Seminar : Paolo Vavassori

CIC nanoGUNE BRTA, 20018 San Sebastian and IKERBASQUE Basque Foundation for Science, 48009 Bilbao(Spain)

Tuesday, June, 1st 2026 at 11 AM
IJL R+4 (N° 4-A014)

Magneto-plasmonics

Biography

Dr. Vavassori received his M.Sc. in Electronic Engineering in 1990 at the Politecnico of Milan (Italy) and his PhD in physics studying electronic correlation in condensed matter.
In 1995, he became a postdoctoral fellow at the University of Ferrara and later, in 1997, he joined the magnetism group of the Materials Science Division at Argonne National Laboratory (Chicago), where he led a project at the Materials Science Division of the Argonne National Laboratory (Chicago, USA) focused on nanostructured magnetic arrays and their application as a new generation of high-density magnetic memories. He developed a novel magneto-optic Kerr effect (MOKE) measurement technique from the light diffracted by nanomagnetic arrays to retrieve quantitative information on both domain formation and magnetic switching mechanisms.
Back to Italy, at Ferrara University as a permanent Research Professor, he established a new research program in the area of magnetic nanostructures, pioneering this research activity in Italy, and set up a world-class laboratory for studying the magnetic and magnetotransport properties of nanostructures.
At CIC nanoGUNE BRTA, initially as an EU FP7 MCSA Senior Research Mobility Fellow and later as an IKERBASQUE Research Professor and co-leader of the group of Nanomagnetism, the focus broadened encompassing the study of novel magnetoplasmonic metamaterials and unconventional applications of magnetic nanostructures to biology, medicine, and chemistry.
He is internationally recognized for his contribution to various research fields. Most notably to: advanced magneto-optical imaging and ultrasensitive magnetometry; defining the role of spin waves in the magnetization reversal of nano-structures; The development of metamaterials for THz amplification; the exploration of the sub-ps thermomechanical and magnetic dynamics of magnetic nanoarrays and magneto-acoustic cavities; the concept development of novel platforms for lab-on-chip bio-applications based on magnetic nanostructures; the study of the plasmon-assisted magneto-optical response for applications to active flat optic and sensing devices; the development of magneto-mechanical nanoactuators; the concept development of plasmon-enhanced ns photo-thermal activation of magnetically frustrated metamaterials.
He is the lead inventor of 3 issued international patents: one on opto-magnetic detection received the 2022 Venture Award from the “European Institute of Innovation&Technology” and is exploited in a portable diagnostic device for fast viral infections detection (e.g., COVID-19) commercialized by the Danish company Blusense Diagnostics.
Dr. Vavassori has (co-) authored 240 peer-reviewed publications in international journals and he has delivered 115 invited oral presentations at international conferences. He is also very actively involved within the scientific community as an advisor and reviewer for journals, international funding agencies, and as conference organizer. He was a Senior member of IEEE Magnetic Society Technical Committee (2010-2015) and serves as an Associated Editor in the Journal of Applied Physics since 2010. Dr. Vavassori received invited Guest Professorships by the Université Pierre et Marie Curie in Paris in 2006, the University of Le Mans in 2019 and 2020, and the Ecole Polytechnique in 2022 and 2023.

Abstract

Plasmons play a large role in the optical properties of metals. The rapidly advancing field of magneto-plasmonics merges concepts from plasmonics and magnetism. This fusion gives rise to novel and unexpected phenomena and functionalities for manipulating light and magnetism at the nanoscale.

In this talk, I present a survey of phenomena and applications across various emerging technologies, showcasing the vast scientific and technological potential of this field.

- Owing to the intertwined optical and magneto-optical properties, magnetoplasmonics provides a versatile toolkit for creating actively tunable optical ultrathin surfaces and metasurfaces. Here, I discuss recent advancements in magnetoplasmonic nanoantennas and two-dimensional magnetoplasmonic crystals. On one hand, these developments enhance our understanding and control of optics at the nanoscale. On the other hand, magnetoplasmonic nanoantennas and surfaces are paving the way for applications in a variety of cutting-edge technologies, including ultrasensitive molecular sensing and ultrathin optical devices

- Thermoplasmonics, the use of plasmonic nanoparticles as nanoscale heat sources that can be remotely controlled by light, has emerged as a dynamic and expanding research area. It offers a unique and adaptable approach for rapidly modulating temperature and creating high temperature gradients with nanoscale spatial precision. When combined with magnetism, these capabilities enable selective heating through optical degrees of freedom, facilitating in-depth investigations of nanostructured magnetic metamaterials and opening opportunities for a new class of ultra-low energy opto-nanomagnetic logic devices suitable for in-memory computing.

- Moreover, the ability of localized plasmons to generate intense and highly localized electromagnetic and magnetic fields heralds exciting possibilities for the optical control of magnetism.

Séminaire organisé dans le cadre du programme interdisciplinaire MAT-PULSE (*Materials and Physics @ Ultimate Scale: Nanotech for a sustainable digital world)*