

HARVARD UNIVERSITY
17 Oxford Street
Cambridge, MA 02138



**Tuesday, March 16, 2021, at 10:00 (Boston)
14:00 (UK/Eire) 15:00 (C.Europe) 22:00 (China)
Mathematical Picture Language Seminar**

Zoom at: <https://harvard.zoom.us/j/779283357?pwd=MitXVm1pYUIJVzZqT3lwV2pCT1ZUQT09>

Exploring new scientific frontiers with programmable quantum systems

Mikhail Lukin, Harvard University

Abstract: I will discuss recent developments at a new scientific interface between quantum optics, quantum many-body physics, information science and engineering. Specifically, I will focus on two examples at this interface involving realization of programmable quantum systems and their first scientific applications. In the first example, I will describe the recent advances involving programmable, coherent manipulation of quantum many-body systems using atom arrays excited into Rydberg states. Recent progress involving programmable quantum simulations with over 200 qubits in two-dimensional arrays, the exploration of exotic many-body phenomena, as well as realization and testing of quantum optimization algorithms will be discussed. In the second example, I will discuss progress towards realization of quantum repeaters for long-distance quantum communication. Specifically, I will describe experimental realization of memory-enhanced quantum communication, which utilizes a solid-state spin memory integrated in a nanophotonic diamond resonator to implement asynchronous Bell-state measurements. Prospects for scaling up these techniques, including realization of larger quantum processors and quantum networks, as well as their novel applications will be discussed.

