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Rydberg Atom-based Sensors for Radio Frequency Spectrum and Waveform Analysis MATTHEW SIMONS, National Institute of Standards and Technology, JOSHUA KAST, Colorado School of Mines, AMY ROBINSON, BRANISLAV KORENKO, University of Colorado, JOSHUA GORDON, CHRISTOPHER HOLLOWAY, National Institute of Standards and Technology — Rydberg atoms have been demonstrated as radio frequency (RF) field sensors over a wide range frequencies, from below 1 GHz to over 200 GHz. Recently, Rydberg atoms have been used for a variety of sensing applications, such as to receiving amplitude, frequency, and phase modulated RF signals, measuring near-field antenna patterns, and discriminating polarization. In this talk we demonstrate the use of Rydberg atoms to measure an RF spectrum through the down-conversion of RF signals. By tuning the LO frequency and monitoring a particular IF frequency, the Rydberg atom-based mixer is used analogously to an RF spectrum analyzer. For a particular atomic state, RF frequencies can be detected within a bandwidth around the center frequency. We examine the reception of multiple signals, various types of signals, intermodulation, and distortion. A Rydberg atom-based spectrum analysis may be particularly advantageous at high frequencies (above 100 GHz). The atom-based mixer can also be used to detect RF waveforms, such as a chirped signal. As an RF signal frequency is varied, the IF signal frequency output from the atom mixer will vary as the difference between the LO and signal, corresponding to the chirp. We show the results of detecting a chrirped RF signal with Rydberg atoms.

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