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Can Dirac Fields Source Traversable Wormholes?

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Traversable wormholes have captivated the interest of the public and of theoretical physicists since their inception, with a recent resurgence of interest in the context of holography. While wormhole geometries are permissible within the framework of general relativity, they require matter with "negative energy" to sustain them; specifically, the matter must violate the null energy condition on a sufficiently large scale. Typical classical matter, however, does not possess the necessary properties to support such geometries.

Nonetheless, the question remains open as to whether a Dirac field can generate sufficient violations of the null energy condition to source a traversable wormhole. In this talk, I will present recent progress in exploring this possibility for positive-frequency Dirac fields within static, spherically symmetric wormhole spacetimes. I will examine whether solutions to the Dirac equation can provide the "negative energy" required to make static, spherically symmetric wormholes viable without the need to invoke nonphysical, exotic matter.

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