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Demonstration of an RF Electrometer Based on EIT Spectroscopy of Non-Resonantly Dressed Rydberg Atoms in a Vapor Cell[1]
LINGYUN CHAI, ROBERT JONES, Univ of Virginia — We present a technique for measuring the amplitude of rf fields of arbitrary frequency. The method uses Rydberg atoms in a Rubidium atomic vapor cell as a detection medium, and electromagnetically induced transparency (EIT) spectroscopy as an optical readout. Unlike other schemes that rely on resonant coupling between Rydberg states [1], our technique is based on non-resonant Rydberg dressing in combined AC and DC fields. The electrometer is self-calibrating from the Rydberg polarizability. Mixing of the AC and DC fields through the second-order Stark shift produces sidebands in the EIT signal, flanking the primary resonance feature associated with the optical 5p – 32s transition. The spectral location of the sidebands reveals the AC field frequency. The ratio of the sideband intensity to that of the central EIT feature gives the AC field amplitude in terms of directly measured quantities. In preliminary work, field amplitudes less than 200 mV/cm have been measured at frequencies from 20 to 100 MHz. With improved laser stability and the use of different Rydberg states, it should be straightforward to significantly improve the amplitude sensitivity and extend the frequency response well into the GHz regime. [1] J. A. Sedlacek et al., Nat. Phys. 8, 819 (2012).

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Lingyun Chai
Univ of Virginia

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