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RELAZIONE ATTIVITA' ANNUALE DEI PERFEZIONANDI/DOTTORANDI – SECONDO ANNO
REPORT ON THE PHD ACTIVITY – SECOND YEAR

NOME E COGNOME NAME AND SURNAME	Mahdi Asgari
DISCIPLINA PHD COURSE	Nanoscience

CORSI FREQUENTATI CON SOSTENIMENTO DI ESAME FINALE ATTENDED COURSES (WITH FINAL EXAM)	VOTAZIONE RIPORTATA MARK	NUMERO DI ORE HOURS
Quantum mechanics	27	
Condensed matter physics	28	
Nanostructured materials	24	
(Attention: Aforementioned courses are fulfilled within the first year of my PhD)		

CORSI FREQUENTATI SENZA SOSTENIMENTO DI ESAME FINALE ATTENDED COURSES (ATTENDANCE ONLY)	NUMERO DI ORE HOURS

ALTRE ATTIVITÀ FORMATIVE (SEMINARI, WORKSHOP, SCUOLE ESTIVE, ECC.) – DESCRIZIONE OTHER PHD ORIENTED ACTIVITIES (SEMINARS, WORKSHOPS, SUMMER SCHOOLS, ETC) – DESCRIPTION	NUMERO DI ORE HOURS
TeraApps MSCA ITN – 2nd Transferrable Skills Course KEYSIGHT 12th – 13th February 2020 • IMEC lab tour and presentations o IMEC introduction o Overview of available technology via Europractice o Photonics o THz research in IMEC	24



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o Fab Tour	
• Strategies to protect IP in today's world • 2D and 3DEM simulation best practices • From idea to product development, how is industry working typically.	
Low Temperature Optical Measurements Laboratoire Charles Coulomb CC074 Campus du Triolet, Université Montpellier Place Eugène Bataillon F-34095, Montpellier, France 4th to 17th October 2020	120



ATTIVITÀ DI RICERCA SVOLTA (MAX. 8.000 CARATTERI)*
RESEARCH ACTIVITY (MAX. 8000 CHARACTERS)

Abstract: Terahertz (THz) technology has recently demonstrated broad scientific and technological applications in different areas such as security monitoring, medical imaging, telecommunications and quantum science, where the need of fast and sensitive photodetectors prospect fascinating impacts in quantum computing and quantum metrology. However, there is still active investigations in the field, owing to the lack of the suitable emitters and detectors in this range of frequency. In this work, we illustrate that quantum dot single electron transistors based on Indium Arsenide/ Indium Arsenide Phosphide (InAs/InAs_{0.3}P_{0.7}) heterostructured nanowires (NW) connected to planar on-chip nanoantennas, behave as highly sensitive quantum detector in low temperature at 2.8 THz. The detector photoresponse can be tuned by playing with the electrical characteristics of the device that clearly reflect energy quantization and single-electron tunneling effects in the quantum dot.

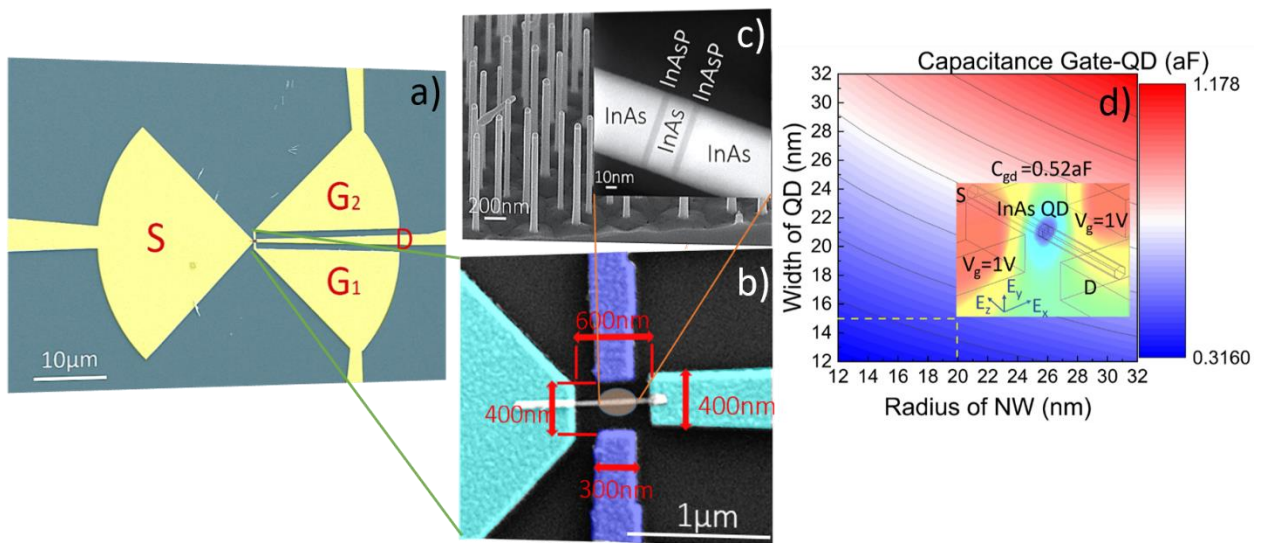


Figure a) Scanning electron microscopy (SEM) image of a planar on-chip bow-tie antenna. One side of the antenna is connected to the source contact while opposite side is connected to the arms of double lateral gate contacts. b) SEM image of a prototypical quantum dot nanowire (QD-NW) single electron transistor (SET), green parts are showing source and drain contacts while blue parts refer to the double lateral gates. c) SEM image of a forest of epitaxially grown InAs nanowires, (inset) transmission electron microscopy (TEM) image of InAs/InAsP QD. d) Color map of simulated gate-QD capacitance (C_{gd}) as a function of size of QD (W_{qd}) and radius of NW (R_{nw}). Dashed lines show the dimensions corresponding to our QD ($W_{qd} = 15$ nm, $R_{nw} = 20$ nm). Inset: simulated 3D image of the SET channel and distribution of electrostatic potential around hexagonal prismatic InAs QD. The simulated C_{gd} value for our architecture is 0.52 aF.



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*se si intende sottoporre una relazione di ricerca più estesa, utilizzare il campo per una descrizione sintetica e allegare il documento in formato .pdf

If you are going to submit a longer report, please fill the box with a synthetic abstract and attach a document in pdf format

EVENTUALI PUBBLICAZIONI PUBLICATIONS (IF AVAILABLE)
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"Unveiling the detection dynamics of semiconducting nanowire photodetectors by terahertz near-field nanoscopy", Journal of Nature light: Science & Application. Eva Pogna, Mahdi Asgari, Leonardo Viti, Valentina Zannier, Lucia Sorba, Miriam Serena Vitiello

NOME DEL RELATORE THESIS ADVISOR

Prof. Miriam Serena Vitiello

DATA DATE	18.10.2020	FIRMA SIGNATURE	<i>MAHDI ASGARI</i>
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