Abstract Submitted
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Free-space microwave-to-optical conversion via six-wave mixing in Rydberg atoms[1] JINGSHAN HAN, THIBAULT VOGT, CHRISTIAN GROSS, Center for Quantum Technologies, National University of Singapore, DIETER JAKSCH, Clarendon Laboratory, University of Oxford, MARTIN KIFFNER, WENHUI LI, Center for Quantum Technologies, National University of Singapore — The interconversion of millimeter waves and optical fields is an important and highly topical subject for classical and quantum technologies. In this talk, we report an experimental demonstration of coherent and efficient microwave-to-optical conversion in free space via six-wave mixing in Rydberg atoms [2]. Our scheme utilizes the strong coupling of millimeter waves to Rydberg atoms as well as the frequency mixing based on electromagnetically induced transparency (EIT) that greatly enhances the nonlinearity for the conversion process. We achieve a free-space conversion efficiency of 0.25% with a bandwidth of about 4 MHz in our experiment. Optimized geometry and energy level configurations should enable the broadband interconversion of microwave and optical fields with near-unity efficiency. These results indicate the tremendous potential of Rydberg atoms for the efficient conversion between microwave and optical fields, and thus paves the way to many applications.

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[2]J. Han, T. Vogt, Ch. Gross, D. Jaksch, M. Kiffner, and W. Li, arXiv:1701.07969.

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