Hamiltonian Cobordism

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Abstract

We study states charged under global symmetries detected by the Cobordism Conjecture, with the goal of understanding when such states can be realized as smooth, finite-energy configurations in asymptotically flat spacetime that satisfy the initial-value constraints of General Relativity. Assuming some energy conditions on the stress-energy tensor, we show that such states cannot be constructed for symmetries associated with bordism generators that do not admit metrics of positive scalar curvature. Consequently, charged states for these symmetries must either be singular, involve quantum matter violating energy conditions, or lead to the collapse of the asymptotically flat spacetime. These global symmetries therefore become manifest only in the UV. We further explore the implications for symmetries detected by spin bordism. We then consider the bordism groups of spin manifolds admitting positive scalar curvature metrics and argue that they detect approximate global symmetries in the IR. Although such symmetries are broken in the UV, from the IR perspective they indicate the necessity of including matter that violates classical energy conditions.

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