Preface

The four articles appearing in this volume present superstring perturbation theory from a geometrical point of view, in terms of super Riemann surfaces. In more detail, the articles are as follows.

The first two articles present background material. Paper I, "Notes on Supermanifolds and Integration," is a basic introduction to supermanifold theory, and Paper II, "Notes on Super Riemann Surfaces and Their Moduli," is a basic introduction to super Riemann surfaces. Generally, there are a variety of references in the literature to the topics treated in Paper I. By contrast, Paper II contains material that does exist in the literature but is not easy to find. For more detail on both of these statements, see the introductions to the two papers.

The main content of this series of papers can be found in Paper III, "Superstring Perturbation Theory Revisited." The reader is assumed to already have a basic familiarity with superstring perturbation theory. What is provided in this paper is a more intrinsic and geometrical formulation in terms of integration over the moduli space of super Riemann surfaces. Hopefully this provides a more direct and natural explanation of the main properties of superstring perturbation theory than one obtains in traditional formulations in which one reduces to the moduli space of ordinary Riemann surfaces with an insertion of picture-changing operators. The main goal of Paper III is to show that superstring perturbation theory is well-behaved, with a physically sensible infrared behavior. The introduction to this paper gives some more detail on what topics are or are not treated there.

Paper IV, "An Overview Of Superstring Perturbation Theory Via Super Riemann Surfaces," gives an informal explanation of some of the main ideas from Paper III, in the context of a particular example (the SO(32) heterotic string on a Calabi-Yau manifold) which is known to be an interesting test case for superstring perturbation theory.

These papers have been written so that they can be read in different ways. One can, of course, start on page 1 of Paper I and work systematically through to the end of Paper IV. However, the reader who wants an overview of the main ideas can start directly with Paper IV, which is written to be relatively self-contained. Alternatively, for a systematic explanation of this geometrical approach to superstring perturbation theory, one can start with Paper III. It is again written to be relatively self-contained, in the sense that it contains a bare minimum explanation of some of the most pertinent

facts about supermanifolds and super Riemann surfaces. Certainly a reader of Paper III might want more detail on some aspects of supermanifolds and/or super Riemann surfaces, and in that case Papers I and II can serve as references. Alternatively, if one has a basic familiarity with supermanifolds and one is interested in super Riemann surfaces, one can start with Paper II.

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