

SALVATORE PERNA

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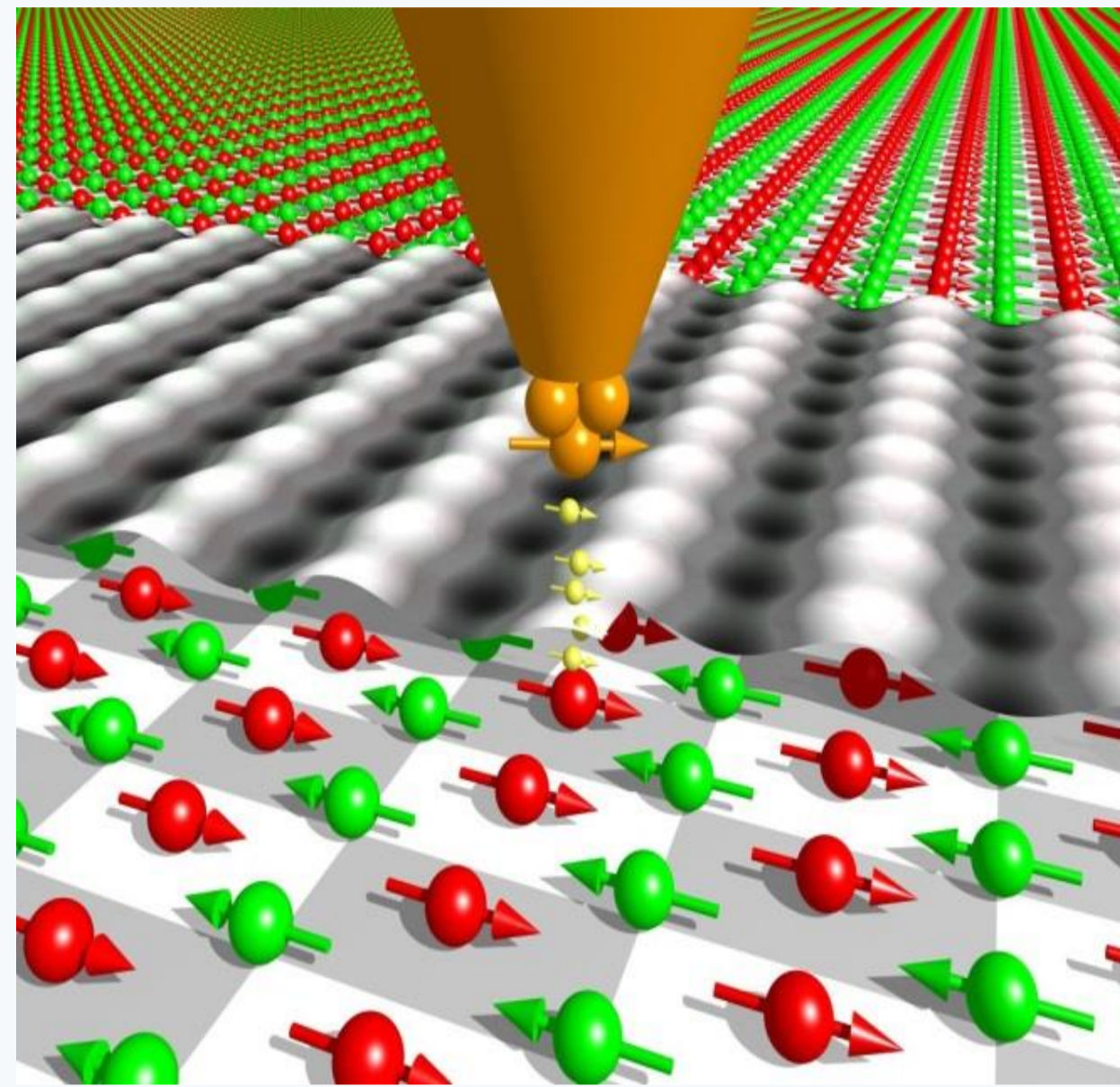
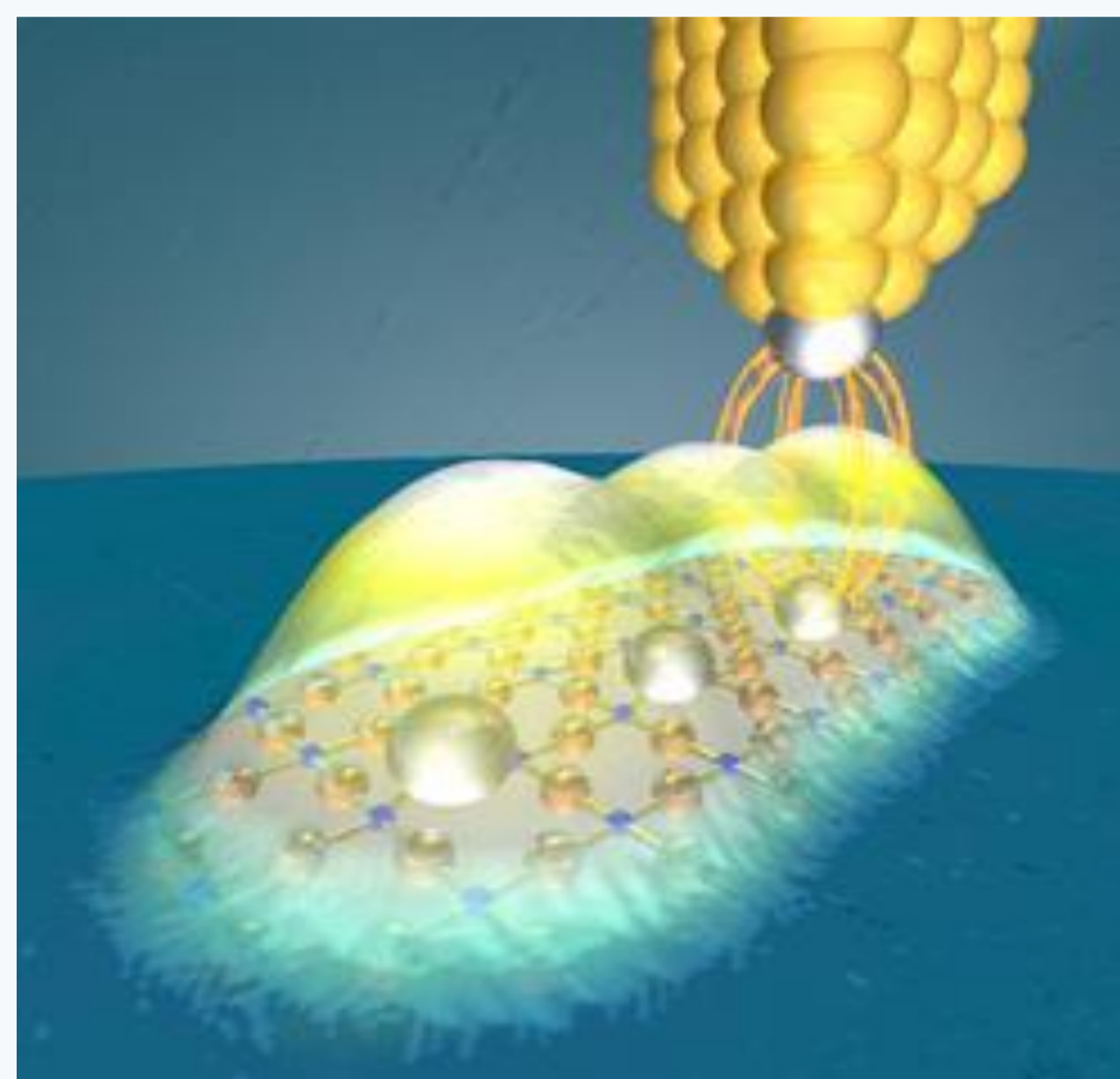
1) University of Naples Federico II , DIETI

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XXIX Cycle - II year presentation

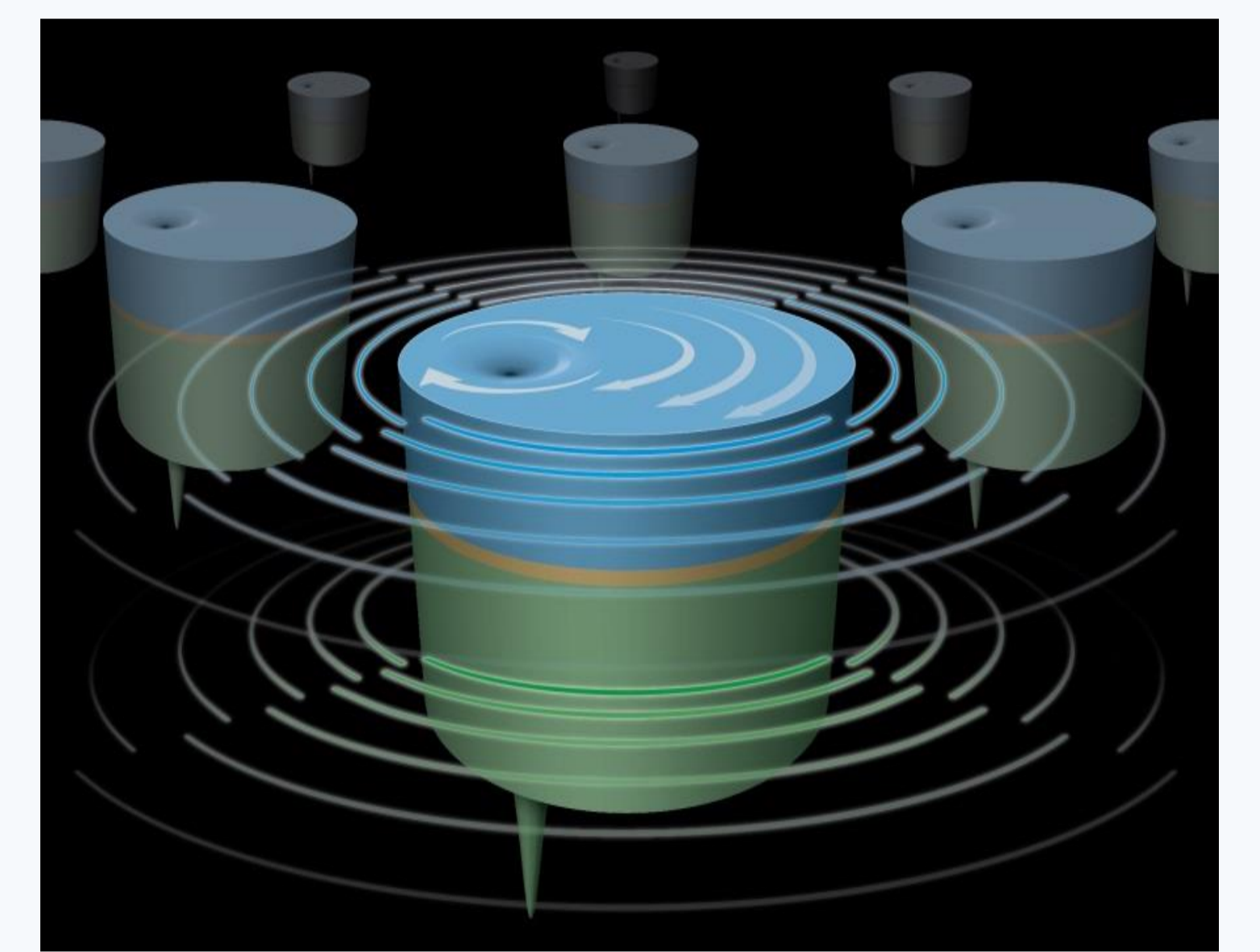
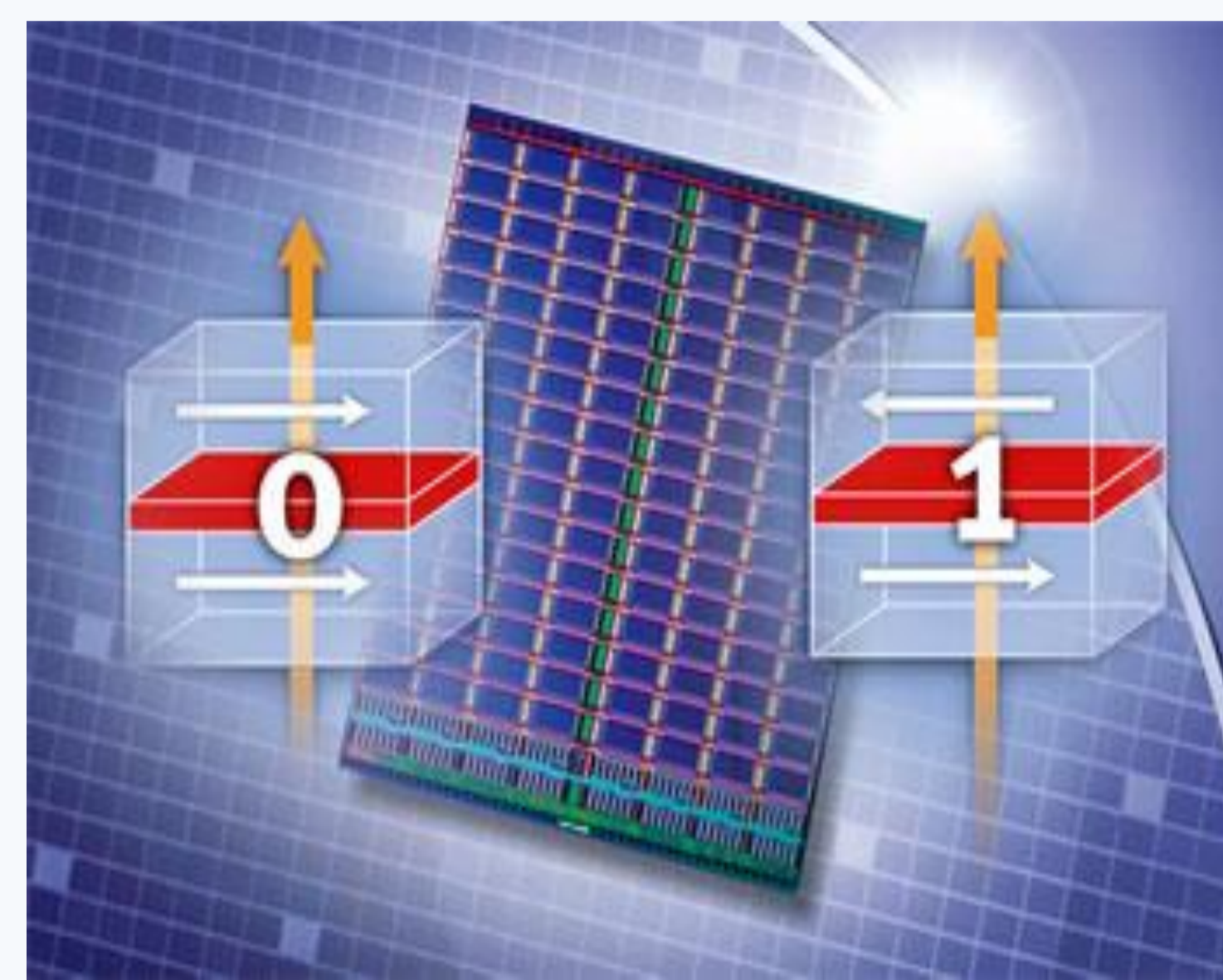
Spintronics and Nanomagnetism

□ Study the evolution of the magnetic properties in materials on nanometric scale, in presence of external excitations such as magnetic field or spin-polarized currents. In a such scale the magnetization dynamics is described by the Landau-Lifshic-Gilbert-Sloncewski equation[2,3].



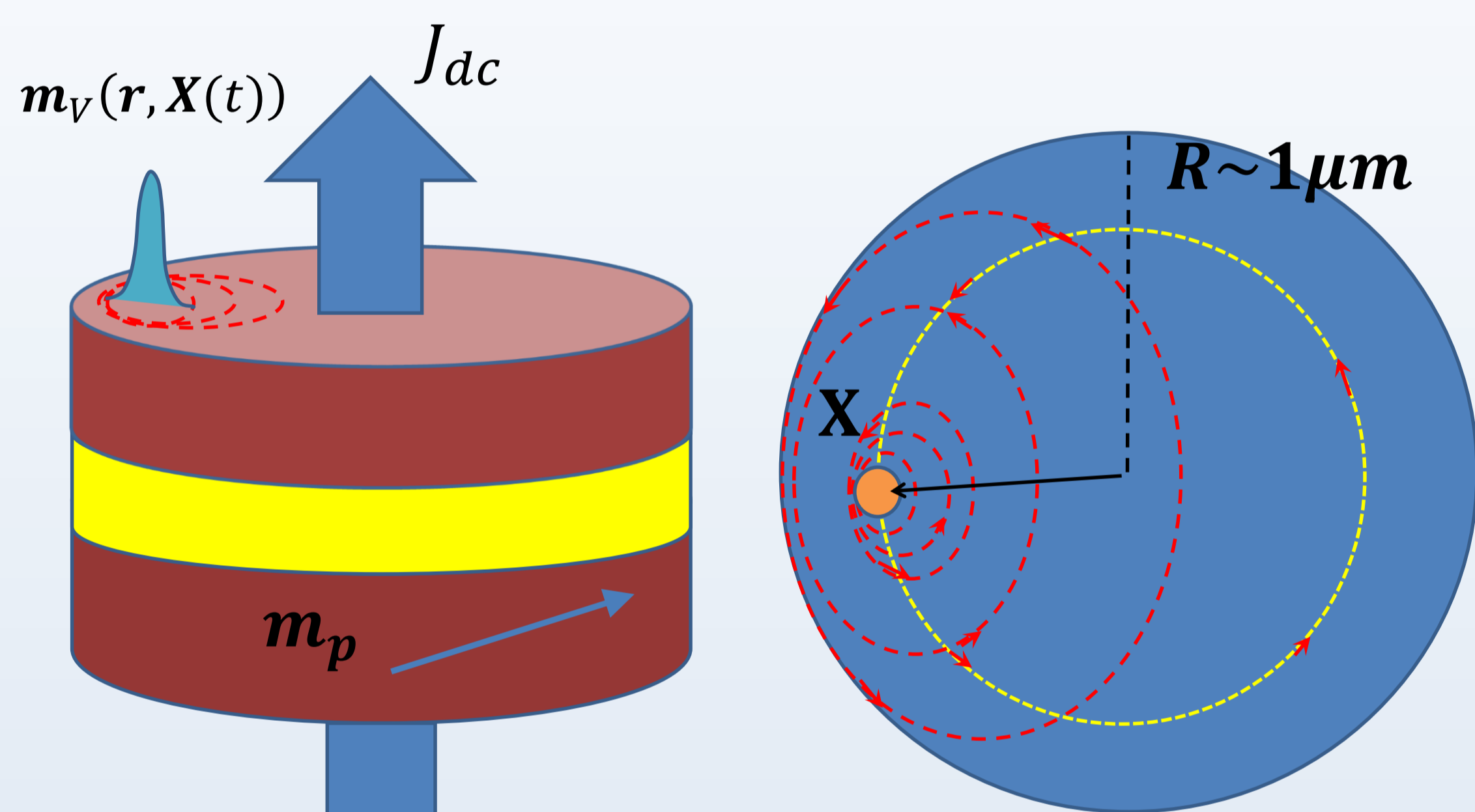
□ In the ICTs field the ability to manipulate the magnetization in a nanostructure opened a wide range of possible applications :

- Improve the hard drive technology (storage density)
- Nanooscillators in the microwave frequencies
- Magnetic logic circuits
- Nano sensors
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Research Group Collaborators: C. Serpico, M. d'Aquino, G. Bertotti, I. D. Mayergoz and A. Quercia

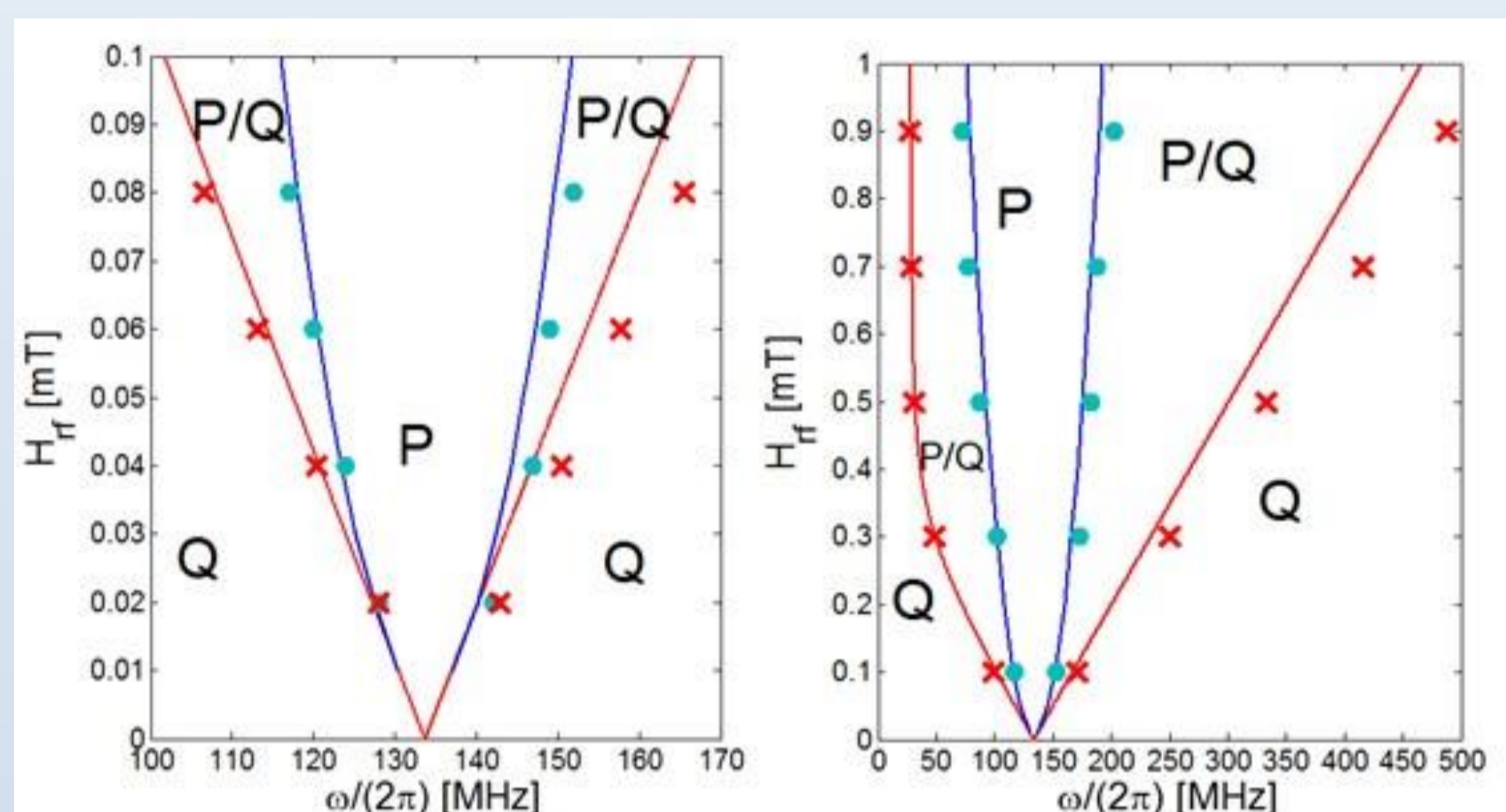
■ Magnetic solitons dynamics in micronsize ferromagnetic layer : synchronization of vortex oscillations with a rf rotating magnetic field



MOTIVATION : one of the proposed solutions to overcome the low output power of magnetic nanoscillators is to synchronize(phase locking) an arbitrary number of them.

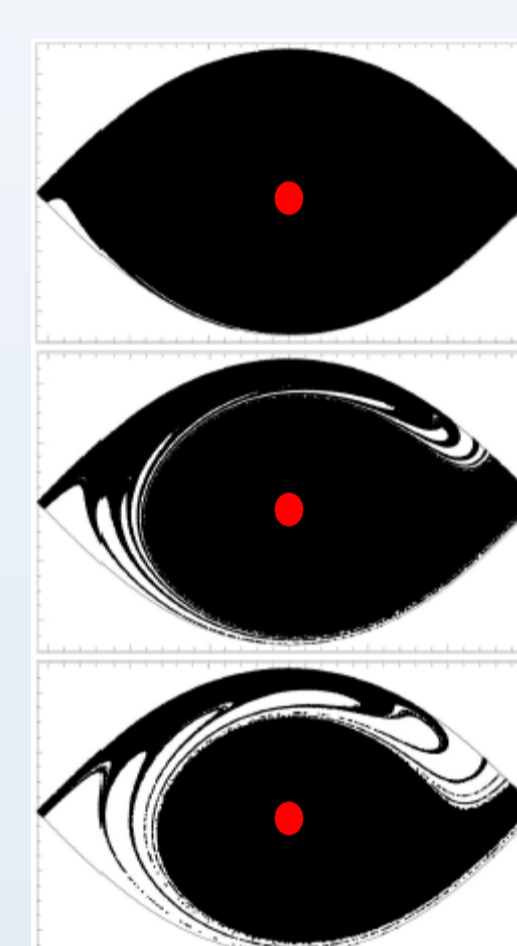
- RESULTS :
- Synchronizations by means rotating magnetic field
 - Definition of a synchronization map
 - Prediction of a region of safe synchronization
 - Prediction of histeresys in the synchronization process

- METHODS :
- Collective variable approach modelling
 - Bifurcation analysis
 - Validations by means full micromagnetic simulations (MUMAX)



■ Microwave assisted magnetic recording in ferromagnetic nanoparticles

MOTIVATION : The capacity of an hard drive storage device fixed the geometry is limited by the information density that is reliably read and written. A way to increase this factor is to novel energy optimized switching techniques.

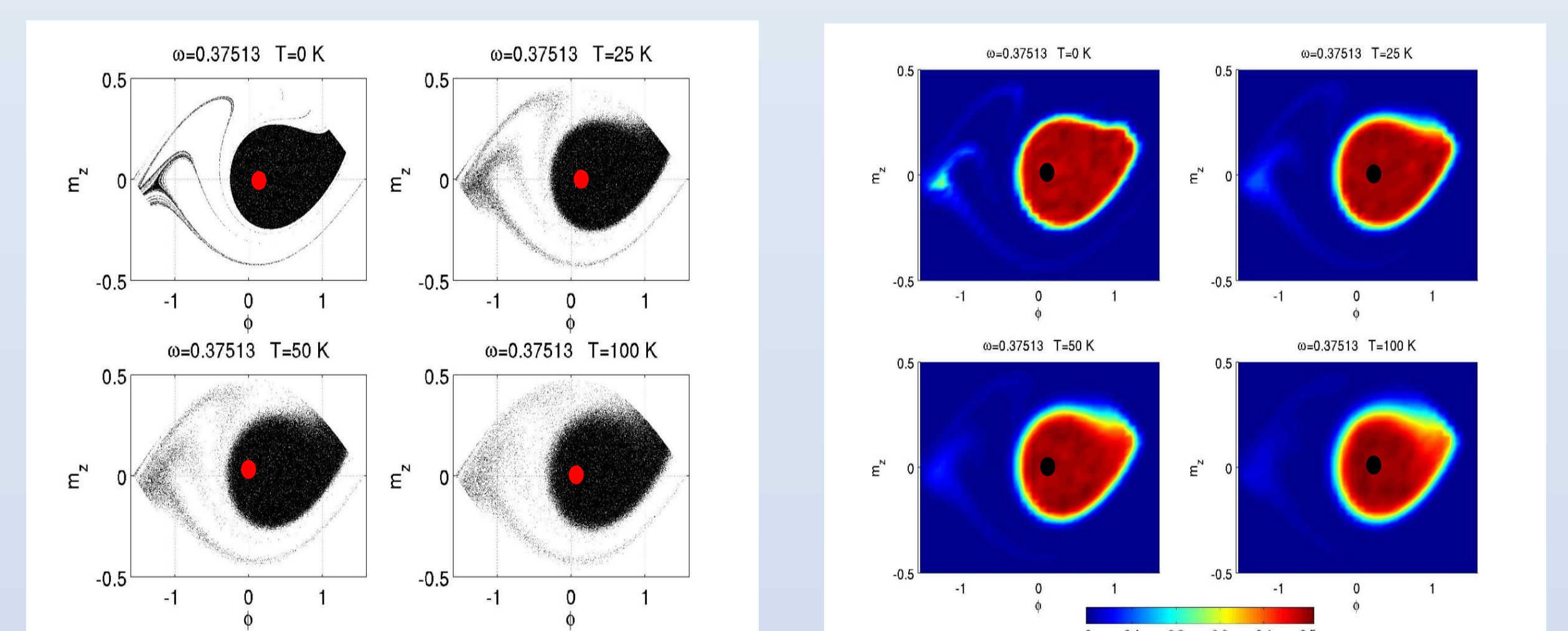


RESULTS :

- Calculation of the threshold microwave field amplitude in function of the frequency at which the erosion starts
- Definition of a safe region for the magnetic state not affected by the progressive erosion of the basin
- The inclusion of the temperature destroys the fractal nature of the eroded basin but preserves the safe states

METHODS :

- Perturbative techniques
- Parallel computation of ensemble of independent magnetic nanoparticles (Poincaré map)



OPEN COLLABORATIONS :

- ❖ UNIVERSIDAD DE SALAMANCA, department of applied physics
- ❖ UNIVERSITA' DEGLI STUDI DI MESSINA, department of engineering



PROJECT PARTECIPATION :

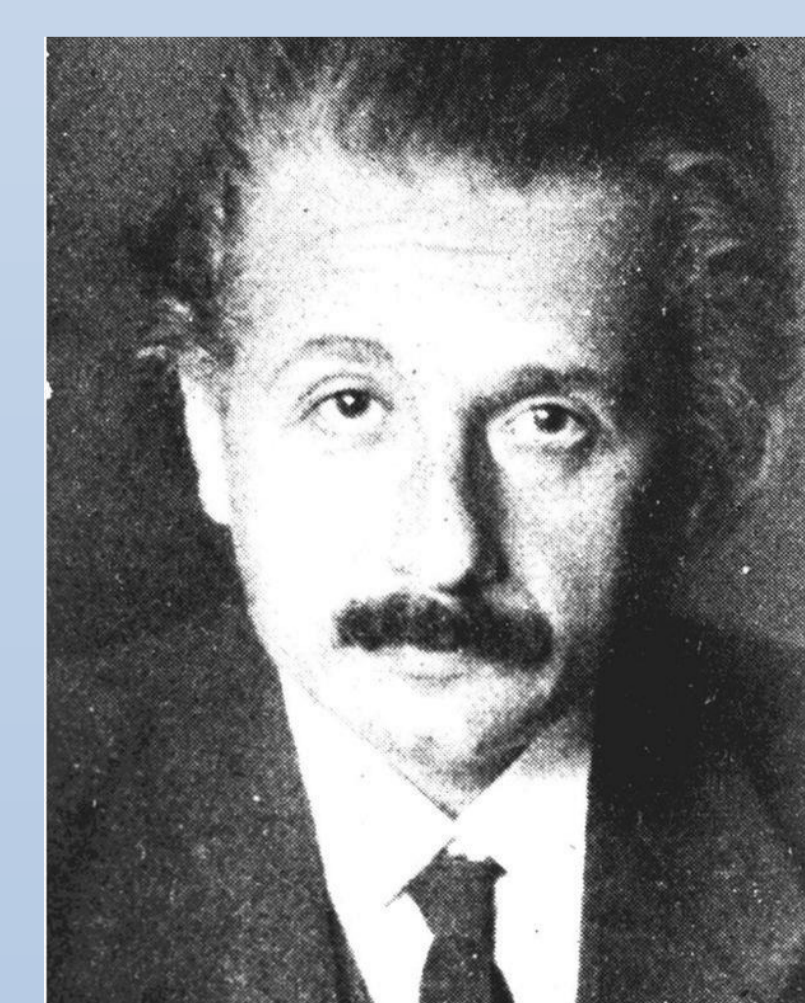
- ❖ PROGRAMMA STAR 2014 LINEA2- Mobilità Giovani Ricercatori

FUTURE DEVELOPMENTS :

- MODELLING OF INTERACTION BETWEEN THE MAGNETIC STATE OF A UNIFORMLY MAGNETIZED NANOMAGNET AND A COSTANT TEMPERATURE THERMAL BATH
- MAGNETIC VORTEX DYNAMICS IN THIN FILM INTERACTING WIT A THERMAL BATH
- CLASSIFICATION AND EXCITATION OF SOLITON DYNAMICS IN MICRONSIZE STRUCTURES
- TWO COUPLED VORTEX DYNAMICS IN FERROMAGNETIC MULTILAYER DEVICES

REFERENCES :

- [1] G. Bertotti, Hysteresis in Magnetism, ACADEMIC PRESS (1998)
- [2] C. Serpico, G. Bertotti and I.D. Mayergoz Nonlinear magnetization dynamics in nanosystems, ELSEVIER (2008)
- [3] M. d'Aquino, Nonlinear magnetization dynamics in thin films and nanoparticles, source : <http://wpage.unina.it/mdaquino>



"Imagination is more important than knowledge. For knowledge is limited, whereas imagination embraces the entire world, stimulating progress, giving birth to evolution." (Albert Einstein, 1920)



"Never think that war, no matter how necessary, nor how justified, is not a crime." (Ernest Hemingway)