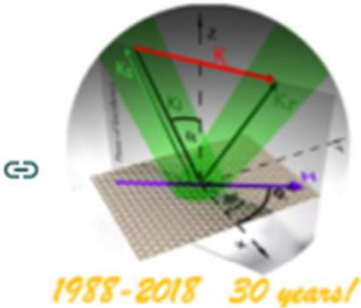
Nanomagnetismo e spintronica

Raffaele Silvani

raffaele.silvani@unipg.it

Group of High-resolution Optical Spectroscopy and related Techniques



Giovanni Carlotti
Dipartimento di Fisica e Geologia
giovanni.carlotti@unipg.it

Gianluca Gubbiotti
CNR-IOM
gubbiotti@iom.cnr.it

Marco Madami
Dipartimento di Fisica e Geologia
marco.madami@unipg.it

Silvia Tacchi
CNR-IOM
tacchi@iom.cnr.it

website: **http://ghost.fisica.unipg.it/**

Quanto è grande un bit?

Western Digital 4TB

Quanto è grande un bit?

Storage area

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

Quanti bit sono 4TB?

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

Area di un singolo bit

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

Lato del quadrato

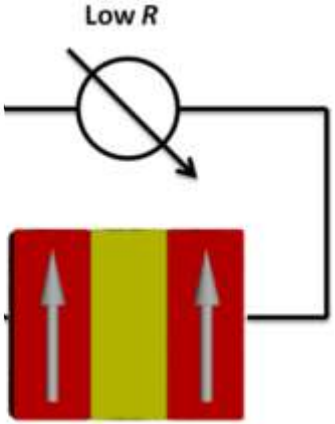
$$\ell_{bit} = \sqrt{A_{bit}} \cong 20\ nm$$

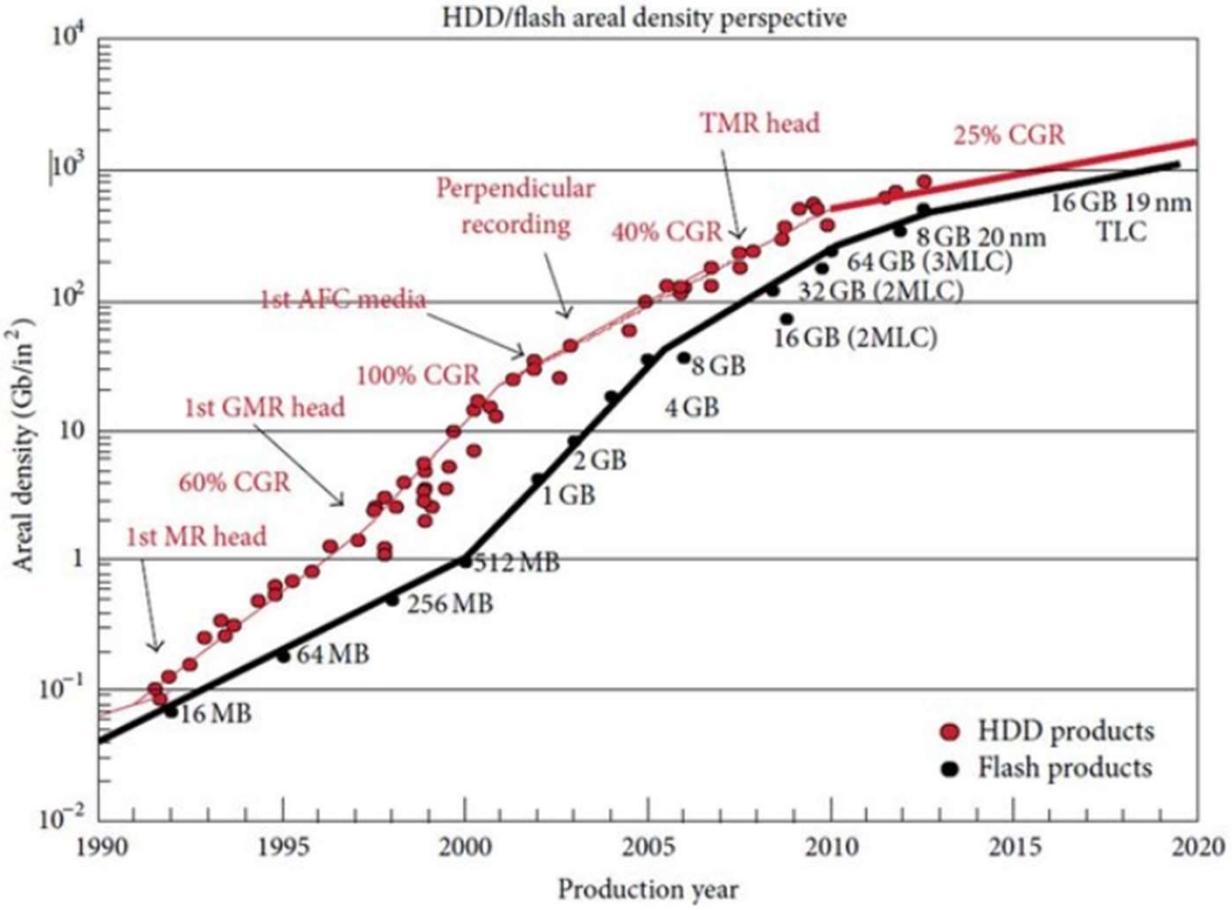
MFM image

1988: Magnetoresistenza gigante (GMR)

Albert Fert

Nobe





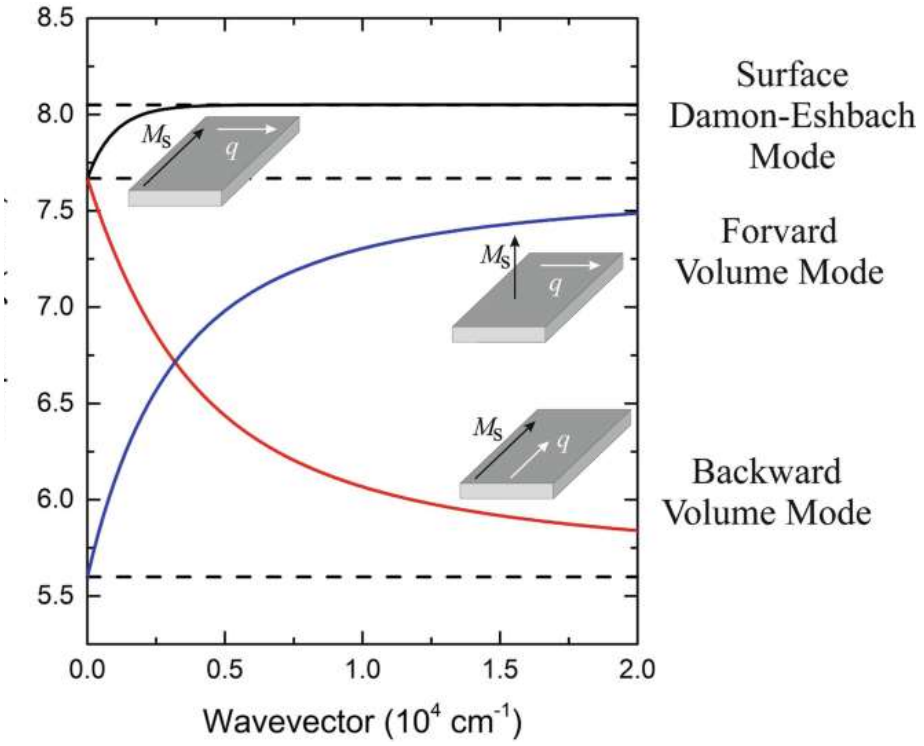
NICA

M. Bruno, The Head-Disk Interface Roadmap to an Areal Density of 4 Tbit/in^2, *Advances in Tribology*, 2013, 521086, 8 pages, 2013. https://doi.org/10.1155/2013/521086

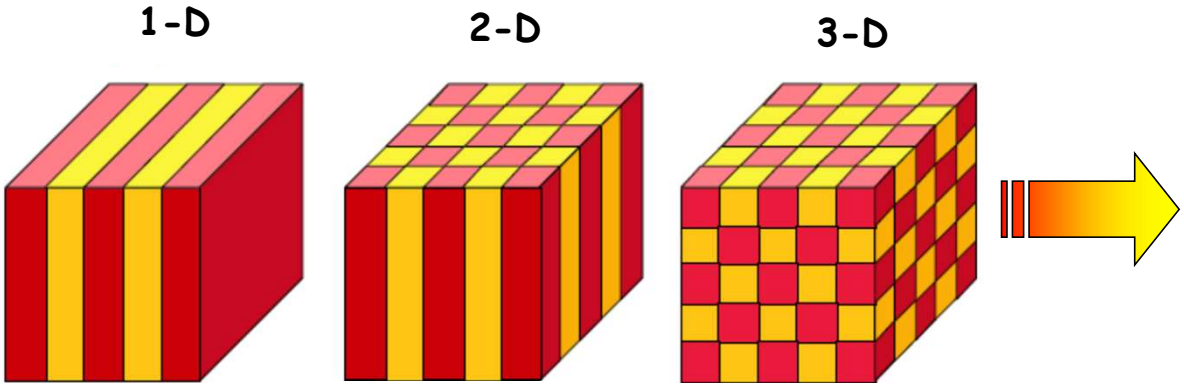
SHARPER
NOTTE EUROPEA
DEI RICERCATORI
EUROPEAN RESEARCHERS' NIGHT

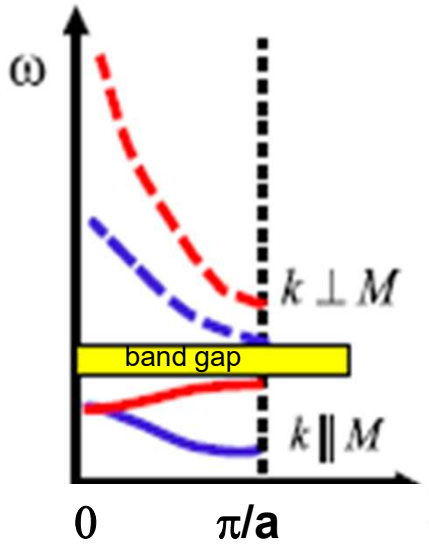
@MAGO_SILVANI

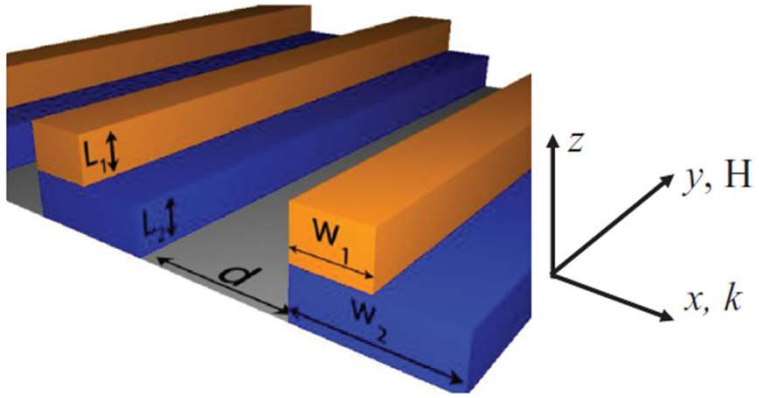
ONDE DI SPIN


8.5
8.0
7.5
7.0
6.5
6.0
5.5
0.0
0.5
1.0
1.5
2.0
Wavevector (10^4 cm^{-1})
M_S
q
Surface
Damon-Eshbach
Mode
Forvard
Volume Mode
Backward
Volume Mode

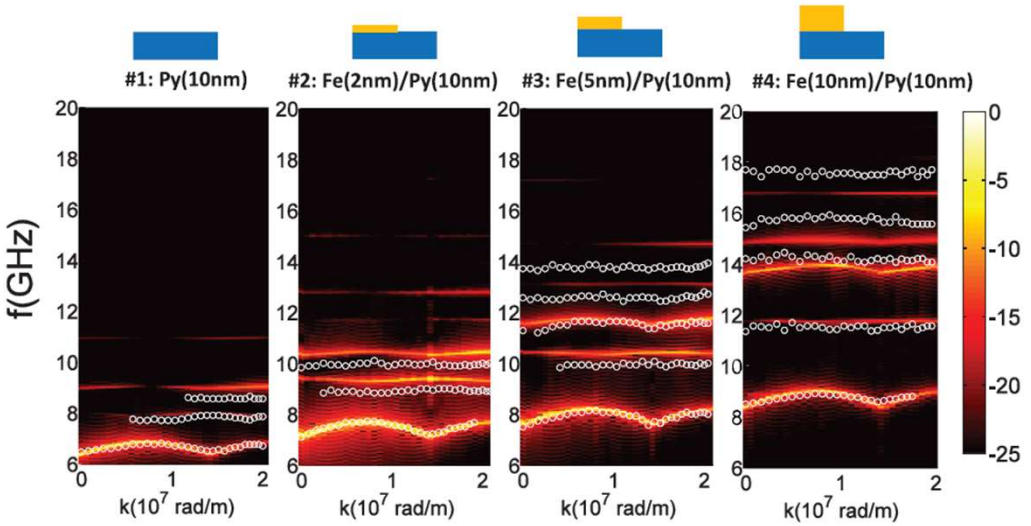
MAGNONICA



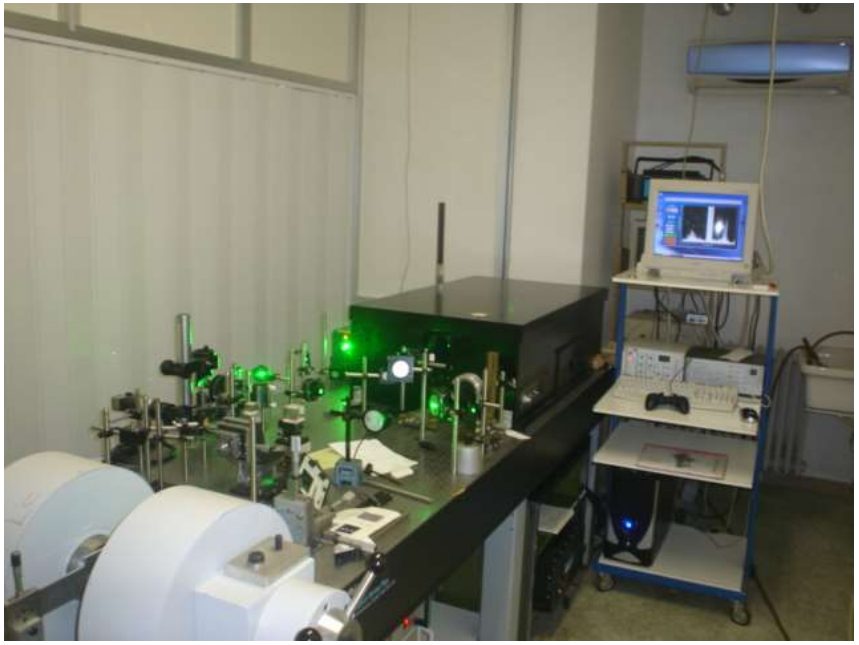


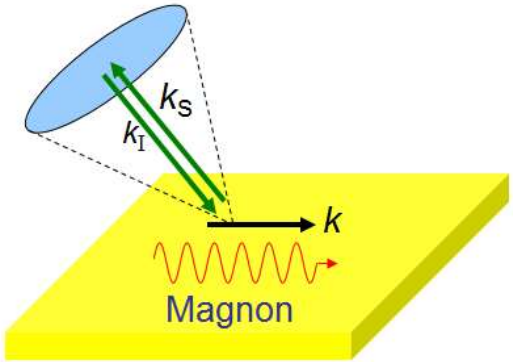


G Gubbiotti *et al* J. Phys. D: Appl. Phys. **50** (2017) 105002

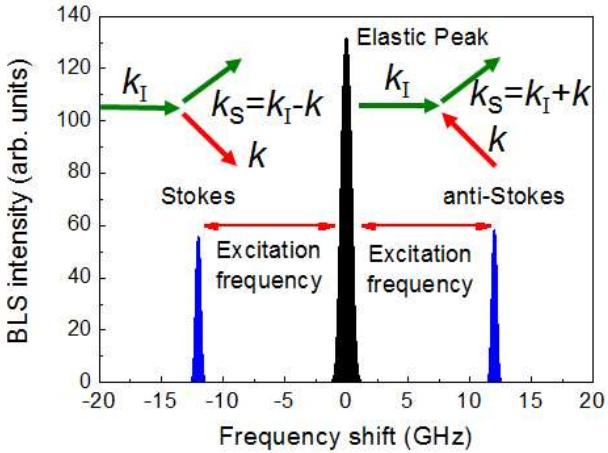


Brillouin Light Scattering (BLS)



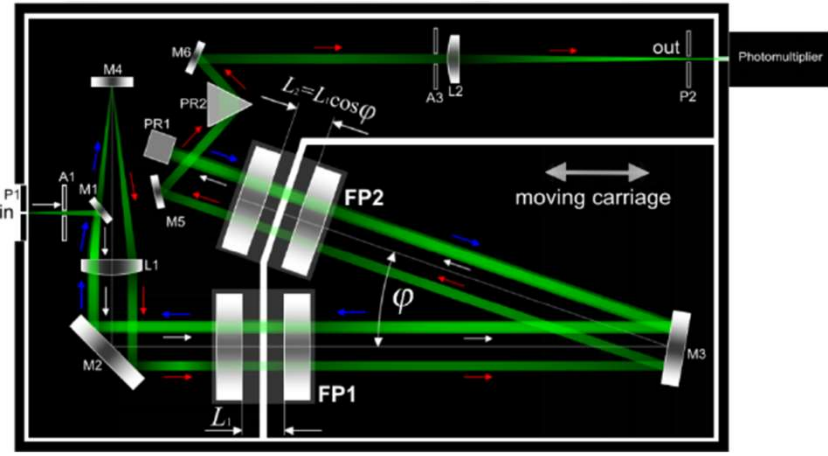


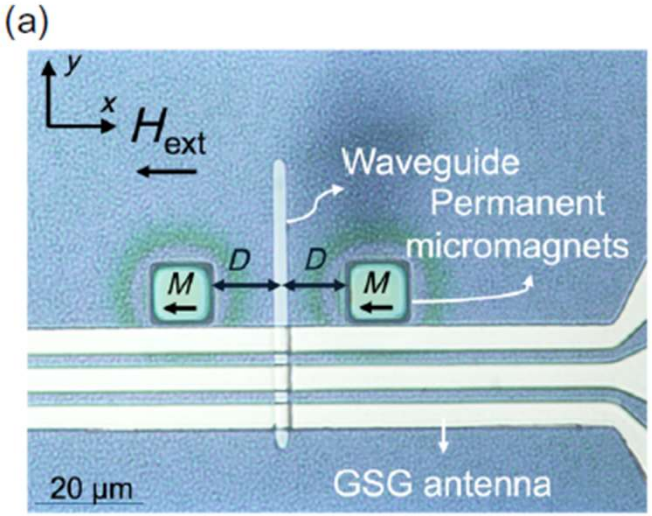
(inelastic scattering of photons by spin waves "magnons")

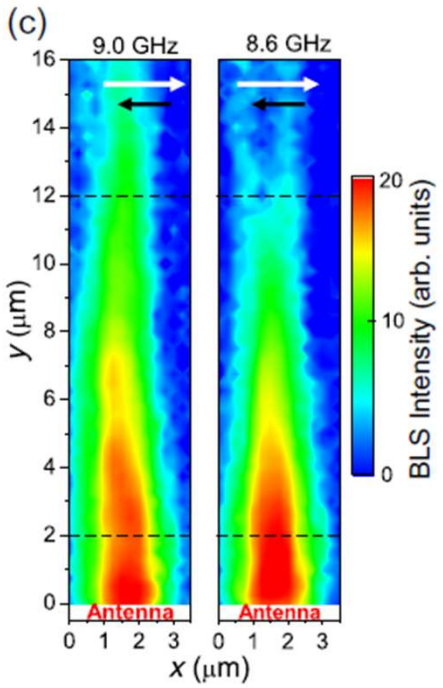


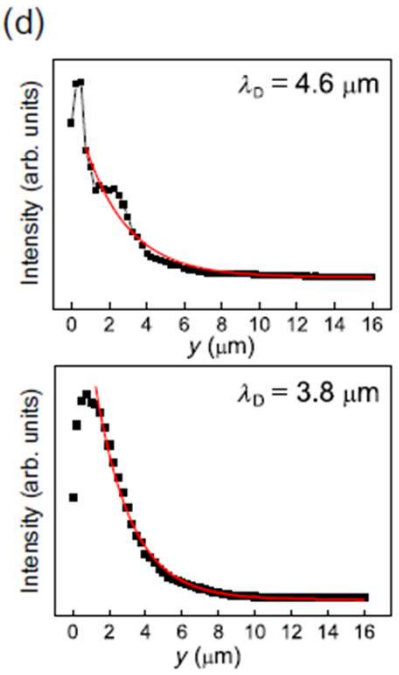
$$\lambda_{verde} = 542\ nm \qquad \rightarrow f = \frac{c}{\lambda} = 554\ THz$$

Tandem Fabry-Perot interferometer









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

M&MEMS

POLITECNICO
MILANO 1863

TECHNISCHE UNIVERSITÄT
KAISERSLAUTERN

μ-Brillouin Light Scattering (μBLS)

SIMULAZIONI MICROMAGNETICHE

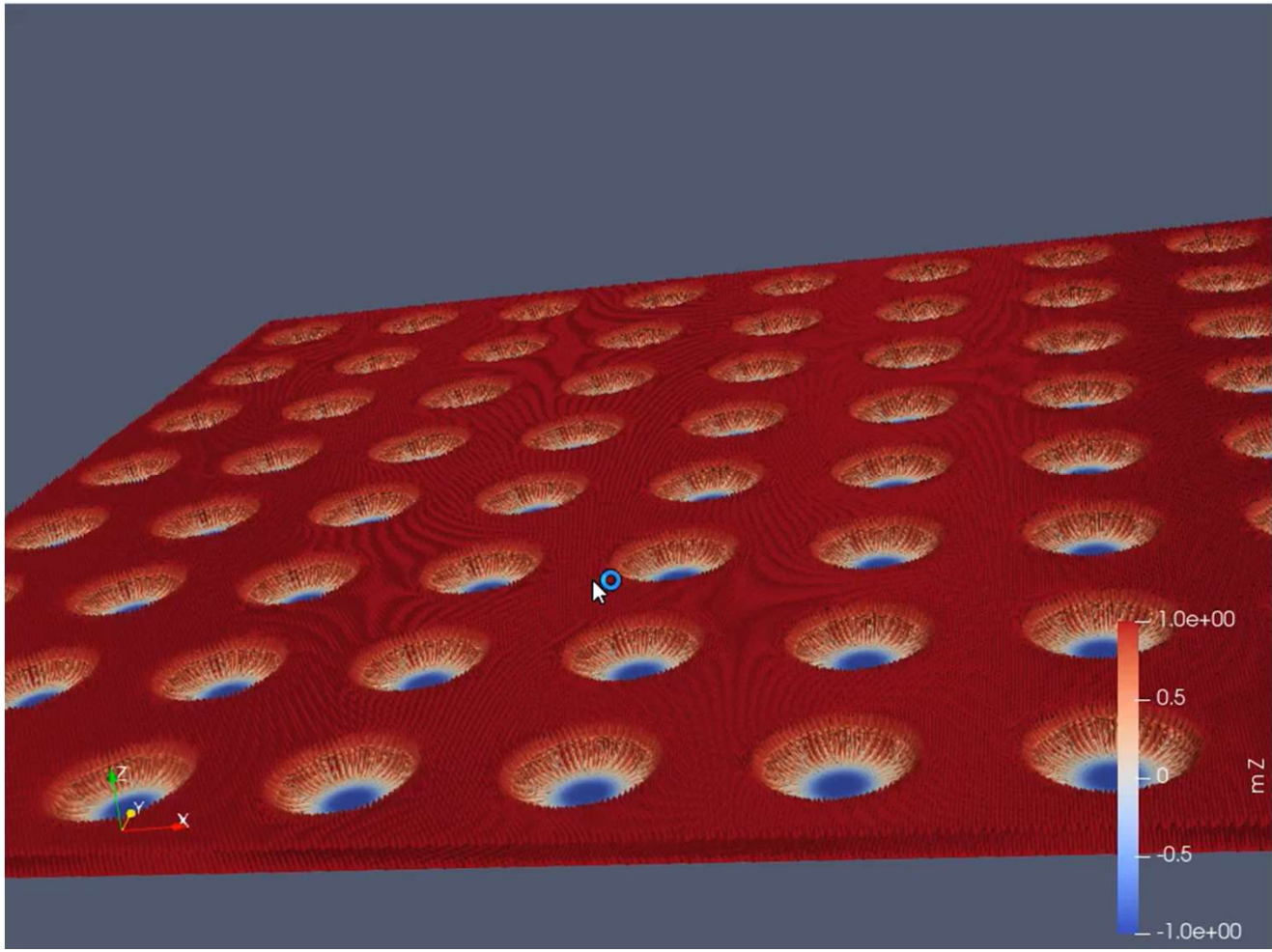
ParaView

mumax^3

GPU-accelerated micromagnetism

python™ MATLAB®

COMSOL MULTIPHYSICS®



Didattica
Bandi e news
Corsi di laurea e laurea magistrale
Area economico-giuridico-sociale
Area medico-sanitaria-veterinaria
Area scientifica
Area tecnologica

Insegnamento NANOMAGNETISMO E SPINTRONICA

Nome del corso di laurea	Fisica
Codice insegnamento	GP005936
Curriculum	Fisica della materia
Docente responsabile	Silvia Tacchi
Docenti	— Silvia Tacchi
Ore	— 47 Ore - Silvia Tacchi
CFU	6

Nanomagnetismo e spintronica

CONTATTI

Raffaele Silvani

raffaele.silvani@unipg.it