Contributed Session

Quantum Metrology IV

10:30 am â€“ 12:18 pm, Wednesday June 18 // Session F06 // Oregon Convention Center, D135-136

Chair: Bachana Lomsadze, Santa Clara University

Topics: Lasers; Quantum Information; Quantum Optics; Metrology; Applications ...

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Transmission spectroscopy of ultracold Rydberg atoms inside a microwave cavity.

11:54 am – 12:06 pm

Presenter: Manuel A. A Lefran Torres (Sao Carlos Institute of Physics at the University of Sao Pau)

Authors: Jorge D. Kondo (Departamento de FÃsica, Universidade Federal de Santa Catarina), Luis Marcassa (University of SÃ£o Paulo)

We have investigated the transmission spectroscopy of Rydberg atoms held in a magneto-optical trap, placed inside a customized microwave cavity. The cavity's frequency of 13.053 GHz is resonant with theÂ Â $67S_{1/2}$Â â†' $66P_{3/2}$Â transition, inducing ladder-type multiphoton microwave absorption and emission in the Rydberg atoms. Rydberg atoms are generated through a two-step process. First, two optical photonsâ€"one at 780 nm and the other at 480 nmâ€"couple the ground state ($5S_{1/2}$) to an intermediate Rydberg stateÂ Â ^{85}Rb(66 â‰¤ n â‰¤ 68 $S_{1/2}$)Â in a ladder configuration. By observing the transmission of a probe laser beam at 780 nm as a function of the coupling laser frequency at 480 nm, we were able to detect Rydberg excitations of about 1-2%. These results represent an improvement compared to our recent work [1]. Additionally, they suggest that Electromagnetically Induced Transparency (EIT) may be achievable in such a system. This could provide valuable insights for the advancement of Rydberg-based sensors, quantum gates in hybrid systems, and the broader development of quantum technologies.

[1]Â J. D. Massayuki Kondo et al. Multiphoton-dressed Rydberg excitations in a microwave cavity with ultracold Rb atoms. Phys. Rev. AÂ 110, L061301, DOI:Â https://doi.org/10.1103/PhysRevA.110.L061301. (2024)

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