UNIVERSITÉ DE GENÈVE

Exploring Approaches to Quantum Spin Liquid Simulation

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Adiabatic Computing

Leveraging slow parameter changes among Rydberg atoms simulating an easy ground state to maintain the ground state as we move toward a target Hamiltonian representation. Is an idealized, theoretical model that would work infinitely slowly.

Quantum Annealing

A practical application of adiabatic computing that usually achieves the best-case solution, uses a finite amount of time. Used by one Harvard led study to generate promising results indicative of QSL with Kagome lattices.

Trotterization

Using digital quantum computing to simulate analog quantum computing techniques, such as quantum annealing. Would allow us to use more available computing techniques, but is computationally complex to implement.

Digital Quantum Computing

1 Variational Quantum Eigensolver (VQE)

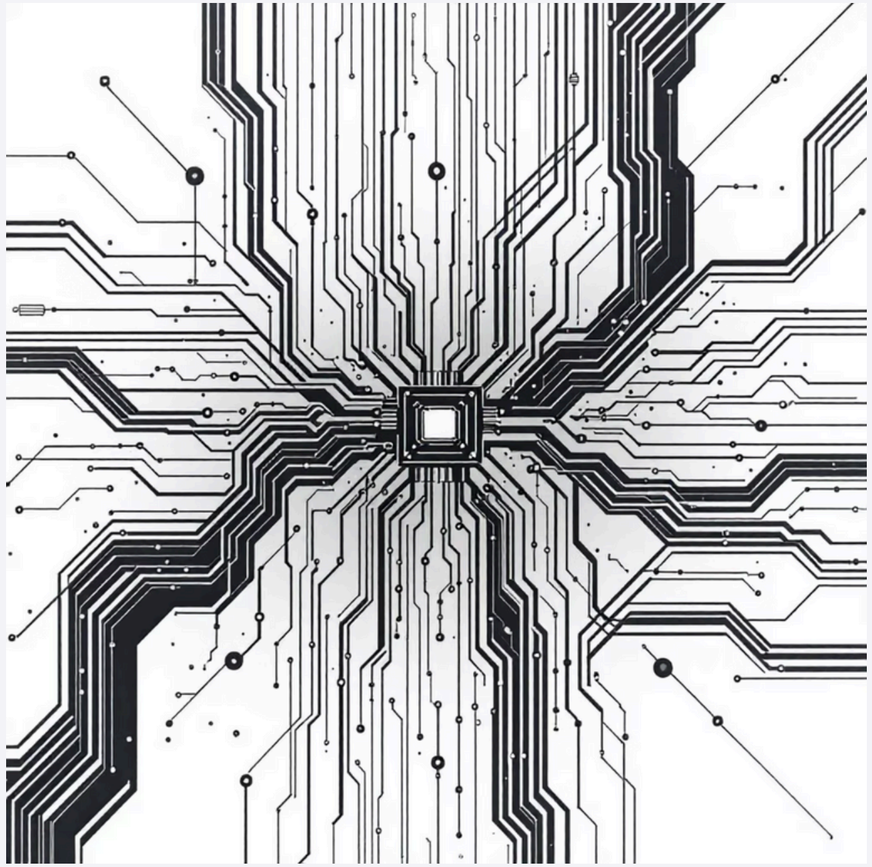
Hybrid classical-quantum algorithm for finding ground state energies of molecular systems.

2 Ansatz Construction

Designing parameterized quantum circuits that capture essential physics of target systems.

3 Ground State Simulation

Reconstructing complete wavefunctions through spin correlation measurements and analysis.



α-RuCl3 Research Strategy

Material Characterization

Investigating α-RuCl3 as a candidate quantum spin liquid with unique magnetic properties and frustrated lattice structure.

Data-Driven Modeling

Applying machine learning techniques to analyze experimental data and predict quantum behavior patterns.

Quantum Simulation

Constructing effective Hamiltonians using 2-week sprint cycles for rapid prototyping and validation of theoretical models.