

# Exploring New Scientific Frontiers with Programmable Atom Arrays

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We will discuss the recent advances involving programmable, coherent manipulation of quantum many-body systems using atom arrays excited into Rydberg states. Specifically, we will describe our recent technical upgrades that now allow the control of over 200 atoms in two-dimensional arrays. Recent results involving the realization of exotic phases of matter, the study of quantum phase transitions and exploration of their non-equilibrium dynamics will be presented. In particular, we will report on the realization and probing of quantum spin liquid states – the exotic states of matter have thus far evaded direct experimental detection. Finally, the realization and testing of quantum optimization algorithms using such systems will be discussed.