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Coherent control of infinite-dimensional quantum systems[1]

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Theories of quantum control have hitherto made the assumption that the Hilbert space of a quantum system can be truncated to finite-dimensions. All the beautiful results of optimal control of chemical reactions, and control in quantum computing are based upon ths premise. Controllability in an infinite- dimensional quantum system is hard to prove with conventional methods, and infinite-dimensional systems provide unique challenges in designing control fields. In this talk, I will present recent dense-subspace controllability results for an infinite-dimensional quantum system. These results are important from the viewpoint of developing more efficient state-to-state transfer protocols, particularly in quantum computing. I will present examples from the control of infinite-dimensional quantum systems such as Rydberg atoms and trapped-ions. This work expands the scope of quantum control research to beyond that of finite-dimensional quantum systems.

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