

ogy Kanpur) and Anirban Kundu (Calcutta University, Kolkata). This volume contains the lectures on Cosmology for Particle Physicists and Quark Gluon Plasma.

The Hyderabad School had four courses with the following topics and lecturers and tutors: Wilsonian RG and Effective Field theory by Shiraz Minwalla and S. Lahiri (Tata Institute of Fundamental Research, Mumbai), Perturbative QCD by V. Ravindran (then at HRI, Allahabad) and P. Mathews (SINP, Kolkata), An Introduction to Anomalies by Dileep Jatkar and Sumathi Rao (HRI, Allahabad) and Electro-Weak symmetry Breaking Scenarios by Gautam Bhattacharyya and Probir Roy (SINP, Kolkata). This volume contains the lectures on Perturbative QCD and Anomalies.

We thank all the lecturers, tutors and students for their dedication and enthusiasm which contributed greatly to the success of the Schools, and also to the preparation of this volume. While this book was being prepared, Abhee Dutt-Mazumder passed away. His lectures on thermal field theory at Ahmedabad were greatly appreciated and we dedicate this book to his memory.

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