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Knot physics, spacetime in co-dimension 2 CLIFFORD ELLGEN, none — Attempts to describe particles as topological phenomena go back at least as far as Kelvin's conjecture that atoms are knots in the ether. A modern parallel is to ask whether the spacetime manifold of general relativity can be knotted and what properties those knots might have. However, if the manifold is everywhere Lorentzian, then a change of the topology of a spacelike slice of spacetime requires violation of causality. A consistent model emerges if we assume that the spacetime manifold is a 4-dimensional manifold embedded in a 6-dimensional Minkowski space and that each spacelike slice of the manifold has finite energy. A finite energy embedding allows the metric on the manifold to be degenerate on a set of measure zero, therefore the manifold may not be everywhere Lorentzian, which allows for certain types of topology change. An n-dimensional manifold embedded in an n+2-dimensional space can be knotted. We show that the possible knots on the spacetime manifold have properties corresponding to the known elementary particles. If we include the electromagnetic potential then we can use a simple Lagrangian to describe all of the forces including gravity. A simple extension of the assumptions produces quantum field theory.

Clifford Ellgen
none

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