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Neutral-atom quantum computing in the Munich Quantum Valley

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Analog quantum simulators based on ultracold atoms trapped in optical lattices can be used to study condensed matter systems with single-site resolution. The quest for more control over individual atoms in such systems has culminated in a new generation of experiments based on atom arrays assembled with optical tweezers. These atom arrays can be created rapidly in arbitrary two- and three-dimensional geometries, and atoms in these arrays can be entangled using long-range Rydberg interactions.

Based on these developments, atom arrays have emerged as one of the most promising platforms to build digital quantum computers, because (1) atoms can realize qubits with many seconds of coherence time; (2) they have no manufacturing variations; and (3) it is easy to scale up to arrays with thousands of qubits. Here, I report on the digital quantum computer demonstrators developed in the academic projects within the Munich Quantum Valley and the commercial quantum computers developed at our spin-off, planqc.

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