

Quantum Optics

The InsLight group is an experimental group led by Dr. Maria Bondani, Researcher of the Institute of Photonics and Nanotechnologies of CNR, operating at the University of Insubria.

The group is involved in two main research activities, as testified by the presence of two Laboratories, namely the Quantum Optics Lab and the Photophysics and Biomolecules Lab.

At present, other two people belong to the group, Dr. Alessia Allevi, tenure-track Researcher at the University of Insubria, and Giovanni Chesi, PhD student at the University of Insubria as well.

The group has a stable cooperation with two external collaborators, Dr. Luca Nardo (University of Milano Bicocca) and Marco Lamperti (Polytechnic of Milan), which are still involved in the research activities performed in the Photophysics and Biomolecules Lab.

The group has several national and international collaborators, among which the group of Prof. Matteo Paris at the University of Milan, the group of Prof. Jan Perina and Prof. Ondrej Haderka at the Joint Laboratory of Optics of the Palacky University in Olomouc (Czech Republic) and the group of Gruppo Prof. Hanne Tønnesen at the University of Oslo.

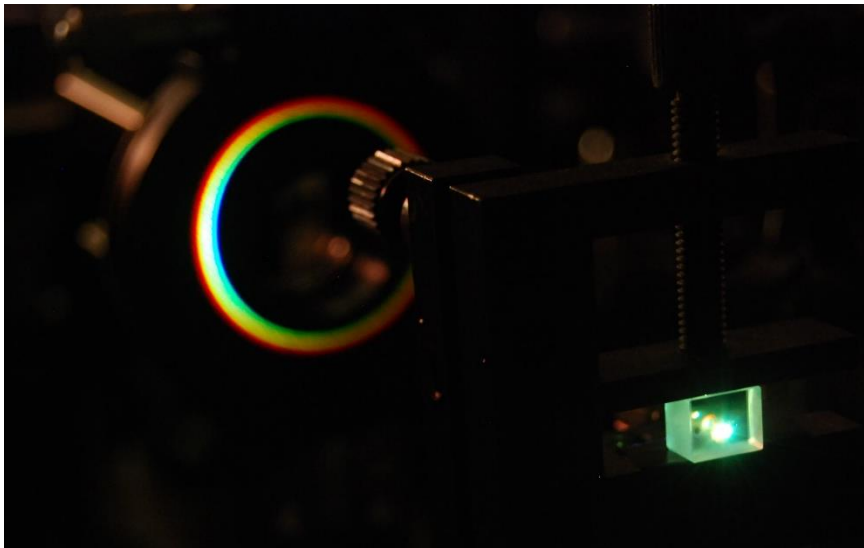
The research activity in the Quantum Optics laboratory includes some relevant topics in light-matter interaction, such as nonlinear optics, quantum optics, quantum information and characterization of different classes of photodetectors. Thanks to the availability of different kinds of laser systems and detection chains, the experimental investigations are performed in different intensity regimes, ranging from the single-photon level up to the macroscopic domain, passing through the so-called mesoscopic photon-number domain, in which pulsed optical states with sizeable numbers of photons per pulse are produced and photon-number resolving detectors are employed.

The research activity addresses the generation and characterization of both classical and nonclassical states useful for applications in the field of Quantum Information and Quantum Communication. At the same time, new detection schemes aimed at investigating both the particle-like and wave-like properties of light are being developed.

The research activity in the Photophysics and Biomolecules Lab is aimed at characterizing and exploiting biological compounds for technological applications. The experimental investigations are based on different techniques, such as time-correlated single-photon counting (TCSPC), fluorescence fluctuation spectroscopy (fluorescence correlation spectroscopy (FCS) and photon-counting histogram (PCH)). In particular, TCSPC is used to characterize new drug substances and nano-scaled drug delivery systems, as well as new polymeric organic and metallorganic compounds for selective adsorption, catalysis and fuels storage. Moreover, this technique is exploited to perform high resolution assessments on biomolecular conformations (recently particularly focused on DNA G-quadruplexes)

through time resolved fluorescence energy transfer measurements. Combined FCS and PCH measurements are being used to study the aggregation of the amyloid beta protein, which is involved in the Alzheimer onset. Moreover, the same techniques are useful to investigate the statistics of light emitted by single-molecules.

In addition to research, the group is strongly involved in Physics Outreach and Education. The research activities aim at finding new educational strategies and, in particular, at encouraging and supporting the experimental activity in high schools. By exploiting the expertise of the members of the group, many activities involve Optics experiments. Among the other initiatives, we mention the project “LuNa – La natura della Luce nella luce della Natura”, the annual “Joint International Physics Summer School – Optics”, organized in Como and in Olomouc (Czech Republic), the Workshop “Officina di didattica e divulgazione della Fisica” on different aspects of Physics and devoted to high-school students and teachers, the organization of PLS (Progetto Lauree Scientifiche) laboratories.



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Publications

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