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Higher-order harmonics for 3D-cavity microwave magnetometry with Rabi resonances. ANDREI TRETIAKOV, CLINTON POTTS, JOHN DAVIS, LINDSAY LEBLANC, University of Alberta — Atomic systems can be used in quantum information applications as an interface between microwaves, which can couple to superconducting quantum circuits, and electromagnetic waves at optical or telecom wavelengths, which are well-suited for transferring quantum information along optical fibers. In addition, due to long coherence times, atomic hyperfine ground states are very promising for microwave quantum memory. Strong coupling to the microwave field, essential for efficient performance, can be achieved by placing the atomic ensemble inside a 3D microwave resonator. A convenient way to measure the coupling strength is to apply a phase modulation to the microwave field and analyze the spectrum of the steady-state oscillations in the population of the hyperfine levels. Here, we go beyond the usual small-signal approximation and experimentally show presence of higher order harmonics in this spectrum in cold ^{87}Rb atoms. We will extend this technique to experimentally study the microwave field inside the 3D resonator and explore applications of this system. Along with numerical simulation, we study the potential of this technique for improving the precision of microwave magnetometry.

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