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# THERMAL CONTROL OF THE MAGNON-PHOTON COUPLING IN A NOTCH FILTER COUPLED TO A YIG/Pt SYSTEM

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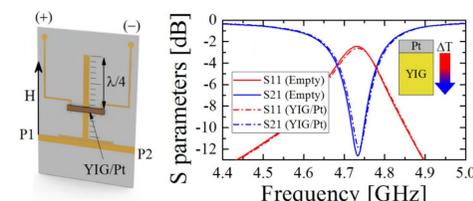
## INTRODUCTION

- **Thermal control** of mode hybridization between the ferromagnetic resonance and a planar resonator [1]
- **Hybrid system:** The chosen magnetic material is a YIG film covered by 6 nm of platinum (Pt)
- **A current-induced heating method** has been used in order to enhance the temperature of the YIG/Pt system

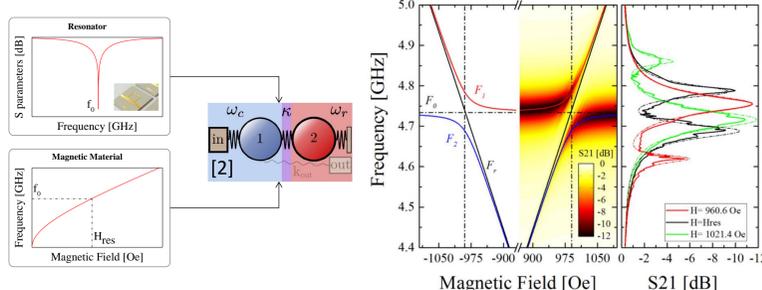
## COMPACT DESIGN DESCRIPTION

### ► Notch filter configuration:

- Replace a massive resonant cavity [2] with a planar configuration resonator
- Control precisely the coupling strength
- Improve the integration of future spin-based microwave devices



## STRONG COUPLING REGIME



### ► Magnetic field dependence of the frequency:

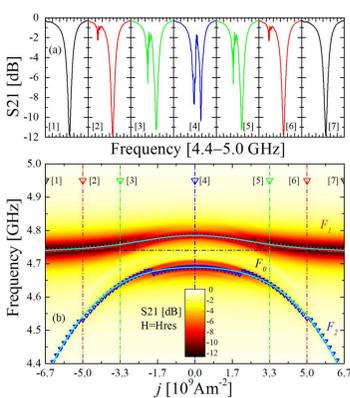
- Observation of the strong coupling regime via the **anticrossing fingerprint** described by:

$$F_{1,2} = \frac{1}{2}[(F_0 + F_r) \pm \sqrt{(F_0 - F_r)^2 + k^4 F_0^2}] \quad (1)$$

### ► Frequency dependence of S21:

- at different applied magnetic fields using the analytic solution from [2].

## THERMAL CONTROL

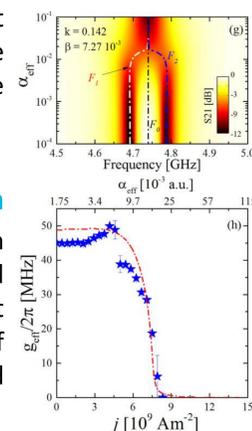


### ► Charge current injection:

- (a) frequency dependence of the S21 the resonant condition for different applied charge current. Labels 1–7 correspond to the magnitude of the applied charge current as indicated in (b).
- (b) Charge current dependence of the frequency measured at the resonant condition. Solid cyan curves correspond to the current dependence of the hybridized frequencies based on Eq. (1), including the temperature dependence of Fr

### ► Thermal annihilation of the coupling strength

- The charge current dependence of the transmission spectra of our system suggests a control of the magnetic losses ( $\alpha_{\text{eff}}$  in our case). It should be noted that our notch filter features remain unchanged as function of the current density sent into the Pt strip. The effect of the Pt heating is not only a shift of the resonance (tuning) but also an increased broadening (decoupling) caused by inhomogeneous heating.



## CONCLUSION & PERSPECTIVES

- **Thermal control of mode hybridization**
- **Potential for tunable filter applications:**
  - Electrically controlling the transmission spectra
  - Magnon-photon coupling strength
- **Perspectives:**
  - Elaboration of **3D printed microcavity**

High Q factor? ✓

Strong coupling regime? ✓

## REFERENCES

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[3] L. Bai et al., PRL 114, 227201 (2015)

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