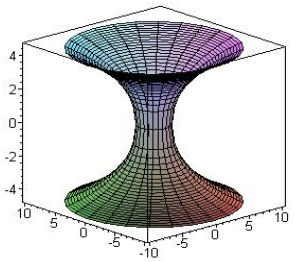

FROM HERE TO ETERNITY AND BACK:
ARE TRAVERSABLE WORMHOLES POSSIBLE?

A Theoretical Analysis of the Morris-Thorne Wormhole Framework with Discussion of Potential Practical Applications

Physics 495 Research Project, Spring 2009
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with advising from Dr. Russell L. Herman

ABSTRACT

Wormholes and their implications for spacetime travel comprise an exciting and burgeoning area of theoretical physics, providing not only excellent fodder for the science fiction aficionado but also prime subject matter for serious investigation by some of history's most reknowned and respected physicists.

In this presentation we provide a brief historical perspective and an outline of the geometric and physical properties necessary for traversable wormholes. We will provide the background in general relativity necessary to understand the simple model introduced by Morris and Thorne, arguably the best working model to date, and how that model satisfies the Einstein equations. In so doing, we will analyze the model in terms of the curvature tensor, the Einstein tensor, and the resulting physical properties. In particular, we will use Cartan calculus in an elegant manner to derive the curvature tensor for the wormhole spacetime. We will present an embedding diagram and geodesics to depict the wormhole's shape and predict what it might be like to travel through the wormhole. We conclude with predictions as to whether a wormhole could provide a realistic vehicle for future interstellar spacetime travel.