Public Abstract

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Title:Quantized massive spin 1/2 fields on static spherically symmetric wormhole spacetimes

Wormhole is a tunnel or shortcut through space and time that enables one to travel to a very far place in a very short period of time, or even travel into the future or into the past. It has not been observed in reality yet, but is a pure theoretical prediction that is based on the solution of the Einstein's field equation.

In a paper published in 1988, Morris and Thorne derived the energy condition for a matter to maintain such a wormhole -- the matter must have negative energy density at the throat of the wormhole. Since normal matter has positive energy density, such a matter is called exotic matter.

Based on the method developed by Peter Groves, I have calculated the energy densities of two quantum fields (the neutrino field and the proton field) in four types of hypothetically existing wormholes. The results of my calculation show that these two fields do have negative energy densities at the throat of the four types of wormholes. But, unfortunately, the negative energy densities are limited to microscopic scales; so the wormholes that these two fields can support are also microscopic, the largest of which is only to the size of a proton. Such small wormholes are not traversable for human beings.