Abstract

This brief explores the use of particle-topology analogs in the Vortex Æther Model (VAM) to construct physically realizable quantum gates. Knot-based particles such as the trefoil (electron), Hopf link (W boson), and Solomon link (e/e) are repurposed as topological logic units. Their genus, chirality, and mutual linkability determine allowable gate operations, entanglement fidelity, and reconnection behavior. This formulation proposes a scalable, geometric alternative to conventional circuit gate architectures.

1. Fermions as Bits, Bosons as Gates

Trefoils encode spin-½ matter bits; Hopf and Solomon links act as vector gate operators, controlling transitions via knot reconnection. W bosons as Hopf links can flip chirality between adjacent trefoils [**?** **?**].

2. Gate Topologies and Allowed Operations

Logic operations (X, Z, CNOT) arise from linking and unlinking configurations. For example, a Hopf-linked trefoil pair undergoing a reconnection acts as a CNOT, while a single Solomon link can mediate a swap via chirality reversal [**?** **?**].

3. Topological Protection

Because operations depend on conserved quantities (link number, genus), gates resist noise-induced errors. Unlike voltage-gated logic, VAM gates rely on swirl vector continuity and curvature invariants [**?**].

Conclusion

A topologically derived logic from particle-knot analogs provides a geometric quantum computation language with built-in symmetry and error suppression.