A New Class of Time Machine

July 8 2005

A physicist at the Israel Institute of Technology in Haifa has proposed a new class of time machines that seems to avoid some of the difficulties inherent in other theoretical time machines.

Like many time machine models, the new proposal requires gravitational fields that curve spacetime in ways that allow observers to travel to their own past. However, unlike previous proposals that have typically required exotic and improbable forms of matter, the new time machine core would consist of a toroidal vacuum embedded in sphere of normal matter.

Important questions remain, but at the very least the material required to make the machine exists in our universe.

Publication:

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Phys. Rev. Lett. **95**, 021101 (2005)
link.aps.org/abstract/PRL/v95/e021101

Abstract

Class of Time-Machine Solutions with a Compact Vacuum Core

We present a class of curved-spacetime vacuum solutions which develop

closed timelike curves at some particular moment. We then use these vacuum solutions to construct a time-machine model. The causality violation occurs inside an empty torus, which constitutes the time-machine core. The matter field surrounding this empty torus satisfies the weak, dominant, and strong energy conditions. The model is regular, asymptotically flat, and topologically trivial. Stability remains the main open question.