

General Relativity and Quantum Cosmology

Trapped ghosts: a new class of wormholes

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We construct examples of static, spherically symmetric wormhole solutions in general relativity with a minimally coupled scalar field ϕ whose kinetic energy is negative in a restricted region of space near the throat (of arbitrary size) and positive far from it. Thus in such configurations a "ghost" is trapped in the strong-field region, which may in principle explain why no ghosts are observed under usual conditions. Some properties of general wormhole models with the ϕ field are revealed: it is shown that (i) trapped-ghost wormholes are only possible with nonzero potentials $V(\phi)$; (ii) in twice asymptotically flat wormholes, a nontrivial potential $V(\phi)$ has an alternate sign, and (iii) a twice asymptotically flat wormhole which is mirror-symmetric with respect to its throat has necessarily a zero Schwarzschild mass at both asymptotics.

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