Statement of purpose

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I've chosen to take an undergraduate degree in physics because of my desire to understand the foundations of science. While taking this degree I realized that physics was not what I have thought it was. What I wanted was not to discover the theories that better explain the observed phenomena but an understanding of the theories themselves. Most physical theories are not really well understood. As a mathematician I want to formalize the mathematics they use and seek a better understanding of the organization of the world.

During my undergraduate studies, I have followed several advanced courses in mathematics because I felt that what I knew was not enough to understand the physical theories but also because mathematics always interested me by itself. Through them I became more and more interested in analysis. Presently I'm particularly interested in those fine questions in analysis related to the characterization of properties of solutions of differential equations, problems of the calculus of variations, geometric measure theory and their consequences for physical theories. However, since I'm not acquainted with many of other topics I'm not sure what I'll choose at the end.

I want to pursue my studies essentially because I want to learn new things and I want to be in a challenging environment in top research, where I can contact a varied group of active mathematicians. So I'm interested in a school with regular research seminars and a strong visitor's program. Anyway, before I choose a specific Ph.D. thesis topic I want to acquire a strong background in several different fields of mathematics because I would like to stand on deep and solid bases. Following that line of thought I had decided to do my master thesis on Integrable Hamiltonian Systems since to that I had to study Lie Theory and Differential Geometry, something I knew nothing about just a few months ago. One important reason why I've chosen to get a Ph.D. in the United States is that its graduate programs are well structured and have larger and much more organized course components than most of the places in Europe. That allows for a period of acquisition of wider and deeper knowledge before the attack of specific research problems.

For the past $2\frac{1}{2}$ years I have been teaching advanced calculus to first and second year undergraduate students in mathematics, physics and engineering. This experience has given me a better understanding of some very basic but very important concepts and I could confirm in practice the impression that I would like teaching. I want to follow a career in research and teaching at the university because in doing so I can conciliate my desire to learn and find out new things with my taste for teaching.