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Strongly Coupled Magnetostatic Modes of YIG and Planar MW Resonators for Applications in Quantum Sensing and Information

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Significant progress has been made in the last decade in quantum sensing and information processing, and there is rising interest in hybrid quantum systems (HQS) to bridge various modalities of these technologies. The main topic of this talk is the HQS based on utilizing the magnetostatic modes of a YIG sphere strongly coupled with planar microwave (MW) resonators.
This study used a 250-micron-diameter YIG sphere and a 5-micron-thick YIG film on a GGG substrate to effectively excite and control magnetostatic modes using planar MW resonators. Coplanar waveguides (CPWs) and Inverse anapole resonators (IAR) are two examples of planar MW resonators that offer a flexible framework for controlling and confining microwave fields. By positioning the YIG sphere close to the regions of concentration of MW filed in these resonators, we enable the hybridization of their eigenmodes with the magnetostatic modes of the YIG sphere. This results in a strong and tunable magnon-photon coupling, enabling enhanced control and manipulation of quantum states.
The strong interaction between magnons and microwave photons offers efficient conversion between microwave and magnon excitations, paving the way for quantum transduction and quantum state transfer between different physical systems with improved coherence and control, which can enable practical implementations of quantum sensors, transducers, and processors [1].

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Reference list

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