

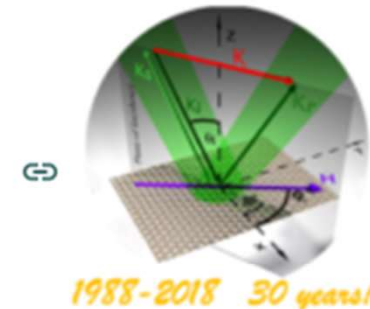
Nanomagnetismo e spintronica

A 3D visualization of a magnetic field, likely representing a skyrmion or a similar nanomagnetic structure. The field is depicted as a dense forest of arrows. Most arrows are red and point upwards, indicating a strong positive magnetic field component. In the center, there is a circular region where the arrows are blue and point downwards, indicating a negative magnetic field component. This central region is surrounded by a ring of arrows that are slightly tilted, showing a complex, non-uniform field distribution. The overall shape is roughly cylindrical or disk-like, with the field lines curving around the central core.

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Quanto è grande un bit?



Western Digital 4TB

Quanto è grande un bit?

Storage area

$$\begin{aligned} A_{sto} &= \pi r_2^2 - \pi r_1^2 = \\ &= \pi(60^2 - 15^2) \cdot 10^{-6} \text{ m}^2 \cong 1,1 \cdot 10^{-2} \text{ m}^2 \end{aligned}$$

Quanti bit sono 4TB?

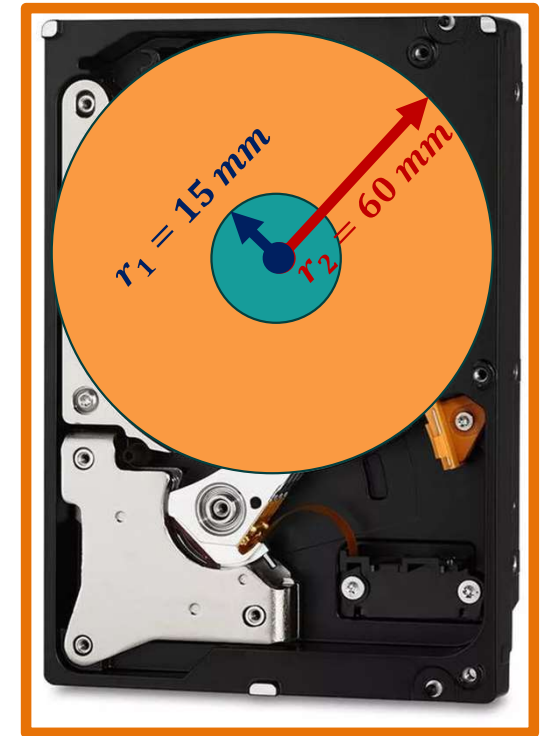
$$N_{bit} = 4TB = 4 \cdot 10^{12} \cdot 8 \text{ bit} = 3,2 \cdot 10^{13} \text{ bit}$$

Area di un singolo bit

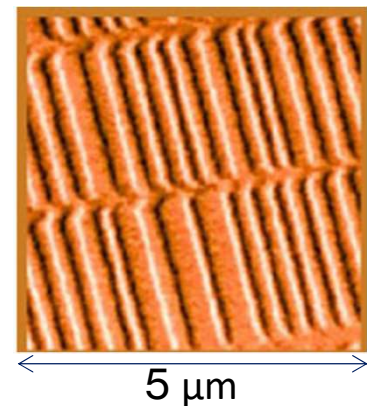
$$A_{bit} = \frac{A_{sto}}{N_{bit}} = \frac{1,1 \cdot 10^{-2} \text{ m}^2}{3,2 \cdot 10^{13}} = 3,4 \cdot 10^{-1} \text{ m}^2$$

Lato del quadrato

$$\ell_{bit} = \sqrt{A_{bit}} \cong 20 \text{ nm}$$



MFM image

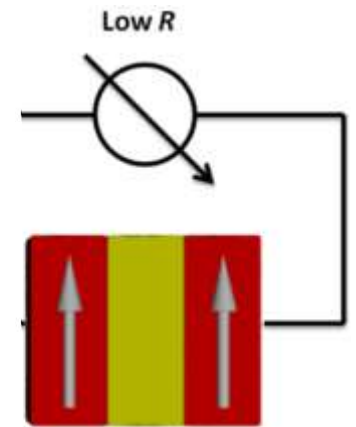
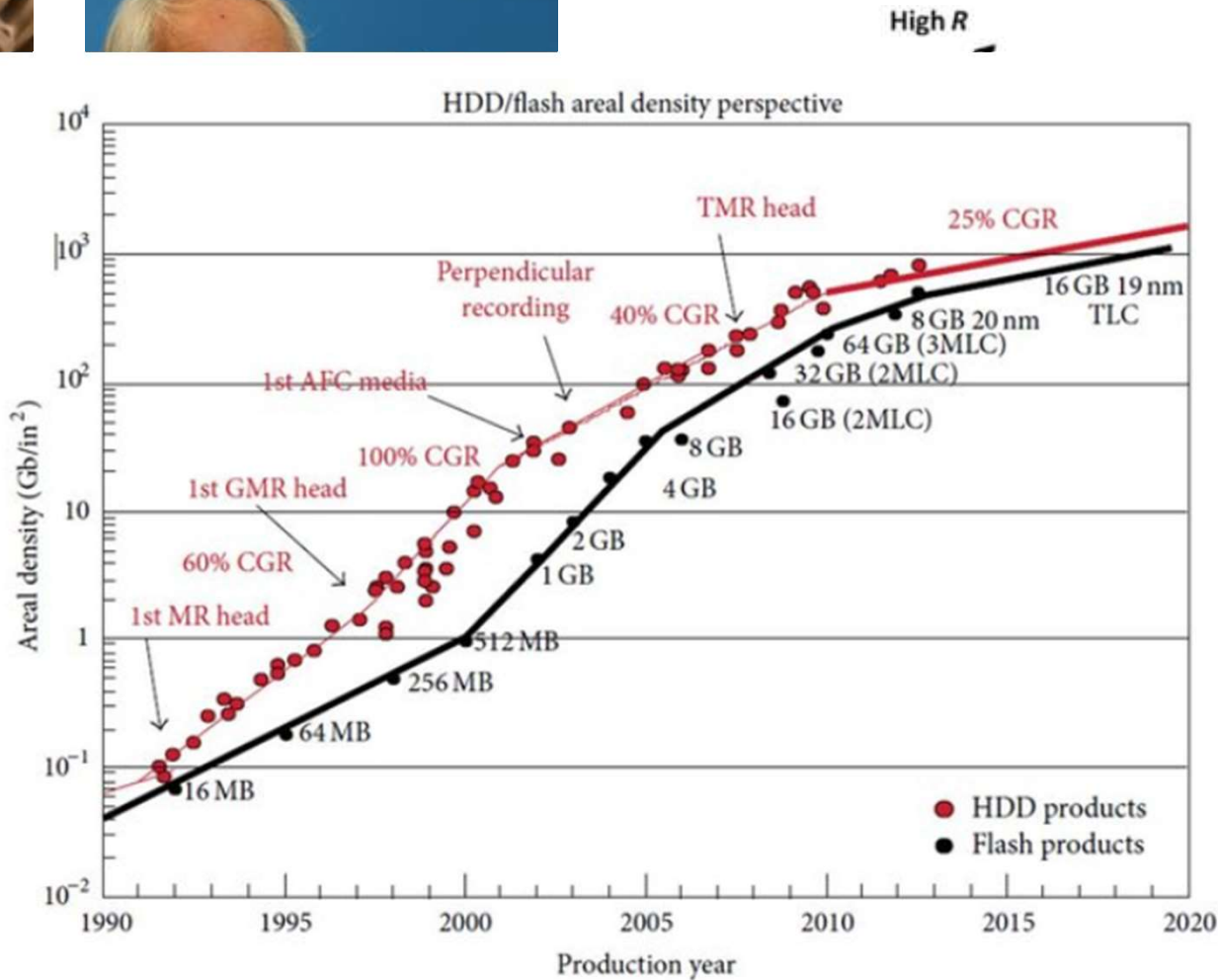




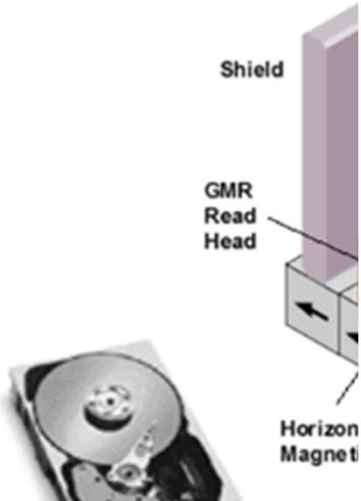
Albert Fert
Nobel



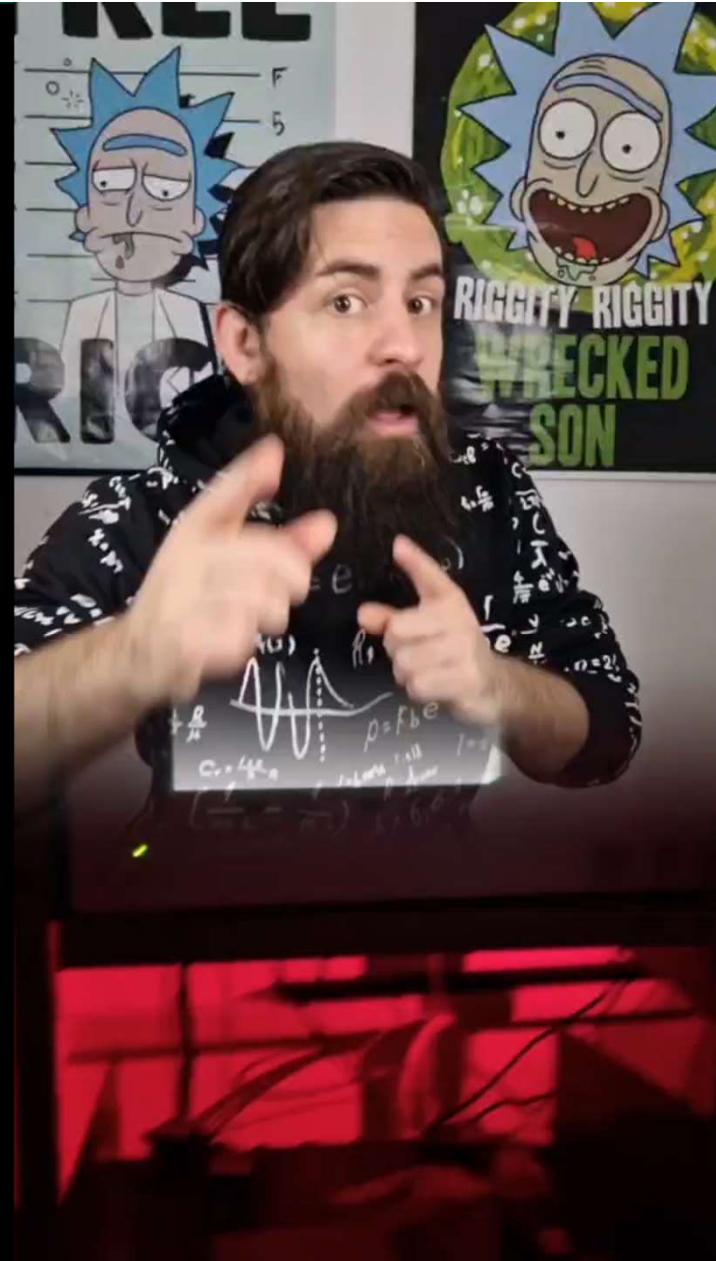
1988: Magnetoresistenza gigante (GMR)



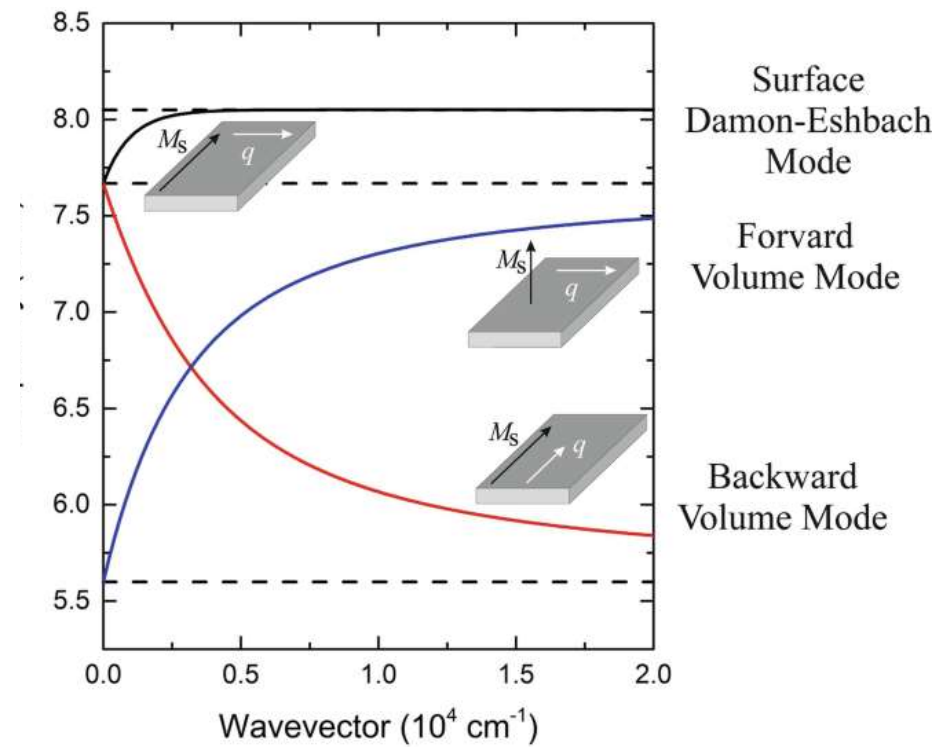
NICA



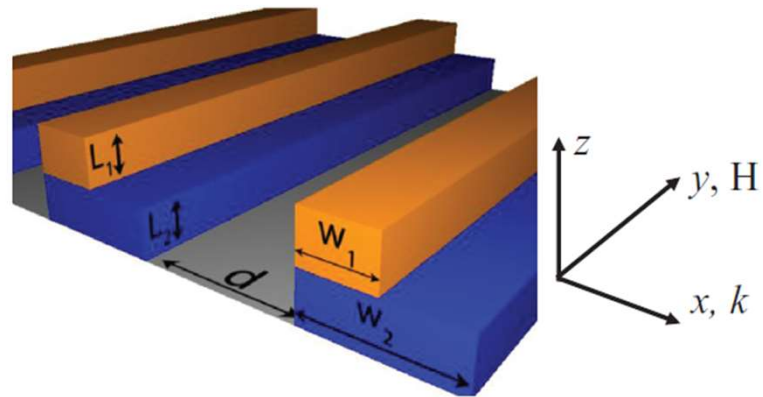
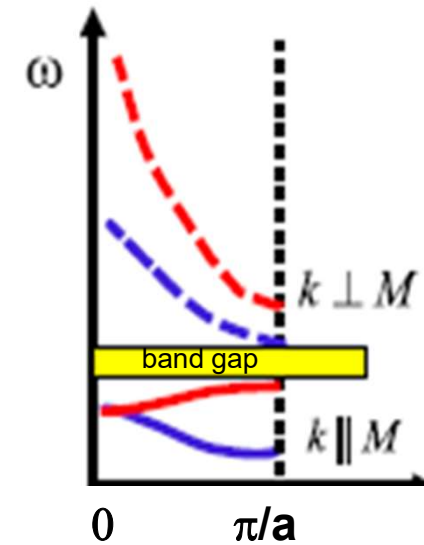
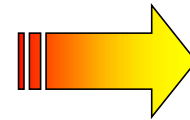
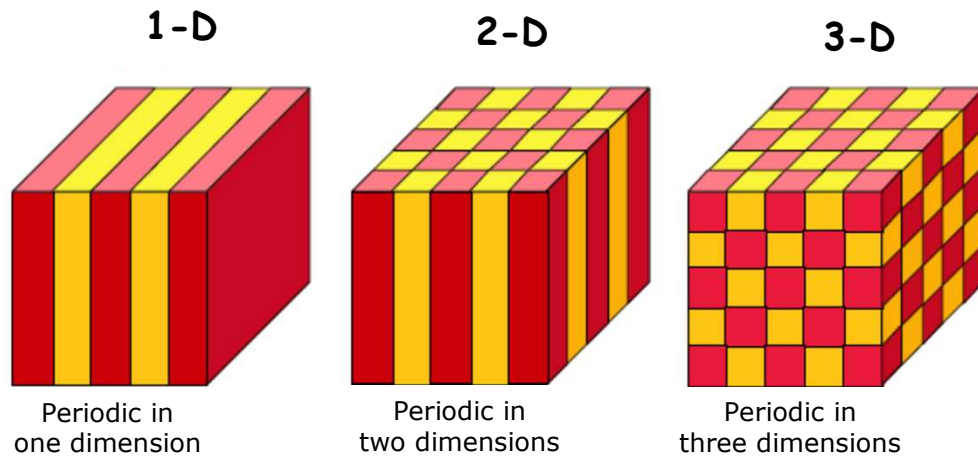
M. Bruno, The Head-Disk Interface Roadmap to an Areal Density of 4 Tbit/in², *Advances in Tribology*, 2013, 521086, 8 pages, 2013. <https://doi.org/10.1155/2013/521086>



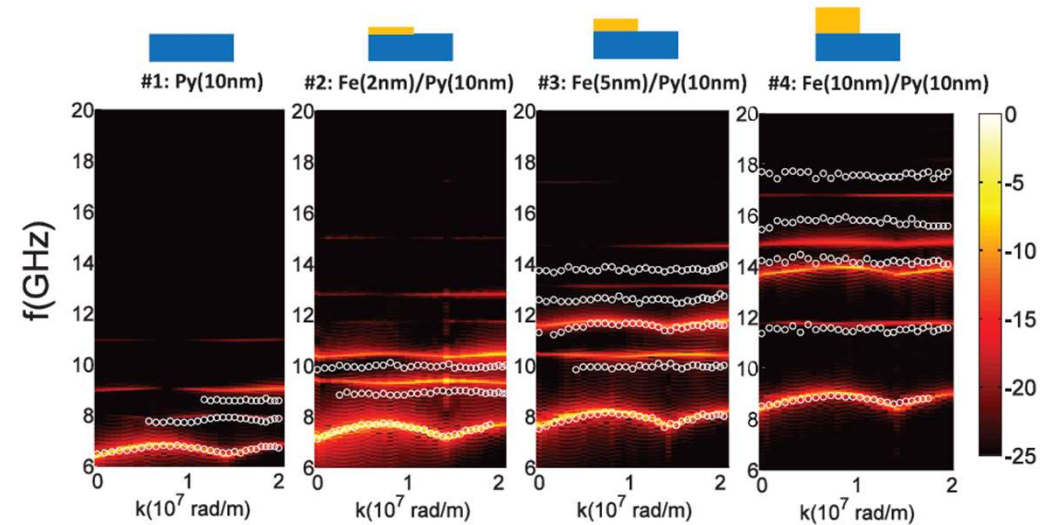
ONDE DI SPIN



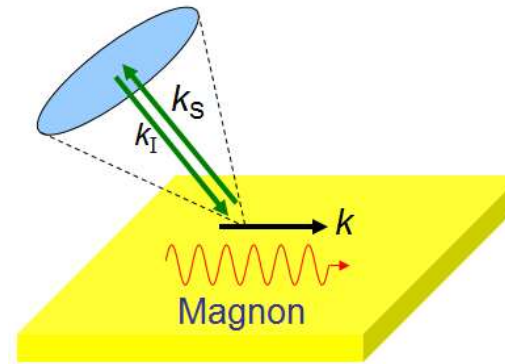
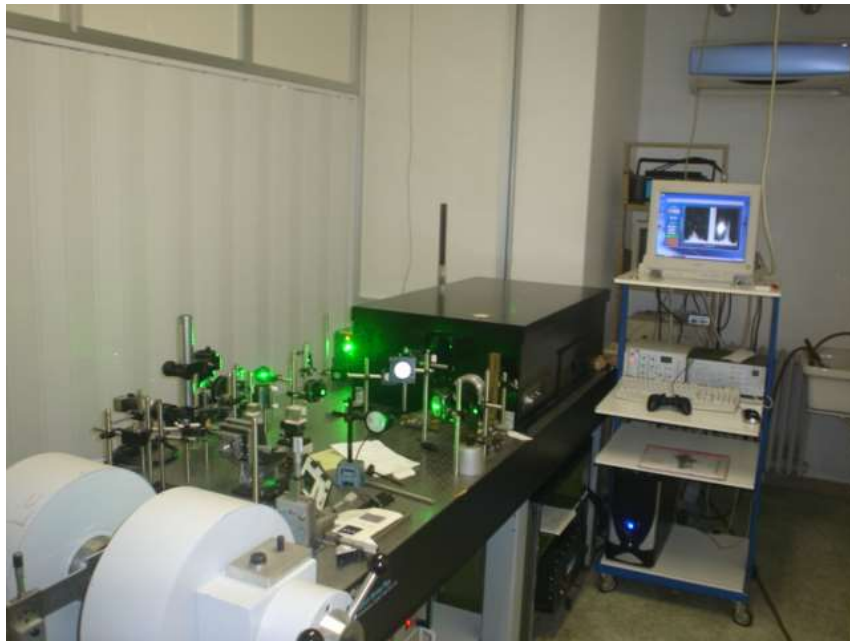
MAGNONICA



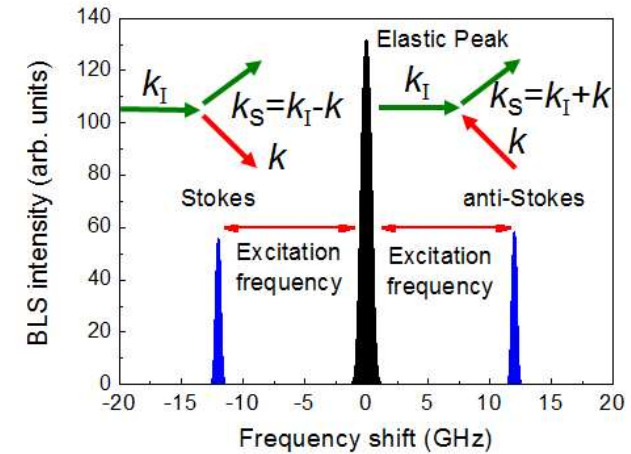
G Gubbiotti *et al*/ J. Phys. D: Appl. Phys. **50** (2017) 105002



Brillouin Light Scattering (BLS)

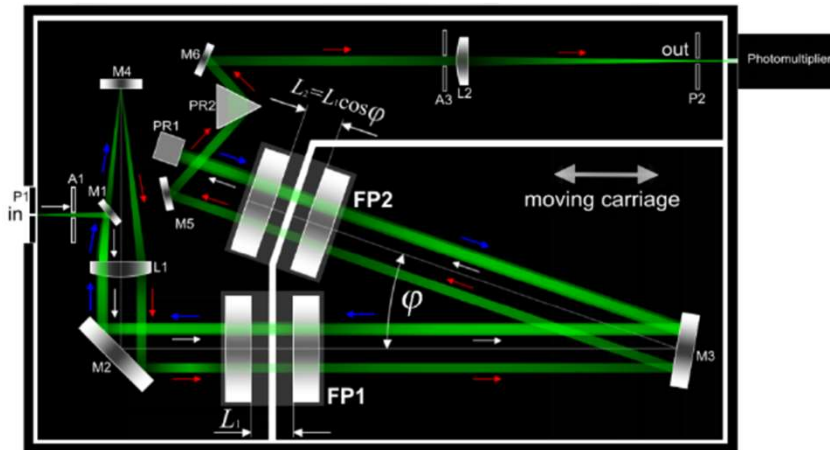


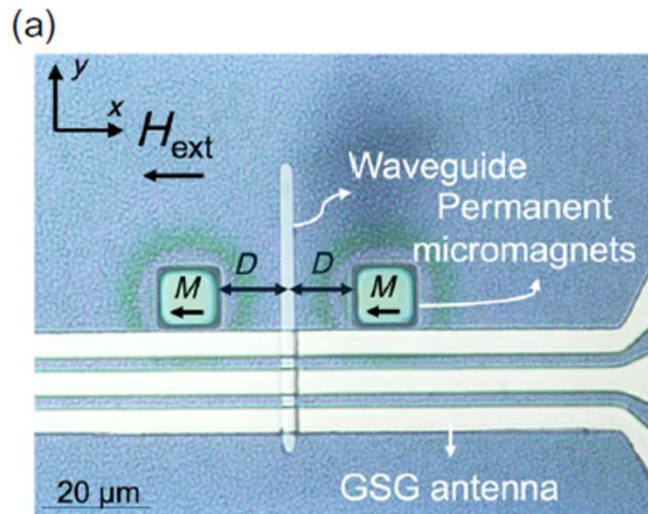
(inelastic scattering of photons by spin waves "magnons")



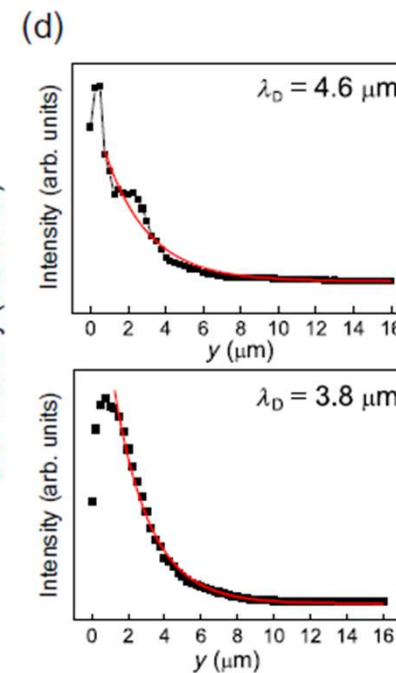
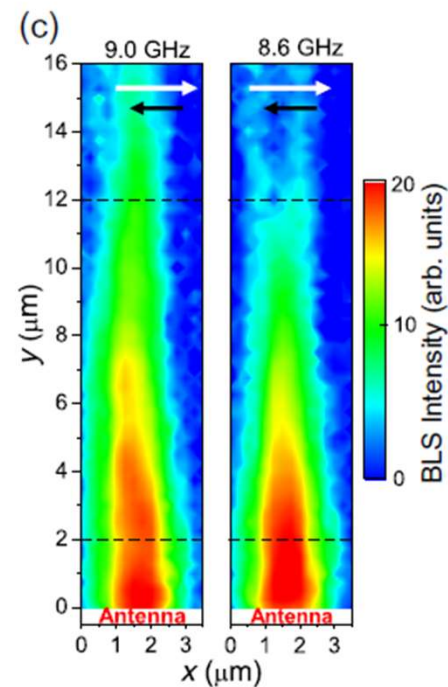
$$\lambda_{verde} = 542 \text{ nm} \quad \rightarrow \quad f = \frac{c}{\lambda} = 554 \text{ THz}$$

Tandem
Fabry-Perot
interferometer





M.Cocconcelli,
PHYS. REV. APPLIED 22,
064063 (2024)



POLITECNICO
MILANO 1863



μ -Brillouin Light Scattering (μ BLS)

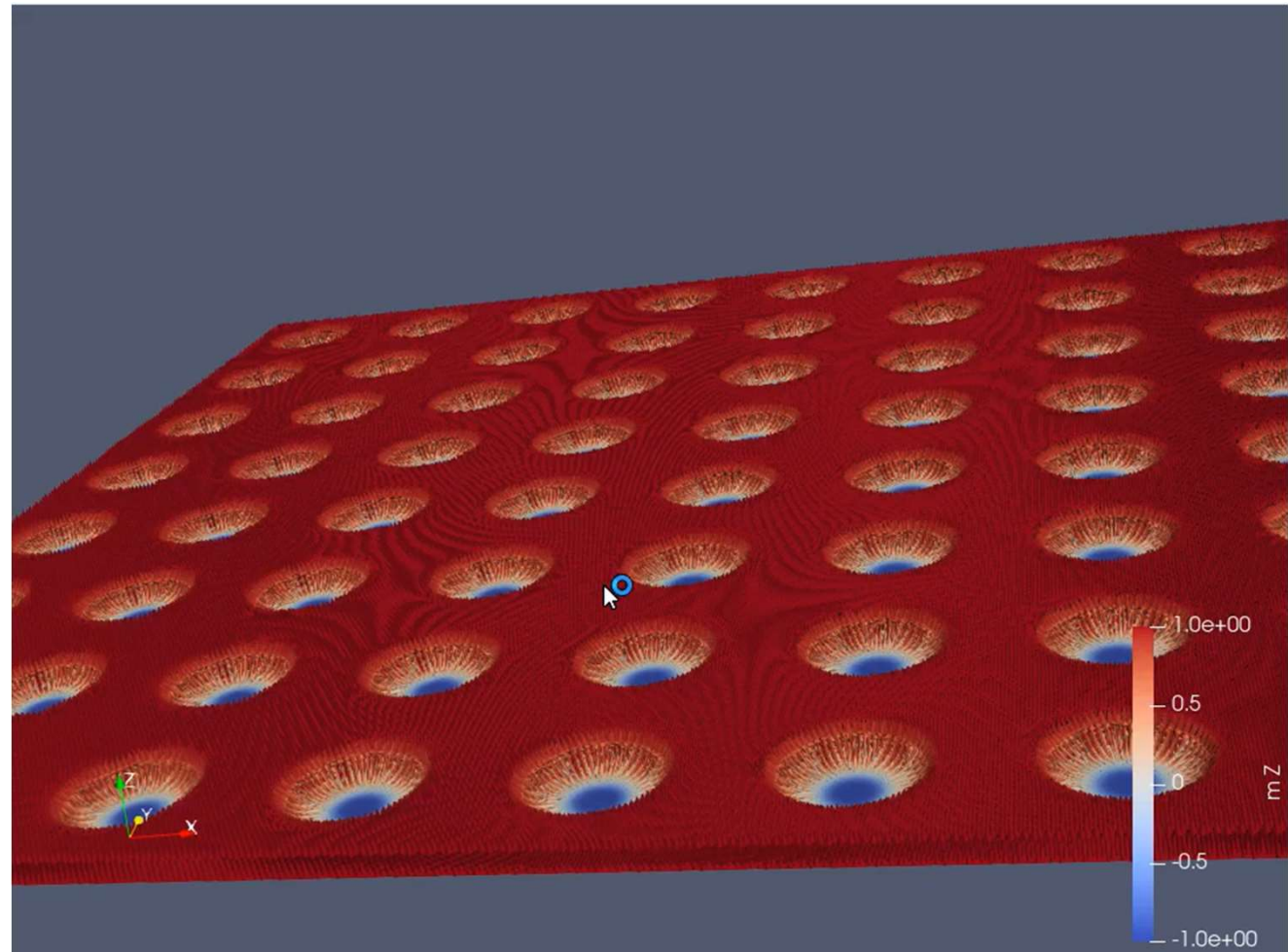
SIMULAZIONI MICROMAGNETICHE



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Nanomagnetismo e spintronica

CONTATTI

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