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Rydberg Atom-based Radio Frequency Sensing for Communications, Metrology and Radar

Wednesday, May 29, 2024 11:30 AM (30 minutes)

We will present an overview of Rydberg atom-based sensing for applications in metrology, communications and radar. Rydberg atom sensors are a new type of radio frequency sensor that promise to have a wide range of uses. Rydberg atom-based sensors have advantages like electromagnetic transparency, self-calibration, broad carrier bandwidth, and optical readout that are unique when compared to conventional antennas. Experiments on a novel approach to Rydberg atom-based sensing that uses a collinear three-photon read-out and detection scheme will be described in this presentation. The experiments show that the collinear three-photon scheme extends the sensing range of the self-calibrated, Autler-Townes sensing mode to lower electric field strengths, while simultaneously improving sensitivity. We demonstrate proof of concept and present concrete results from first experiments, where the spectral resolution is increased by >18 over conventional methods and the sensitivity is increased by >15 over other all-optical readout experiments. Approaches to engineering vapor cells for specific applications will also be described. Experiments on vapor cells that integrate amplification of the RF target signal will be presented. The vapor cell designs are centered on photonic crystal and metamaterial concepts. Vapor cell engineering is a critical element in the development of any Rydberg atom-based sensor.

Keyword-1

Keyword-2

Keyword-3

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