

Prof. Giulio Cerullo (GC)

Research Experiences and Academic Career

- He received the degree in Electronic Engineering at Politecnico di Milano (110/110 Cum Laude) in 1988.
- From 1991 to 1999 he was Staff Researcher with the Physics Department, Politecnico di Milano.
- In the years 1995-1996 he was Visiting Scientist with the Lawrence Berkeley National Laboratory (Berkeley, California, U.S.A.) with a Nato Advanced Research Fellowship, under the supervision of Prof. C.V. Shank.
- Since 1999 he is Associate Professor with the Physics Department, Politecnico di Milano.
- Since July 2011 he is Full professor with the Physics Department, Politecnico di Milano.

Research Activity

GC's research activity covers a broad area known as "Ultrafast Optical Science", and concerns on the one hand pushing our capabilities to generate and manipulate ultrashort light pulses, and on the other hand using such pulses to capture the dynamics of ultrafast events in molecular and solid-state systems. Additional research topics are the applications of ultrafast lasers to microscopy and micro/nanomachining.

GC has published **more than 480 scientific papers** on renowned international journals of high impact factor (including Science, Nature, Nature Materials, Nature Physics, Nature Nanotechnology, Nature Photonics, Physical Review Letters). These papers have received **over 25000 citations**. According to the Scopus his **h-index is 80**.

His main research achievements can be summarized as follows:

Ultrafast optics:

- Kerr-lens mode-locking of the Ti:sapphire laser (*Opt. Lett.* **19**, 1040 (1994); *Opt. Lett.* **19**, 807 (1994)).
- Generation of tunable sub-10-fs pulses by the non-collinear optical parametric amplifier (*Appl. Phys. Lett.* **71**, 3616 (1997); *Opt. Lett.* **23**, 1283 (1998); *Opt. Lett.* **24**, 1529 (1999); *Opt. Lett.* **26**, 1155 (2001)).
- Generation of few-optical-cycle light pulses with stable carrier-envelope phase (*Opt. Lett.* **29**, 2668 (2004); *Opt. Lett.* **31**, 963 (2006) *Opt. Express* **14**, 10109 (2006)).
- Sub-10-fs pulse generation in the near- and mid-infrared (*Opt. Lett.* **33**, 741 (2008); *Opt. Lett.* **33**, 2901 (2008); *Opt. Express* **17**, 12510 (2009)).
- Coherent synthesis of optical parametric amplifiers (*Nature Photonics* **5**, 475(2011); *Opt. Lett.* **37**, 1880-1882 (2012)).
- Strong-field photoemission from metal nanotips (*Nature Photonics* **8**, 37 (2014)).
- Generation of phase-locked pulses for two-dimensional spectroscopy by a birefringent delay line (*Opt. Lett.* **37**, 3027 (2012); *Opt. Express* **22**, 9063 (2014))

Ultrafast spectroscopy:

- Measurement of the inter-system crossing rate of a prototypical transition metal complex (*Science* **275**, 54 (1997)).
- Study of charge generation dynamics in conjugated polymers (*Phys. Rev. Lett.* **81**, 3259 (1998); *Phys. Rev. Lett.* **89**, 117402 (2002); *Phys. Rev. Lett.* **90**, 247402 (2003); *Phys. Rev. Lett.* **94**, 117402 (2005); *J. Am. Chem. Soc.* **135**, 4282 (2013)).
- Time-domain vibrational spectroscopy of conjugated molecules (*Phys. Rev. Lett.* **83**, 231 (1999); *Phys. Rev. Lett.* **86**, 3439 (2001); *Phys. Rev. Lett.* **90**, 047402 (2003); *Nature Commun.* **4**, 1602 (2013)).
- Ultrafast charge-transfer processes in polymer-fullerene blends (*Chem. Phys. Lett.* **340**, 232 (2001); *Phys. Rev. B* **64**, 075206 (2001); *Chem. Phys. Lett.* **345**, 33 (2001); *Nature Materials* **12**, 29 (2013); *Science* **344**, 1001-1005(2014)).
- Study of ultrafast internal conversion dynamics in carotenoids and detection of novel excited states (*Phys. Rev. B* **63**, 241104 (2001); *Science* **298**, 2395 (2002); *Phys. Rev. Lett.* **93**, 163002 (2004)).

- Study of energy transfer and non-photochemical quenching mechanisms in photosynthetic systems (PNAS **109**, 1473 (2012); PNAS **111**, E2431 (2014); *Nature plants* **2**, 16131 (2016))
- Exciton relaxation dynamics in carbon nanotubes (*Phys. Rev. Lett.* **94**, 207401 (2005); *Nature Physics* **2**, 515 (2006)).
 - Ultrafast phase transitions in strongly correlated materials (*Nature Materials* **6**, 643 (2007); *Phys. Rev. Lett.* **99**, 027401 (2007); *Phys. Rev. Lett.* **105**, 257001 (2010); *Nature Physics* **7**, 114-118 (2011); *Nature Physics* **11**, 421 (2015), *Nature Physics* **13**, 806 (2017)).
- Ultrafast isomerization of rhodopsin (*Nature* **467**, 440 (2010); *Angew. Chem. Intl. Ed.* **53**, 2504 (2014)).
 - Ultrafast spectroscopy of graphene and two-dimensional materials (*Nature Commun.* **4**, 1987 (2013), *ACS Nano* **10**, 1182(2016), *Nature Nanotechnology* **13**, 41 (2018)).
- Coherent acoustic phonons in solids and metal nanoparticles (*ACS Nano* **5**, 57852011; *Nano Lett.* **13**, 504 (2013); *Nano Lett.* **13**, 4914 (2013); *Nature Commun.* **4**, 1793 (2013)).
- Strong coupling in metal-molecular hybrid nanostructures (*ACS Nano* **4**, 7559-7565 (2010), *Nature Photonics* **7**, 128 (2013)).

Invited presentations to internationally established conferences:

In the last 10 years GC presented >25 Invited/Keynote/Plenary talks at international conferences, among which:

- 2009: Keynote Talk, CLEO/Europe (Munich, Germany)
- 2011: Invited Talk, Advanced Solid-State Photonics (Istanbul, Turkey)
- 2012: Plenary Talk, 21st International Laser Physics Workshop (Calgary, Canada)
- 2013: Invited Talk, XVIth Time-Resolved Vibrational Spectroscopy Conference (Beppu, Japan)
- 2014: Invited Talk, International conference on Ultrafast Phenomena (Okinawa, Japan)
- 2015: Invited Talk, CLEO USA (San Jose, USA)
- 2015: Plenary Talk, Photonica 2015 (Belgrade, Serbia)
- 2016: Invited Talk, 12th European Conference on Atoms, Molecules and Photons (Frankfurt, Germany)
- 2016: Plenary Talk, 1st International Conference on Optics, Photonics and Materials (Nice, France)
- 2017: Plenary Talk, German Physical Society Spring Meeting (Mainz, Germany)
- 2018: Invited Talk, 256th ACS National Meeting (Boston, USA)
- 2018: Keynote Talk, 7th EuCheMS Chemistry Conference (Liverpool, U.K.)
- 2019: Keynote Talk, 10th International Conference on Metamaterials, Photonic Crystals and Plasmonics (Lisbon, Portugal)
- 2019: Keynote Talk, Advances in Optics and Photonics 2019 (Lisbon, Portugal)

Lectures at international advanced schools:

In the last 10 years GC presented >15 lectures at international advanced schools, among which:

- 2010: SUSSP66 Summer School on Ultrafast Nonlinear Optics (Edinburgh, U.K.);
- 2012: Advanced Solid-State Photonics (San Diego, U.S.A.): short course;
- 2013: Winter School on Exciton Dynamics in Natural and Man Made Systems (Ein Gedi, Israel);
- 2013: Heraeus-Seminar, "Modern Concepts of Continuous Wave and pulsed High Power Lasers";
- 2014: "Materials Challenges in Devices for Fuel Solar Production and Employment" (Trieste, Italy);
- 2016: 7th EPS-QEOD Europhoton Conference Summer School (Vienna, Austria);
- 2017: Workshop on Spectroscopy and Dynamics of Photoinduced Electronic Excitations (Trieste, Italy);
- 2018: International school on Plasmonics and Nano-Optics (Cetraro, Italy).

Organisation of International conferences

In the last years GC has been heavily involved in the organizing committees of the main international conferences in the field of laser physics and ultrafast optical spectroscopy.

- *CLEO Europe 2005, 2007* member of the Subcommittee "Ultrafast Optics, Electrooptics and Applications".
- *Ultrafast Phenomena 2006, 2008, 2010* member of the Program Committee.
- *Photonics Europe 2006, 2008* member of the Subcommittee "Solid-State Lasers and Amplifiers".
- *Ultrafast Optics 2007, 2009* member of the Steering Committee.
- *CLEO U.S.A. 2008, 2009, 2010* member of the Subcommittee "Ultrafast Optics, Electrooptics and Applications".
- *1st EOS Topical Meeting on Lasers*, 2009, member of the Program Committee.
- *CLEO Europe-EQEC 2011-2013*, Sub-committee chair, "Ultrafast Phenomena and Frequency Combs".
- *Ultrafast Optics 2013*, Program Chair.

- *CLEO Europe-EQEC 2015*, Program Chair.
- *Ultrafast Phenomena 2016*, Program Chair.
- *CLEO Europe-EQEC 2017*, General Chair.
- *International Conference on Raman Spectroscopy (ICORS) 2016, ICORS 2018*, Member of the Steering Committee.
- *Ultrafast Phenomena 2018*, General Chair.
- *CLEO Europe-EQEC 2019*, Chair of the Steering Committee.
- *ICORS 2020*, General Chair.

Memberships to Editorials Boards of International Journals.

From 2006 to 2012 he has been Topical Editor of Optics Letters (OSA publishing) in the area of “Ultrafast Phenomena” and since 2016 he is Associate Editor of Optica (OSA Publishing). He is on the editorial boards of the following journals: Chemical Physics (Elsevier); Journal of Raman spectroscopy (Wiley); Laser and Photonics Reviews (Wiley); Scientific Reports (Nature Publishing Group).

Memberships to International committees.

GC is a member of the Laser Advisory Committee (LAC) of European XFEL and DESY (Hamburg, Germany). He is a member of the Scientific Advisory Board of LENS (Florence, Italy) and of the Max-Born Institute for Nonlinear Optics and Short-Pulse Spectroscopy (Berlin, Germany). He is the chair of the Quantum Electronics and Optics Division (QEOD) of the European Physical Society. He has been a member for the ERC Advanced Grants Review Panel (PE4) in 2017 and 2019.

Awards

In 2015 GC was elected Fellow of the Optical Society of America.

In 2019 GC was elected Fellow of the European Physical Society.

Funding ID

- EU-FP5 CRAFT project *DACO (Development and application of a Compact femtosecond Oscillator)*, years 2003-2005. “Laser application in waveguide writing” (€ 308,000, Research Line Leader).
- EU-FP6 STREP project *HIBISCUS (Hybrid Integrated Biophotonic Sensors Created by Ultrafast laser Systems)*, years 2006-2009 (€ 464,000, Project Coordinator).
- National Research Project “*PRIN- Spectral and temporal control of femtosecond pulses with second order nonlinear processes*”, years 2006-2008 (€ 104,286, Project Coordinator).
- EU-FP7 STREP project *microFLUID (micro-Fabrication of polymeric Lab-on-a-chip by Ultrafast lasers with Integrated optical Detection)*, years 2008-2011 (€ 433,000, Workpackage Leader).
- US Air Force Research Laboratories project: “*Single-cycle pulse synthesis by coherent superposition of ultra-broadband optical parametric amplifiers*”, years 2009-2010 (\$ 100,000, Project Leader).
- National Research Project “*PRIN-Tracking ultrafast photoinduced intra- and inter-molecular processes in natural and artificial photosensors*”, years 2008-2009 (€ 62,000, Project Coordinator).
- EU-FP7 STREP project *CROSS TRAP (Coherently-enhanced Raman one-beam standoff spectroscopic tracing of airborne pollutants)*, years 2010-2012 (€ 327,480, WorkpackageLeader).
- Regional Research Project: “*Passive optical memories by liquid crystals in three-dimensional microstructures*”, years 2009-2010 (€ 80,000, Leader of the Research Unit).
- Regional Research Project: “*Development of a coherent Raman microscopy system for biomedical imaging*”, years 2010-2012 (€ 180,000, Project coordinator).
- European Research Council (ERC) Advanced Grant “*STRATUS: structure and dynamics of biomolecules by two-dimensional UV spectroscopy*” years 2012-2017 (€ 2,493,000, Principal Investigator).
- European Research Council (ERC) Proof of Concept Grant “*MISSION: Mid Infrared Spectroscopy by Innovative Optical iNterferometers*” years 2015-2016 (€ 149,600, Principal Investigator).
- FET Flagship project GRAPHENE (“*Graphene-Driven Revolutions in ICT and Beyond*) years 2013-2016 (€ 477,067, participant to WP5 (Optoelectronics)).

- FET Flagship project GRAPHENE CORE 1 (“Graphene-Driven Revolutions in ICT and Beyond) years 2016-2018 (€ 638,000, participant to WP8 (Optoelectronics)).
- FET Flagship project GRAPHENE CORE 2 (“Graphene-Driven Revolutions in ICT and Beyond) years 2018-2020 (€ 509,000, participant to WP8 (Optoelectronics)).
- H2020 ETN project “LightDyNAMics – DNA as a training platform for photodynamic processes in soft materials”, years 2017-2022 (€ 254.000, leader of WP1)
- H2020 ETN project “MUSIQ – Multiphoton Microscopy and Ultrafast Spectroscopy: Imaging meets Quantum”, years 2018-2023(€ 508.000, leader of WP1)
- H2020 ITN project “CHIRALSCOPY - Probing Ultrafast Stereochemical Dynamics by Femtosecond Electronic Circular Dichroism Spectroscopy”, years 2019-2021 (€ 171.473, project coordinator)