

Thesis Proposal

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March 28, 2001

For my senior thesis, I intend to work with Professor Helliwell on the topic of quantum singularities in classical space-times. This continues work he is currently doing with Valerie Arndt for her thesis in physics. It is a good topic for me because while it is unquestionably physical research, it has enough purely mathematical content to involve substantial mathematical work.

A singularity in classical physics is a point on a manifold where the normal laws of physics cease to work properly – an example would be a black hole or a cosmic string. Such a singularity could absorb particles and reemit them at random times, with information effectively disappearing at the singularity. Hence world lines are "cut" by this singularity.

Quantum physics complicates this classical picture because of the impossibility of ascribing a single position to a particle. For this reason, a different characterization of how world lines can be "cut" is necessary. One proposal is that the world lines are cut if a particle has more than one equally valid future as the result of interacting with the singularity. Current work by Professor Helliwell and Ms. Arndt has shown that a certain class of space-

times exhibits this property for a certain class of particles. Possible thesis work would involve extending this result to other classes of space-times or particles.