Curriculum Vitae Daniele Bajoni

PERSONAL INFORMATION

Researcher unique identifier(s): ORCID 0000-0001-6506-8485 Research ID: P-8123-2015
Date of birth: June 9th 1976
Nationality: Italian
URL for web site: www.unipv.it/bajoni

• EDUCATION

2004 PhD in Physics: Faculty of Science - Department of Physics, University of Pavia, Italy. Title of the thesis: "Optical Spectroscopy of Photonic Crystals and Microcavities". PhD supervisor: Prof. Giorgio Guizzetti.
2000 Master degree in Physics (Italian Laurea): Faculty of Science - Department of Physics, University of Pavia, Italy, supervisor Prof Giorgio Guizzetti.

• CURRENT POSITION

2014 – **Associate Professor**, Department of Electrical, Computing and Biomedical Engineering, University of Pavia, Italy

• PREVIOUS POSITIONS

2008 – 2014 **Assistant Professor** (with tenure), Department of Electrical, Computing and Biomedical Engineering, University of Pavia, Italy
2005 – 2007 Post doctoral researcher at **LPN-CNRS in Marcoussis, France**, in the group led by prof. Jacqueline Bloch.

• INSTITUTIONAL RESPONSIBILITIES

2008 – **Faculty member**, Department of Electrical, Computing and Biomedical Engineering, University of Pavia, Italy
2015 – Member of the **Ph.D. Board** at the Department of Electrical, Computing and Biomedical Engineering, University of Pavia, Italy

• COMMISSIONS OF TRUST

I have reviewed scientific projects for the following institutions
2011 - 2013 Italian Ministry of Education (MIUR, Italy)
2011 Agence Nationale de la Recherche (ANR, France)
2010 Department of Energy (DoE, United States of America)

• MEMBERSHIPS OF SCIENTIFIC SOCIETIES

2013,2015 – Member, Optical Society of America
2008 – Associated Member, National Interuniversity Consortium for the Physical Sciences of Matter (CNISM, Italy)
2015 – Associated Member, National Institute for Nuclear Physics (INFN, Italy)

• SUPERVISION OF GRADUATE STUDENTS AND POSTDOCTORAL FELLOWS

2008 – 2015 I took part in the supervision of 1 post-doc/ 4 PhD students/1 Master student, Department of Electrical, Computing and Biomedical Engineering and the Department of Physics, University of Pavia, Italy

• TEACHING ACTIVITIES

2015 – Engineering Department, Università degli Studi di Pavia, Italy. Professor of "General Physics II" (Electromagnetism), course for undergraduate students.

2012 – Engineering Department, Università degli Studi di Pavia, Italy. Professor of "Semiconductor Device Physics", course for master students.

2008–2015 Engineering Department, Università degli Studi di Pavia, Italy. Professor of "General Physics I" (Mechanics and Thermodynamics), course for undergraduate students.

2000–2001 Engineering Department, Università degli Studi di Bergamo, Italy. Assistant of "General Physics II" (Electromagnetism), course for undergraduate students.

• SCIENTIFIC OUTPUT

Number of publications: 88
Number of publications without PhD supervisor: 65
Number of publications with last authorship: 24
Number of publications with first authorship: 15
Citations
- Google Scholar: 1540
- Scopus: 1067
- ISI Web of Science: 1041

H-factor
- Google Scholar: 23
- Scopus: 20
- ISI Web of Science: 19

According to Thomson Reuters' Web of Science, two of my papers ([Grassani2015] and [BajoniPRL2008a] in section c below) have received enough citations to place them in the top 1% of their academic field based on a highly cited threshold for the field and publication year.

• MAJOR COLLABORATIONS

Jacqueline Bloch Laboratoire de Photonique et Nanostructures – CNRS, Marcoussis, France
Dirk Englund Department of Electrical Engineering and Computer Science, Massachusetts Institute of Technology
Christophe Galland Ecole Polytechnique Fédérale de Lausanne, 1015 Lausanne, Switzerland
Matteo Galli Department of Physics, University of Pavia, Italy
Marco Liscidini Department of Physics, University of Pavia, Italy
Chiara Macchiavello Department of Physics, University of Pavia, Italy and National Institute of Nuclear Physics (INFN Italy)
Oreste Nicrosini National Institute of Nuclear Physics (INFN Italy)
John Sipe Department of Physics and Institute for Optical Sciences, University of Toronto, Ontario, Canada
Isabelle Sagnes Laboratoire de Photonique et Nanostructures – CNRS, Marcoussis, France
Marc Sorel School of Engineering, University of Glasgow, UK

Early achievements track-record

During my PhD my main research interest have been the spectroscopic characterization of photonic crystal structures, and during this time I learned a lot of the basic concepts of integrated photonics, and especially experimental physics. I perfected the skills needed to successfully **build** from scratch **photonic experiments**, skills that proved very useful in my later activities in experimental optics.

After my PhD, I spent three years as a **post-doc** in the group of Jacqueline Bloch at the Laboratoire de Photonique et Nanostructures in **France**. The theme of the post doc concerned the emerging field of exciton polariton physics. I achieved many important results, including significant milestones in the field of *polaritonics*. Exciton polaritons are fascinating states that can form in a semiconductor cavity, and are hybrid waves part light, and part matter. In my research I demonstrated that confinement can greatly increase polariton interactions and showed **polariton lasing** in micropillar cavities [Bajoni2008PRLa]. I also worked toward the applicability of polariton devices, and showed for the first time the *electrical injection* of polaritons [Bajoni2008PRB] and demonstrated that polariton diodes have very strong bistability [Bajoni2008PRLb].

In 2008 I became tenured at the Department of Electrical, Computing and Biomedical Engineering and the Department of Physics, University of Pavia, Italy. I started at the University of Pavia **my own research group,** building a **new research activity** in experimental quantum optics. I successfully applied my competences in polariton physics and decided to work on the idea to exploit waveguiding structures to further amplify their strong nonlinearities [Liscidini2011]. The ultimate confinement in dielectric media is obtained in photonics crystal cavities, and we successfully worked toward the goal of getting strong light-matter coupling in such a cavity. This resulted in a polariton laser with threshold power in the nW range, which remains to date *the lowest reported threshold* for a polariton lasing device [Azzini2011]. My results on polariton physics are widely recognized and I have been asked to write a **review paper on invitation** on these topics [Bajoni2012].

The problem with polariton devices is that they generally need very low temperatures (~10K) to work, limiting their applicability. Besides, I have always been convinced of the groundbreaking potentialities of producing entanglement in semiconductor devices, and the strong light-matter interactions in polariton systems make the generation of entanglement very difficult because of the presence of thermal noise sources. I therefore decided to move the research effort of my group toward **silicon integrated photonics**, which seemed to me to hold a much greater potential for quantum optics. Silicon has in fact a reasonably strong $\chi^{(3)}$ nonlinearity, silicon photonic devices work at room temperature, and can be produced in standardized industrial processes, all properties I viewed as promising toward applications. We started investigating several ways to enhance silicon nonlinear processes using resonant integrated structures, including **ring resonators** [Azzini2012OL] and photonics crystal cavities [Azzini2013]. We found ring resonators to be solid and reliable structures for the generation of nonclassical states of light, and demonstrated emission of **photon pairs** from silicon rings [Azzini2012OE], a result that has taken my group at the forefront of research in silicon integrated sources of quantum states of light, and earned us several invited talks, including an **invited talk** at the **CLEO** conference in San Jose in 2013. Our most **prominent recent achievement** is surely the demonstration that the **photon pairs** emitted by ring resonators are indeed **entangled** [Grassani2015], reaching the longstanding goal of a source of entangled photons which is microscopic, bright and integrated on a silicon chip. This recent result was featured by 35 different media outlets with an estimated audience of over 26 million.

To finance the research activities of my group I have successfully applied for several grants: I have been **principal investigator** of the project from the National Interuniversity Consortium for the Physical Sciences of Matter (CNISM) "Photonic crystal polaritons for entangled photon generation" (36 month project, total financing about 250 keuros, national call for project with only 2 project financed over about 100 applications); I have been the **principal investigator** of the Alma Mater Ticinensis foundation project "Semiconductor devices for entangled photon pair generation" (24 month project, total financing 70 keuros); I have been been the **principal investigator** of the Italian Ministry of Research FIRB project "Nonlinear and quantum optics in photonics nano structures" (36 month project, total financing about 360 keuros). Several young researchers have been trained as PhDs or Post-docs in the framework of these activities.

10 main publications in peer reviewed journals after PhD, without PhD supervisor, excluding conference papers. (citations data from Scopus)

[Grassani2015] Grassani, D., Azzini, S., Liscidini, M., Galli, M., Strain, M.J., Sorel, M., Sipe, J.E., **Bajoni, D.** "Micrometer-scale integrated silicon source of time-energy entangled photons" (2015) Optica, 2 (2), pp. 88-94. Cited 9 times.

[Azzini2013] Azzini, S., Grassani, D., Galli, M., Gerace, D., Patrini, M., Liscidini, M., Velha, P., **Bajoni, D.** "Stimulated and spontaneous four-wave mixing in silicon-on-insulator coupled photonic wire nano-cavities" (2013) Applied Physics Letters, 103 (3), art. no. 031117. Cited 11 times.

[Azzini2012OE] Azzini, S., Grassani, D., Strain, M.J., Sorel, M., Helt, L.G., Sipe, J.E., Liscidini, M., Galli, M., **Bajoni, D. "**Ultra-low power generation of twin photons in a compact silicon ring resonator" (2012) Optics Express, 20 (21), pp. 23100-23107. Cited 60 times.

[Azzini2012OL] Azzini, S., Grassani, D., Galli, M., Andreani, L.C., Sorel, M., Strain, M.J., Helt, L.G., Sipe, J.E., Liscidini, M., **Bajoni, D. "**From classical four-wave mixing to parametric fluorescence in silicon microring resonators" (2012) Optics Letters, 37 (18), pp. 3807-3809. Cited 22 times.

[Bajoni2012] **Bajoni, D. "**Polariton lasers. Hybrid light-matter lasers without inversion" (2012) Journal of Physics D: Applied Physics, **45** (31), art. no. 313001. ***Review paper on invitation***. Cited 18 times.

[Azzini2011] Azzini, S., Gerace, D., Galli, M., Sagnes, I., Braive, R., Lemaître, A., Bloch, J., **Bajoni, D.** "Ultra-low threshold polariton lasing in photonic crystal cavities" (2011) Appl. Phys. Lett., 99, 111106. Cited 23 times.

[Liscidini2011] Liscidini, M., Gerace, D., Sanvitto, D., **Bajoni, D. "**Guided Bloch surface wave polaritons" (2011) Appl. Phys. Lett., 98, 121118. Cited 35 times.

[Bajoni2008PRLb] **Bajoni, D.,** Semenova, E., Lemaître, A., Bouchoule, S., Wertz, E., Senellart, P., Barbay, S., Kuszelewicz, R., Bloch, J. "Optical bistability in a GaAs-based polariton diode" (2008) Physical Review Letters **101**, 266402 (2008). Cite 58 times.

[Bajoni2008PRB] **Bajoni, D.**, Semenova, E., Lemaître, A., Bouchoule, S., Wertz, E., Senellart, P., Bloch, J. "Polariton light-emitting diode in a GaAs-based microcavity" (2008) Physical Review B **77** (11), 113303. Cited 63 times.

[Bajoni2008PRLa] **Bajoni, D.**, Senellart, P., Wertz, E., Sagnes, I., Miard, A., Lemaître, A., Bloch, J. "Polariton laser using single micropillar GaAs-GaAlAs semiconductor cavities" (2008) Physical Review Letters **100**, 047401. Cited 197 times.

Invited talks at major international conferences and institutions.

- "Four-wave mixing and generation of correlated photon pairs in silicon ring resonators and photonic molecules", CLEO, San Jose (US) 2013
- "Quantum Nonlinear Optics in Integrated Silicon Photonic Structures", SPIE Photonics North, Ottawa (CA) 2013
- "Quantum Optics in Silicon Ring Resonators", University of Toronto (CA), 2013
- "Nonlinear optics and entagled photon pairs generation in silicon ring resonators", University of Trento, 2013
- "Polariton diodes". 9th International Conference on Physics of Light-Matter Coupling in Nanostructures, Lecce (IT), 2009.
- "Polariton lasing in single micropillar semiconductor cavities": invited talk. 9th International Workshop on Nonlinear Optics and Excitation Kinetics in Semiconductors, Klink (DE), 2008.
- "Thermalization of polaritons in III-V Microcavities": invited talk. Condensed Matter and Materials Physics 2007, Leicester (UK), 2007.