

**Stony Brook University  
The Graduate School**

Doctoral Defense Announcement

**Abstract**

Worldgraph Approach to Amplitudes

By

**Peng Dai**

String theory uses first-quantization formalism (quantum mechanics) to derive scattering amplitudes. External states are considered as vertex operators inserted on the worldsheet generated by an internal string and the amplitudes are calculated perturbatively by calculating vacuum expectation values (vev's) of these vertex operators on worldsheets with different topologies. This approach is different from the common approach of particle theories in which second-quantization formalism (quantum field theory) is adopted to calculate amplitudes. A natural question to ask is whether there exists a first-quantization formalism for particles that gives particle amplitudes to all orders. I will present my recent research in answering this question.

In the first-quantization approach for particles, amplitudes are considered as the vev's of vertex operators inserted on different graphs generated by an internal particle. I refer to these graphs as worldgraphs and first-quantization approach for particles as worldgraph approach. To evaluate these vev's, vertex operators for different external states and Green functions on different worldgraphs are needed. I will present various vertex operators and a general method to obtain scalar Green functions on different graphs. I'll also give some examples of worldgraph approach to amplitudes in scalar theory and Yang-Mills theory.

**Date:** Nov. 11, 2009

**Time:** 11:00am

**Place:** YITP Common Room, Math Tower 6-125

**Program:** Physics and Astronomy

**Dissertation Advisor:** Warren Siegel