A Little Topology

- Coffee and donuts:
  - Knots:
    - Exponentially hard problem!
A Little More Topology

Topological Quantum Field Theory:

- Amplitudes depend only on the topology of the process

Therefore,

- Amplitudes = knot invariants

TQFT computer!
Non-Abelian Statistics and Anyons

- Non-Abelian = non-commuting
- Anyons = 2D quasiparticles

- Ground state is degenerate
- Braiding quasiparticles creates transitions between ground states
- Local operators cannot mix ground states
Topological Quantum Computation

- Qubits = degenerate ground states
  - Input = particle pairs from vacuum
  - Output = particle pairs that are not annihilated
- Gates = braids
Surface Codes

- Topological methods to encode information
- Existing qubit technology
- Scalability
- Error correction/suppression
Resources

https://www.youtube.com/watch?v=FAiiXp9IoBk
https://www.youtube.com/watch?v=igPXzKjqrNg