Hybrid quantum computing with ultracold strontium atoms

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Our project has the goal of building a quantum co-processor as part of a hybrid quantum computer that will be tailored to solving problems in quantum chemistry. This will be experimentally realized by trapping strontium-88 atoms in a 2D array of optical tweezers, generated by a spatial light modulator. As qubit states we plan to use the ground $^1S_0$, and clock state $^3P_0$ of the Sr atom. Transitions between these states will be driven by a 698 nm laser and a strong magnetic field. Site selectivity will be achieved with the use of crossed acousto-optic deflectors and may in the future be expanded upon by using a fiber array for parallel qubit addressing. Global excitations to Rydberg states with a 317 nm laser will be used to generate entanglement between the qubits.

On this poster, we will report on the progress we have made so far on building the experimental setup and loading atoms in a blue and red magneto-optical trap. Further, we report on our future plans of using a pulse-based instead of gate-based approach and making our system available online on the Quantum Inspire platform