Nanophotonics & Nanooptics

Tuesday March 18th

3:15 P.M. - 6:30 P.M.

AMPHITHEATRE LOUIS ARMAND OUEST

Program of the session :

Chairs: Maria TCHERNYCHEVA & Erik DUJARDIN

HOUR	NAME	TITLE
15:15	**Hai-Son NGUYEN** **INL - Ecole CentraLe de Lyon**	**Engineering on-demand Band Structures and Non-Hermitian State of Light in Photonic Crystal**
15:45	Nordin FELIDJ ITODYS - Université Paris Cité	Aluminum Plasmonics : Overcoming Strong Damping for High-Performance Applications in the Near-Infrared
16:00	Pascale NASR, INSP - CNRS	Harvesting the Magnetic Field of Light at the Nanoscale
16:15	Benedict S. MORRIS LuMIn, Université Paris-Saclay	Strong coupling in plasmonic-photonic hybrid microcavities
17:00	Benoît REYNIER INSP - Sorbonne Université	Photon-avalanche manipulation of Tm^{3+} doped nanoparticles using a gold nanomirror
17:15	Alban GASSENQ ILM - UCBL	Rare Earth doped microstructures made by pulse laser deposition
17:30	Kevin KIM L2n - Univ. Reims Champagne Ardenne	Surface functional group and contaminant mapping in MXene materials via photo-induced force microscopy
17:45	Chang ZHOU institut Langevin - CNRS	Single-molecule fluorescence lifetime imaging nanoscopy to study plasmonic and biomimetic materials
18:00	Simon VASSANT SPEC - CEA	Optical characterization of a single molecule complete spatial orientation using intra-molecular triplet–triplet absorption
18:15	Vadim ZAKOMIRNYI L2n - UTT	Surprisingly large fluorescence enhancement via all-dielectric spherical mesoparticles

Hai Son NGUYEN (École Centrale de Lyon – INL, Lyon)

Short biography

Hai Son Nguyen holds a degree in Physics (2009) from the École Normale Supérieure de Paris and a PhD in Physics (2011) from the Laboratoire Pierre Aigrain (ENS Paris), where he studied single-photon emission from semiconductor quantum dots.
From 2011 to 2014, he was a CNRS postdoctoral researcher at the Laboratoire de Photonique et de Nanostructures, focusing on light-matter coupling in nanophotonics.
Since 2014, he has been an Associate Professor at École Centrale de Lyon and a junior member of the Institut Universitaire de France (2020–2025).
In 2024, he received the Fabry de Gramont Prize for his contributions to non-Hermitian photonics and optoelectronic devices.
His research at the Institut des Nanotechnologies de Lyon focuses on light-matter interactions in three key areas: optical lattices and metasurfaces, perovskite-based emitting devices, and single-photon emitters for telecom wavelengths.

Two-level system in graphene double quantum dots and Tamm resonators for THz quantum technology

Quantum technologies are experiencing considerable growth in the microwave and optical domains, while their development in the THz spectral range is still in its infancy, but promises significant technological impact1. In this context, developing a novel technology to realize two-level quantum systems at THz frequencies compatible with direct on-chip integration would represent a major breakthrough.
To this aim, graphene quantum dots are very attractive due to their high flexibility in engineering electronic states through their size, shape, and edges2. Here, we present a two-level system based on a hBN-encapsulated graphene double quantum dot (DQD) exhibiting a tunable transition frequency within the THz spectral range. Using low temperature transport measurements, we demonstrate a two-level system with resonance frequency of up to 0.14 THz. We further show that a single graphene QD exhibits a large THz electric dipole with a length of ≈230 nm, revealed by transport measurements under coherent THz illumination and the photon-assisted tunnelling phenomenon3. We also present original hybrid THz resonators4,5 that combine relatively high quality factors (Q~37) with a deep subwavelength mode volume (V~3.2x10−4λ3). Coupling graphene DQDs to these Tamm resonators opens new avenues for generating and detecting non-classical THz light states, essential building blocks of quantum technologies.

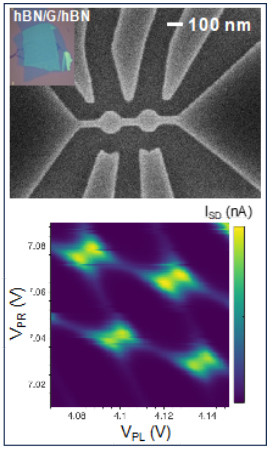

Figure 1 : Top) SEM image of the graphene DQD. Bottom) Measured charge stability diagram of a graphene DQD based device.

Keywords

Graphene, Quantum Dots, Terahertz, Resonators

Acknowledgement

We would like to thank Rebeca Ribeiro for her fruitful assistance in the fabrication of hBN/graphene/hBN heterostructures.

References

[1] Y. Todorov, S. Dhillon, J. Mangeney, Nanophotonics 13, 1681 (2024).
[2] E. Riccardi, et al. Nano Letters 20, 5408 (2020).
[3] S. Messelot et al. Phys. Rev. Res. 4, L012018 (2022).
[4] Simon Messelot et al. ACS Photonics, 7, 2906 (2020).
[5] S. Messelot, S. Coeymans, J. Tignon, S. Dhillon, J. Mangeney. Photon. Res. 11, 1203 (2023).

Wednesday March 19th

4:30 P.M. - 6:30 P.M.

AMPHITHEATRE LOUIS ARMAND EST

Program of the session :

Chairs: Jean-Luc DUVAIL

HOUR	NAME	TITLE
16:30	**Juliette MANGENEY** **LPENS - CNRS**	**Two-level system in graphene double quantum dots and Tamm resonators for THz quantum technology**
17:00	Diana SINGH ICB - UBFC	Understanding the early-stage formation of electron traps responsible for light emission in memristive artificial neurons
17:15	Adrià MEDEIROS GARAY C2n - Université Paris Saclay	Heralding of a single spin via giant polarization rotations in a QD-based spin-photon interface
17:30	Roméo ZAPATA INSP - Sorbonne Université	All-optical generation of drift currents through inverse Faraday effect
17:45	Francesco TALENTI C2n - Paris Cité	AlGaAs microrings with mixed optical nonlinearities
18:00	PEPR - OFCOC	-
18:15	PEPR NANOFILN	-

Juliette MANGENEY (CNRS – LPENS, Paris)

juliette.mangeney@phys.ens.fr

Short biography

Dr Juliette Mangeney is a CNRS researcher in the NanoTHz group of the Laboratoire Physique de l'Ecole Normale Supérieure, Paris since 2012. Her main research focuses on exploring nanomaterials and novel physical concepts to develop advanced THz devices and instrumentation to support the development of THz technology. She currently coordinates an ERC consolidator project (2019-2025) on graphene quantum dots for coherent THz emission. Previously to her current position, she was a CNRS researcher at the Institute of Fundamental Electronics (IEF), Univ. Paris Sud, and studied devices and metrology tools driven by telecom optical waves for THz optoelectronics. She is the author of 101 publications in peer-reviewed journals, 29 invited talks and she holds 4 patents. She headed the French national network on "Nanodevices for THz and MIR radiation" from 2015 to 2023 and the French side of the Russian-French international research network FIRLAB from 2018 to 2022.

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To this aim, graphene quantum dots are very attractive due to their high flexibility in engineering electronic states through their size, shape, and edges2. Here, we present a two-level system based on a hBN-encapsulated graphene double quantum dot (DQD) exhibiting a tunable transition frequency within the THz spectral range. Using low temperature transport measurements, we demonstrate a two-level system with resonance frequency of up to 0.14 THz. We further show that a single graphene QD exhibits a large THz electric dipole with a length of ≈230 nm, revealed by transport measurements under coherent THz illumination and the photon-assisted tunnelling phenomenon3. We also present original hybrid THz resonators4,5 that combine relatively high quality factors (Q~37) with a deep subwavelength mode volume (V~3.2x10−4λ3). Coupling graphene DQDs to these Tamm resonators opens new avenues for generating and detecting non-classical THz light states, essential building blocks of quantum technologies.

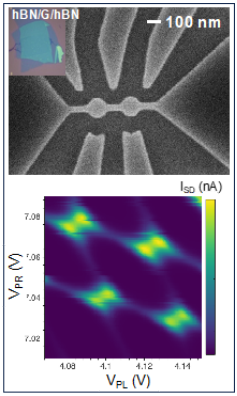

Figure 1 : Top) SEM image of the graphene DQD. Bottom) Measured charge stability diagram of a graphene DQD based device.

Thursday March 20th

2:00 P.M. - 4:30 P.M.

AMPHITHEATRE LOUIS ARMAND EST

Program of the session :

Chairs: Valentina KRACHMALNICOFF & Jean-Baptiste TREBBIA

HOUR	NAME	TITLE
14:00	**Aloyse DEGIRON** **MPQ - CNRS**	**Hybridizing colloidal quantum dots with structured photonic environments reveals unintuitive optoelectronic properties**
14:30	Benjamin ROUSSEAUX FEMTO-ST - Université Marie et Louis Pasteur	Semiclassical theory of strong coupling between emitters and optical resonators
14:45	Marius GAUCHET ILM - UCBL	Exploring Chiroplasmonic Effects on Single Metallic Nano-Objects
15:00	Matthias PAULY MdC, Institut Charles Sadron, ENS de Lyon	Chiral assembled thin films of plasmonic nanowires
15:15	Guillaume LAGUE INSP - Sorbonne université	Pump-probe investigation of charge carrier spin dynamics and dynamic nuclear polarization in FAPbI3 polycrystalline films
15:30	Thomas PONS LPEM - INSERM	Sub-monoexcitonic lasing of semiconductor nanocrystals in polymeric parabolic microcavities
15:45	Alban GASSENQ ILM - UCBL	CdSe Quantum dots integrated into micro-lenses made by photolithography
16:00	Kaouther TLILI INSP - Sorbonne Univ.	Exciton in Halide Perovskite Nanoplatelets: Finite Confinement and Dielectric Effect in Effective Mass Approximation
16:15	Arjun BABU ICCF - Université Clermont Auvergne	Comparative Study of Luminescent Coatings Containing YVO4:Eu3+ Nanoparticles of Different Sizes

Aloyse DEGIRON (CNRS – MPQ, Paris)

https://mpq.u-paris.fr/don/

Short biography

Aloyse Degiron received the PhD in physics from the University of Strasbourg in 2004. In 2005, he joined the metamaterial research team of David R. Smith at Duke University (USA) as a postdoctoral researcher. In 2008, he was appointed as an assistant research professor in the same group. From 2009 to 2018, he worked at the Institut d'Electronique Fondamentale in Orsay as a researcher for the French National Center for Scientific Research (CNRS). In 2018, he moved to the Matériaux et Phénomènes Quantiques laboratory in Paris where he explores new phenomena in optoelectronics using colloidal nanocrystals and photonic nanostructures

Hybridizing colloidal quantum dots with structured photonic environments reveals unintuitive optoelectronic properties

Colloidal quantum dots (QDs) offer attractive opportunities for light sources, detectors and solar cells. They can self-assemble into solid compact layers and their properties can be adjusted with great flexibility during their synthesis to address frequency windows that are otherwise difficult and/or expensive to cover with standard semiconductors [1]. One of the current frontiers in the field is to increase the performances and to obtain new functionalities by hybridizing QD films with tailored photonic environments, such as gratings, metasurfaces or optical antennas. In this talk, I will show that such hybridization produces quite unexpected features, such as carrier lifetimes that are essentially independent of their photonic environment, even if the latter contains sharp resonances that strongly enhance the emission or, to the contrary, no resonance at all [2]. I will rationalize these observations with carrier thermalization arguments [2-4], discuss their fundamental implications and show how these effects can be leveraged in optoelectronic devices [5,6].

Keywords

Financial support for this work comes from the European Research Council grant FORWARD (reference: 771688).

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References

[1] J. Zhang, S. Zhang, Y. Zhang, O. A. Al-Hartomy, S. Wageh, A. G. Al-Sehemi, Y. Hao, L. Gao, H. Wang, and H. Zhang, Laser Photon. Rev. 17, 2200551 (2023).
[2] P. He, A. Caillas, G. Boulliard, I. Hamdi, P. Filloux, M. Ravaro, E. Lhuillier and A. Degiron, ACS Photon. 11, 437 (2024).
[3] J.-J. Greffet, P. Bouchon, G. Brucoli, and F. Marquier, Phys. Rev. X 8, 021008 (2018).
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[5] A. Caillas, S. Suffit, P. Filloux, E. Lhuillier and A. Degiron, Nano Lett. 22, 2155 (2022).

Friday March 21th

10:30 A.M. - 12:30 A.M.

AMPHITHEATRE LOUIS ARMAND EST

Program of the session :

Chairs: Maria TCHERNYCHEVA & Erik DUJARDIN

HOUR	NAME	TITLE
10:30	**Davy GERARD** **L2n - UTT**	**Self-hybridization and hot electron generation in aluminum nanoantennas**
11:00	Jean-François BRYCHE L2n - CNRS	Control of heat anisotropy by pump-probe spectroscopy and imaging method of photodegradation at the nanoscale
11:15	Céline MOLINARO IS2M - CNRS	Macro to nanoscale polymerization induced through controlled heat generation by thermoplasmonics
11:30	Sugi KORATH SHIVAN CINAM - Aix Marseille University	Engineering metasurfaces by plasmon-assisted nanoreactors
11:45	Emmanuel O. IDOWU ICMCB - CNRS	Synthesis of Si@Au core-shell particles for directional light scattering
12:00	Karmel de Oliveira LIMA LCIM - CEA	Nanocomposite scintillators: enhancing nanoparticle incorporation and optical stabilization
12:15	Valentin ALLARD	Optical Nearfield characterization of Nb2O5 and SiO2 dielectric thin films for quantitative measurement in the visible spectral range

Davy GERARD (UTT - L2N, Troyes)

https://recherche.utt.fr/light-nanomaterials-nanotechnologies-l2n/members/davy-gerard

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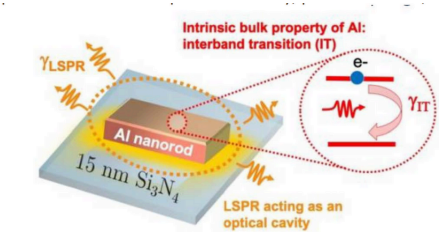
Short biography

Davy Gérard obtained his PhD in physics in 2004 from the University of Burgundy (Dijon) for his work on near-field optical microscopy applied to photonic crystals. In 2008, he joined the Light, nanomaterials, nanotechnologies (L2n) laboratory. Davy Gerard's research focuses on light-matter interactions at the nanoscale, particularly in the vicinity of metallic nanostructures. This encompasses the use of optical antennas and metasurfaces to manipulate light emission, the development of novel plasmonics materials, and the study of chiroptical interactions. His current research endeavors center on aluminum as a novel plasmonic material, particularly in the context of UV-plasmonics, collective resonances in arrays of nanoparticles, and chiral plasmonics.

Self-hybridization and hot electron generation in aluminum nanoantennas

Strong coupling is typically observed between two distinct entities or between an entity and its environment (e.g., an atom and a cavity). However, it can also occur between two distinct excitations within the same object, a phenomenon that has been less extensively investigated. In this work, we present evidence of strong coupling between localized surface plasmon resonances and the interband transition in aluminum nanorods. This coupling is evidenced by optical spectroscopy and electron energy loss spectroscopy (EELS), supported by numerical simulations. The strong coupling involves multiple orders of plasmon modes, including dark modes. The corresponding Rabi energy, which defines the energy splitting between the two polaritonic branches, is determined in each case. Importantly, the use of EELS allowed us to experimentally map the hybrid modes with nanoscale resolution, giving further evidence of the strong coupling. Moreover, a dedicated numerical model [1] is employed to demonstrate that strong coupling in the near-infrared region facilitates efficient hot electron generation, exploiting the hybrid nature of the modes.

The plasmonic component provides a high absorption cross-section, while the interband transition ensures efficient hot electron generation. As a result, aluminum nanorods emerge as a highly efficient source of hot electrons in the visible and near-infrared regions, with possible applications in localized photochemistry, photodetection, and solar energy harvesting.



References

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Poster Session

NANOPHOTONICS & NANOOPTICS

N° POSTER	TITLE	NOM	Prénom
1	Plasmon-induced thermo-polymerization of PETA in presence of various thermal initiators	BASTIDE	Mathieu
2	Twin-photon generation and manipulation in thin film lithium niobate on insulator waveguides	BENCHEIKH	Kamel
3	24 mode universal photonic processor in a femto second laser writing platform	BENEFICE	Maelle
4	Tomographic Shearmetry of Flows at Cell Surfaces using Nanoprobes	BONETTI	Marcello
5	Thousand-fold Purcell factors for single molecules in DNA origami-assembled gold nanocube dimers	CAPUZZO	Marco
6	Bright, large and flexible structural colors	CHOUITER	Manele
7	SMARTLIGHT PLATFORM: a french key facility for smart photonics	CLUZEL	Benoit
8	GaAs Schottky diodes with sub-micron anode for THz applications	CUVELLIER	Jean-Baptiste
9	Ultrasensitive Label-Free Optical Detection Based on Functionalized Plasmonic Nanofilms and Enhanced Phase Singularity	DU	Fusheng
10	Optimized Electron Beam Lithography for the Fabrication of Resonant Waveguide Gratings	DUSSARD	Antoine
11	Controlling fluorescence of perovskite quantum dots with nanostructured aluminum	GARCELON	Eloïse
12	Mapping of Surface Acoustic Waves for Mid-Infrared Integrated Acousto-Optics	GÉRODOU	Thomas
13	High sensitivity Grating-SPR based sensor using Low-Loss Surface Plasmon modes coupling for the detection of H2	MEYER	Arnaud
14	Enhancement of quadratic nonlinear responses from resonant Gallium Phosphide nanospheres	GUENGARD-MORINEAU	Lola
15	Optically magnetizing gold nanoantennas through the Inverse Faraday effect	HAREAU	Chantal
16	Molecular photoactuators at the nanoscale	ISHOW	Eléna
17	All-optical, interconnect-free Arithmetic and Logic Units (ALU): design by hybrid AI, nanofabrication and experimental demonstration	KHITOUS	Amine
18	Nonlinear generation of orbital angular momentum in metasurfaces	LECASBLE	Célestin
19	Microscope stabilization for single particle tracking in thick biological tissues using phase imaging	MANKO	Hanna
20	Skyrmion Generation in a Plasmonic Nanoantenna through the Inverse Faraday Effect	MIVELLE	Mathieu
21	Compact Light Projector Metalens	OUSSAID	Ziad
22	ZnO nanowire-based gratings for light extraction enhancement	RÉVERET	François
23	Photonic crystal nanostructures for strong atom-photon interaction in a quantum network	SAUTEL	Valère
24	Thermalization of photons in disordered scattering media	SONCIN	Lorenzo
25	From optically-pumped towards electrically-pumped ridge polariton laser	SOUISSI	Hassen
26	Photoluminescence enhancement based on multi-material metasurfaces	SRAJ	Ali
27	In-rich InGaN/GaN nanowires for red light emitting diodes	TCHOULAYEU POSSIE	Nidel Dilan
28	Optimization of thermochromic perovskites (RENiO3) radiative properties for thermal screening application	TOSTIVINT	Pierre-Antoine
29	Enhanced Near-Infrared Plasmonic Sensing Chips with Ultra-Thin Optical Absorption Nanolayer Fabricated by Cross-beam Pulsed Laser Deposition	ZAKIROV	Nurzad
30	Composites nanoparticles/liquid crystals, structure and electro-optical properties	ZHOU	Muyan