Evan D. Randles Application for C.A.M.

Statement of Purpose

My name is Evan Randles. I am a masters student of mathematics at California State University, Northridge, and an LSAMP-Bridge to the Doctorate Fellow. I am currently working on my master's thesis in mathematical relativity under Professor David Klein. I will graduate in May of 2011 with an M.S. in mathematics. My thesis is entitled "*Spacelike Foliations of Robertson-Walker Spacetime by Fermi-Hypersurfaces.*" In May 2010, I graduated with a B.A. in mathematics and a B.S. in physics from CSUN. My next goal is to obtain a Ph.D. in mathematical physics from the Center for Applied Mathematics at Cornell University.

My inspiration for the path I currently follow was a course I took with Professor David Klein, my advisor and mentor. In this course we covered multivariable calculus, including Stokes' theorem and a healthy introduction to Fourier series. I was fascinated by the material, and was motivated by its constant relationship with physics, particularly electricity and magnetism. On my own, I continued to explore these topics, focusing on differential forms. It was clear to me that Maxwell's equations were elegantly expressed in this language.

During my coursework, I was captivated by the central link between linear algebra, functional analysis and quantum mechanics by the Spectral theorem. I was most interested in the axiomatic development of quantum mechanics by its basic postulates, particularly by the physical predictions made by this axiomatization, including the Uncertainty Principle. At this point, I decided to explore the relationship between geometry and gravity.

I began my research in mathematical relativity and cosmology under Professor Klein. Our preliminary discussions centered around the expansion of the universe and geometric definitions of velocity in curved space-times. This led to the exploration of Fermi-surfaces and their defining space-like geodesics in Roberston-Walker space-times. We examined one particular argument regarding the expansion of space involving the existence of superluminal relative velocities between observers as being a coordinate-dependent phenomenon. Through geometrically defined velocities (coordinate independent), I showed that comoving observers in a large class of space-times could exhibit superluminal relative velocities. Following this, we defined a new way to describe the expansion of space. A paper summarizing our research has been accepted for publication in *Annales Henri Poincaré*.

At Cornell I would like to research quantum field theory and functional analysis. The versatility of the Ph.D. program at C.A.M. will enable me to continue pursuing my cross-disciplinary interests. It will allow me to work with experts from the departments of mathematics, physics and chemistry, including Professor Leonard Gross. I met with Professor Gross and discussed some possibilities for my studies at C.A.M.. He encouraged me, as did Professor Klein (an alumnus of C.A.M.), to apply to the Ph.D. program. They both feel C.A.M. is an excellent fit for me.

Upon receiving my Ph.D. my goal is to continue research in mathematical physics and eventually teach at a research-oriented university. In my future work, I will continue to make contributions to mathematics and physics. It is crucial that I share my work and add to the collective body of science. Admission to the Ph.D. program in applied mathematics at Cornell University will make this possible.