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Part I

Superstring Theory

In this part of the thesis I will give an introduction of various aspects of superstring theory. The readers who are already familiar with general knowledge of string theory can safely skip this part and go directly to other topics of interests.

Facing such a vast subject as string theory is now, it is absolutely not my intention to give a complete account of the subjects. Rather I will try to compactly introduce the key concepts and important results that will be crucial for our study of the spectra of supersymmetric states, in systems resulting from various compactifications of superstring theory. This is done as part of the effort to present a self-contained PhD thesis accessible to beginning graduate students of the field and and should not appeal to all readers.

This part of the thesis is organised as follows. In the first section I will begin with aspects of perturbative superstring theory from a world-sheet viewpoint. The resulting spacetime physics will be introduced in the second section, with a focus on low-energy effective action and the relationship with spacetime coupling constants and the world-sheet fields. In the last section I will turn to the non-perturbative aspects of the "superstring theory", where fundamental string loses its fundamental status. Topics included in this section are M-theory and S-duality, D-branes and gauge/gravity correspondence.