We reformulate the quantum wave equation (governing the evolution of the quantum computer's wavefunction, $|\Psi\rangle$) as a quantum Boltzmann equation (governing the occupancy probability $\langle\Psi(t)|\hat{n}_\alpha|\Psi(t)\rangle$)

- Quantum mechanical evolution equation:

  $$|\Psi(t+\tau)\rangle = e^{i\hat{H}\tau/\hbar}|\Psi(t)\rangle = \hat{S}\hat{C}|\Psi(t)\rangle,$$

  where $\hat{S}$ is the streaming operator and $\hat{C}$ is the collision operator.

- The probability of occupancy:

  $$p_a(\vec{x},t) \equiv \langle\Psi(t)|\hat{n}_\alpha|\Psi(t)\rangle,$$

  where $\hat{n}_\alpha$ is the number operator for the α^{th}-qubit that is located at the lattice node $\vec{x}$ and is translated along the lattice direction $\hat{e}_a$ by action of the $\hat{S}$ operator.

- Quantum Boltzmann equation:

  $$p_a(\vec{x}+\ell\hat{e}_a, t+\tau) = p_a(\vec{x},t) + \langle\Psi(t)|\hat{C}^\dagger\hat{n}_\alpha\hat{C} - \hat{n}_\alpha|\Psi(t)\rangle.$$

  The collision matrix $\hat{C} = \bigotimes_{x=1}^{V}\hat{U}$, is a separable tensor product (acts on each lattice node independently) and causes local quantum entanglement of outgoing collisional configurations of the particles at each node.