

Spintronic emitters in the Terahertz Regime

Applied optical spectroscopy

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Outline

Recap

The spectrum

Applications for THz

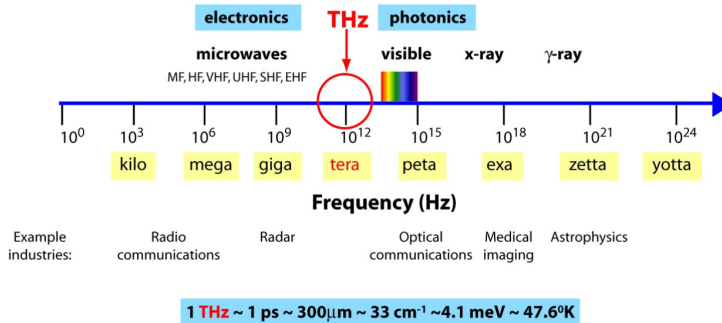
Introduction

Common emitters

Inverse Spin Hall effect

References

The THz Gap



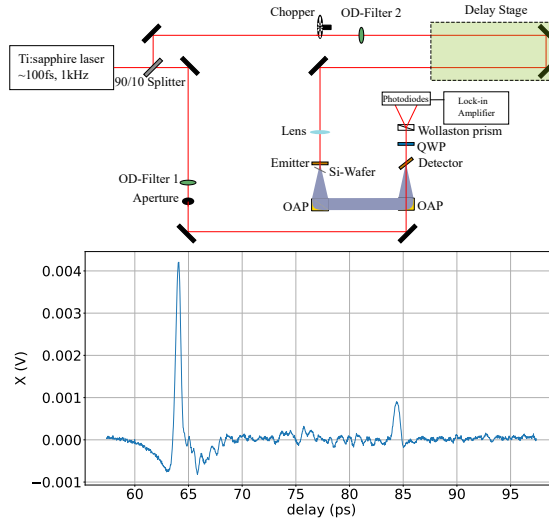
The electromagnetic spectrum from G. P. Williams, Rep. Prog. Phys, **69** (2005).

Terahertz

So why do we need terahertz radiation?

- medicine
- security
- data transmission & saving
- physics

Introduction

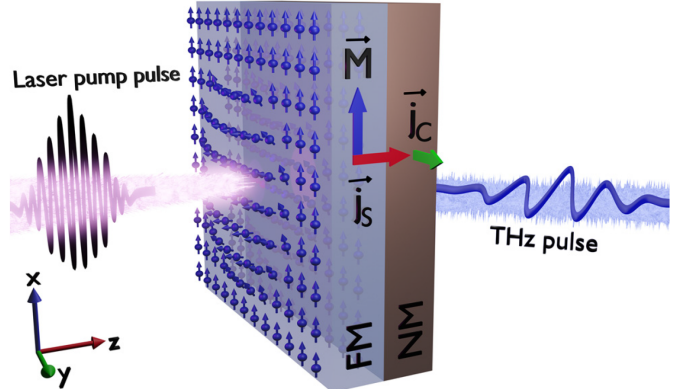


■ PCA

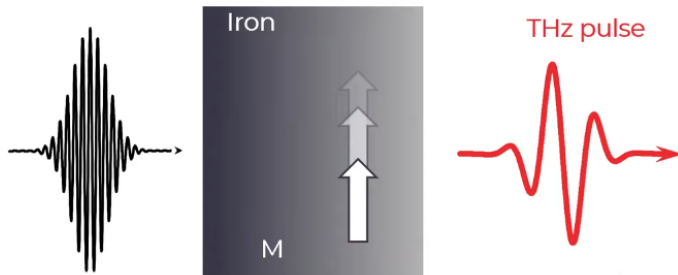
■ Non linear crystals

What are Spintronic emitters?

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



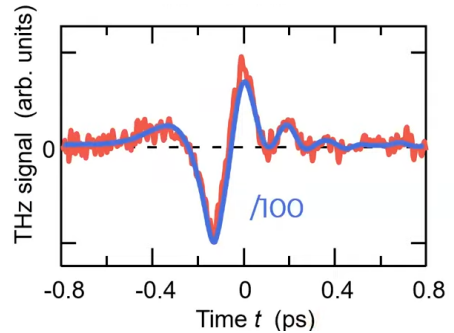
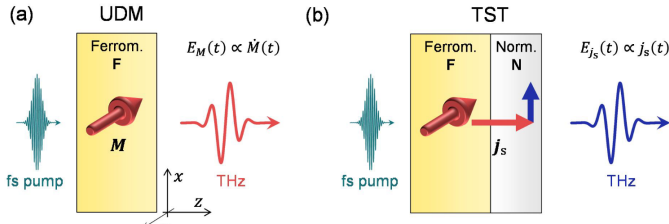
How does it work?



$$E_{\text{DM}} \propto \dot{M}(t)$$

(1)

Stronger if we attach NM

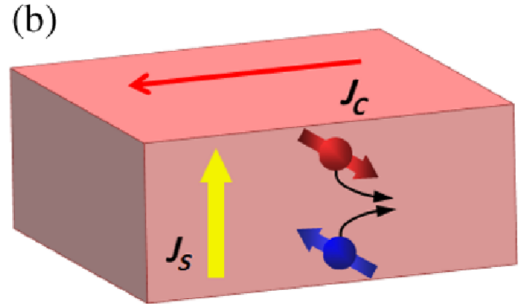
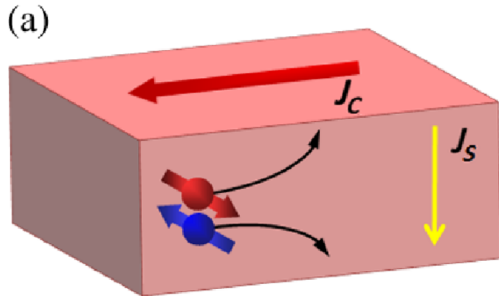


Where does the current come from?

Spin Hall effect

Inverse Spin Hall effect!

Inverse Spin Hall effect



Thank you all for your attention!

- [1] Gwyn P Williams. “Filling the THz gap—high power sources and applications.” In: *Reports on Progress in Physics* 69.2 (2005), p. 301.
- [2] Y. P. Ashish et al. “Terahertz technology and its applications.” In: *Drug Invention Today* 5.2 (2013), pp. 157–163. ISSN: 0975-7619. DOI: <https://doi.org/10.1016/j.dit.2013.03.009>.
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- [4] K. Rikkinen et al. “THz radio communication: Link budget analysis toward 6G.” In: *IEEE Communications Magazine* 58.11 (2020), pp. 22–27.
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- [6] I. Wilke and S. Sengupta. Nonlinear Optical Techniques for Terahertz Pulse Generation and Detection—Optical Rectification and Electrooptic Sampling. CRC press, 2017, pp. 59–90.
- [7] R. Rouzegar et al. “Laser-induced terahertz spin transport in magnetic nanostructures arises from the same force as ultrafast demagnetization.” In: (2021). DOI: [10.48550/ARXIV.2103.11710](https://doi.org/10.48550/ARXIV.2103.11710). URL: <https://arxiv.org/abs/2103.11710>.