Preface

One of the major open problems in theoretical physics is the lack of a unified description of the theory of general relativity and the theory of quantum fields. During the last decades string theory has provided a promising framework for the investigation of this issue. The basic idea is simple and revolutionary at the same time: by replacing the concept of a point particle with a one-dimensional string a whole new field of research has been opened up. The consequences of this are not yet fully conceivable today. Up to now string theory has offered a new way to view all particles as different excitations of the same fundamental object, it has celebrated success by discovering the graviton in its spectrum, it has forced us to consider space-times with more than four dimensions containing dynamical hypermanifolds, D-branes, in their vacuum structure and it has triggered numerous interesting developments in fields as different as condensed matter physics and pure mathematics. Still, as a physical theory string theory is not yet fully understood and remains a very active area of research.

In this book it is our aim to collect pedagogical lectures by leading experts in string theory introducing the reader to some of the newest developments in the field. In no way it is possible to give an overview over the whole research spectrum of string theory. Rather we have carefully selected topics which are at the cutting edge of research in string theory. This includes new developments in topics with long history like for example topological strings or AdS/CFT dualities, but also topics which appeared only recently like doubled field theory and holography in the hydrodynamical regime.

The contributions to this book are selected in a way so that it can be considered as a self-contained textbook. Readers with a basic familiarity with string theory will find it possible to use these lectures to catch up with some of the latest developments, enabling them to follow recent research articles on the subjects.

These lectures were given at the summer school “Strings and Fundamental Physics 2010” in the framework of the Excellence Cluster ‘Universe’, Munich, Germany, and was attended by numerous students and postdoctoral researchers. Videos of the lectures and additional material like exercises can be found on the

webpage of the school: www.theorie.physik.uni-muenchen.de/activities/schools/archiv/sfp10

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