Corso di Dottorato in Scienza e Tecnologia per la Fisica e la Geologia XXX Ciclo

Pauselli Maurizio

Who am I ???

- Bachelor's Degree in 2012.

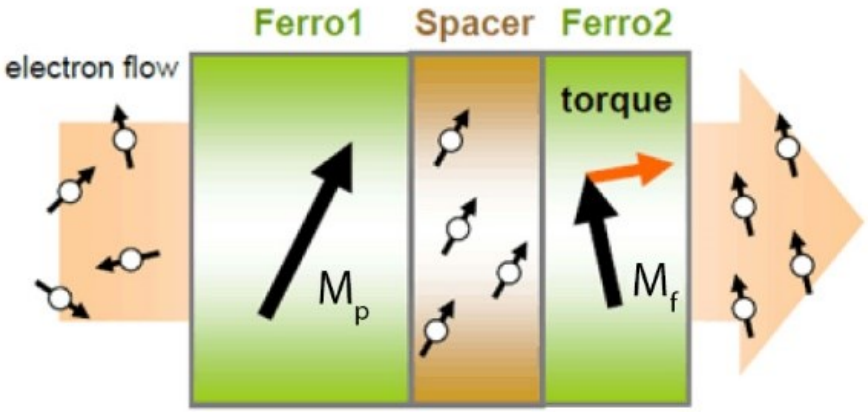
  Thesis argument: "Spintronic Devices".

- Post graduate Master's Degree in 2014.

  Thesis argument: " Study of magnetization dynamic induced by Spin polarized current in ferromagnetic nano-Pillar and nano-Contact".

- Currently PhD Student.

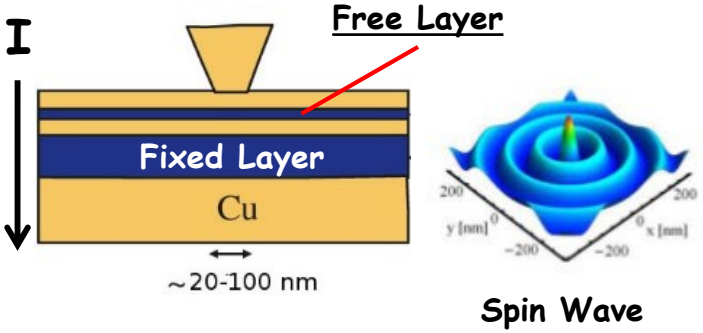
My past work……. Spin Tranfer Torque



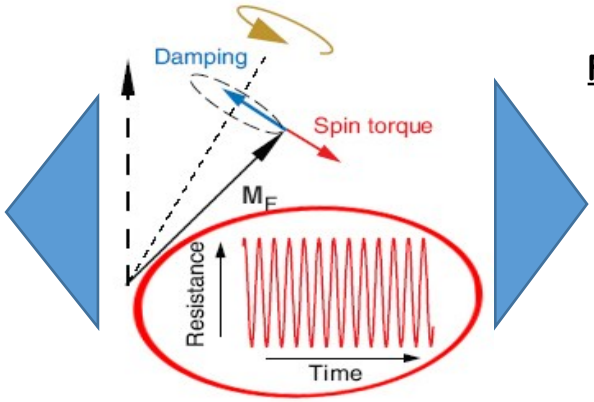
$$\frac{\partial \boldsymbol{M_F}}{\partial t} = -\gamma \boldsymbol{M_F} \times \mathbf{H}_{eff} + \frac{\alpha}{M_s}\left(\boldsymbol{M_F} \times \frac{\partial \boldsymbol{M_F}}{\partial t}\right) + \frac{g\mu_B J}{deM_s^2}\epsilon(\theta,\eta)[\boldsymbol{M_F} \times (\boldsymbol{M_F} \times \boldsymbol{M_P})]$$

Precession **Damping** **Spin Tranfer Torque**

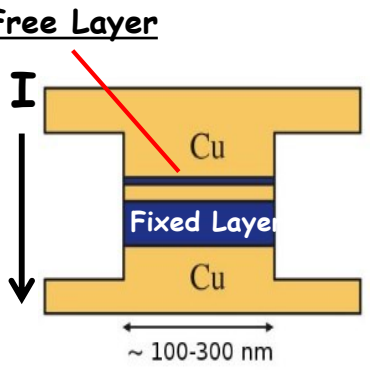
Nano-Contact

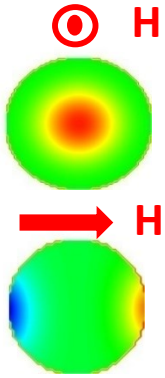


Spin Wave



Nano-Pillar

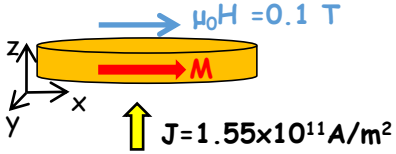




Eigenmode

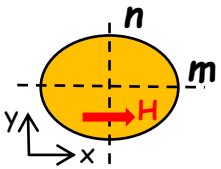
My past work……Nano-Pillar

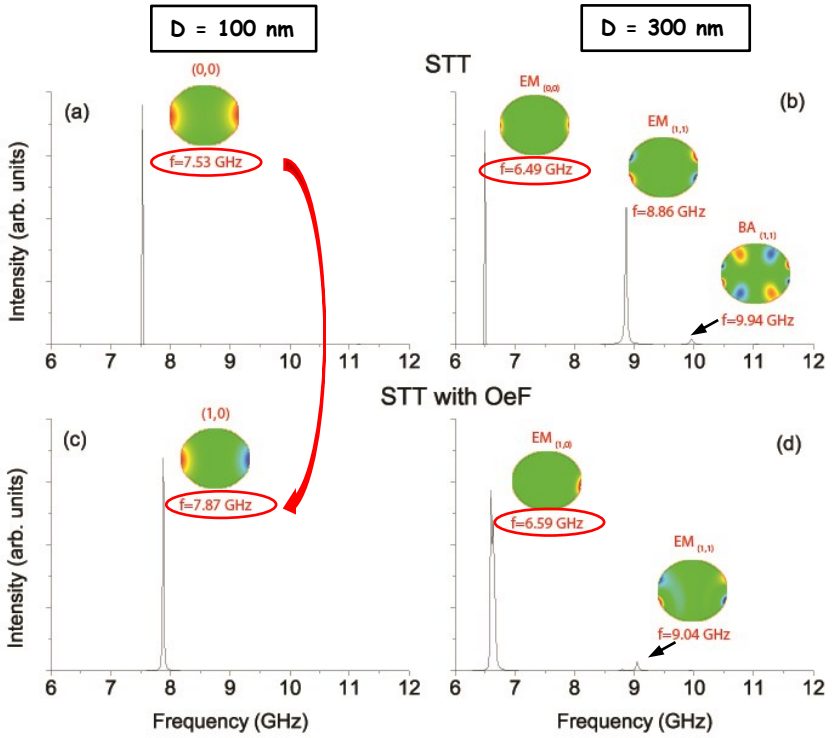
H in-Plane



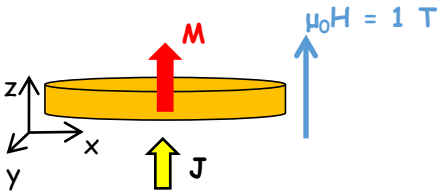
Mode classification (n,m):

- *n* nodal plane ⊥ to H
- *m* nodal plane ∥ to H



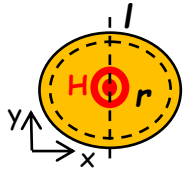


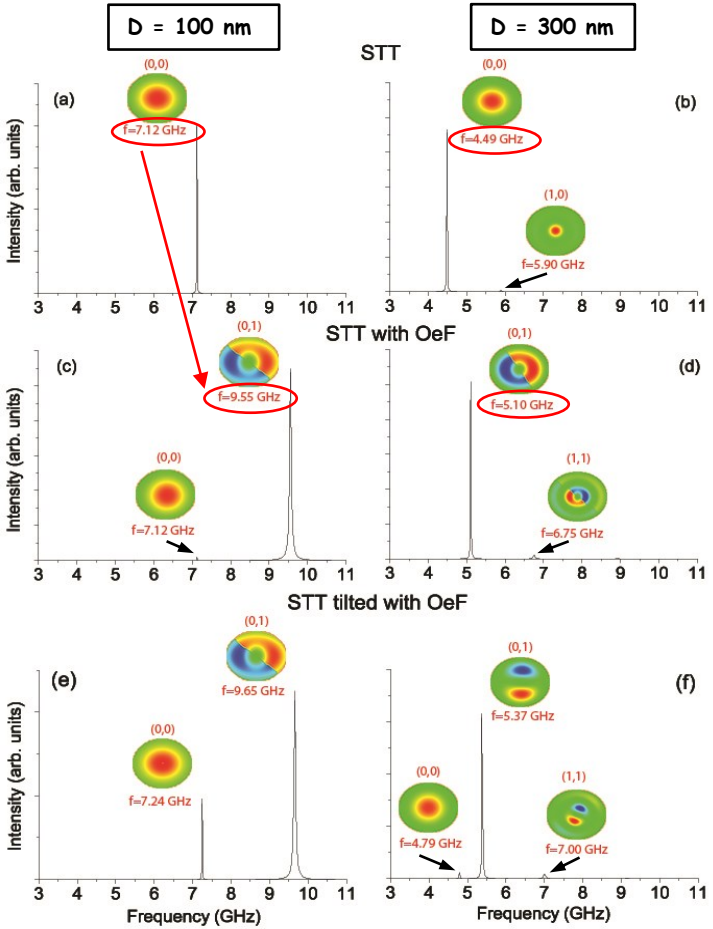
H out-of-Plane



Mode classification (n,m):

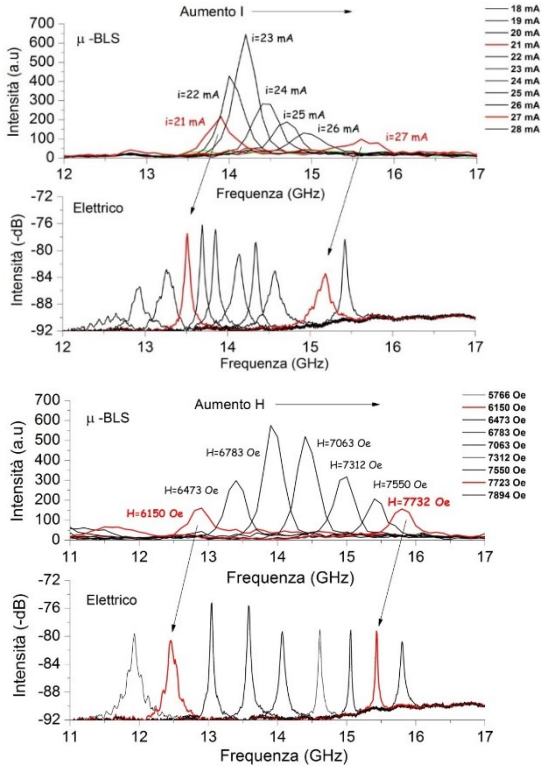
- *r* radial node
- *l* azimuthal node

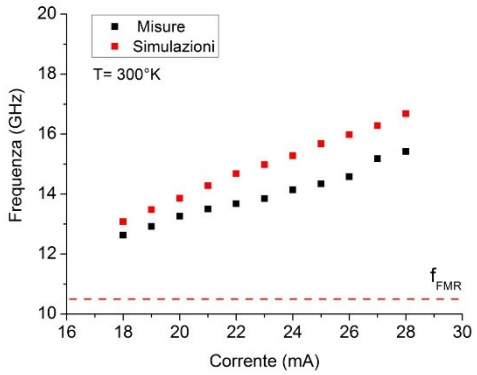


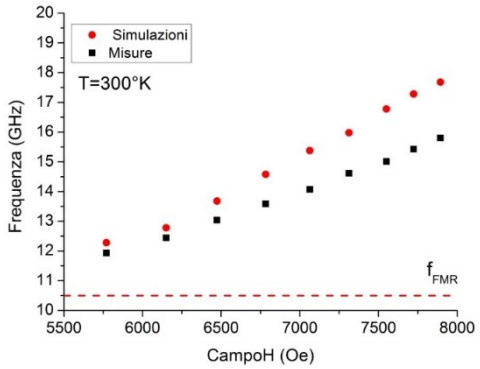


My past work…….Nano-Contact

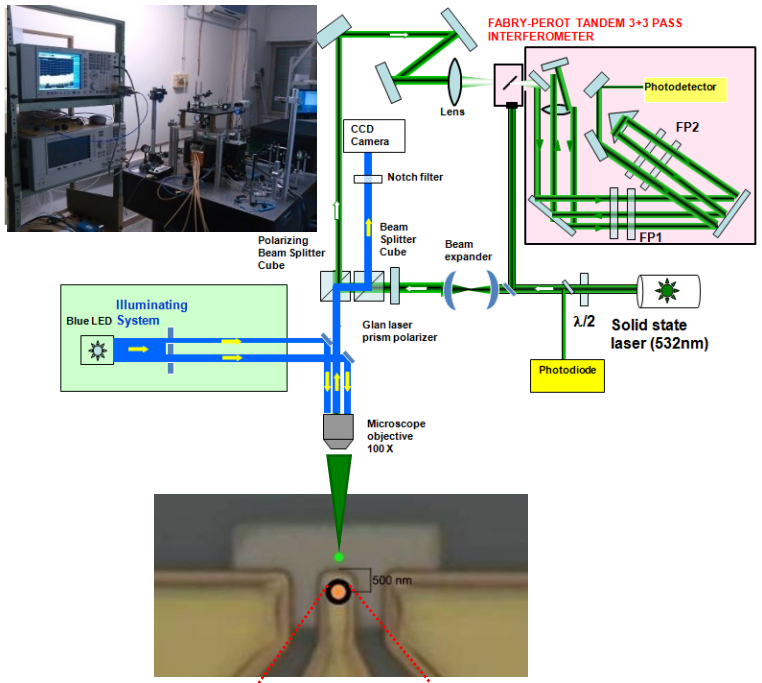
Frequency characterization- Mesurements & Simulations



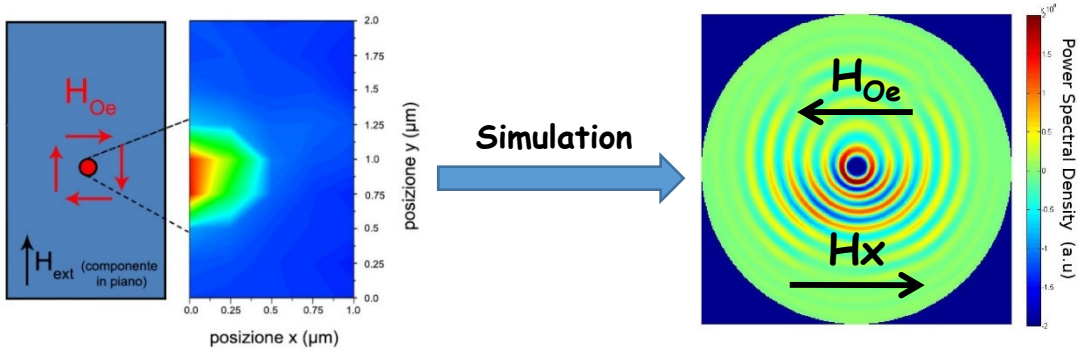


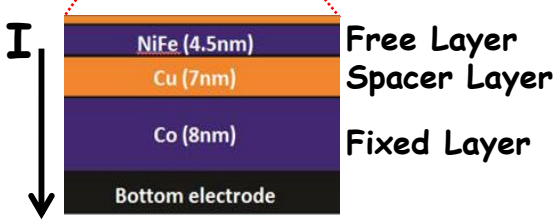


μ-BLS

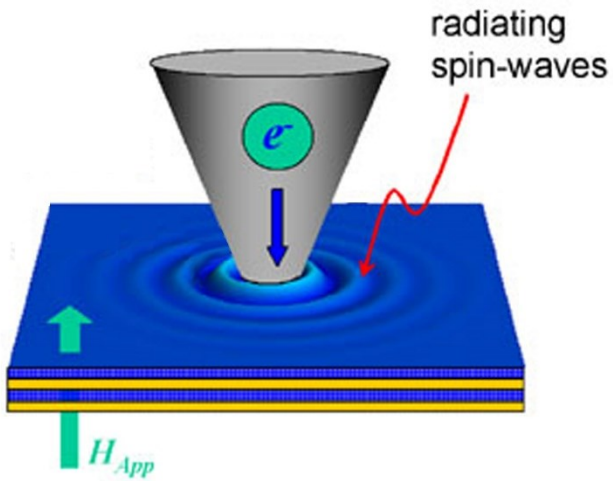


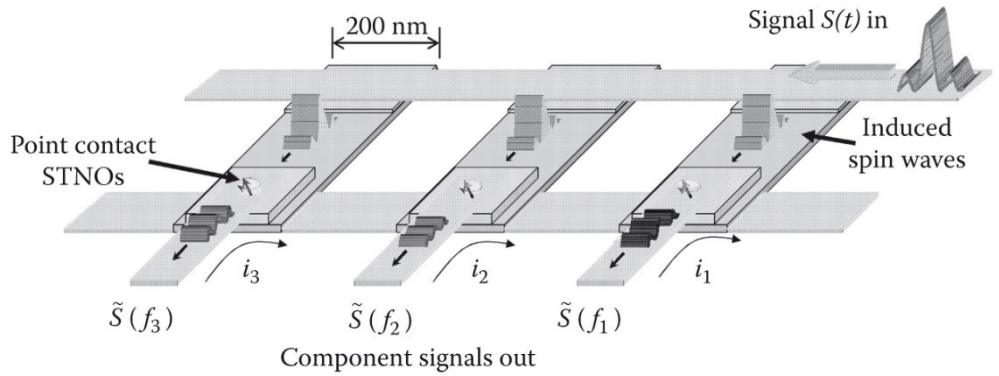
Intensity of Spin Wave emitted by Nanocontact





My Future work……..Magnon Spintronics



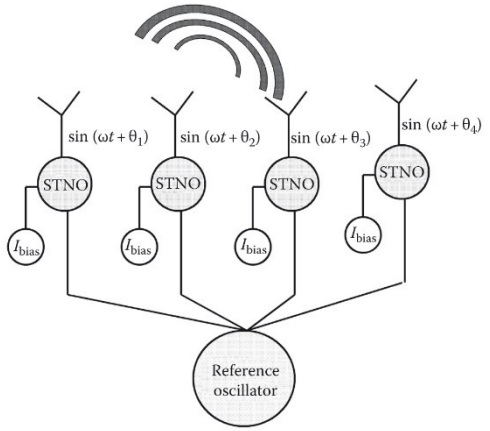


Advantages

- Frequencies range (GHz)
- Sub-µm scale
- Low Power consumption
- Spin waves emitter

Problems

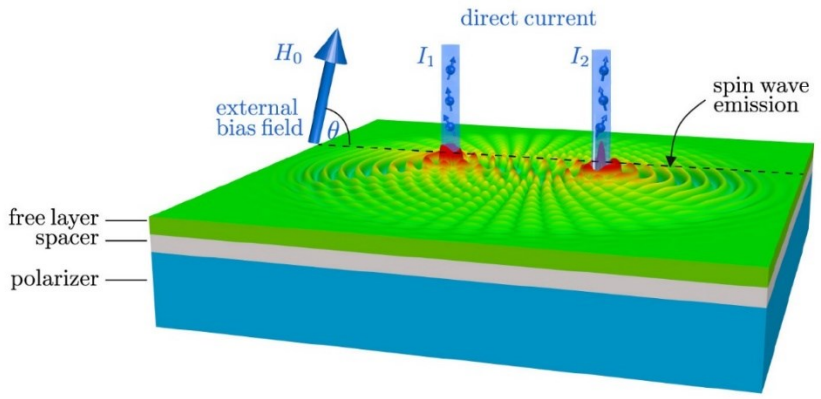
- Low output Power (pW)
- Short propagation of emitted Spin Wave
- High Manetic Field (~ 1T)

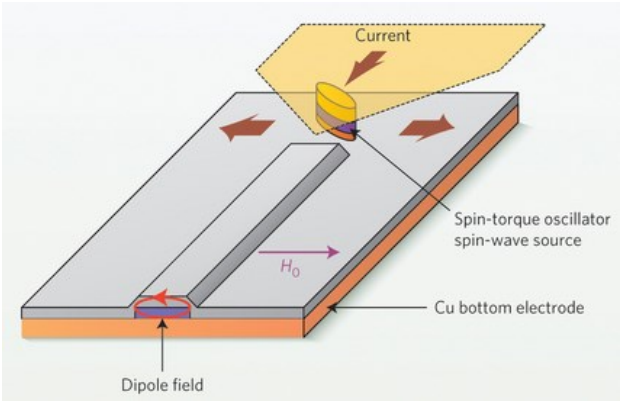


Array of STNO

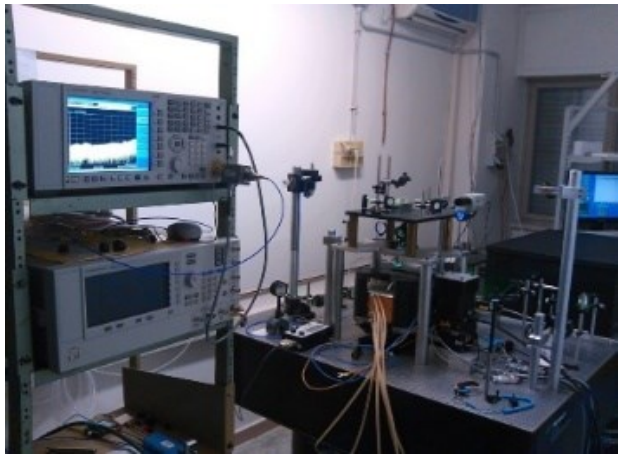
- N phase lock Oscillators
  - Output Power N^2

My Future work…….. Magnon Spintronics





- Study of interaction between STNO conneted by extended ferromagnetic free layer
- Characterization of propagating spin wave in nanopatterned ferromagnetic waveguide, generated by STNO
- Study of the phase lock between two or more oscillators in such configuartions
- Micromagnetic Simulations with GPU
- Collaboration with eurpean universities



mumax^3

GPU-accelerated micromagnetism


THANK YOU