Marco Clementi

Curriculum Vitae

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Personal information

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Education

Oct. 2016–Present **PhD student in Physics**, *Università degli Studi di Pavia*, Italy.
Specialized in Photonics and Quantum Optical technologies (held in English)

Sept. 2014–Oct. 2016 **Master's degree (hons.) in Electronic Engineering**, *Università degli Studi di Pavia*, Italy.
Specialized in Photonics (held in English)

Sept. 2011–Sept. 2014 **Bachelor's degree (hons.) in Electronic and Computer Engineering**, *Università degli Studi di Pavia*, Italy.
Specialized in Electronics

Sept. 2006–July 2011 **High School Scientific Diploma**, *Liceo Scientifico B. Pinchetti*, Tirano.

Bachelor's Thesis

Title Studio e realizzazione di un autocorrelatore ottico per misure di impulsi tra 1 e 10 micron
Design and realization of an optical autocorrelator for pulse characterization between 1 and 10 micrometers

Supervisor Dr. Federico Pirzio

Grade 110/110 cum laude

Master's Thesis

Title — Design and demonstration of a protocol for quantum-enhanced secure delegated computing

Based upon the theoretical and experimental work carried out at the Clarendon Laboratories (University of Oxford) in the framework of a four months research internship (see below).

Supervisors — Dr. Daniele Bajoni (University of Pavia),
Dr. Stefanie Barz (University of Oxford)

Grade — 110/110 cum laude

Research

Current group — **Photonics and Nanostructures**, *Department of Physics*, University of Pavia, Headed by Prof. L.C. Andreani.

Supervisor — Prof. Matteo Galli

Website — `fisica.unipv.it/nanophotonics`

Research interests

1. **Structures and materials for the manipulation of light at nanoscale**.
   Semiconductor fabrication techniques developed in the last few decades enabled to realize with unprecedented precision more and more sophisticated integrated devices for the generation, manipulation and detection of light on the nanometre scale. A prominent example are structures with a periodic modulation of refractive index (*photonic crystals*) which enable to widely engineer the properties of light propagation. My research consists in the experimental study of these nanostructures and of the physical processes which these enable to highlight. Moreover, I investigate the possibility to employ novel materials, such as silicon nitride and gallium nitride, for the realization of such devices.
2. **Integrated sources of non-classical light**.
   The development of optical quantum technologies can remarkably benefit from the integration of table-top experiments to on-chip devices, which provide a compact and repeatable platform for experiments and a suitable pathway for practical applications. This advantage is particularly evident when the complexity of the system is substantial. My research is oriented to the realization of integrated sources of single photons and other non-classical states of light by means of nonlinear parametric processes. Taking advantage from the strong field enhancement which can be achieved in optical microresonators, such as photonic crystal cavities and microrings, I investigate the possibility of creating compact, low-power and scalable photon sources.

3. **Optical quantum information processing**.
Optical photons are proven to be physical supports suitable as quantum information carriers. An optical *qubit* benefits of long coherence time and strong decoupling from environmental noise. I am interested in the applications of single photons in quantum information experiments, such as linear optical quantum computing, quantum cryptography and quantum-enhanced secure classical computation. My work focuses in particular on experiments combining the objectives of quantum information science with the benefits provided by photonic integration.

Publications

1. M Clementi, A Pappa, A Eckstein, IA Walmsley, E Kashefi, S Barz, "Classical multiparty computation using quantum resources," Physical Review A 96 (6), 062317 (2017)
2. K Debnath, M Clementi, TD Bucio, M Galli, AZ Khokhar, M Sotto, KM Grabska, S Saito, F Gardes, "Ultrahigh-Q photonic crystal cavities in silicon rich nitride," Optics express 25 (22), 27334-27340 (2017)
3. M Clementi, K Debnath, M Sotto, TD Bucio M Liscidini, D Bajoni, Y Gardes, M Galli,"Harmonic Generation in Silicon Rich Nitride Photonic Crystal Cavities," CLEO 2018, *Accepted for Oral Presentation - code STu3F.2* (2018)

Experience

March 2016–June 2016 **Research internship**, *Ultrafast Quantum Optics and Optical Metrology group*, University of Oxford.
During this four months internship, I carried out both theoretical and experimental research in quantum optics. A significant part of my work's results constitute the topic of my master thesis and of a publication (currently in preparation). The internship took place in the framework of the Erasmus+ exchange programme.

Teaching

May 2017, April 2018 **Introductory Modern Physics for high school**, *Liceo Scientifico T. Taramelli*.
I gave a short series of Modern Physics lectures for the students at their last year of high school, in the framework of the project "Adotta un dottorando" promoted by the University of Pavia.

2011–Present **University Student Tutor**, *Università degli Studi di Pavia*.
I assisted the teaching activity, helping students autonomously sort out exam exercises. The activities involved different degree courses from the Departments of Industrial and Information Engineering and Civil and Building Engineering over several years.

Topics:
- Electromagnetic Fields and Circuits
- Computer Science fundamentals and C programming
- Applied Electronics
- General Physics

Physics Outreach

September 2017 **European Researchers' Night**, *Università degli Studi di Pavia*.
Our group proposed a public exhibition about the concept of Quantum Eraser, including a qualitative experimental demonstration.

March 2017 **Pi Day**, *Università degli Studi di Pavia*.
Our group showed a laser interferometer to the public and its physical principle of operation was explained. We also showed how laser interferometers have been useful for the detection of gravitational waves in early 2016.

Awards and honours

2015 Mobility fellowship - Erasmus+ programme
2016 Best thesis prize 2016 - AEIT
2016 PhD fellowship - University of Pavia

Computer skills

Basic Python, Mathematica, HTML, LabView, VHDL, Adobe Acrobat, Adobe Photoshop, Linux systems, LaTeX
Intermediate Computational electromagnetics, MATLAB, SPICE, Microsoft Office
Advanced Microsoft Windows, C

Languages

Italian **Mothertongue**
English **Fluent** *Cambridge FCE (B2)*
French **Basic**

Scientific Interests

- Photonics
- Photonic Crystal nanocavities
- Quantum Optics
- Quantum Technologies