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**Lattice gauge theories and cold atomic mixtures**

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In the fundamental laws of physics, gauge fields mediate the interaction between charged particles. An example is quantum electrodynamics—the theory of electrons interacting with the electromagnetic field—based on  $U(1)$  gauge symmetry. Solving such gauge theories is in general a hard problem for classical computational techniques. While quantum computers suggest a way forward, it is difficult to build large-scale digital quantum devices required for complex simulations. In this talk, I will present our work on analog quantum simulators of a  $U(1)$  gauge theory in one spatial dimension. To engineer the local gauge symmetry, we employ inter-species spin-changing collisions in an atomic mixture. We demonstrate the experimental realization of the elementary building block and discuss how it can be scaled to a  $U(1)$  gauge theory in one spatial dimension.