Simulated Spin-foam Amplitudes in Loop Quantum Gravity

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The Project

- **LQG**
  Loop-quantum gravity is a theory that attempts to merge general relativity and quantum mechanics using **spacetime atoms**, which are the smallest discrete unit of space (Planck scale).

- **Quantum simulation**
  This is approached with a quantum simulation of **spin-foam amplitudes**. These amplitudes are the dynamics of the creation and entanglement of spacetime atoms.

- **Circuits**
  Each circuit is a representation of a specific **spin-foam network**, which is a **3+1 dimensional** representation of the spacetime atom dynamics.

Results

Network	Result	Expected	Error
Zero-Spin Monopole	0.2085	0.25	16.59%
One-Spin Monopole	0.2540	0.75	66.14%
Zero-Spin Dipole 1	0.07025	0.0625	12.39%
Zero-Spin Dipole 2	0.01627	0.01625	4.127%

Table: Spin-foam amplitude error of networks

- Zero-spin dipole 2 network had error of 16.62% on the first submission, and 4.127% on the second submission.
- Qubit malfunction in first submission, which is why only the zero-spin dipole 2 network had results to compare with the second submission.