

FRONTIERS IN THEORETICAL PHYSICS

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FRONTIERS IN THEORETICAL PHYSICS

Volume I

Lecture Notes on String Theory, Field Theory, & Holographic Theory

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International Press

www.intlpress.com



HIGHER EDUCATION PRESS

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ISBN: 978-1-57146-446-0

Printed in the United States of America.

Preface

The field of theoretical physics is dedicated to accurately describing the fundamental laws governing the natural world using mathematical language. Its development has not only allowed for a deeper understanding of nature, but also more precise utilization of its laws, while providing rich questions and new inspiration for research in fundamental mathematics. Theoretical physics is one of the core disciplines in basic science.

In order to expose students of theoretical physics to frontier research topics, help them more accurately find their preferred research direction, provide professional training, and facilitate interaction with frontline researchers, Europe and the United States regularly hold short-term courses in theoretical physics for graduate students, such as the “Les Houches School of Physics” in Europe and “TASI Lectures” in the United States. These short-term schools solidify students’ foundational knowledge, broaden their academic horizons, and have an incredibly positive impact on their future academic research. We hope to establish similar short-term schools in China, providing a platform for domestic students interested in studying theoretical physics.

In August 2020, with the support of Professor Shing-Tung Yau, we held the first online summer school on “String Theory, Field Theory, and Holographic Theory”, which achieved excellent results and received positive feedback from students. As a result, we decided to continue this summer school. In August 2021, we held the second online summer school, covering frontier research topics such as scattering amplitudes, supergravity, AdS/CFT and integrability, holographic theories beyond AdS/CFT, and the intersection of cosmology and particle physics.

Encouraged by Professor Yau, we have decided to compile lecture notes from this year’s summer school, which will benefit more students and encourage instructors to perform their best. We hope that the publication of this lecture notes will serve as a good starting point and continue to promote the development of theoretical physics research in China.

Qiang Wen
Southeast University, Nanjing
July 2023

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