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Quantum Engineering with Atoms and Photons

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The dream of the quantum engineer is for every physics lab to have an arbitrary waveform generator for designing quantum states and Hamiltonians. Atoms in optical cavities offer fertile ground for making progress towards this vision, providing versatility for controlling long-range spin interactions via laser fields. I will give a pedagogical overview of recent work on engineering atom-light interactions for applications in quantum simulation and quantum metrology, highlighting the vital role played by a close interplay of experiment and theory.