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Spintronic emitters in the Terahertz Regime

Applied optical spectroscopy

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Outline

Recap
- The spectrum
- Applications for THz

Introduction
- Common emitters

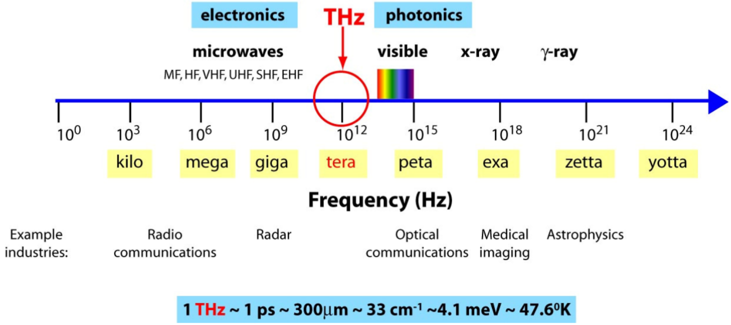
Inverse Spin Hall effect

Advantages
- Polarization
- Broadband

Conclusion

References

The THz Gap



The electromagntic spectrum from G. P. Williams, Rep. Prog. Phys, **69** (2005) .

Terahertz

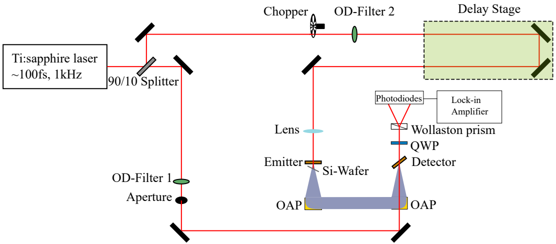
So why do we need terahertz radiation?

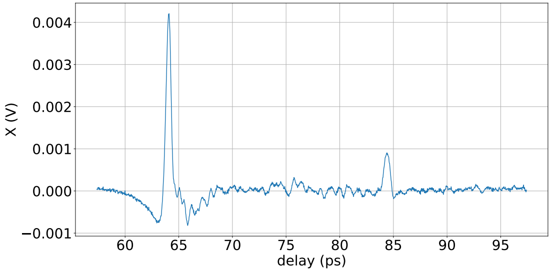
- medicine
- security
- data transmission & saving
- physics

Introduction

Common emitters:

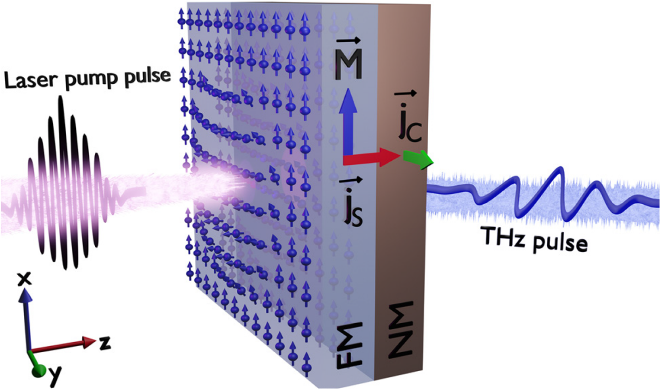
- PCA
- Non linear crystals



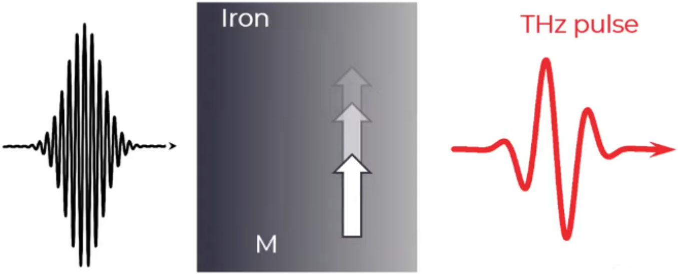


What are Spintronic emitters?

- Ferromagnetic Material (FM)
- Non Magnetic (NM)
- Magnetic field

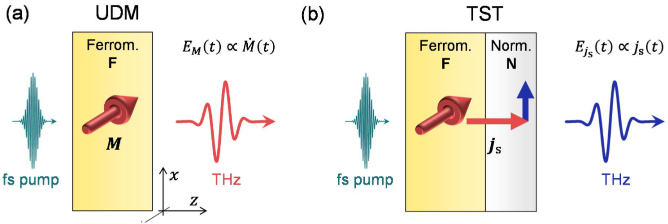


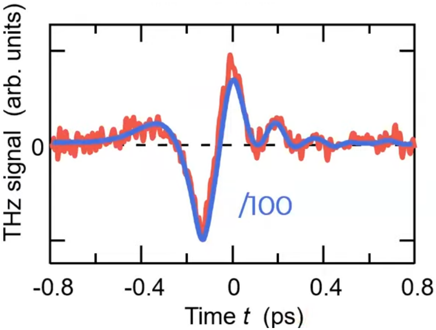
How does it work?



$$E_{\mathrm{DM}} \propto \dot{M}(t) \tag{1}$$

Stronger if we attach NM



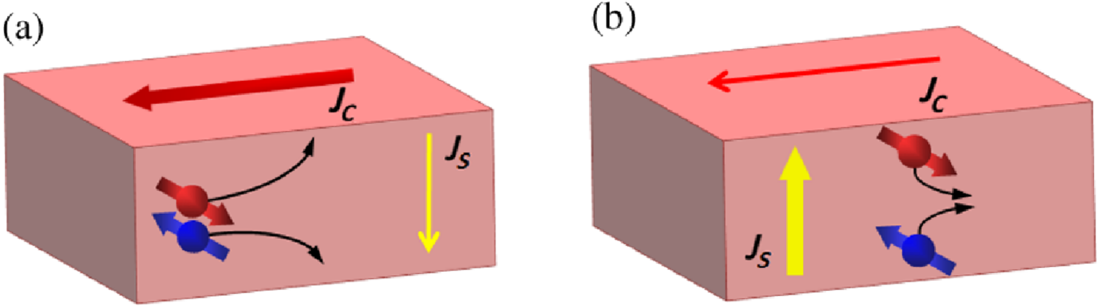


Where does the current come frome?

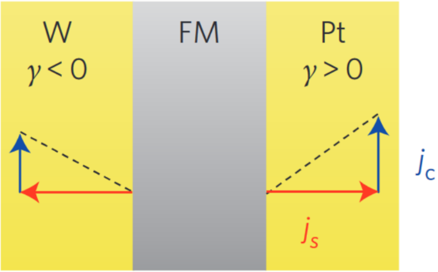
Inverse Spin Hall effect!

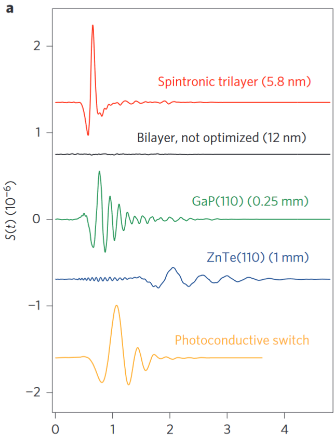
Spin Hall effect

Inverse Spin Hall effect



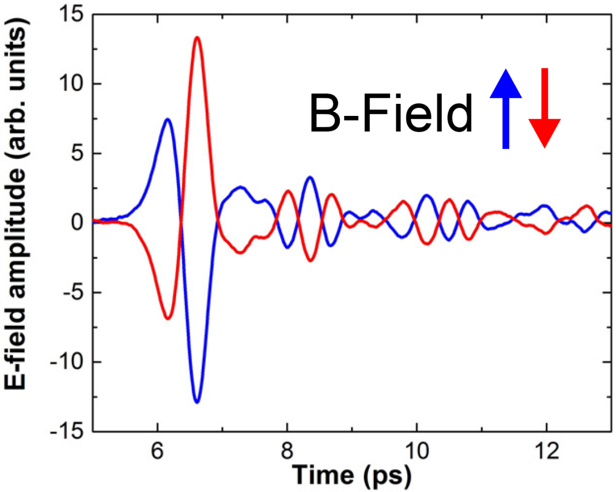
Two Layers are not the end





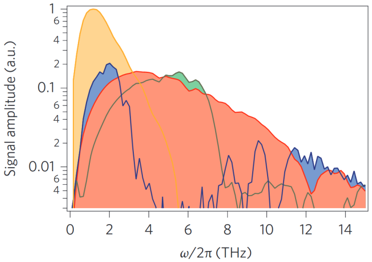
Polarization

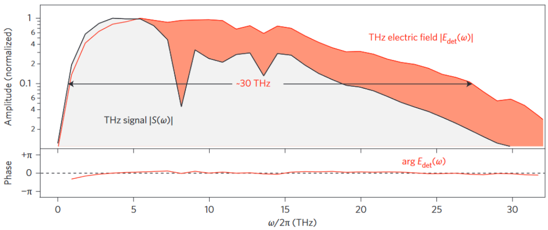
- Change in B-Field changes THz-Field Polarization
- No filter needed
- → Easy change of THz-Field Polarization



Broadband

- Super Broadband Signal
- Achieved with
  W/Co40Fe40B20/Pt (5.8 nm)





Conclusion

- Easy to setup
- Cheap to produce
- High damage threshold
- Easy change in Polarization
- Very Broadband (no phonon modes)
- No problems with phasematching

Thank you all for your attention!

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