4CF15-2015-000298

Abstract for an Invited Paper
for the 4CF15 Meeting of
the American Physical Society

Quantum Optics with Atoms and Photons

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Quantum mechanics has changed the way we think about our world at a fundamental level. It has provided us with a better understanding of the microscopic world, and has allowed us to imagine and realize technologies that have changed the way we live. However, there is still great potential for using quantum properties of physical systems to process information much more efficiently, which could lead to the realization of information technologies outperforming conventional ones. These new technologies could, for example, allow us to communicate in an absolute secure way, or to read out information contained in physical systems with much higher fidelities than what is possible with conventional detection schemes. We study the quantum properties of light and matter to enhance the capabilities of information technologies for measurement, communication and information processing. I will discuss our advancements in the realizations of quantum measurements of states of light with overlapping quantum noise to decode information for communications. In addition, I will present our progress in the study of atom-photon interfaces for quantum information and communications.