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Proposed Program of Study

My passion for trying to get to the heart of complicated physical concepts and see what pictures make them tick has formed the basis for all my studies and will continue to do so in the future. This fascination has generated within me an interest in high energy theory due to its manifolds, noncommutative geometry, Feynman diagrams, and other such concepts. As such, I will be using this year, my last at the University of Chicago, to take a wide variety of graduate courses in physics and mathematics that will aid me in my studies of high energy theory. I plan to take a Quantum Field Theory (QFT) sequence of three courses that follows Peskin and Schroeder's *Introduction to Field Theory* and covers the material in the Part III courses: QFT, Advanced QFT, and the Standard Model. In addition, I plan to take a graduate General Relativity (GR) course that had its curriculum designed by R. Wald himself, and closely follows his book. Thus, this GR course at UChicago will overlap with the GR course offered in Part III. Finally, this summer I undertook a project studying Weyl's law on Riemannian manifolds. Working with Riemannian geometry in this fashion would give me a good prerequisite for the Riemannian Geometry course offered in Part III. Therefore, many of the graduate courses I plan to take this upcoming year overlap, or provide prerequisites for, many Applied Mathematics and Theoretical Physics courses in the Part III curriculum. Such an overlap would give me excellent prerequisites, allowing me to take advantage of the most advanced courses offered in Part III.

Taking these advanced courses would help put me close to the frontier of high energy physics. I might take Symmetries, Fields, and Particles; Statistical Field Theory; and Riemannian Geometry during the Michaelmas term; String Theory, Black Holes, and Spinor Techniques in GR during the Lent term; and Supersymmetry, and Classical and Quantum Solitons during the Easter term. Taken with the material I plan to learn in my graduate courses this upcoming year, these courses would give me exposure to all of the content contained in the Particle Physics, Quantum Fields and Strings courses. Additionally, I would get to explore the Relativity and Gravitation courses which are relevant to unification, *and* get to take a course about rigorous approaches to differential geometry. Therefore, this list of courses would allow me to understand a broad range of approaches to unification and topics in high energy theory. I am excited about that potential, but I am particularly excited about the course selection. For example, the course description of the Statistical Field Theory course states field theory "is presented and applied to the Ising model." Since my experience with the Ising model has only been modest and through computational physics, the application of field theory to the model sounds fascinating to me. Additionally, the Black Holes(!) course states that some of the focus will be on QFT in curved spacetime. Needless to say, I am very excited about the possibility of taking the eight courses listed above and really digging deep into the course material.

Having read the Part III Churchill primer and talked to previous Part III participants, I do, however, realize that often the way to get the most out of Part III is by choosing courses based on lecturer quality and not entirely on course content, and that courses change from year to year. As such, if I were to be a Churchill scholar I would commit to surveying a wide array of courses before settling on the courses I would ultimately prepare for examination. Depending on the courses I choose, I would also benefit immensely from the long essay. The essay would give me the opportunity to survey the frontiers of high energy physics and seems pleasantly similar in format to the papers I have written for past UChicago mathematics REUs, including this years' project on Weyl's law on Riemannian manifolds. Finally, I would also like to express that I am very excited not just for the potential of the paper and courses, but also for the ability to work independently to study such fascinating material and to delve into the pictures that make high energy theory tick.