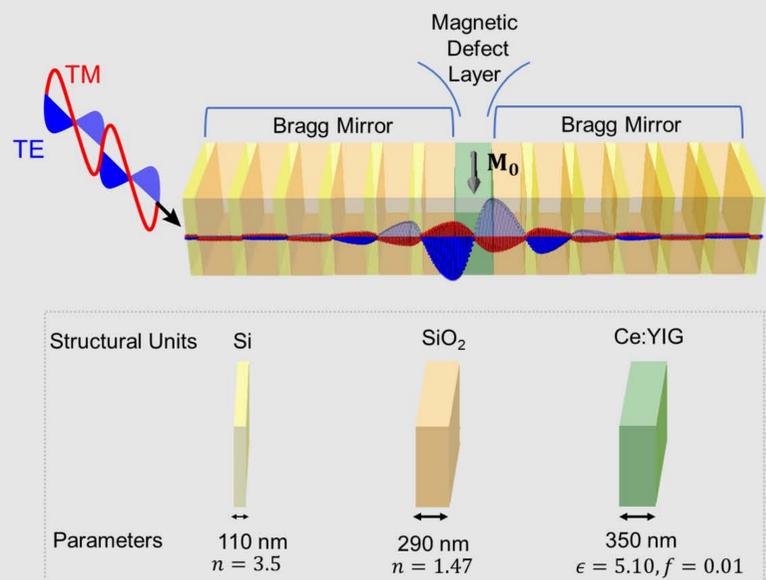


PLANAR OPTOMAGNONIC STRUCTURES

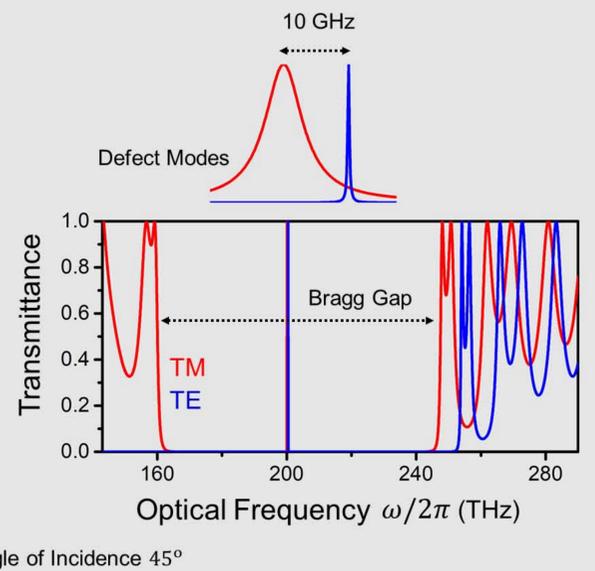
Adiabatic description and beyond

Structure

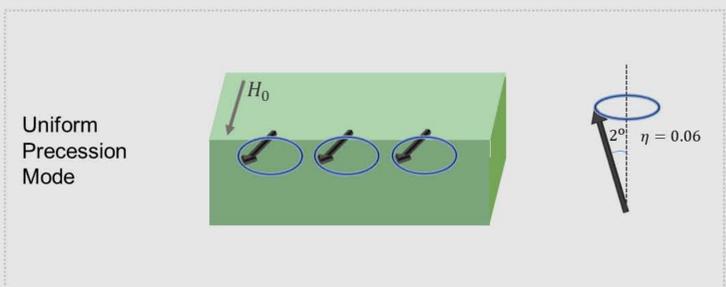


- ✓ Voigt Configuration
- ✓ Telecom Frequencies
- ✓ High-Q Resonances
- ✓ Optical Defect Modes Localized in the Magnetic Film

Static Optical Response



Spin Waves



- ✓ Magnons Localized in the Magnetic Film

$$\Omega = \gamma\mu_0\sqrt{H_0(H_0 + M_0)} \quad \mathbf{M}/M_0 = \hat{x} + \eta A_y \sin(\Omega t) \hat{y} + \eta A_z \cos(\Omega t) \hat{z}$$

$$A_y = \sqrt{\frac{H_0 + M_0}{2H_0 + M_0}} \quad A_z = \sqrt{\frac{H_0}{2H_0 + M_0}}$$

η : Spin-wave amplitude

Optomagnonic Interaction

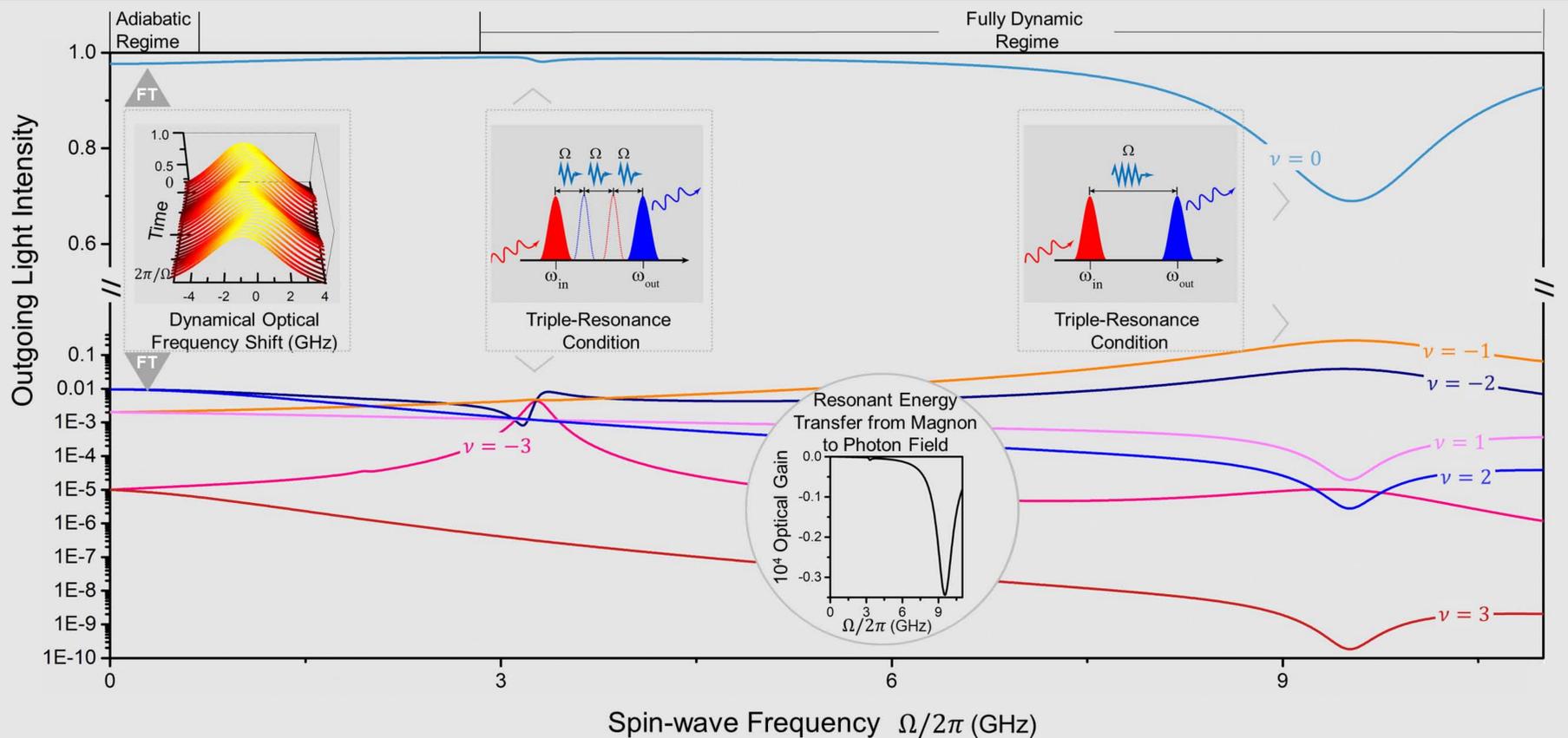
$$\delta\epsilon(t) = \frac{1}{2} [\delta\epsilon \exp(-i\Omega t) + \delta\epsilon^\dagger \exp(i\Omega t)] \quad \delta\epsilon = f\eta \begin{pmatrix} 0 & iA_z & A_y \\ -iA_z & 0 & 0 \\ -A_y & 0 & 0 \end{pmatrix}$$

- ✓ Quasistatic Adiabatic Approach
- ✓ Fully Dynamic Time-Floquet Scattering-Matrix Method
- ✓ Outgoing Light Beams $\sim e^{i(\omega - \nu\Omega)t}$
- ✓ ν -Magnon Absorption/Emission

Selection Rules

- ✓ Propagation Direction Conservation
- ✓ Energy Conservation $\omega_{\text{out}} = \omega_{\text{in}} \pm \nu\Omega$
- ✓ Polarization Conversion (TM \leftrightarrow TE) under One-magnon Exchange

Results



Conclusions

- ✓ Simultaneous Subwavelength Localization of Light and Spin Waves
- ✓ Strongly Enhanced Photon-Magnon Interaction
- ✓ Optical Sideband Generation
- ✓ 30% Conversion Efficiency
- ✓ Multimagnon Absorption/Emission Processes
- ✓ Resonant Energy Transfer from Magnon to Photon Field
- ✓ Perfect Matching Between Adiabatic and Dynamical Theories

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