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Inaccessibility of traversable wormholes

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Wormhole solutions in general relativity have some spectacular local and global properties. An invariant characterisation of a wormhole's throat presents it as an outer marginal trapped surface subject to additional conditions. The requirement that this trapped surface forms within a finite time from the perspective of a distant observer leads to unusual properties of black and white holes and may be contentious. However, it is mandatory if a wormhole is to be traversable.

The paradigmatic traversable wormholes are described by static, spherically symmetric Ellis-Morris-Thorne and Simpson-Visser metrics. We show that no dynamical solution of the semiclassical Einstein equations can have these metrics as their static limit. Conversely, possible static limits of the allowed dynamical solutions are not traversable and result in the breach of a quantum energy inequality that limits the null energy condition violations by quantum fields and/or divergent tidal forces. This finding holds irrespective of the specific properties of fields suggested for wormhole construction, indicating that spherically symmetric wormholes are not feasible in semiclassical gravity. This conclusion does not depend on specific properties of fields that may be proposed for wormhole construction. As a result, spherically symmetric wormholes cannot exist in semiclassical gravity.

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