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Title:Sub-THz dielectric resonance in single crystal yttrium iron garnet and magnetic field tuning of the modes

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Abstract: The observation of dielectric resonance over the frequency range 40-110 GHz in single crystal yttrium iron garnet (YIG) and its magnetic field tuning characteristics are reported. The dimensions of YIG are appropriately chosen in order to have the dielectric resonance occur at a much higher frequency than the ferromagnetic resonance and avoid any hybrid spin-electromagnetic modes. The dielectric modes are magnetically tunable by 1 GHz with a magnetic field of ~ 1.75 kOe. The tuning range and required bias magnetic fields, however, can be controlled with the sample dimensions (or the demagnetization factor N_{zz}). Theoretical calculations on magnetic field tuning characteristics for the dielectric modes are in reasonable agreement with the data. The theory also predicts a similar magnetic tuning of the dielectric modes in the sub-THz frequency range as well. The dielectric modes that can be tuned with a magnetic field are of importance for the realization of low-loss tunable devices, including resonators, isolators, and phase shifters operating in the sub-THz region.

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