






PERSONAL INFORMATION

Paolo De Natale



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-  <http://www.ino.it> and [http://scholar.google.it/citations?user=kC\\_WPz0AAAAJ](http://scholar.google.it/citations?user=kC_WPz0AAAAJ)
-  ORCID: 0000-0002-3308-8569

Sex Male | Nationality Italian

EDUCATION AND TRAINING

- 2013 **Italian habilitation to full university professor for Experimental Physics-Structure of Matter**
- 1993 **PhD/Diploma in Optics**  
University of Florence – Italy
- 1987 **Degree in Physics “magna cum laude”**  
University Federico II, Naples - Italy

WORK EXPERIENCE

- 2003 - present **Research Director**  
National Institute of Optics (INO) of Italian Research Council (CNR), Italy
- 2010 - 2021 **Director**  
Founder and first director of the National Institute of Optics (INO) of the Italian Research Council (CNR), Italy
- 2007 - 2010 **Director**  
National Institute of Applied Optics (INOA) of CNR, Italy
- 2001 - 2007 **Director**  
INOA local unit in Pozzuoli, Italy
- 1997 - 2003 **Senior Research Scientist**  
National Institute of Optics (INO) of Italian Research Council (CNR), Italy
- 1996 - 1997 **Research Scientist**  
National Institute of Optics (INO) of Italian Research Council (CNR), Italy
- 1988 - 1996 **Permanent staff position**  
European Laboratory for Nonlinear Spectroscopy (LENS), University of Florence, Italy

AWARDS, FELLOWSHIPS

- 2015 Appointed Italian representative of **ICO** – International Commission for Optics
- 2015 Awarded with **OSA** (the Optical Society of America) **Fellowship**
- 2012 “All-Optical Radiocarbon Dating” by D. Mazzotti, S. Bartalini, S. Borri, P. Cancio, I. Galli, G. Giusfredi, and P. De Natale selected as one of the **best 3 contributions in Optics in 2012 by OSA**
- 2012 Awarded with **SPIE** (the International Society for Optical Engineering) **Fellowship**
- 2010 Awarded as one of the best contributions in Optics in 2010 in OPN by **OSA**, *Quiet Cascade*

PERSONAL SKILLS

Mother tongue(s) Italian

Other language(s)

	UNDERSTANDING		SPEAKING		WRITING
	Listening	Reading	Spoken interaction	Spoken production	
English	C1	C1	C1	C1	C1

Levels: A1/2: Basic user - B1/2: Independent user - C1/2 Proficient user  
Common European Framework of Reference for Languages

Organisational / managerial skills

ORGANIZATION OF SCIENTIFIC MEETINGS AND PARTICIPATION TO CONFERENCES COMMITTEES (SELECTION)

- 2022-24 Chairman International Quantum Cascade Lasers School and Workshop-IQCLSW 2024
- 2015 - 2017 Program sub-committee member CLEO Europe (Optical Sensing and Metrology)
- 2015 Scientific committee FISMAT (Condensed Matter Physics)
- 2013 - 2015 Sub-committee member CLEO (Laser Science to Photonic Applications)
- 2011 - present Executive and Scientific committee HRMS (High-Resolution Molecular Spectroscopy) - held every 2 years
- 2010 - 2017 Executive committee Fotonica (Photonic Technologies)
- 2009 Chairman HRMS (High-Resolution Molecular Spectroscopy)
- 2009 Co-chairman Fotonica (Photonic Technologies, Italy)
- 2008 Executive committee Elettroottica (Electro-optic methods and instruments, Italy)

MANAGEMENT ACTIVITY

Across 14 years (2/2007-2/2021) PDN directs INOA and then INO-CNR, without any gap. In 2010, INOA becomes part of the scientific Network of CNR with 67 overall employees, the headquarters in Florence and two local Units (Lecce and Naples). Since the foundation of INO-CNR and during the years 2010-2021, the Institute grows and, in 2/2021, at the end of the term of PDN as Director, the Institute has about 300 scientists and employees working throughout the 8 units located all over Italy, with 45 people in the technical and administrative staff. At that date, about 90 national and international projects are active, in the area of Atomic, Molecular and Optical-AMO Physics.

- 2021 - present Member of the Advisory Committee to implement the Framework Agreement between the Italian National Research Council-CNR and the Italian Ministry of Defense-General Secretariat (SegreDifesa)
- 2020 - present Co-founder of the CNR-INO Spin-off company : QTI Srl
- 2019 – present Member of the LENS Executive Council (the only member elected by LENS personnel)
- 2018-2020 President of CNR Research Area (AdR) in Sesto Fiorentino (FI), with about 500 units of personnel operating in the AdR.
- 2016 - present Co-founder of the CNR-INO Spin-off company: ppqSense Srl
- 2017 - Present Italian representative in the Quantum Community Network-QCN Board of the EU Quantum Technologies Flagship
- 2017 - present Italian academic representative within the European Defence Agency-EDA for the CAPTECH Optronics
- 2016 - 2022 Member of the Board of Directors of the Company: Collezione Nazionale dei Composti Chimici e Centro Screening (Italian National Collection of Chemical Compounds and Screening Center) – CNCCS S.c.ar.l.
- 2010-2021 Founder and first Director of INO-CNR, created from the fusion of INOA, INFIM and CNR groups
- 2007 - 2010 Director of INOA-CNR
- 2002 - 2012 Member of the Scientific Board and of the Board of Directors of the public consortium for Environmental Risk Analysis and Monitoring - AMRA S.c.ar.l.
- 2001 – 2007 Foundation and direction of the INOA-CNR unit in Pozzuoli. The Unit grew from 2 to 10 employees in that period. 35 ISI papers were published in 2006.
- 2002 - 2005 Member of the Scientific Board of the National Group of Volcanology (GNV)-INGV.

TECHNOLOGY TRANSFER AND START-UP FOUNDATION

In the period 2010-2015, the overall revenues from contracts with companies amounted to about 2.2

MEuros, that is an average of more than 370 kEuros/year.

In order to properly address the theme of Technological Transfer, in 2015 PDN created, at INO, a **Tech Transfer team**, including 6 scientists/technologists, each working in a different INO Unit and already experienced in the field. The tasks of this team include: reinvestment of royalties from patents in other tech transfer-related activities, dissemination of tech transfer best practices and information towards INO scientists, promotion and commercialization of INO Patents, consultancy for spin off activities, interaction with the central CNR Tech Transfer Office (UVR) in Rome. In the period 2010-2019, 36 patents were filed by INO. INO has hosted a spin-off company, founded by INO researchers, from 2012 to 2015 in the Lecce Unit.

The International Committee appointed for the CNR internal Evaluation (performed in 2015 and evaluating the 2011-2014 period, when PDN was the director) has written for INO what follows:

*"...In terms of patents, the Institute did very well in 2013 and less well in 2014, but I am less concerned about the number of patents as such rather than how they were used. In this respect, the translation of research appears to be improving, which is good to see; there are some very nice examples of technology transfer. ..."*

During the two years term as President of CNR Research Area in Sesto Fiorentino (Firenze), PDN started a Technology Transfer Center, named CENTRATEC, to enhance and reorganize interaction of multidisciplinary activities of CNR Institutes with Companies.

### Foundation of start-up Companies

#### 2016-ppqSense Srl

Following this intense Tech-Transfer activity, with the aim to train a generation of scientists in the field, PDN co-founded a CNR **spin-off company** on April, 29<sup>th</sup> 2016, following formal approval by CNR and MIUR in February 2016. This company, named **ppqSense Srl**, was conceived and based on the unique scientific results achieved with the groundbreaking invention of a new laser spectroscopy technique, named *SCAR-Saturated absorption Cavity-Ringdown* first published in 2010 (*Saturated-absorption cavity ring-down spectroscopy* Physical Review Letters **104**, 110801 (2010)) which already showed a record sensitivity for <sup>14</sup>CO<sub>2</sub> (radiocarbon dioxide) detection in 2011 (*Molecular gas sensing below parts per trillion: radiocarbon-dioxide optical detection* Physical Review Letters **107**, 270802 (2011)), increasing of orders of magnitude a few years later (*Spectroscopic detection of radiocarbon dioxide at parts-per-quadrillion sensitivity* Optica **3**, 385-388 (2016): this ultimate sensitivity level gave also the acronym to the Company-ppq (i.e. 10<sup>-15</sup>)) and very recently unfolding its potential to solve key problems in the area of Energy&Environment (*Biogenic Fraction Determination in Fuel Blends by Laser-Based <sup>14</sup>CO<sub>2</sub> Detection* Advanced Photonics Research **2**, 2000069 (2021) and *Precise radiocarbon determination in radioactive waste by a laser-based spectroscopic technique* Proceedings of the National Academy of Sciences-PNAS **119**, e2122122119 (2022)).

Other key areas of application of the commercially developed SCAR spectrometer are: portable/on-site laser dating of archeological remains; leakage detection around underground reservoirs of sequestered carbon dioxide for greenhouse effect mitigation; metabolic curve measurement for novel <sup>14</sup>C-marked pharmaceuticals under test; precise assessment of fossil-fuels burning by local dilution measurement of radiocarbon dioxide, in view of mitigation of climate change.

Another key discovery that took to the realization of the control electronics of the Quantum Cascade Lasers-QCLs used in SCAR spectrometers, was the strong dependence of QCLs linewidth from the driving current noise (*Observing the intrinsic linewidth of a quantum-cascade laser: beyond the Schawlow-Townes limit* Physical Review Letters **104**, 083904 (2010)).

At present, two different lines of products are commercialized by ppqSense Srl: the SCAR spectrometer and a wide range of control electronics for semiconductor lasers (see also the company website: [www.ppqsense.com](http://www.ppqsense.com)). **Three patents**, extended in several Countries worldwide, cover these technologies. Since April 2022, CNR had to sell to the other stakeholders its 25% of shares, the spin-off phase being finished, at a price almost 10 times higher than the original value at the foundation.

In the last few years, ppqSense Srl has been partner in key EU projects, including two in the framework of the FET-Flagship on Quantum Technologies: QOMBS (on Quantum Simulation) just completed on July, 31<sup>st</sup> 2022 and, very recently, MUQUABIS (on Quantum Sensing), started on July, 1<sup>st</sup> 2022.

#### 2020-QTI Srl

More recently, and following the launch of the FET- Flagship 10-years long program on Quantum Technologies, PDN has cofounded a start-up named QTI Srl in 2020, to commercialize Quantum Communication systems ([www.qticompany.com](http://www.qticompany.com)). In particular, reconfigurable quantum key distribution architectures are developed, from the design phase to the building of the final system. On July, 14<sup>th</sup> 2021, a Commercial Agreement with the TIM telecommunication group, was signed. This was a strategic step for QTI, allowing to speed up the commercialization of Quantum Key Distribution systems in combination with existing Networks: this is the only case, until now, of a big

telecommunication company, in Europe, that develops quantum communication systems within the group. **Two patents** have been filed to protect QTI technologies. The technologies under development rely on a long and impactful scientific history of the founders, in the fields of quantum science and photonics. Moreover, public demonstration of these technologies has been done at national and even trans-national level (see e.g.: *Deploying an inter-European quantum network* Advanced Quantum Technologies (2023)).

## RESPONSIBILITY OF RESEARCH PROJECTS (SELECTION OF THE MAIN PROJECTS)

2022-present	<b>PNRR-Research Infrastructures: I-PHOQS</b> Scientific Coordinator. Funded by MUR (50 M€ over 3 years), Network including 4 Infrastructures, 9 sites throughout Italy, 2 Legal entities (CNR, PoliMI)
2020-2022	<b>PASCQUA Infrastructural Project</b> Coordination. Funded by MUR through CNR (3.5 M€ I-year+1M€ II-year)
2015	<b>EU-FET (Future Emerging Technologies): UltraQCL.</b> Responsible for INO-CNR (for INO-CNR: 133 k€)
2011 - present	<b>ELI Extreme Light Infrastructure.</b> Responsible for INO-CNR. Belonging to the EU ESFRI roadmap and MIUR (total amount till now: about 4.5 M€).
2014 - 2015	<b>Progetto Premiale MIUR:</b> Synchronization of distributed laboratories by time&frequency standards using an optical fiber. Responsible for CNR (131 k€)
2011 - 2014	<b>Energia da Fonti Rinnovabili (Renewable energy)-EFOR,</b> funded by MIUR/MEF. Responsible for INO-CNR (for INO-CNR: 187 k€)
2010 - 2012	<b>CTOTUS – Integrated Project</b> for the development of Space Science&Technology in Tuscany. Funded by Toscana Region (for INO-CNR: 750 k€)
2004 - 2006	<b>Photonic circuits for optical communications and sensing for the study of innovative optical devices and sensors.</b> Funded by MIUR (562.5 k€)
2002 - 2007	Coordinator <b>FIRB-negoziale</b> (Basic Research Funding from the Italian Ministry of Univ. and Research-MIUR) for the development of techniques and photonic devices in lithium niobate. (Total amount: 3 M€)
2003 - 2005	Coordinator international research project: <b>Development of an integrated spectroscopic system for remote and continuous detection of volcanic gases.</b> Funded by INGV and GNV. Partners: Cambridge Univ., UK; Rice University Houston, TX, USA; II Univ. Naples. (Total amount: 465 k€)
2002 - 2006	<b>PON Integrated Environmental Monitoring System-SIMONA.</b> Funded by EU and MIUR (1.033 M€ + Training 697 k€)
2002 - 2006	<b>POR</b> project-(Funded by EU through Campania Region) on Analysis and monitoring of environmental risk for the realization of optical innovative sensors based on coherent sources and fiber optical technologies. (for INOA: 559 k€)

## EVALUATION OF PROJECTS

PDN regularly serves as evaluator of projects for several Agencies funding Research (including EU, Belgium, the Netherlands, France, Austria, Switzerland)

## PUBLICATIONS, CITATIONS, H-INDEX

PDN main fields of interest are mostly related to experimental Atomic, Molecular and Optical (AMO) Physics and applications and, more specifically, are: Environmental applications of photonic instrumentation, nonlinear optics, laser physics, atomic and molecular high precision spectroscopy, frequency metrology, development of high performance photonic sensors, quantum technologies with application to communication and simulation. PDN is editor of 8 scientific books/special volumes and co-author of the book on *Laser-Based Measurements for Time and Frequency Domain Applications – A Handbook* (CRC Press –Taylor & Francis Group).

**PATENTS**

According to the EU Patent Office

( [https://worldwide.espacenet.com/searchResults?submitted=true&locale=en\\_EP&DB=EPODOC&ST=advanced&TI=&AB=&PN=&AP=&PR=&PD=&PA=&IN=De+Natale+Paolo&CPC=&IC=&Submit=Search](https://worldwide.espacenet.com/searchResults?submitted=true&locale=en_EP&DB=EPODOC&ST=advanced&TI=&AB=&PN=&AP=&PR=&PD=&PA=&IN=De+Natale+Paolo&CPC=&IC=&Submit=Search)): 14 Patents

# CURRICULUM VITAE

## SIMONE BORRI

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**NAME SURNAME:** Simone Borri

### PROFESSIONAL EXPERIENCE AND EDUCATION

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- **From Sept 2013:** Researcher at CNR-INO, Sesto Fiorentino
- **2018** - Italian habilitation (Abilitazione Scientifica Nazionale) to Associate University Professor for Experimental Physics-Structure of Matter
- **2014 – today:** Associate research at INFN, Firenze
- **2013 – today:** Associate research at LENS, Firenze
- **Nov 2011 – Aug 2013:** researcher at CNR-IFN, Bari
- **Aug 2010 – Oct 2011:** researcher at CNR-INO, Firenze
- **Mar 2008 – Jul 2010:** research fellow at CNR-INO
- **Mar 2007 – Feb 2008:** research fellow at LENS
- **2007** Phd in Physics, from Università degli Studi di Firenze, Thesis “High-sensitivity and high-precision spectroscopic techniques using quantum cascade lasers”, Supervisor: dr. Paolo De Natale
- **2002** MSc in Physics from Università degli Studi di Firenze, Thesis “Rivelazione in saturazione della CO<sub>2</sub> in cavità risonante con una sorgente coerente in differenza di frequenza a 4.25  $\mu\text{m}$ ”, Supervisor: dr. Paolo De Natale

### SCIENTIFIC RESEARCH AND ACHIEVEMENTS

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My research activity is focused on the development of coherent sources and techniques for high-sensitivity and high-precision molecular spectroscopy, with particular attention to the mid infrared spectral region. During my scientific activity I developed mid-IR and THz sources based on nonlinear frequency generation, trace-gas sensors based on cavity-enhanced absorption spectroscopy, photoacoustic techniques, Doppler-free spectroscopy, high-accuracy frequency measurements of molecular transitions.

### PUBLICATIONS AND METRICS

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Author or co-author of over 40 scientific papers related to experimental Atomic, Molecular and Optical Physics in peer-review journals including Physical Review Letters (3), Laser & Photonics Review (2), Scientific Reports (1), Advances in Physics: X (1). He is also co-author of about 70 communications to conferences (23 proceedings with ISBN).

**Total citations:** 1901 (Isi Web of Science); 1995 (Scopus)

**H-index:** 26 (Isi Web of Science); 27 (Scopus)

ORCID ID: 0000-0001-8471-2803

Scopus ID: 7801624490

# CURRICULUM VITAE

## SIMONE BORRI

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### INVITED TALKS

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**2016** - 102° Congresso Nazionale della Società Italiana di Fisica, Padova 26-30 Sept 2016

Title of the talk: "Crystalline microresonators for mid-IR laser stabilization"

**2017** - 25th Colloquium on High-Resolution Molecular Spectroscopy – HRMS, Helsinki 20-25 Aug 2017

Title of the talk: "QCLs for high-resolution molecular spectroscopy in the mid IR"

**2017** - 8th International Conference and Exhibition on Lasers, Optics & Photonics, Las Vegas 15-17 Nov 2017

Title of the talk: "Novel sources and resonators for high-resolution molecular spectroscopy in the mid infrared"

**2018** - Nonlinear Frequency Generation and Conversion: Materials and Devices XVII – SPIE Photonics West 2018, San Francisco 27 Jan – 01 Feb 2018

Title of the talk: "Metrological-grade tunable coherent source in the mid-infrared for molecular precision spectroscopy"

**2018** - 19th World Congress on Materials Science and Engineering, Barcelona 11-13 Jun 2018

Title of the talk: "Material Science and Optics: Applications from Spectroscopy to Metrology, from Fundamental Physics to Space"

**2019** - 41th Progress In Electromagnetics Research Symposium - PIERS 2019, Rome 17-20 Jun 2019

Title of the talk: "Interband Cascade Lasers frequency noise characterization and stabilization"

### INSTITUTIONAL RESPONSIBILITIES (NATIONAL/INTERNATIONAL)

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**Expert-Referee** – Evaluation of a proposal for competitive projects intra-ateneo UniCampania – Evaluation of the Proposal "CIRCE ABC - Development and application of archaeometric methodologies to the pre-industrial craft productions and artistic workshops" – April 2019

**Expert-Referee** – Member of the Evaluation Board for proposal applications to the "Centro di Competenza ad Alta Specializzazione" under the coordination of Scuola Superiore Sant'Anna di Pisa – project Artes 4.0 – May 2018

### RESEARCH GRANTS AND RESPONSIBILITIES

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**PI** for the Project "QualIDAD – Quantum cascade laser LIDar Advanced Device", European Union's Horizon 2020 research and innovation programme - Grant agreement number 101034794. Total Budget: 100 ke

**PI** for the Project "COSMO - Molecole controllare per misure di precisione e sensing", Bando Ricerca Scientifica 2016 finanziato da Ente Cassa di Risparmio di Firenze. Total Budget: 50 ke

**Local PI** for the Project "SUPREMO - Sounding the Time Unwinding of the proton-to-electron mass ratio, funded by INFN CSN2". Total budget 585 ke

# CURRICULUM VITAE

## SIMONE BORRI

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### AWARDS

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**2010** “Quiet Cascade: Measuring QCL Intrinsic Linewidth” by S. Bartalini, S. Borri, P. Cancio, A. Castrillo, I. Galli, G. Giusfredi, D. Mazzotti, L. Gianfrani and P. De Natale, selected as one of the best contributions in Optics in 2010 by OSA - DOI: 10.1364/OPN.21.12.000032

### INTERNATIONAL CONFERENCES AND EDITORIAL APPOINTMENTS

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**Nov 2019 – today:** Member of the Editorial Board of the journal *Sensors* (MDPI AG, ISSN 1424-8220)

**2019:** Guest Editor for the Special Issue “Optical Spectroscopic Sensors Based on Mid-Infrared Semiconductor Lasers” of the journal *Sensors*

### ONGOING MAJOR INTERNATIONAL COLLABORATIONS

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Since 2002 Prof. Ady Arie, Tel Aviv Univ., Israel, subject: Nonlinear Optics. A new joint lab, “NOICE”, was started and funded in 2016, based at CNR-INO, Naples Italy, and with activities at CNR-INO Firenze. This new lab was funded based on a long term recognized collaboration on the subject, with a number of joint Projects.

Since 2002 Prof. F. Capasso, Harvard University, subject: Physics and applications of Quantum Cascade Lasers

Since 2009 Prof. J. Faist, ETH-Zuerich, Switzerland, subject: Comb-emitting and injection-locked Quantum Cascade Lasers

Since 2011 N. Akikusa and (formerly) M. Yamanishi, Hamamatsu Photonics, Japan, subject: Physics of Quantum cascade Lasers and novel applications

Since 2011 Prof. Jean-Jacques Zondy, Nazarbaev Univ., Physics Dept., Astana, Kazakhstan, subject: Novel Optical Parametric Oscillators and nonlinear optics in new crystals

Since 2011 Prof. Vincenzo Spagnolo, Politecnico di Bari, subject: high sensitivity photoacoustic spectroscopy and photoacoustic sensors.

Since 2015 L. Maleki, A. Matsko, OE Waves Inc., Pasadena USA, subject: Whispering Gallery Mode resonators for infrared applications

Since 2016 P. G. Schunemann, BAE Systems Inc., Nashua, New Hampshire 03061-0868, USA  
subject: new nonlinear materials for infrared generation

Since 2018 Prof. W. Ren, Chinese University of Hong Kong, subject: novel photoacoustic sensors based on MEMS cantilevers

Since 2019 Prof. G. Strasser and prof. B. Schwarz, Technische Universität Wien, subject: novel metrological sources based on Interband Cascade Lasers

### Main scientific publications on peer review journals

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**1.** *Mid-infrared homodyne balanced detector for quantum light characterization*

T. Gabbrielli, F. Cappelli, N. Bruno, N. Corrias, S. Borri, P. De Natale, and A. Zavatta  
*Optics Express* 29, 14536 (2021)



# CURRICULUM VITAE

## SIMONE BORRI

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**2. Unveiling quantum-limited operation of interband cascade lasers**

S. Borri, M. Siciliani de Cumis, S. Viciani, F. D'Amato, P. De Natale  
APL Photonics 5, 036101 (2020)

**3. Approaching the transit time limit for high-precision spectroscopy on metastable CO around 6  $\mu\text{m}$**

D. D'Ambrosio, S. Borri, M. Verde, A. Borgognoni, G. Insero, P. De Natale, G. Santambrogio  
Phys. Chem. Chem. Phys. 21, 24506 (2019)

**6. Measuring molecular frequencies in the 1-10  $\mu\text{m}$  range at 11-digits accuracy**

G. Insero, S. Borri, D. Calonico, P. Cancio Pastor, C. Clivati, D. D'Ambrosio, P. De Natale, M. Inguscio, F. Levi, and G. Santambrogio  
Scientific Reports 7, 12780 (2017)

**7. Difference frequency generation in the mid-infrared with orientation-patterned gallium phosphide crystals**

G. Insero, C. Clivati, D. D'Ambrosio, P. De Natale, G. Santambrogio, P. G. Schunemann, J. J. Zondy, and S. Borri  
Opt. Lett. 41, 5114-5117 (2016)

**8. Laser spectroscopy of cold molecules**

S. Borri, and G. Santambrogio  
Advances in Physics: X 1, 368-386 (2016)

**9. Frequency stability characterization of a quantum cascade laser frequency comb**

F. Cappelli, G. Campo, I. Galli, G. Giusfredi, S. Bartalini, D. Mazzotti, P. Cancio, S. Borri, B. Hinkov, J. Faist, and P. De Natale  
Laser Photonics Rev. 10, 623-630 (2016)

**11. Microcavity-Stabilized Quantum Cascade Laser**

M. Siciliani de Cumis, S. Borri, G. Insero, I. Galli, A. Savchenkov, D. Eliyahu, V. Ilchenko, N. Akikusa, A. Matsko, L. Maleki, and P. De Natale  
Laser Photonics Rev. 10, 153-157 (2016)  
\*Selected as cover paper\*

**15. Intracavity quartz-enhanced photoacoustic sensor**

S. Borri, P. Patimisco, I. Galli, D. Mazzotti, G. Giusfredi, N. Akikusa, M. Yamanishi, G. Scamarcio, P. De Natale, and V. Spagnolo  
Appl. Phys. Lett. 104, 091114 (2014)

**17. THz quartz enhanced photo-acoustic sensor**

S. Borri, P. Patimisco, A. Sampaolo, H. A. Beere, D. A. Ritchie, M. S. Vitiello, G. Scamarcio, and V. Spagnolo  
Appl. Phys. Lett. 103, 021105 (2013)  
\*Selected as cover paper\*

**18. Intrinsic stability of quantum cascade lasers against optical feedback**

# CURRICULUM VITAE

## SIMONE BORRI

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F. P. Mezzapesa, L. L. Columbo, M. Brambilla, M. Dabbicco, S. Borri, M. S. Vitiello, H. A. Beere, D. A. Ritchie, and G. Scamarcio  
Opt. Express 21, 13748 (2013)

**19.** *Comb-assisted subkilohertz linewidth quantum cascade laser for high-precision mid-IR spectroscopy*

I. Galli, M. Siciliani de Cumis, F. Cappelli, S. Bartalini, D. Mazzotti, S. Borri, A. Montori, N. Akikusa, M. Yamanishi, G. Giusfredi, P. Cancio, and P. De Natale  
Appl. Phys. Lett. 102, 121117 (2013)

**21.** *Subkilohertz linewidth room-temperature mid-infrared quantum cascade laser using a molecular sub-Doppler reference*

F. Cappelli, I. Galli, S. Borri, G. Giusfredi, P. Cancio, D. Mazzotti, A. Montori, N. Akikusa, M. Yamanishi, S. Bartalini, and P. De Natale  
Opt. Lett. 37, 4811 (2012)

**22.** *Part-per-trillion level SF<sub>6</sub> detection using a quartz enhanced photoacoustic spectroscopy-based sensor with single-mode fiber-coupled quantum cascade laser excitation*

V. Spagnolo, P. Patimisco, S. Borri, G. Scamarcio, B. E. Bernacki, and J. Kriesel  
Opt. Lett. 37, 4461 (2012)

**23.** *Direct link of a mid-infrared QCL to a frequency comb by optical injection*

S. Borri, I. Galli, F. Cappelli, A. Bismuto, S. Bartalini, P. Cancio, G. Giusfredi, D. Mazzotti, J. Faist and P. De Natale  
Opt. Lett. 37, 1011 (2012)

**24.** *Molecular Gas Sensing Below Parts Per Trillion: Radiocarbon-Dioxide Optical Detection*

I. Galli, S. Bartalini, S. Borri, P. Cancio, D. Mazzotti, P. De Natale and G. Giusfredi  
Phys. Rev. Lett. 107, 270802 (2011)

**27.** *Frequency-comb-referenced mid-IR sources for next-generation environmental sensors*

P. Cancio, S. Bartalini, S. Borri, I. Galli, G. Gagliardi, G. Giusfredi, P. Maddaloni, P. Malara, D. Mazzotti and P. De Natale,  
Appl. Phys. B 102, 255-269 (2011)

Sesto Fiorentino, 04/03/2024

# CURRICULUM VITAE

## IACOPO GALLI

### INFORMAZIONI PERSONALI

Nome

Indirizzo

Telefono

Fax

E-mail

Nazionalità

Data di nascita

**IACOPO GALLI**

### ESPERIENZA LAVORATIVA

- Date (da – a) 01/01/2024 – oggi  
• Nome e indirizzo del datore di lavoro Istituto Nazionale di Ottica, Largo Fermi 6, 50125 Firenze.  
• Tipo di azienda o settore Ente di ricerca scientifica  
• Tipo di impiego Contratto a tempo indeterminato di primo ricercatore  
• Principali mansioni e responsabilità sviluppo di sistemi sensing basati su tecniche spettroscopiche ad alte prestazioni nell'infrarosso.
- Date (da – a) 28/12/2018 – 31/12/2023  
• Nome e indirizzo del datore di lavoro Istituto Nazionale di Ottica, Largo Fermi 6, 50125 Firenze.  
• Tipo di azienda o settore Ente di ricerca scientifica  
• Tipo di impiego Contratto a tempo indeterminato di ricercatore terzo livello  
• Principali mansioni e responsabilità sviluppo di sistemi sensing basati su tecniche spettroscopiche ad alte prestazioni nell'infrarosso.
- Date (da – a) 03/09/12 – 27/12/2018  
• Nome e indirizzo del datore di lavoro Istituto Nazionale di Ottica, Largo Fermi 6, 50125 Firenze.  
• Tipo di azienda o settore Ente di ricerca scientifica  
• Tipo di impiego Contratto a tempo determinato di ricercatore terzo livello  
• Principali mansioni e responsabilità sviluppo di sistemi sensing basati su tecniche spettroscopiche ad alte prestazioni nell'infrarosso.
- Date (da – a) 01/09/10 – 31/08/12  
• Nome e indirizzo del datore di lavoro Istituto Nazionale di Ottica, Largo Fermi 6, 50125 Firenze.  
• Tipo di azienda o settore Ente di ricerca scientifica  
• Tipo di impiego Assegno di ricerca  
• Principali mansioni e responsabilità Sviluppo di sorgenti coerenti altamente sintonizzabili per la rivelazione di molecole inquinanti nell'infrarosso.
- Date (da – a) 07/01/09 – 31/08/10  
• Nome e indirizzo del datore di lavoro Istituto Nazionale di Ottica, Largo Fermi 6, 50125 Firenze.  
• Tipo di azienda o settore Ente di ricerca scientifica  
• Tipo di impiego Assegno di ricerca  
• Principali mansioni e responsabilità Misura di frequenze infrarosse con tecniche spettroscopiche.
- Date (da – a) 02/02/06 – 02/06/06  
• Nome e indirizzo del datore di lavoro Istituto Nazionale di Ottica, Largo Fermi 6, 50125 Firenze.

- Tipo di azienda o settore
  - Tipo di impiego
- Principali mansioni e responsabilità
  
- Date (da – a)
- Nome e indirizzo del datore di lavoro
  - Tipo di azienda o settore
  - Tipo di impiego
- Principali mansioni e responsabilità
  
- Date (da – a)
- Nome e indirizzo del datore di lavoro
  - Tipo di azienda o settore
  - Tipo di impiego
- Principali mansioni e responsabilità

### **ISTRUZIONE E FORMAZIONE**

- Date (da – a)
- Nome e tipo di istituto di istruzione o formazione
  - Principali materie / abilità professionali oggetto dello studio
  - Qualifica conseguita
  
- Data
- Nome e tipo di istituto di istruzione o formazione
  - Principali materie / abilità professionali oggetto dello studio
  - Qualifica conseguita
  
- Anno
- Nome e tipo di istituto di istruzione o formazione
  - Qualifica conseguita

Ente di ricerca scientifica

Contratto di prestazione d'opera in regime di lavoro autonomo occasionale

Verifica delle prestazioni di un sistema di aggancio in fase e frequenza tra laser e radiazione prodotta da un generatore di pettini di frequenza.

31/05/05 – 30/12/05

Istituto Nazionale di Ottica, Largo Fermi 6, 50125 Firenze.

Ente di ricerca scientifica

Contratto per l'effettuazione di una collaborazione coordinata e continuativa nell'ambito del progetto negoziale FIRB dal titolo "Microdispositivi fotonici in niobato di litio"

Realizzazione di un sistema di aggancio in fase e frequenza tra laser e radiazione prodotta da un generatore di pettini di frequenza.

15/10/04 – 15/04/05

Istituto Nazionale di Ottica, Largo Fermi 6, 50125 Firenze.

Ente di ricerca scientifica

Contratto per l'effettuazione di una collaborazione coordinata e continuativa nell'ambito del progetto negoziale FIRB dal titolo "Microdispositivi fotonici in niobato di litio"

Sviluppo di un sistema optomeccanico compatto per il montaggio di un laser criogenico.

01/01/06 – 31/12/08

Università di Firenze

Realizzazione di una sorgente ad alta stabilità nel medio infrarosso con riferimento assoluto di frequenza per rivelazione sensibile di CO<sub>2</sub>.

Dottorato di ricerca in fisica (XXI ciclo)

28/04/04

Università di Firenze

Realizzazione di un laser compatto a Ti:zaffiro iniettato.

Laurea in fisica

1995

IPSIA Rocco Chinnici di Firenze

Diploma di Maturità

**CAPACITÀ E COMPETENZE  
PERSONALI**

MADRELINGUA

**ITALIANO**

ALTRE LINGUA

**INGLESE**

- Capacità di lettura
- Capacità di scrittura
- Capacità di espressione orale

buono

buono

sufficiente

**CAPACITÀ E COMPETENZE  
RELAZIONALI**

Ho sviluppato capacità e competenze relazionali sia nell'ambito lavorativo, sia nell'ambito sportivo. Nella ricerca scientifica è fondamentale il lavoro di gruppo per ottenere il risultato, quindi ho sviluppato negli anni una buona esperienza relazionale nell'ambito lavorativo. Per quanto riguarda la comunicazione ho avuto esperienze sportive come viceallenatore di squadre giovanili di calcio dove è fondamentale la comunicazione con i ragazzi per ottenere un ottimo gruppo.

**CAPACITÀ E COMPETENZE  
ORGANIZZATIVE**

Nell'ambito lavorativo ho acquisito esperienze organizzative per la progettazione e organizzazione del lavoro di laboratorio.

**CAPACITÀ E COMPETENZE  
TECNICHE**

Durante la mia formazione ho acquisito competenze di informatica riguardanti programmi come: AutoCad, Corel Draw, Excel, Labview, Latex, Origin, Power Point, Word.

**ALTRE CAPACITÀ E COMPETENZE**

Nel campo della ricerca scientifica ho esperienza in:  
Aggancio in fase tra laser e generatore di pettini di frequenza  
Analisi dati.  
Analisi della purezza spettrale di sorgenti laser.  
Analisi di rumore di strumentazione.  
Collimazione di fasci gaussiani mediante sistemi ottici.  
Controllo computerizzato di strumentazione da laboratorio ed automazione di apparati sperimentali tramite programmazione in LabView.  
Metrologia di frequenza tramite l'utilizzo di Sintetizzatori Ottici di Frequenza.  
Progettazione di cavità laser.  
Progettazione di sistemi da vuoto e sistemi criogenici.  
Progettazione e assemblaggio di elettronica da laboratorio per elaborazione di segnali.  
Progettazione pezzi meccanici.  
Realizzazione di sorgenti di radiazione coerente tramite mescolamento di frequenze ottiche in cristalli non lineari.  
Stabilizzazione in frequenza di sorgenti laser tramite aggancio a transizioni molecolari e/o cavità risonanti con tecniche Pound Drevel Hall, di polarizzazione, di iniezione ottica.  
Tecniche di spettroscopia molecolare ad alta sensibilità e precisione nel vicino e medio infrarosso: spettroscopia con tecnica di cavity ring-down e di cavity ring-down in assorbimento saturato, spettroscopia sub-Doppler in polarizzazione e in saturazione, con riferimento assoluto di frequenza.

**PATENTE O PATENTI**

Patente di guida A,B

## ULTERIORI INFORMAZIONI

Autore di oltre 60 pubblicazioni scientifiche su riviste e libri, autore di brevetti (vedi lista sotto).

[www.scopus.com/authid/detail.uri?authorId=25821721300](http://www.scopus.com/authid/detail.uri?authorId=25821721300)

[www.ino.it/?p2=persone&p=persone-dettagli&indice=179](http://www.ino.it/?p2=persone&p=persone-dettagli&indice=179)

Socio fondatore della società "ppqSense SRL". L'azienda è uno spin-off del Consiglio Nazionale delle Ricerche e ha come oggetto lo sviluppo, la produzione e la commercializzazione di prodotti o servizi innovativi ad alto valore tecnologico e più specificatamente lo sviluppo, produzione, commercializzazione, progettazione, prototipazione, supporto e manutenzione di sistemi ottici, meccanici ed elettronici ad alto contenuto di innovazione, anche per strumentazioni di analisi basata su tecniche di spettroscopia laser per la rivelazione di molecole; certificazione di apparati di misura; fornitura di servizi finalizzati alla misura di concentrazioni di molecole.

Firenze  
04/03/2024

Iacopo Galli

A handwritten signature in blue ink, appearing to read 'I. Galli', written in a cursive style.

Ai sensi dell'art. 13 del D. Lgs. 196/2003, autorizzo il trattamento dei dati personali contenuti nel presente curriculum vitae.