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Research field: Mathematical Physics

Keywords: mathematical Physics

Present research

I am interested in the meaning of “quantization” in string theories and quantum field theories, especially their dualities and universality. Very often dualities lead to deep mathematical conjectures. String dualities may lead to the successful unification of general relativity and quantum field theory. My current research interest is as follows:

- Application of duality to low dimensional topology, representation theory and combinatorics.
- Renormalization and quantization: its algebraic, geometric and categorical meaning
- Gauge/gravity correspondence, open/closed string duality

Notice for the students

(1) Mathematical Prerequisites String theory has connection with almost all branch of mathematics. To attack mathematical physics, you should not specialize yourself too early. According to my experience, however, some background knowledge and real experience in

- Representation theory (Lie algebras/groups or finite groups)
- Basic differential geometry and topology

is very helpful.

(2) Physical Prerequisites Motivation for mathematical physics is not what I can give you, but what you should possess before choosing me as your supervisor. If you really want to make a research in mathematical physics, you should have enjoyed struggling through some standard textbooks in physics such as:

- Toda, Kubo, Saito and Hashidume *Statistical Physics I & II*
- G. Parisi, *Statistical Field theory*
- L. D. Landau and E. M. Lifshitz, *Mechanics*
- V. I. Arnold, *Mathematical Methods in Classical Mechanics*
- C. Itzykson and J.-B. Zuber *Quantum field theory*
- M. E. Peskin and D. V. Schroeder, *An Introduction To Quantum Field Theory*

(3) Others Doing research in graduate course is completely different from taking courses. You won't be able to write a master's thesis however hard you read textbooks. Nothing will happen unless you make your own research plan. Always raise your own questions. Deep thinking is more important than shallow grasp. Mathematical physics have been developing very quickly over the last several decades; you may find it difficult to make your own contribution in this area. Knowledge is helpful, but your energy and enthusiasm in your own research will be much more important in the long run.