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Novel High Cooperativity Photon-Magnon Cavity QED MICHAEL TOBAR, JEREMY BOURHILL, NIKITA KOSTYLEV, MAXIM G, DANIEL CREEDON, School of Physics, University of Western Australia, ARC Centre of Excellence for Engineered Quantum Systems — Novel microwave cavities are presented, which couple photons and magnons in YIG spheres in a super- and ultra-strong way at around 20 mK in temperature. Few/Single photon couplings (or normal mode splitting, 2g) of more than 6 GHz at microwave frequencies are obtained. Types of cavities include multiple post reentrant cavities, which co-couple photons at different frequencies with a coupling greater that the free spectral range, as well as spherical loaded dielectric cavity resonators. In such cavities we show that the bare dielectric properties can be obtained by polarizing all magnon modes to high energy using a 7 Tesla magnet. We also show that at zero-field, collective effects of the spins significantly perturb the photon modes. Other effects like time-reversal symmetry breaking are observed.

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