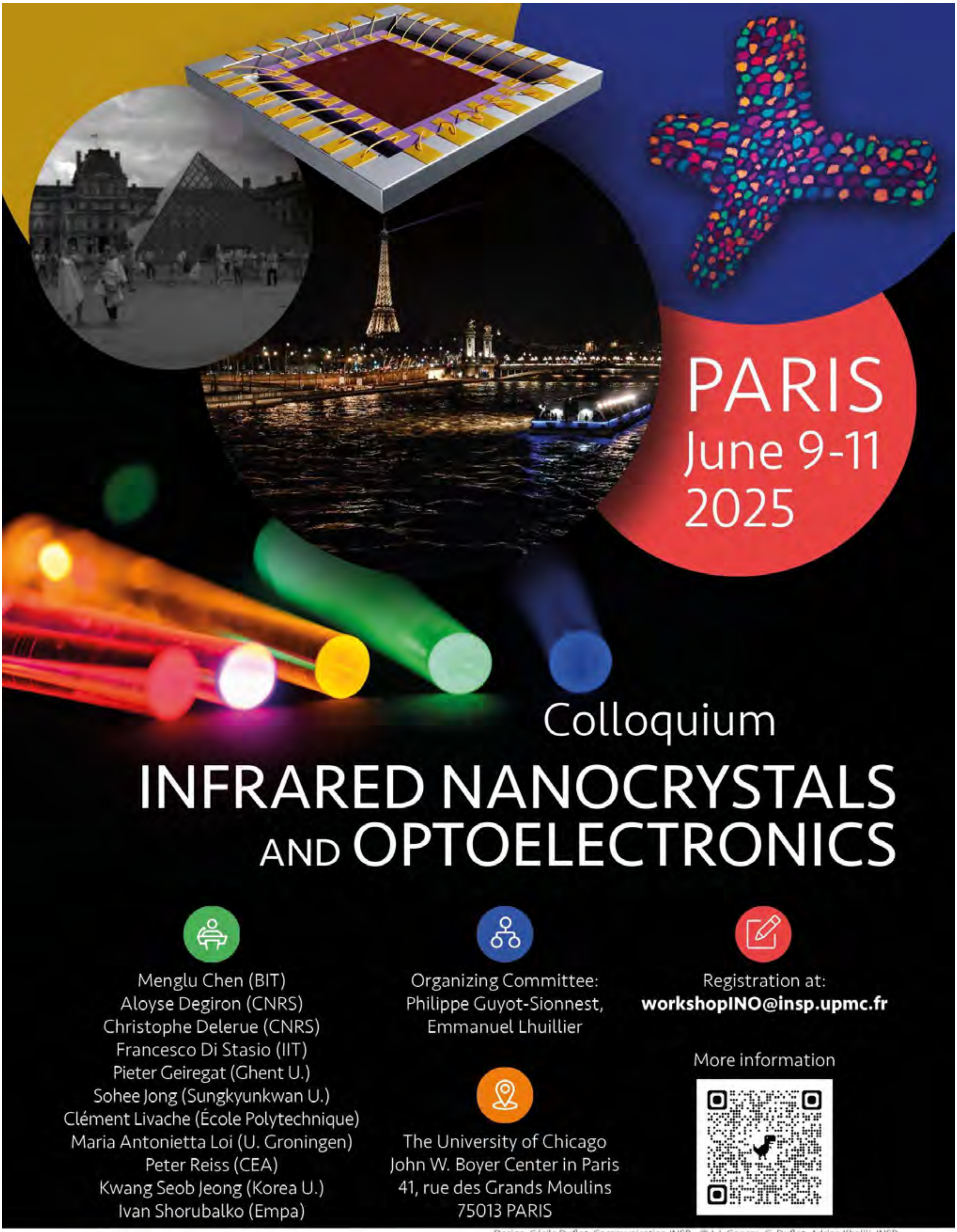


Design: Cécile Duflot, Communication INSP - © J. J. Ganem, C. Duflot, Adrien Khalili, INSP

cnrs SORBONNE UNIVERSITÉ THE UNIVERSITY OF CHICAGO INTERNATIONAL INSTITUTE OF RESEARCH IN PARIS John W. Boyer Center in Paris insp

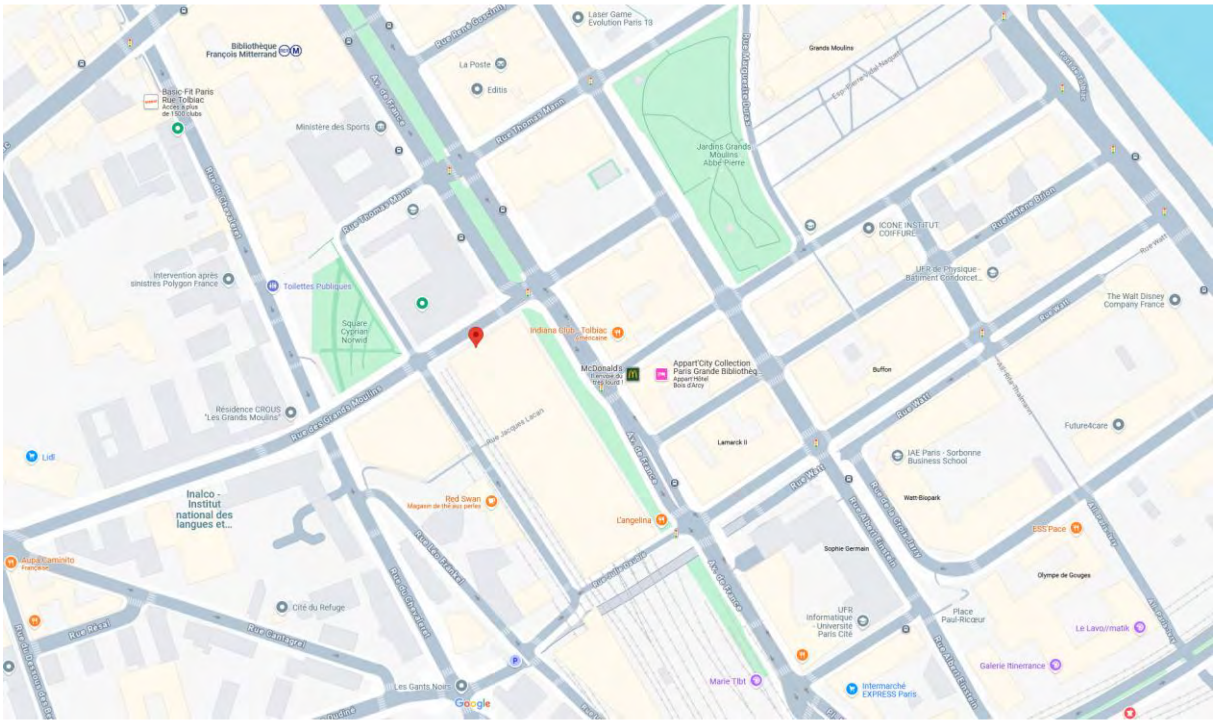
TALKS

Talks will be given in University of Chicago Center in Paris

41 rue des Grands Moulins – 75013 Paris, France

Ampitheater from 1st floor

Subway station: Bibliothèque Francois Mitterand (Line 14 or RER C)



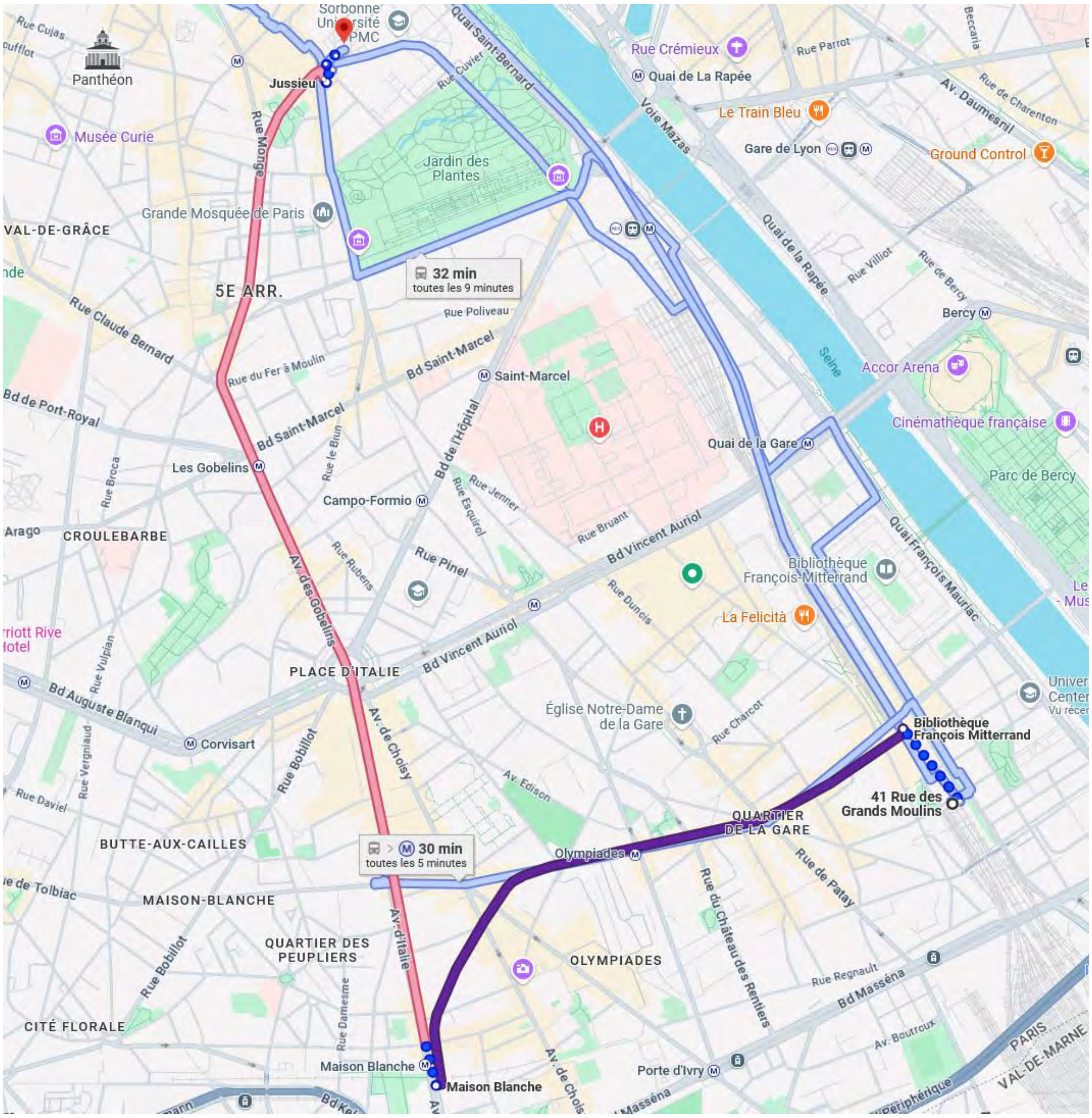
SOCIAL DINNER

Tuesday evening party will be given on 24th floor of Zamanski tower at Sorbonne Université Campus
4 place Jussieu, 75005 Paris

Party starts at 7 pm up to 9 :45pm

Subway station Jussieu (line 7 and 10) or by bus,

Or, as depicted on map below, use line 14 (purple line), change at « maison blanche » toward line 7 (pink line) up to Jussieu.



PROGRAM

Monday 9th june

9h-9h15	opening	**PGS+EL**	
9h15-10h00	invited	Maria Loi	**Advanced devices Chair: P. Guyot Sionnest**
10h00-10h45	invited	Ivan Shorubalko	
10h45-11h	COFEE		
11h00-11h45	invited	Menglu Chen	
11h45-12h05	Contri.	A. Caillas	
12h05-13h45	lunch+**poster**		
13h45-14h30	invited	Francesco Di Stasio	**IR source Chiar: E. Lhuillier**
14h30-15h15	invited	Clement Livache	
15h15-15h35	Contri.	E. Bossavit	
15h35-15h55	Contri.	R. Caremelita	
15h55-16h15	COFEE		
16h15-17h00	invited	Pieter Geiregat	
17h-17h20	Contri.	X. Shen	
17h20-20h	**Poster - Drink**		

Tuesday 10th june

9h15-10h00	invited	Aloyse Degiron	**Photonics Chair: P. Geiregat**
10h00-10h45	invited	Kwang Seob Jeong	
10h45-11h	COFEE		
11h00-11h45	invited	Xinzheng Lan	
11h45-12h05	Contr.	A. Portniagin	
12h05-12h25	Contr.	T. Zhao	
12h15-14h00	free time for lunch		
14h00-14h45	invited	Christophe Delerue	**Theory and new concept Chair A. Degiron**
14h45-15h05	Contri.	J. Utterback	
15h05-15h25	Contri.	M. Tharrault	
15h25-15h45	Contri.	H. Roshan	
15h55-16h15	Contri.	J.W. Kim	
16h15-16h35	Contri.	M.K. Takur	
up to 17h	**poster**		
19h-21h45	**Dinner** *(detail previous page)*		

Wednesday 11th june

9h15-10h00	invited	Peter Reiss	**beyond II-VI and IV VI chair: F. Di Stasio**
10h00-10h20	Contr.	Y. Wang	
10h20-10h40	Contr.	B. Ji	
10h40-11h	COFEE		
11h00-11h45	invited	Sohee Jeong	
11h45-12h15	Contr.	L. Protesescu	
12h15-12h45	Closing word	PGS+EL	
12h45-14h	Final Lunch		

END of workshop

INVITED

TALKS

COLLOIDAL QUANTUM DOT SUPERLATTICES: TOWARDS OPTOELETRONIC METAMATERIALS

M.A.Loi

[1] Zernike Institute for Advanced Materials, University of Groningen, Groningen, The Netherlands

Abstract: 3D superlattices made of colloidal quantum dots are a promising candidate for the next generation of optoelectronic devices as they are expected to exhibit a unique combination of tunable optical properties and coherent electrical transport through minibands. In my presentation I will show the fabrication of 3D superlattices of PbSe and PbS QDs with nanoscale-level controlled ordering over large areas [1, 2], and of outstanding transport properties. The measured electron mobilities for PbSe superlattices are the highest ever reported for a self-assembled solid of fully quantum-confined objects (electron mobility up to 278 $cm^2\ V^{-1}\ s^{-1}$). This ultimately demonstrates that optoelectronic metamaterials with highly tunable optical properties (in this case in the short-wavelength infrared spectral range) and charge mobilities approaching that of bulk semiconductor can be obtained. This finding paves the way toward a new generation of optoelectronic devices.

Keywords: Superlattices, Transport properties, PbS, PbSe, SWIR.

References:

[1] J. Pinna, R. Mehrabi Koushki, D. S. Gavhane, M. Ahmadi, S. Mutalik, M. Zohaib, L. Protesescu, B. J. Kooi, G. Portale, M. A. Loi, Approaching Bulk Mobility in PbSe Colloidal Quantum Dots 3D Superlattices. Adv. Mater., 35, 2207364 (2023).

[2] J. Pinna, E. Pili, R. Mehrabi Koushki, D. S. Gavhane, F. Carlà, B. J. Kooi, G. Portale, and M. A. Loi PbI2 Passivation of Three Dimensional PbS Quantum Dot Superlattices Toward Optoelectronic Metamaterials ACS Nano, 18, 19124 (2024).

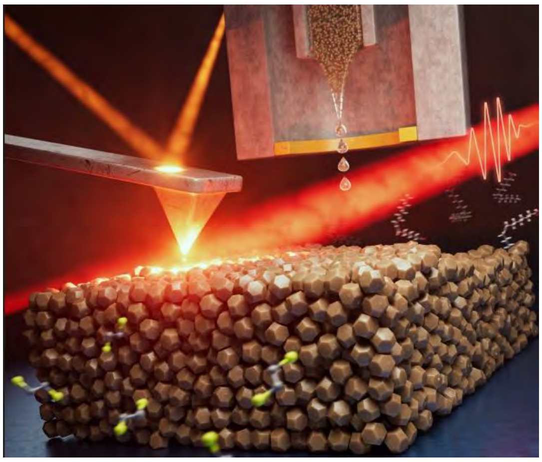
Printed colloidal quantum dots IR-photodetectors

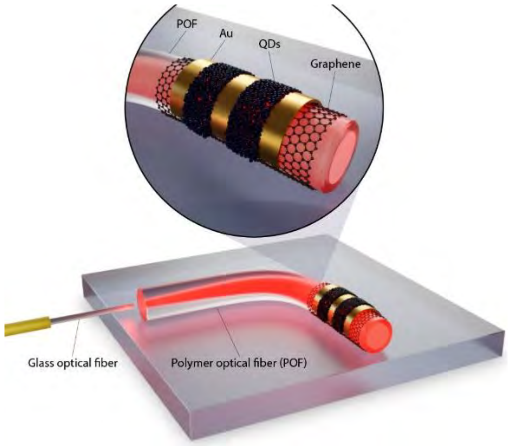
Ivan Shorubalko

Nanoelectronics and Nano-Optics Group, Empa – Swiss Federal Laboratories for Materials Science and Technology, CH8600 Dubendorf, Switzerland

Abstract: Printing provides precise microscopic spatial control over the deposition of colloidal quantum dots (cQDs), enabling novel device architectures and applications, optimizing performance, and offering deeper insights into the mechanisms of device functionality. IR-phototransistors fabricated by electrohydrodynamic printing of PbS and HgTe cQDs on top of graphene are realized [1]. AFM-IR technique is utilized to develop printing protocols and solid-state ligand exchange recipes [2]. Conformal integration of an QDs-graphene IR Photodetector on a polymer optical fiber is demonstrated with a vision towards wearable sensing [3]. Scaling of the photodetector devices to subwavelength dimensions is investigated for miniaturization of IR-spectrometers [4].

Keywords: printing, flexible electronics, cQDs, IR-detectors, wearables





References

[1] (a) M. J. Grotevent et al, Adv. Optical Mater. 7, 1900019 (2019), 10.1002/adom.201900019; (b) M. J. Grotevent et al, Adv. Sci. 8, 2003360 (2021), 10.1002/advs.202003360

[2] L. J. A. Ferraresi et al, Nano Lett. 24, 10908 (2024), 10.1021/acs.nanolett.4c02631

[3] G. Kara et al, Adv. Mater. Technol. 8, 2201922 (2023), 10.1002/admt.202201922

[4] (a) G. Kara et al, ACS Photonics 11, 2194 (2024), 10.1021/acsphotonics.3c01759; (b) M. J. Grotevent et al, Nature Photonics 7, 59–64 (2023), 10.1038/s41566-022-01088-7

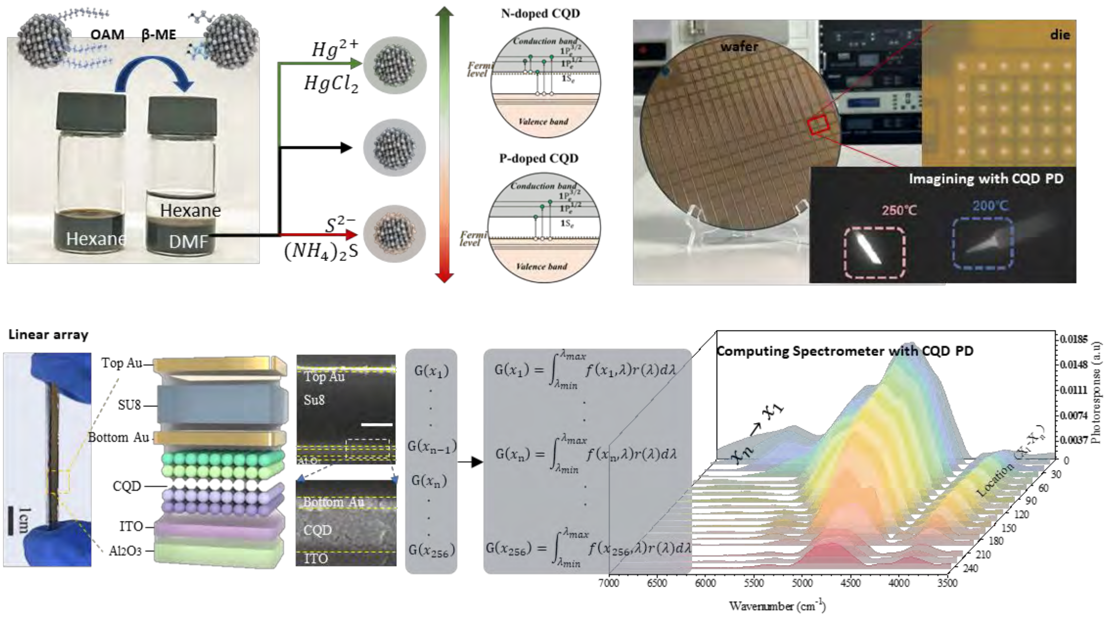
Research on Infrared Colloidal Quantum Dots and Their Applications

Menglu Chen[1,2] , Xiaomeng Xue[1]

[1] School of Optics and Photonics, Beijing Institute of Technology, Beijing 100081, China
[2] Zhejiang Key Laboratory of 3D Micro/Nano Fabrication and Characterization, Westlake Institute for Optoelectronics, Hangzhou, Zhejiang 311421, China

Abstract: Colloidal quantum dots (CQDs) are of interest for optoelectronic devices because of the possibility of high-throughput solution processing and the wide energy gap tunability from ultraviolet to infrared wavelengths. Particularly, HgTe CQD is one of the promising candidates for infrared photodetection. Here, we would like to share our recent work on HgTe CQD synthesis and their properties, as well as the applications on narrow/broad band infrared photodetectors, infrared spectrometers and infrared focal plane arrays.

Keywords: Infrared, Colloidal quantum dot, photodetection, HgTe.



References :

[1] Xue, X; Hao, Q..; Chen, M. Very Long Wave Infrared Quantum Dot Photodetector up to 18 μm. Light: Science & Applications 13, (2024)
[2] Xue, X. ; Chen, M. ; Luo, Y.; Qin, T.; Tang, X.; Hao, Q. High-Operating-Temperature Mid-Infrared Photodetectors via Quantum Dot Gradient Homojunction. Light: Science & Applications 12, 2 (2023).*
[3] Xue, X.; Lv, H. .; Qiu, Y.; Hao, Q.; Chen, M. Thermally Stable High Carrier Mobility Nanocomposite Infrared Photodetector. APL Photonics 9: 046101 (2024).

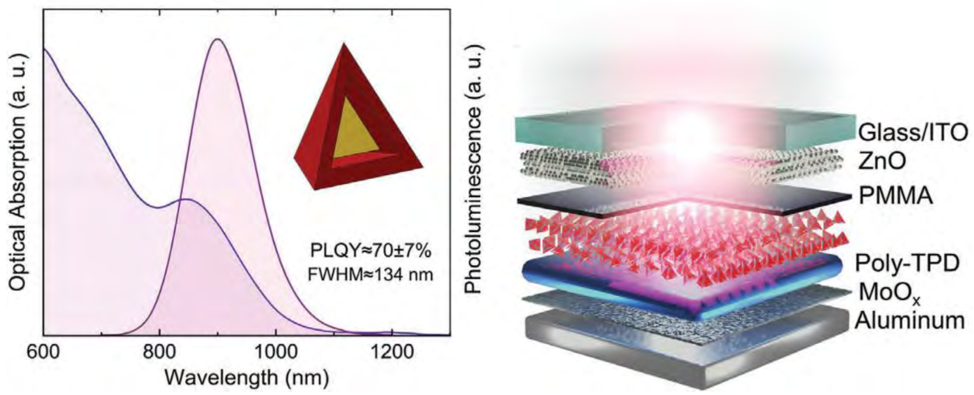
Near-infrared light-sources based on colloidal semiconductor quantum dots

Francesco Di Stasio[1]

[1] Photonic Nanomaterials, Istituto Italiano di Tecnologia, Via Morego 30, 16163 Genova, Italy

Abstract: Near-infrared (NIR) light-sources are of interest for a variety of applications such as hyperspectral imaging, night vision, telecommunication systems and point-of-care testing. Colloidal quantum dots (QDs) possess interesting properties for NIR optoelectronics thanks to their tunable photoluminescence, solution processability, and capability for CMOS integration. Here, I will discuss our recent findings on different NIR-emitting QDs of different composition, such as InAs and CdHgSe ones. In fact, both InAs/ZnSe and CdHgSe/CdS core-shell QDs[1,2] can be employed for the fabrication of NIR light-emitting diodes with high external quantum efficiencies (EQE), with the former composition being of technological interest given that is fully RoHS-compliant.[3]

Keywords: Colloidal quantum dots, III-V, II-VI, nanocrystals, light-emitting diodes, near-infrared.



References :

[1] Prudnikau, A. et al. Adv Funct Mater n/a, 2310067 (2023)

[2] Roshan, H. et al. Advanced Science 11, 2400734 (2024)

[3] Bahmani Jalali, H. et al. Chem. Soc. Rev. 51, 9861 (2022)

Ultrafast Spin-Exchange Interactions Leading to Efficient Carrier Multiplication in Infrared Core-Shell Quantum Dots

C. Livache[1,2], H. Jin[2], WD Kim[2], J. Noh[2], V. Pinchetti[2], N. Ahn[2], V.I. Klimov[2]

[1]. Laboratoire de Physique de la Matière Condensée, Ecole polytechnique, Institut Polytechnique de Paris, CNRS UMR 7643, Palaiseau France
[2]. Chemistry Division, Los Alamos National Laboratory, Los Alamos NM, USA

Abstract: Manganese-doped CQDs have been used for photoemission and catalysis applications thanks to their capability to generate hot carriers. Recently, our work have shed light on the mechanisms underlying such processes,[1] demonstrating that Mn:CdSe with resonant spin-exchange interactions feature considerably accelerated Auger recombination rates, outpacing carrier cooling and allowing for efficient multiple-step Auger photoemission.[1] Carrier multiplication (CM) is akin to an inverse Auger relaxation process, prompting us to design an Mn-doped infrared CQD system that could take advantage of such accelerated Auger rates for CM, exploiting not direct but spin-exchange Coulomb interactions. We discuss application of this idea in manganese-doped PbSe/CdSe[2] and CdSe/HgSe[3] CQDs, as well as important aspects relative to device application.

Keywords: Carrier multiplication, phototransport, Auger recombination, SWIR, CQD doping, spectroscopy.

References

[1]. Livache et al. "High-Efficiency Photoemission from Magnetically Doped Quantum Dots Driven by Multi-Step Spin-Exchange Auger Ionization." Nature Photonics 16, 433 (2022)

[2]. Jin et al. "Spin-Exchange Carrier Multiplication in Manganese-Doped Colloidal Quantum Dots." Nature Materials 22, 1013 (2023)

[3]. Noh et al. "Highly Efficient Carrier Multiplication in 'Inverted' CdSe/HgSe Quantum Dots Mediated by Magnetic Impurities", submitted.

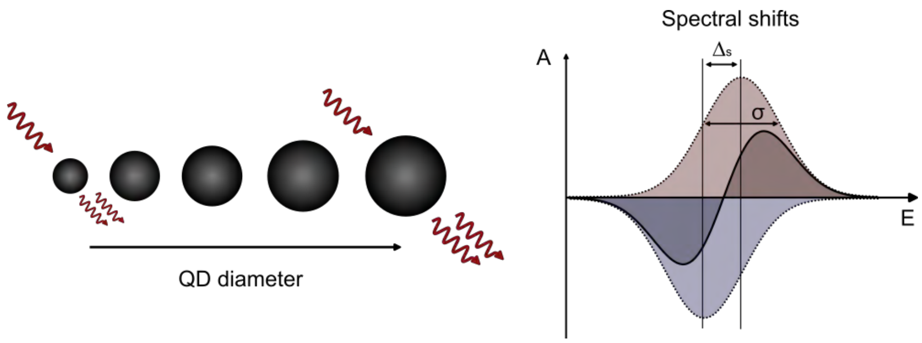
Unraveling the Nature of Near to Short-Wave Infrared Stimulated Emission from PbS Nanocrystals under Vanishing Quantum Confinement

Jan Matthys[1,2], Alexander Arutunyan[1,2], Ranjana Yadav[1,2], Nastaran Kazemi Tofighi[1,2], Shuaijun Liu[1,2], Papa Seck[1,2], **Pieter Geiregat**

[1] Physics and Chemistry of Nanostructures Group, Department of Chemistry, Ghent University, 9000 Gent, Belgium
[2] NOLIMITS Center for Non-Linear Microscopy and Spectroscopy, Ghent University, 9000 Gent, Belgium

Abstract: Colloidal nanocrystals (NCs) are touted for their use in opto-electronics, where their size tunable optical properties enabled such applications as photo-detectors and light-emitting diodes. Most of these applications are however in the visible spectrum, whereas much more impact could be reached in the short and mid-wave infrared. Moreover, where current state-of-art relies on light absorption and spontaneous emission, the use of NCs for IR light amplification remains a frontier. In this talk, I will highlight how quantitative analysis of NCs in a regime of strong photo-excitation identifies the driving forces behind efficient light amplification, and how such insights can be used to for realizing short and mid-wave infrared light sources of the future. I will use the model system of PbS NCs to illustrate that a push towards larger '*bulk*' nanocrystals seems the optimal way forward. [1]

Keywords: Ultrafast Spectroscopy, Stimulated Emission, Infrared.



References :

[1] Tanghe, I. et al. Disruptive Optical Gain from Bulk CdS Nanocrystals through Giant Band Gap Renormalization. Nature Nanotechnology 18, 1423 (2023). https://doi.org:10.1038/s41565-023-01521-0

Why nanocrystal solids are so different from individual emitters when it comes to tailor their properties with photonic environments

Puyuan HE[1], Guillaume BOULLIARD[1], Pascal FILLOUX[1], Emmanuel LHUILLIER[2] and **Aloyse DEGIRON**[1]

[1] Université de Paris, CNRS, Laboratoire Matériaux et Phénomènes Quantiques, F-75205 Paris, France
[2] Sorbonne Université, CNRS, Institut des NanoSciences de Paris, INSP, F-75005 Paris, France

Abstract: One of the current frontiers in the field of colloidal nanocrystals (NCs) is to increase the performances of the devices and to obtain new functionalities by hybridizing NC films with tailored photonic environments, such as gratings, metasurfaces and optical antennas. Here, we 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 [1]. We will rationalize these observations by showing that mutual interactions among NCs play a key role in their optoelectronic properties and then discuss how these effects can be leveraged in novel optoelectronic devices [2].

Keywords: PbS nanocrystals, quantum dot LEDs, metasurfaces, hot carriers, optical vortices, local Kirchhoff law

References :

[1] P. He, A. Caillas, G. Boulliard, I. Hamdi, P. Filloux, M. Ravaro, E. Lhuillier and A. Degiron, "Observation of quasi-invariant photocarrier lifetimes in PbS nanocrystal assemblies coupled to resonant and nonresonant arrays of optical antennas," ACS Photon. 11, 437 (2024).

[2] G. Boulliard, I. Roland, D. Schanne, M. Petolat, P. Filloux, E. Lhuillier, and A Degiron, "Quantum dot LEDs emitting broadband vortex beams," submitted.

Optical Properties of Silver Chalcogenides Colloidal Quantum Dot and thier MWIR-SWIR Optoelectronic Applications

Kwang Seob Jeong

[1] *Center for Molecular Spectroscopy and Dynamics, Institute for Basic Science (IBS), Korea University, Seoul 02841, Korea*
[2] Department of Chemistry, Korea University, Seoul 02841, Republic of Korea

Abstract: The development of nontoxic, wavelength-tunable colloidal quantum dots (CQDs) has attracted significant interest for short-wavelength infrared (SWIR) to mid-wavelength infrared (MWIR) applications. In this talk, I will present nonstoichiometric silver chalcogenides (Ag_xE, x > 2, E=S, Se, Te) CQDs with tunable optical properties. Precise compositional control, surface passivation strategies, and shell passivation offer enhanced infrared responsivity, external quantum efficiency of the SWIR-MWIR CQD photodetectors, and intriguing fundamental properties. The enhanced air-stability, reduced trap-density, and excellent optoelectronic performance of Ag_2E-based CQDs highlight their potential as solution-processed, environmentally benign SWIR-MWIR optoelectronic applications.

Keywords: Self-doped quantum dot, Silver selenide, Silver telluride, Cation-exchange, Infrared, Quantum-Plasmon Resonance

References :

[1] Extended Short-wavelength Infrared Ink by Surface Tuned Silver Telluride Colloidal Quantum Dots and their Infrared Photodetection. ACS Materials Lett. 6, 11, 4988– (2024)

[2] Silver Telluride Colloidal Quantum Dot Solid for Fast Extended Shortwave Infrared Photodetector. Adv. Sci. 11, 44, 2407453 (2024)

[3] Extended Short-Wavelength Infrared Photoluminescence and Photocurrent of Nonstoichiometric Silver Telluride Colloidal Nanocrystals. Nano Lett. 21, 19, 8073 (2021)

The electronic property engineering of HgTe CQDs for short-wave infrared photodetectors

Mengxuan Yu[1], Ji Yang[2], Binbin Wang[1], **Xinzheng Lan**[1,2,*]

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Abstract: HgTe colloidal quantum dots (CQDs) have emerged as promising candidates for the next-generation infrared photodetectors.due to their extremely wide spectral response and excellent solution processability. However, the synthesis of materials and the regulation of electronic properties are still not mature enough, which limits the development of high-performance photodetectors. Here we report a series of approaches that improve the electronic properties of HgTe CQDs, which either leads to improved detector performance, or allows for application-oriented new device structure. The development of high-performance photodetectors based on other CQD materials will also be briefly discussed.

Keywords: HgTe quantum dots, Electronic properties, Infrared photodetectors.

References :

[1]. Ligand-Engineered HgTe Colloidal Quantum Dot Solids for Infrared Photodetectors. Nano Lett. 22, 3465 (2022).

[2]. In-Synthesis Se-Stabilization Enables Defect and Doping Engineering of HgTe Colloidal Quantum Dots. Adv. Mater. 36, 2311830 (2024).

[2]. Synergism in Binary Nanocrystals Enables Top-Illuminated HgTe Colloidal Quantum Dot Short-Wave Infrared Imager. Nano Lett. 24, 9583 (2024).

Unique characteristics of the electronic and optical properties of HgTe nanocrystals

Antoine Hage, **Christophe Delerue**

IEMN, Villeneuve d'Ascq, France

Abstract: HgTe is a semi-metallic material with unconventional electronic properties compared to the usual III-V or II-VI semiconductors, characterized by a negative bandgap, band inversion and topological insulator properties under the action of quantum confinement [1]. How do these unique characteristics impact the electronic and optical properties of HgTe nanocrystals, particularly when their band gap approaches zero, when their optical response ranges from the mid-infrared to the THz? We are answering this question through a theoretical study that allows us to deal with large nanocrystals, in the vicinity of the topological transition [2]. The optical inter-band and intra-band transitions of these nanocrystals are analyzed in detail.

Keywords: HgTe, topological transition, optical properties, nanocrystals

References :

[1] K. A. Sergeeva, H. Zhang, A. S. Portniagin, E. Bossavit, G. Mu, S. V. Kershaw, S. Ithurria, P. Guyot-Sionnest, S. Keuleyan, C. Delerue, X. Tang, A. L. Rogach, E. Lhuillier, The Rise of HgTe Colloidal Quantum Dots for Infrared Optoelectronics. Adv. Funct. Mater. 2024, 34, 2405307. https://doi.org/10.1002/adfm.202405307

[2] A. Hage and C. Delerue, unpublished.

Pb-Free InAs Colloidal Quantum Dots for Infrared Harvesting

Youngsang Park[1], Hyoin Kim[1], **Sohee Jeong**[1,2]

[1] Department of Energy Science (DOES) and Center for Artificial Atoms, Sungkyunkwan University (SKKU) Suwon 16419, Republic of Korea
[2] Sungkyunkwan Institute of Energy Science and Technology (SIEST) Suwon 16419, Republic of Korea

Abstract: Infrared light harvesting is crucial for advancing next-generation optoelectronic devices, including photodetectors and photovoltaics. Colloidal quantum dots, particularly InAs-based systems, provide a promising Pb-free alternative due to their tunable electronic properties and strong IR absorption. However, traditional InAs CQDs exhibit dominant n-type behavior, limiting their versatility in device applications. In this work, we demonstrate a novel synthetic approach that enables precise control over the p- and n-type characteristics of InAs CQDs through the choice of reducing agents during synthesis. The p-type InAs CQDs, achieved *via* Zn-assisted doping, facilitate improved charge transport and reduced recombination losses, making them highly suitable for IR photodetection and other IR harvesting applications. By modulating these tunable electronic properties, we highlight the potential of p-type InAs CQDs in developing efficient and RoHS-compliant IR detectors and energy-harvesting devices, expanding their role in advanced optoelectronic technologies.

Near-Infrared Active III-V Quantum Dots for Optoelectronics

Oleksandra Yeromina,[1] Majed Ibrahim,[1] Sudhakar Vediappan,[1] Wai Li Ling,[2] Stéphanie Pouget,[3] Bérangère Hyot,[4] **Peter Reiss**[1,*]

1- Univ. Grenoble Alpes, CEA, CNRS, IRIG-SyMMES, 38000 Grenoble, France
2- Univ. Grenoble Alpes, CEA, CNRS, IBS, 38000 Grenoble, France
3- Univ.Grenoble Alpes, CEA, IRIG/MEM, 38000 Grenoble, France
4- Univ. Grenoble Alpes, CEA, Leti, 38000, Grenoble, France

Abstract: Colloidal quantum dots (CQDs) have become the most prominent class of phosphors for the color conversion in micro-LED displays in the past decade. By switching to narrower bandgap materials, the NIR/SWIR spectral range becomes accessible which enables leveraging novel functionalities. In particular, the integration of QD-based NIR/SWIR photo-diodes with micro-LED panels paves the way for the design and low-cost fabrication of smart displays. Narrow bandgap RoHS-compliant III-V materials have been much less explored than lead chalcogenide QDs (PbS, PbSe) due to synthetic challenges related to their more covalent character, the scarcity of appropriate group-V precursors, and their high oxidation sensitivity. We present a novel synthetic platform for InAs and InSb QDs, giving access to wavelengths up to 2 µm (Fig. 1).1 After overgrowth with appropriate shell materials, they can also act as efficient NIR/SWIR emitters for various applications.2

Keywords: III-V quantum dots, NIR/SWIR photodetectors, smart displays.

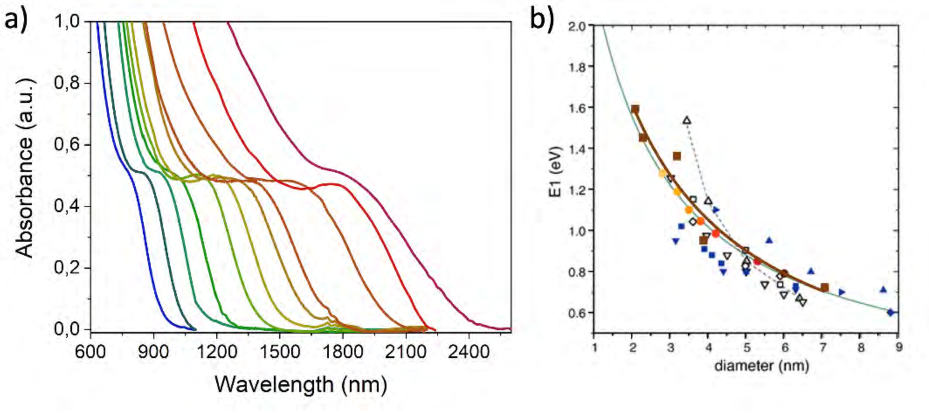


Figure 1: a) Absorption spectra of InSb QDs (around 2-7 nm left to right). b) Sizing curve (brown) compared to literature data.

References

[1] Kwon, Y.; et alSynthesis of NIR/SWIR Absorbing InSb Nanocrystals Using Indium(I) Halide and Aminostibine Precursors. Adv. Funct. Mater. 2403912.

[2] Bossavit, E.; et al Advancing the Coupling of III–V Quantum Dots to Photonic Structures to Shape Their Emission Diagram. Advanced Optical Materials 2401601 (2024).

CONTRIBUTED

TALKS

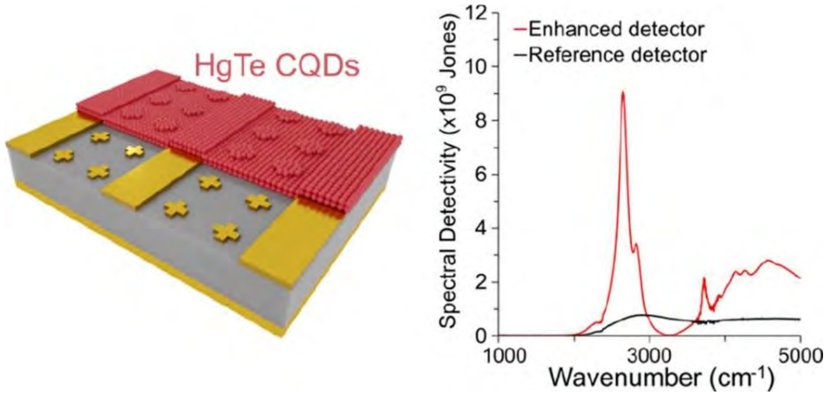
Using plasmonics to improve the performance of quantum dot-based infrared photodetectors

Augustin Caillas[1]; Philippe Guyot-Sionnest[1]

[1]James Franck Institute, The University of Chicago, 929 East 57th Street, Chicago, Illinois 60637, United States

Abstract: As the field of colloidal quantum dot (CQD) optoelectronics advances rapidly, enhancing light-matter interactions within these systems has become a key focus to improve device performance and enable advanced functionalities. Here, we explore strategies that combine plasmonic resonators with HgTe CQDs to develop high-performance devices for room-temperature infrared photodetection. These structures not only enhance optical absorption but also leverage the highly localized optical modes of plasmonic resonators, which concentrate the electromagnetic field in a small region of the device. As a result, the plasmonic structures are also used as a tool to focus light within small volumes, which we exploit to reduce the amount of active material and thereby reduce the noise in photodetectors.

Keywords: HgTe, Infrared photodetection, plasmonics.



References:

Caillas, A.; Guyot-Sionnest, P. Uncooled High Detectivity Mid-Infrared Photoconductor Using HgTe Dots and Nanoantennas. ACS Nano 18, 8952 (2024)

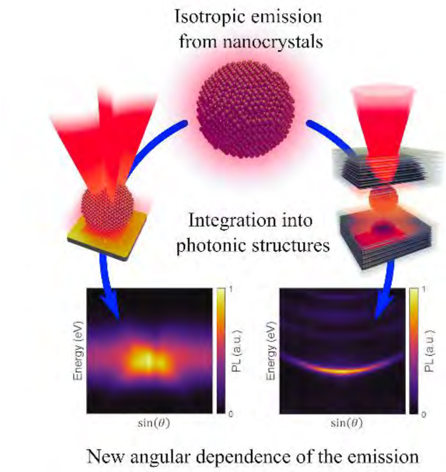
Shaping the Photoluminescence of Infrared-Emitting Nanocrystals Through Their Coupling to Photonic Structures

Erwan Bossavit[1,2], Oleksandra Yeromina[3], Lina Makke[4], Yoann Prado[2], Mathieu G. Silly[1], Sandrine Ithurria[4], Peter Reiss[3], Emmanuel Lhuillier[2]

[1.] Synchrotron SOLEIL, L'Orme des Merisiers, Départementale 128, 91190 Saint-Aubin, France.
[2.] Sorbonne Université, CNRS, Institut des NanoSciences de Paris, 75005 Paris.
[3.] Univ. Grenoble Alpes, CEA, CNRS, IRIG, SyMMES, 38000 Grenoble, France
[4.] Laboratoire de Physique et d'Etude des Matériaux, ESPCI, 75005 Paris, France

Abstract: Infrared-active colloidal quantum dots (CQDs) now present high photoluminescence (PL) quantum yields. However, their efficiency drops drastically after device integration. A key component of this issue is the efficient extraction of light from devices, since only ~20% of generated photons radiate outside of light emitting diodes (LEDs) due to optical phenomena. We explore the coupling of the CQDs' emission to photonic structures as a strategy to address this problem. These structures can grant directionality to an isotropic emission to ensure the outcoupling of photons from LEDs. We studied several infrared-active CQDs – from HgTe[1] to heavy-metal-free materials[2,3]– and demonstrated their successful integration to different photonic structures, ranging from plasmonic metallic gratings[1,2] to full-dielectric cavities[3], which led to increased PL magnitudes[1], strong directivities around normal incidence[3], and highly decreased linewidths[3].

Keywords: HgTe, luminescence, photonic structure



References:

1. *E. Bossavit, et al., Advanced Optical Materials 2023, 11, 2300863. 2023*
2. *E. Bossavit, et al. Advanced Optical Materials n.d., n/a, 2401601. 2024*
3. *L. Makke, at al. Advanced Optical Materials, 2402747. 2025*

Optical amplification and lasing in infrared colloidal quantum dots.

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Abstract: Colloidal quantum dots (CQDs) have great potential for realizing compact lasers. Here, I present our recent results on short-wave infrared (SWIR) optical amplification and lasing in lead chalcogenide quantum dot films. Using transient absorption spectroscopy, the development of optical gain and the relevant gain metrics are investigated in the size range between 3 and 14 nm. While in small dots optical gain is hampered by competing photo-induced absorbance, films of CQDs with size bigger than 5 nm show amplified spontaneous emission and lasing under fs-pumping, tunable from ≈1580 nm to ≈2400 nm. Finally, by exploiting the higher cross section of big CQDs and rationalizing the charge carrier dynamics in these systems, ns-lasing in the SWIR is demonstrated for the first time.

Keywords: SWIR, lasing, optical gain, colloidal quantum dots, transient absorption

References :

[1] Whitworth, Guy L., Carmelita Roda, Mariona Dalmases, Nima Taghipour, Miguel Dosil, Katerina Nikolaidou, Hamed Dehghanpour, and Gerasimos Konstantatos. "Extended Short-Wave Infrared Colloidal Quantum Dot Lasers with Nanosecond Excitation." Advanced Materials 37, 2410207 (2025).

[2] Whitworth, G.L., Dalmases, M., Taghipour, N. and Konstantatos, G., 2021. Solution-processed PbS quantum dot infrared laser with room-temperature tunable emission in the optical telecommunications window. Nature photonics, 15, 738.

Mid-infrared electroluminescence from CdSe colloidal quantum dots

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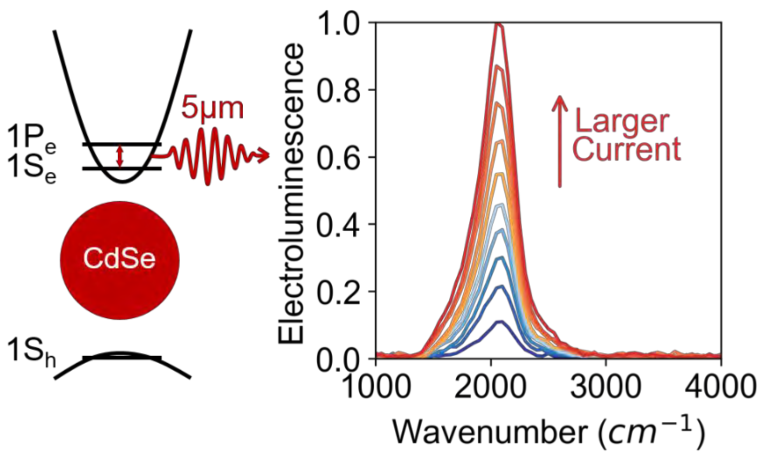
Abstract: Mid-infrared electroluminescence from the electron intraband transition is demonstrated with intrinsic CdSe colloidal quantum dots. The device consists of a thin film of CdSe dots and a layer of ZnO nanocrystals, sandwiched between two electrodes which enhance light outcoupling at 5 microns. The emission is a cascade process. At 100 mA and 15 V, the electron to photon efficiency is 0.40% and the power conversion efficiency is 0.013%. The devices show good air and thermal stability. Electron transport layers and surface traps are discussed.

Keywords: Colloidal quantum dots, intraband, electroluminescence, CdSe, cascade



References:

Shen, X., & Guyot-Sionnest, P. Mid-infrared Electroluminescence from CdSe Quantm Dots. ACS nano. ACS nano, 19(5), 5811 (2025).

Nonlinear Light Conversion and Infrared Photodetection with Laser-Printed Plasmonic Metasurfaces Supporting Bound States in the Continuum

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Abstract: Plasmonic metasurfaces supporting high-Q resonances offer unprecedented ways for controlling light-matter interaction at the nanoscale, yet scalable fabrication of such sophisticated designs relies on expensive and multi-step fabrication routes hindering their practical application. Here, we produced plasmonic metasurfaces (the regular arrangement of hollow protruding nanobumps) via direct femtosecond laser patterning of thin gold films. By using comprehensive optical modeling, infrared spectroscopy and angle-resolved third harmonic generation experiments, we justified that such nanobumps support symmetry-protected plasmonic bound states in the continuum (BIC) with a Q-factor up to 40. Moreover, under critical coupling conditions providing matching of the radiative and nonradiative losses of the high-Q mode, the metasurfaces demonstrate the third harmonic generation enhanced by a factor of 10^5 as compared to the smooth Au film. Finally, by taking advantage of the straightforward character of the laser printing process, we realized field-effect transistor device with a HgTe quantum dots as an active medium and BIC-supporting plasmonic metasurface imprinted over drain and source electrodes. The resulting metasurface-empowered device operating at 200 K and 5 V bias voltage demonstrates superior specific detectivity around 8.7 10^{11} at the plasmonic-BIC spectral region and fast response time holding promise for realization of advanced shortwave IR photodetectors.

III-V QD Synthesis and Nano-printing Assembly for Infrared Photodetection

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[2] Department of Materials Science and Engineering, The University of Pennsylvania, USA

Abstract: We have reported a general synthetic approach for III-V QDs, including InAs, InSb, and InAsSb, with wide size and composition tunability (**Fig.1a**). In recent progress, their absorption wavelengths have been extended to the short-wave IR (SWIR, >1500 nm) regime. We have also developed the surface ligand exchange and passivation strategies for III-V QDs to achieve high carrier mobility and photoresponse. We established a nano-resolution printing method to deposit inks from the colloidal nanocrystal library, followed by onsite room-temperature ligand exchange to functionalise the nanocrystal solids (**Fig.1b**). This enables layer-by-layer printing with a wide selection of NC inks, ligand reagents, substrates, and device architectures. We demonstrate all-printed multi-layer PbS QD SWIR photodiodes with 10-μm pixel sizes.

Keywords: III-V QDs, InSb QDs, hybrid ligand exchange, all-printed QD IR photodetectors

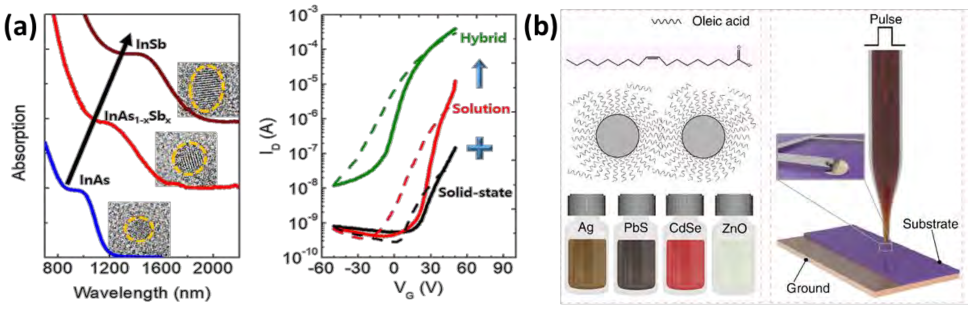

Fig. 1. (a) Synthesis of III-V IR QDs. (b) Nano-printing assembly of NC devices

References :

1. Zhao, T.**;** # Oh, N.; # et al. J. Am. Chem. Soc. 2019, 141 (38), 15145–15152.

2. Zhao, T.**;** # Zhao, Q.; # et al. Chemistry of Materials. 2022, 34 (18), 8306–8315.

3. Zhao, Z.; An, R.; et al. Under revision.

Tailoring LSPR from NIR to MIR by continuous growth and assembly of $Cs_xWO_{3-\delta}$ nanocrystals

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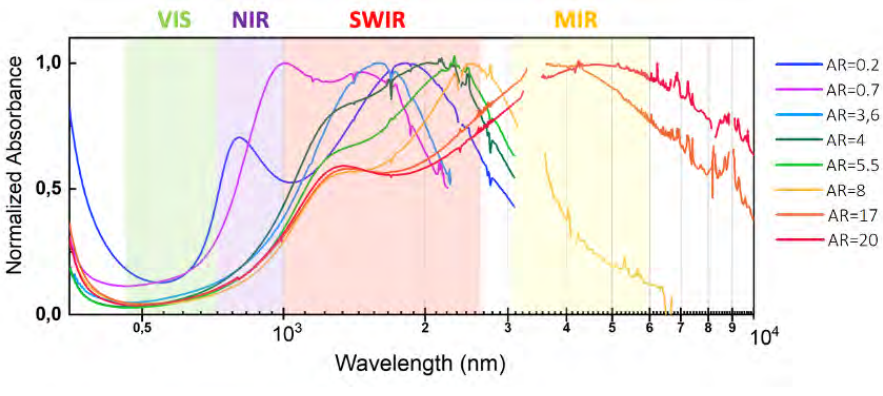
Abstract: The exceptional IR-selective and tunable LSPR (localized surface plasmon resonance) of CsxWO3-δ nanocrystals stems from their high thresholds for Cs+ and VO•• co-doping levels. Also, their structural anisotropy in hexagonal phase generates a unique dual-mode LSPR that can be useful for multi-band or switchable infrared optics [1,2]. This presentation introduces novel methods to control the nanostructure of individual CsxWO3-δ nanocrystals and their collective assemblies, and explores how structural factors promote unique LSPR characteristics that are unseen from noble metal nanoparticles. We emphasize that the anisotropic crystal structure and surface chemistry offer key advantages in controlling particle shape [3,4], facilitating oriented assemblies [5], and expanding the LSPR spectral range across the NIR, SWIR, and MIR regions (750 ~ 6000 nm). Furthermore, we demonstrate how these tunable plasmonic properties can be harnessed to design NIR-shielding windows for energy saving [6] or active energy harvesting devices.



References :

[1] *Nano Letters16, 3879 (2016)*

[2] *Nano Letters 15, 5574 (2015)*

[3] *Chem. Mater. 34, 9795, (2022)*

[4] *Under review*

[5] *Nano Letters, 24, 3074 (2014)*

[6] *Adv. Funct. Mater., 33, 2212845, (2023)*

Microscopic Charge and Heat Transport in Nanocrystal Assemblies

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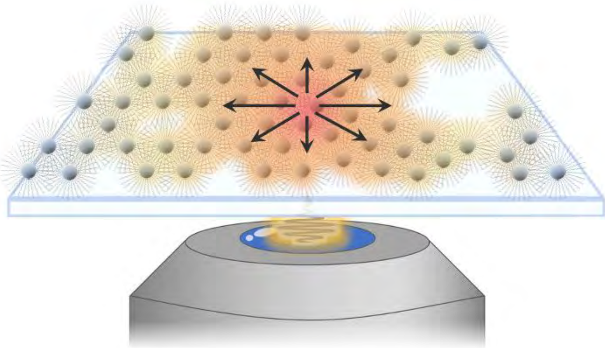
Abstract: Optoelectronics applications require control over the generation and extraction of photoexcited charges as well as thermal management. Understanding and controlling carrier dynamics in realistic environments is necessary for the rational design of device-level efficiency. There are many approaches to inferring microscopic energy transport through energetic, temporal, or spatial markers, but each faces limitations. This presentation will focus on the following questions: How can we access information about energy carriers that traditionally do not have clear spectroscopic signals? How do heterogeneous environments and interfaces impact microscopic energy transport? How can we control the directionality of charge and heat flow in nanocrystal assemblies? I will describe pump–probe optical measurements and modeling of both charge-carrier and thermal transport in nanocrystal assemblies.

Keywords: Pump–probe spectroscopy, charge transport, thermal transport, colloidal nanocrystals



References :

[1] M. Feldman, C. Vernier, R. Nag, J. J. Barrios-Capuchino, S. Royer, H. Cruguel, E. Lacaze, E. Lhuillier, D. Fournier, F. Schulz, C. Hamon, H. Portalès, J. K. Utterback "Anisotropic Thermal Transport in Tunable Self-Assembled Nanocrystal Supercrystals" ACS Nano 2024, 18(50), 34341.*

[2] J. K. Utterback, A. Sood, I. Coropceanu, B. Guzelturk, D. V. Talapin, A. M. Lindenberg, N. S. Ginsberg. "Nanoscale disorder generates subdiffusive heat transport in self-assembled nanocrystal films" Nano Lett. 2021, 21(8), 3540.

Integration of InAs@ZnSe nanocrystals with 2D Materials for Infrared Optoelectronics

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Abstract: Harvesting infrared (IR) light is essential for enhancing the efficiency of photovoltaic and photoelectric applications, including imaging and communication. However, existing IR technologies primarily rely on toxic materials such as lead, cadmium, and mercury chalcogenides, raising significant environmental and health concerns.
Indium arsenide (InAs) has recently attracted attention due to its tunable IR absorption, high quantum efficiency, and compliance with the European Union's "Restriction of Hazardous Substances" (RoHS) directives. However, the long-chain organic ligands present in colloidal InAs nanocrystals hinder their direct integration into optoelectronic devices. To overcome this limitation, we explore the potential of combining InAs with 2D materials such as graphene, fluorographene, and MoS_2, where InAs serve as an IR-absorbing material while 2D materials act as efficient charge transporters.
In this study, we investigate the annealing effect on InAs nanocrystals to facilitate ligand removal. Our initial results indicate that InAs nanocrystals exhibit thermal stability up to 300°C. Furthermore, annealing enhances ligand removal, particularly in InAs@ZnSe core-shell structures, as confirmed by optical and electrical characterization. Photoluminescence and Raman spectroscopy further reveal the successful integration of InAs with 2D materials. These findings highlight a promising approach for optimizing InAs nanocrystals in next-generation infrared optoelectronic applications.

References :

[1] Di Stasio et al., Adv. Sci., 11, 2400734 (2024).
[2] M. De Franco et al., ACS Energy Lett. 7, 3788 (2022)
[3] D. Zhu., Adv. Mater. 35, 2303621 (2023)
[4] Thakur et al., Adv. Funct. Mater. 34, 2409951 (2024)

ROAD TO PHOTON GAS CONDENSATION IN A PLASMONIC CAVITY

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Abstract: Making a thermal gas out of photons may seem paradoxical. However, it can be done by mediating the interactions between photons with an active medium. At high enough density, the bosonic photon gas can reach the threshold of Bose-Einstein condensation, allowing for long-range correlations and opening up exciting new physics [1]. Following the first demonstration of 2D photon condensation in the weak coupling regime [2], we propose a near-infrared surface plasmon polariton paraxial cavity, reducing the system to 1D. In this talk, I will present the experimental challenges faced in achieving thermalization with such short-lived quasiparticles. We will compare the use of an organic laser dye and nanocrystal emitters. Finally, we will study the regimes that can be attained while varying the pump fluence within such a system.

Keywords: photon condensation, thermalization, laser, surface plasmon polaritons, cavity, nanocrystal emitters, dye.

References :

[1] Bloch, J., Carusotto, I. & Wouters, M. Non-equilibrium Bose–Einstein condensation in photonic systems. Nat Rev Phys 4, 470 (2022).

[2] Klaers, J., Schmitt, J., Vewinger, F. & Weitz, M. Bose–Einstein condensation of photons in an optical microcavity. Nature 468, 545 (2010).

InAs Colloidal Quantum Dot Light Emitting Diodes

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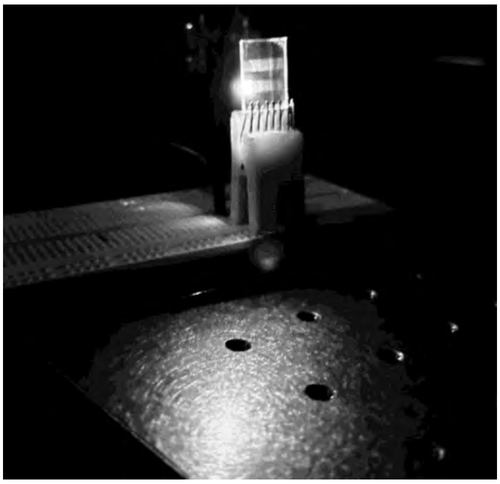
Abstract: A major challenge in synthesizing infrared QDs has been the reliance on hazardous and heavy metal-containing materials like PbS and HgTe. This study presents an improved synthesis method using tris(dimethylamino)-arsine (amino-As) along with Alane N,N-dimethylethylamine as a reducing agent and $ZnCl_2$ as an additive. The resulting InAs/ZnSe core/shell QDs, with a tunable shell thickness, exhibited photoluminescence around 900 nm and a photoluminescence quantum yield of up to 70%. Using these QDs, an LED was developed with an external quantum efficiency of 13.3% and a radiance of 12 $Wsr^{-1}cm^{-2}$ [1]. Furthermore, the LED architecture was optimized for high-speed switching and pulse generation.

Keywords: InAs QDs, LEDs.



References

[1] Adv. Sci. 11, 2400734 (2024)

Silver Telluride Colloidal Quantum Dots for Shortwave Infrared Photodetectors

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Abstract: Colloidal quantum dots (CQDs) have been developed for low-cost shortwave infrared (SWIR) photodetection, and extraordinary device performances have been achieved after decades' efforts. However, their widespread adoption has been hindered by the toxicity of lead/mercury-based materials. Here we will present our recent progress on silver telluride quantum dots and their application in high-performance SWIR photodetectors. The CQD photodetector stack employs materials compliant with the Restriction of Hazardous Substances directives and demonstrated performance comparable with their heavy-metal counterparts. We further realized a monolithically integrated SWIR imager and proof-of-concept LiDAR based on solution-processed, toxic-heavy-metal-free materials, paving the way to the consumer electronics market.

Keywords: colloidal quantum dots, heavy-metal-free, shortwave infrared, photodiodes

References

[1] Wang, Y. et al. Silver telluride colloidal quantum dot infrared photodetectors and image sensors. Nat. Photon. 18, 236 (2024).

[2] Wang, Y. et al. Shortwave Infrared Light Detection and Ranging using Silver Telluride Quantum Dots. Under Revision.

Controlled synthesis of III-V QDs for optoelectric applications

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[2] Westlake Institute for Optoelectronics, Hangzhou, China

Abstract: Colloidal III-V QDs (InP, InAs) are gaining attention for optoelectronic applications due to their heavy-metal-free composition. Compared to II-VI QDs, III-V QDs exhibit two distinct characteristics: (1) a tendency to form amorphous surface oxides and (2) strong binding between In and surface ligands. Hydrofluoric acid etching is commonly used to remove oxides from InP QDs, enabling high-quality InP core/shell QDs.[1] In this presentation, we will demonstrate an alternative surface activation strategy that avoids HF treatment to synthesize high-quality III-V QDs. Additionally, we discover fluoride species modulate ZnSe growth during the synthesis of NIR InAs/ZnSe QDs, resulting in uniform QDs with quantum yields nearing 100%.[2] We explore their optoelectronic applications, including photon upconversion and NIR light-emitting diodes.[2,3]

Keywords: III-V QDs, InAs, surface activation, near-infrared light-emitting diodes, up-conversion

References :

[1] Won, Y.-H. et al. Highly Efficient and Stable InP/ZnSe/ZnS Quantum Dot Light-Emitting Diodes. Nature 575, 634 (2019).

[2] Li, B. et al. Over 20% External Quantum Efficiency in Near-Infrared Quantum Dot Light-Emitting Diodes by Using Photo-Crosslinked Hole-Transport Layers. Research Square, 2024. DOI: 10.21203/rs.3.rs-4667950/v1.

[3] Sun R. et al. Near-Infrared-to-Visible Photon Upconversion with Efficiency Exceeding 21% Sensitized by InAs Quantum Dots. J. Am. Chem. Soc. 146, 17618 (2024).

Synthesis Mechanisms and Surface Chemistry of InSb Quantum Dots

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Abstract: Indium antimonide (InSb) quantum dots (QDs) are promising materials for infrared optoelectronics due to their narrow bandgap, strong quantum confinement effects, and tunable absorption in the short-wave to mid-wave infrared (SWIR-MWIR) regions. These properties make InSb QDs attractive for applications in photodetectors, optical communications, and bioimaging. However, challenges remain in achieving monodisperse, high-quality QDs with controlled surface chemistry for processability in solution-based applications.

In this study, we demonstrate the rapid formation of InSb nanoclusters (~2 nm) at room temperature, serving as precursors for high-quality InSb QDs. By comparing heating-up and hot-injection methods, we identify heating-up synthesis as the superior approach for achieving well-defined excitonic features. Systematic optimization of key parameters—including superhydride injection, quenching conditions, and precursor selection—enables precise tuning of InSb QD sizes. Notably, varying halide precursors allows for controlled blue shifts in absorption, while tailored In-to-Sb ratios extend the absorption wavelength up to 2200 nm. Despite polydispersity in preformed nanoclusters, we explore size-selection strategies and highlight the need for direct synthesis of monodisperse nanoclusters to achieve uniform QDs.

Beyond synthesis, a fundamental understanding of surface chemistry is crucial for the integration of InSb QDs into functional devices. In this presentation, I will also discuss strategies to tailor surface ligands for improved colloidal stability, electronic properties, and ink formulation. By engineering the surface chemistry, we aim to develop high-quality InSb QD inks for solution-processed infrared devices. These findings provide a comprehensive framework for advancing InSb QD synthesis and processing, enabling scalable infrared optoelectronics applications.

Keywords: InSb, quantum dots, mechanism

POSTER

N°	Author name	Poster title
1	Lorenzo Ferraresi	Time-response Optimization in PbS and InAs cQDs IR-photodiodes for High-Frequency Applications
2	Albin Colle	thermally stable core shell HgTe nanocrystals for infrared sensing
3	Wen Xin	The influence of cations and anions on ligand exchange in InAs.
4	Alexander Arutunyan	Bulk Nanocrystals in the Infrared Spectrum, from Tools to Spectroscopy
5	Gaurav Kumar	CQDs-based long-wavelength infrared sensing
6	Adrien Khalili	SWIR imaging with photoconductive operation
7	Dario Mastrippolito	Design of infrared transparent electrodes
8	Yihao Yuan	Measuring hot carrier temperatures in layers of PbS quantum dots coupled to Au metasurfaces
9	Nastaran Kazemi Tofighi	Single and multi-Exciton Dynamics across Intraband transitions in III-V InP/ZnSe nanocrystals
10	Tommaso Gemo	Design of transparent resonant electrodes for mid IR
11	Francesco De Bellis	Electronic and Thermal Signatures in Pump–Probe Spectroscopy of Semiconductor Nanocrystal Films
12	Rajesh Bera	Mid-Infrared Active Non Toxic Colloidal Quantum Dots
13	Xavier Kirchherr	Chemistry and synthesis of III-V quantum dots for SWIR applications
14	Papa Seck	Ehancing Silicon Photonics with Infrared Nanocrystals
15	Ibrahim Majed	Synthesis and Functionalization of Indium Arsenide and Indium Antimonide for SWIR Photodetectors
16	Antoine Hage	Optoelectronic and topological properties of HgTe quantum dots
17	Huichen Zhang	light modulator based on colloidal nanocrystals
18	Ranjana Yadav	Synthesis of ‘Bulk’ lead chalcogenides through Non-classical Growth Mechanisms
19	Ekaterina salikhova	Synthesis of ultra-large InAs Quantum Dots for Optoelectronic Applications
20	Matias Feldman	Nanoscale imaging and control of heat flux in self-assembled ordered nanocrystal solids
21	Clement Gureghian	Heavily doped semiconductor nanostructures on LWIR T2SL for reduced detector thickness
22	Jan Matthys	Trap State Spectroscopy of III-V Nanocrystals
23	Wang Han	Stable *p*-type PbS quantum dot ink for all-blade-coated short-wavelength infrared photodiode
24	Alexandre Neyret	Nanocrystal-based detectors for space application

25	Dongsun Choi	Engineering Broadband SWIR–MWIR Optical Properties in Non-Toxic Silver Chalcogenides Colloidal Quantum Dot through Intraband Transitions and Surface Chemistry.
26	Inigo Ramiro	Embedding infrared quantum dots in perovskites for novel optoelectronic devices and applications: the TANGO project
27	Mariarosa Cavallo	Ferroelectric gating of narrow band gap nanocrystals
28	Alexandru Mednicov	Exploring novel ligands for fabrication of 3D PbS Quantum Dot Superlattices
29	Jacopo Pinna	Langmuir-Schaefer Deposition of 2D PbS Quantum Dot Superlattices
30	So Young Eom	Synthetic Control of MWIR Optical and Electronic Properties in Silver-Doped Mercury Telluride and Silver Telluride Colloidal Quantum Dot.
31	Debora Pierucci	Operando Photoemission unveiling nanocrystal based energy landscape
32	Haemin Song	Quantum Plasmon Resonance of Silver Selenide Colloidal Quantum Dots
33	Daekwon Shin	Design strategies for efficient infrared optoelectronics based on PbS and InAs colloidal quantum dots