

Take a Ride on a Time Machine

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Abstract

We discuss the possibility to build and operate a time machine, a device that produces closed timelike curves (CTCs). We specify the spacetime structure needed to implement a time machine and assess attempted no-go results against time machines in classical general relativity, semi-classical quantum gravity, quantum field theory on curved spacetime, and in Euclidean quantum gravity. Such no-go theorems for time machines would show that, under physically reasonable conditions, CTCs cannot develop in spacetimes initially free of these pathologies. Our review indicates that an investigation of the prospects of achieving no-go results has not been entirely successful in establishing such generality. At the same time, the pursuit of chronology protection results has proved to be a fruitful way to probe the foundations of classical GTR and the interface between general relativity and quantum field theory.

Keywords: Time machines, time travel, causality, closed timelike curves, potency condition, classical general relativity, semi-classical quantum gravity, quantum field theory on curved spacetime, Euclidean quantum gravity

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