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Observation of magnon number states in a superconducting qubit spectrum DANY LACHANCE-QUIRION, Université de Sherbrooke, YUTAKA TABUCHI, SEIICHIRO ISHINO, ATSUSHI NOGUCHI, TOYOFUMI ISHIKAWA, REKISHU YAMAZAKI, KOJI USAMI, RCAST, The University of Tokyo, YASUNOBU NAKAMURA, RCAST, The University of Tokyo, CEMS, RIKEN — A quantum transducer interfacing qubits in the microwave domain to optical light requires a quantum system interacting with photons of both frequency domains. Coherent interaction between collective excitations (magnons) in the ferrimagnetic insulator yttrium iron garnet (YIG) and a superconducting qubit through virtual microwave photons has recently been demonstrated [1]. In this talk, we present results on the observation of magnon number states in a superconducting qubit spectrum when creating a coherent state in a magnetostatic mode of a YIG sphere interacting dispersively with the qubit. The dispersive interaction strength of 1.2 MHz measured in the straddling regime is in good agreement with numerical simulations. Furthermore the probability distribution of magnon number states, recovered from the qubit spectrum, is compared with the Poisson distribution expected for a coherent state. Resolving magnon number states constitutes a first step toward encoding quantum information into a quantum state of a magnetostatic mode [2].

[1] Y. Tabuchi, S. Ishino, A. Noguchi, T. Ishikawa, R. Yamazaki, K. Usami, and Y. Nakamura, Science 349, 405 (2015).

[2] Z. Leghtas, G. Kirchmair, B. Vlastakis, M. Devoret, R. Schoelkopf, and M. Mirrahimi, Phys. Rev. A 87, 042315 (2013).

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