

## Davide Rotta

---

E-mail: /

### RESEARCH ACTIVITY

*Process Engineer* - Integrated Photonic Technologies Center      June 2018 onwards  
Fondazione INPHOTEC

Area di Ricerca del CNR - Via G. Moruzzi, 1 - 56124 Pisa - Italy

- Research field: fabrication of photonic and electronic integrated circuits. Development of highly automatic packaging processes for prototyping, basic characterization and small volume production of integrated photonic devices for academy (Graphene flagship), companies (ST Microelectronics, Ericsson) and the Italian (ASI) and European (ESA) Space Agency.
- Responsible for metal deposition processes in INPHOTEC 6" technology platform for Si photonics: development of resistive heaters, metal interconnects and AuSn solder films for 3D integration.
- Responsible for fiber optics pigtailling at the Advanced Packaging Laboratory: development of hybrid integration of laser and SOA chips and innovative optical input-output methods for Si photonics.

*Process Engineer* - Integrated Photonic Technologies Center      June 2016 - May 2018  
INPHOTEC - TeCIP Institute, Scuola Superiore Sant'Anna

Area di Ricerca del CNR - Via G. Moruzzi, 1 - 56124 Pisa - Italy

- Research field: fabrication of photonic and electronic integrated circuits. Development of highly automatic packaging processes for prototyping, basic characterization and small volume production of integrated photonic devices for academy (Graphene flagship), companies (ST Microelectronics, Ericsson) and the Italian Space Agency (ASI).

*Process Engineer* - Advanced packaging group      June 2015 - May 2016

Consorzio Nazionale Interuniversitario per le Telecomunicazioni - Unità di Pisa

Integrated Photonic Technologies Center - TeCIP Institute, Scuola Superiore Sant'Anna

Area di Ricerca del CNR - Via G. Moruzzi, 1 - 56124 Pisa - Italy

- Research field: back-end processing of photonic and electronic integrated circuits. Development of highly automatic packaging processes for fiber array pigtailling and alignment of microlenses in optical subassembly devices; prototyping and small volume production of photonic devices for academy and companies.

*Scientific collaboration*

April 2015 - June 2015

Istituto di Fotonica e Nanotecnologie, Consiglio Nazionale delle Ricerche

Piazza Leonardo da Vinci 32, 20133 Milan, Italy

- Research field: scalability of CMOS architectures for quantum computation

### EDUCATION

*PhD*, Nanostructures and Nanotechnologies      January 2012 - February 2015

Università degli studi di Milano Bicocca, Milan, Italy

Laboratorio MDM-IMM-CNR, Agrate Brianza, Italy

Thesis: "*Emerging research devices and materials for nanoelectronics*"

Full text available at: <https://boa.unimib.it/handle/10281/76048>

Supervisor: Prof. Marco Fanciulli

PhD full scholarship. Activity in the framework of projects QuDec (Ministero della Difesa Italiana) and 2D-Nanolattices (European Union - FP7)

- Design of experiment, TCAD modeling, development of process flow and CMOS

nanofabrication of silicon devices based on quantum dots for quantum information processing

- Quantum transport and single charge sensing of silicon donors and quantum dots at cryogenic temperatures down to 300 mK and high magnetic fields up to 12 T
- Evaluation of the scalable integration of silicon qubits in CMOS technology
- Fabrication and characterization of single layer MoS<sub>2</sub> transistors

*Master of Science (MSc)*, Physics November 2008 - October 2011

Università degli studi di Milano Bicocca, Milan, Italy

Thesis: "*Spin-dependent transport in silicon nanowires*" (written in Italian)

Supervisor: Prof. Marco Fanciulli

Grade 110/110 *cum laude*

- Top-down fabrication of silicon nanowires by electron beam lithography (critical dimension < 20nm)
- Electrically detected spin resonance in n-doped nanowires

*Bachelor of Science (BSc)*, Physics September 2005 - October 2008

Università degli studi di Milano Bicocca, Milan, Italy

Thesis: "*Enhancement of solar energy conversion efficiency by light harvesting of organo-lanthanide complexes*" (written in Italian)

Supervisor: Dr Maurizio Acciarri

Grade 107/110

- Electrical and optical characterization of silicon photovoltaic cells (spectral response and efficiency)

*Scientific High School Degree* September 1999 - July 2005

Liceo Scientifico Sacro Cuore, Milan, MI, Italy

Diploma di Maturità Scientifica, Grade 100/100 *cum laude*

## WORKSHOPS & SCHOOLS

- *22nd Microelectronics and Packaging Conference (EMPC) & Exhibition* - Pisa, September 16-19 2019
- *Photonics & Optoelectronic Packaging Conference (POP 2016)* - Edinburgh, November 22-23 2016
- *18th International Winterschool on New Developments in Solid State Physics* - Mauterndorf, February 23-28 2014
- *Summer Course on Nanofabrication: concepts, techniques and applications in Nanotechnology* - Jaca, July 15-17 2013
- *European School On Nanosciences & Nanotechnologies ESONN '12* - Grenoble, Aug. 27 Sep. 16 2012
- *International School of Physics "E. Fermi"* - Varenna, June 19-29 2012
- *Workshop: "Micro- and Nano- electronics"* held by IMM in Agrate B.za/Milano, 21-22 march 2012
- *Workshop: "Spintronics for memory applications"* held by MDM Laboratory in Agrate B.za, 30 January 2012

## JOURNAL PUBLICATIONS

- D. Rotta, F. Sebastiano, E. Charbon, and E. Prati, "Quantum information density scaling and qubit operation time constraints of CMOS silicon-based quantum computer architectures", npj Quantum Information (2017) 3:26, <http://www.nature.com/articles/s41534-017-0023-5>
- E. Prati, D. Rotta, F. Sebastiano, and E. Charbon, "From the Quantum Moore's Law toward Silicon Based Universal Quantum Computing", Rebooting Computing (ICRC), 2017 IEEE International Conference on, <http://ieeexplore.ieee.org/abstract/document/8123662/>
- D. Rotta, M. De Michielis, E. Ferraro, M. Fanciulli and E. Prati, "Electron Confinement at the Si/MoS<sub>2</sub> Heterosheet Interface", Adv. Mater. Interfaces 3, 1500619 (2016), <http://doi.dx.org/10.1002/admi.201500619>
- D. Rotta, M. De Michielis, E. Ferraro, M. Fanciulli and E. Prati, "Maximum density of quantum information in a scalable CMOS implementation of the hybrid qubit architecture", Quantum Inf. Process. 15, 2253 (2016) <http://doi.dx.org/10.1007/s11128-016-1282-3>
- A. Crippa, M. L. V. Tagliaferri, D. Rotta, M. De Michielis, G. Mazzeo, M. Fanciulli, R. Wacquez, M. Vinet and E. Prati, "Valley blockade and multielectron spin-valley Kondo effect in silicon", Phys. Rev. B 92, 035424 (2015), <http://dx.doi.org/10.1103/PhysRevB.92.035424>
- D. Rotta, A. Vellei, G. Mazzeo, M. Belli, S. Cocco, M. Tagliaferri, A. Crippa, E. Prati and M. Fanciulli, "Spin-dependent recombination and single charge dynamics in silicon nanostructures" Eur. Phys. J. Plus (2014) 129: 121, <http://dx.doi.org/10.1140/epjp/i2014-14121-4>

## BOOK CHAPTERS

- E. Prati, and D. Rotta, "Nanosilicon for Quantum Information", in Silicon Nanomaterials Sourcebook, Chapter 29, CRC Press - Taylor & Francis Group, ISBN 9781498763783

## CONTRIBUTIONS TO CONFERENCES

- M. Avesani, L. Calderaro, M. Schiavon, A. Stanco, C. Agnesi, A. Santamato, M. Zahidy, A. Scriminich, G. Foletto, G. Contestabile, M. Chiesa, D. Rotta, M. Artiglia, A. Montanaro, M. Romagnoli, V. Soriano, F. Vedovato, G. Vallone, and P. Villorosi, "QCoSOne: a chip-based prototype for daylight free-space QKD at telecom wavelength" in Frontiers in Optics + Laser Science APS/DLS, OSA Technical Digest (Optical Society of America, 2019), paper FTu6A.2
- D. Rotta, G. B. Preve, "Optical interconnection for Si photonics devices: the Teraboard project solution and results", **Invited** at European Optical Society Biennial Meeting (EOSAM 2018), Delft, October 8-12, 2018
- D. Rotta, G. B. Preve, "Advanced photonics packaging and integration of silicon photonic devices at CNIT/INPHOTEC", *Oral* at Photonic Packaging Workshop, Berlin, June 12-13, 2018
- A. Molle, D. Chiappe, D. Rotta, A. Lamperti, C. Grazianetti, E. Cinquanta, M. Fanciulli, "Electron confinement at the Si-MoS<sub>2</sub> heterosheet junction", *Oral* at APS March Meeting, San Antonio, March 2-6, 2015
- D. Rotta, M. De Michielis, E. Ferraro, M. Fanciulli, E. Prati, "Maximum density of quantum information in a scalable CMOS-compatible implementation of the silicon hybrid spin qubit architecture", *Oral* at SiQIP 2014, London, September 12, 2014

- A. Crippa, M. L. V. Tagliaferri, D. Rotta, M. De Michielis, G. Mazzeo, M. Fanciulli, R. Wacquez, M. Vinet, E. Prati, “*Valley blockade and valley-dependent Kondo transport in a silicon donor quantum dot*”, *Poster at Condensed Matter in Paris*, August 24-29, 2014
- A. Molle, D. Chiappe, E. Cinquanta, C. Grazianetti, D. Rotta, M. Fanciulli, “*Two dimensional silicon for electronic devices*”, *Oral at Flatlands Beyond Graphene 2014*, Dublin July 9-11, 2014
- D. Rotta, E. Cinquanta, D. Chiappe, A. Molle, M. Fanciulli, “*Admittance spectroscopy of MoS<sub>2</sub> nanosheet transistors*”, *Oral at Flatlands Beyond Graphene 2014*, Dublin July 9-11, 2014
- A. Crippa, M. Tagliaferri, D. Rotta, M. De Michielis, G. Mazzeo, M. Fanciulli, E. Wacquez, M. Vinet, E. Prati, “*Universality of microwave suppression of valley Kondo in silicon donor quantum dot*”, *Oral at 8th International Conference on Quantum Dots*, Pisa May 11-15, 2014
- M. De Michielis, E. Ferraro, D. Rotta, G. Mazzeo, M. L. V. Tagliaferri, A. Crippa, M. Fanciulli, E. Prati, “*Universal Set of Quantum Gates for Double-Dot Exchange-Only Spin Qubits Under Realistic Conditions*”, *Oral at APS March Meeting*, Denver, March 3-7, 2014
- D. Rotta, G. Mazzeo, M. Belli, E. Prati, M. Fanciulli, “*Charge dynamics and spin-dependent transport in silicon nanostructures*”, *Poster at European School On Nanosciences & Nanotechnologies ESONN '12 - Grenoble*, Aug. 27 Sep. 16 2012
- D. Rotta, G. Mazzeo, M. Belli, E. Prati, M. Fanciulli, “*Charge dynamics and spin-dependent transport in silicon nanostructures*”, *Poster at International School of Physics “E. Fermi” - Varenna*, June 19-29 2012
- M. Fanciulli, A. Vellei, C. Canevali, D. Rotta, M. Basini, S. Paleari, “*Electrically detected magnetic resonance characterization of silicon nanowires*”, *Oral at Conference on Spin physics, spin chemistry and spin technology*, Kazan, November 1-6, 2011
- A. Le Donne, M. Acciarri, S. Binetti, S. Marchionna, D. Narducci, D. Rotta, “*Enhancement of Solar Energy Conversion Efficiency by Light Harvesting of Organo-Lanthanide Complexes*”, *Oral at 23rd European Photovoltaic Solar Energy Conference and Exhibition*, Valencia, September 1-5, 2008

## RESEARCH SKILLS

- Back-end processing of photonic and electronic integrated devices. Process engineering and automation development for fiber-optic pigtailling and Laser Micro-Package fixing with active alignment. Hybrid integration of Semiconductor Optical Amplifier chips for the fabrication of an external cavity laser. Fabrication of Sub-Assembly devices including the alignment of microlenses. Development and integration in Si photonics of innovative input-output coupling technologies (adiabatic coupling). Basic experience with wire-bonding.
- Design and front-end processing of nanoelectronic and photonic devices. Excellent knowledge of photo- and high-resolution Electron-Beam Lithography with multi-level alignment and e-beam evaporation for deposition of metal thin films. Good experience in Rapid Thermal Processing, deposition techniques (thermal and e-beam evaporation, basic knowledge of Atomic Layer Deposition), wet etching and plasma treatments for nanoelectronics.
- Basic characterization and testing at wafer scale of integrated photonic devices.
- Good knowledge of standard electrical characterization: transport and differential admittance measurements in MOS capacitors and FET, Hall measurements.

- Good knowledge of quantum transport in nanoscaled FET and single atom devices: Coulomb blockade characterization, single charge sensing techniques and pulsed-gate control.  
Operation of a  $^3\text{He}$  cryostat at high magnetic fields.
- Good knowledge of magnetic resonance spectroscopy: continuous-wave electron spin resonance and spin dependent transport in materials and nanostructures.
- Basic experience with optical spectroscopy techniques: absorption and micro-Raman spectroscopy.

**COMPUTER SKILLS**

Good knowledge of the following softwares:

- Document production: Microsoft Office and  $\text{\LaTeX}$ .
- Data analysis and automation: Origin, Matlab, Labview, Igor
- Software for lithography: Tanner L-Edit, K-layout, Raith Elphy Plus
- Technology CAD: Silvaco Athena

Basic usage of operating systems: Windows, Mac, Linux

Basic knowledge of programming languages: C, C++, Fortran

**LANGUAGE SKILLS**

Italian: mother tongue

English: fluent, written and spoken (First Certificate in English in 2004)

**TEACHING EXPERIENCE**

*Photonic Integrated Circuits Design, Fabrication & Packaging* September 2016  
Integrated Photonic Technologies Center - TeCIP Institute, Scuola Superiore Sant'Anna  
Co-teaching in an intensive course on silicon photonics technology for academy and industry students.

*Teaching assistant - laboratory technician* September 2008 - June 2012  
Liceo Scientifico Sacro Cuore, Milan  
Technical support (setup of physics experiments in laboratory) and lecturing to high school students (approximately 240 hours)