# Curriculum vitae

Cosimo D'Andrea PhD

Date of Birth:	
Citizenship: Italy	
Business Address:	
Business Phone:	
Fax:	-
Email: cosimo.dandrea@polimi.it	

## **EDUCATION:**

A.Y. 94/95	<b>Erasmus student</b> in Physics, Ludwig-Maximilians- Universität of Munich (Germany).
04/1997	<b>Physics degree</b> at the University of Florence (Italy) Master Thesis "Realization of a CO <sub>2</sub> laser dipole trap for Rubidium atoms", supervisor Prof. T.W. Hänsch.
02/2001	<b>Ph.D in Physics</b> at Politecnico di Milano (Italy) <i>PhD Thesis "Time-resolved optical imaging of fluorescent and diffusive media",</i> <i>supervisor Prof. R. Cubeddu.</i>

## **ACADEMIC APPOINTEMENTS:**

- 2001 2014: Assistant Professor of Physics, Politecnico di Milano, Department Physics.
- 2014 2022: Associate Professor of Physics, Politecnico di Milano, Department of Physics.
- 2022 present: Full Professor of Physics, Politecnico di Milano, Department of Physics.

## **PROFESSIONAL ACTIVITIES:**

- 31/7/2006 31/12/2016: Associated scientist at the Institute for Photonics and Nanotechnologies at National Research Council (CNR) in Milan (Italy).
- 21/7/2010 present: Associated scientist at the Center for Nano Science and Technology of the Italian Institute of Technology (IIT) in Milan (Italy).

#### **RESEARCH ACTIVITY AT INTERNATIONAL LABORATORY**

- 1/3/1995 31/10/1996: Research activity at Laser Spectroscopy Division of Max Planck-Institut für Quantenoptik in Garching (Germany).
- 26/8/2013 16/9/2013: Visiting scientist at Department of Radiology, Feinberg School of Medicine, Northwestern (USA).
- 3/7/2017 4/9/2017: Visiting scientist at Molecular Foundry Lawrence Berkeley National Laboratory (USA).

## INSTITUTIONAL SERVICE

- 2007 2010: Member of the Teaching Committee for the revision of Electrical Engineering Bachelor program at Politecnico di Milano.
- 2010 2012; 2020 2022: Member of the Department Board ("*Giunta di Dipartimento*") of the Department of Physics (Politecnico di Milano).
- 2013 present: Member of the Physics Graduate Board at Politecnico di Milano.
- 2022 present: Member of the Teaching Committee of the Department of Physics (Politecnico di Milano).

#### LANGUAGE SKILLS

EnglishfluentSpanishgoodGermangood

### **TEACHING ACTIVITIES**

**Lecturer** of the following courses of Physics by the Engineering School of Politecnico di Milano in the following Academic Years:

- 2021/2022 2022/2023 2023/2024
  - Biophotonics Diffuse Optical Tomography (5 CFU) (language: English)
  - Fisica (Mechanics) (7 CFU)
- 2017/2018 2018/2019 2019/2020 2020/2021
  Fisica (Mechanics and Thermodinamics) (12 CFU)
- 2014/2015 2015/2016 2016/2017
  - Fisica I (Mechanics and Thermodinamics) (8 CFU)
  - o Fisica (Mechanics) (6 CFU)
- 2008/2009 2009/2010 2010/2011 2011/2012 2012/2013 2013/2014
  - Fisica I (Mechanics and Thermodinamics) (8 CFU)
  - Fisica Sperimentale (Mechanics and Electromagnetism) (9 CFU)
- 2003/2004 2004/2005 2005/2006 2006/2007 2007/2008
  Fisica sperimentale A+II (Mechanics and Electromagnetism) (12.5 CFU)
- 2001/2002-2002/2003
  - Fisica sperimentale A (Mechanics) (5 CFU)
  - Fisica sperimentale A+B (Mechanics and Electromagnetism) (10 CFU)

**Teaching assistant** of the following courses of Physics by the Engineering School of Politecnico di Milano in the following Academic Years:

- 2006/2007 2007/2008
  - Fisica Sperimentale A (Mechanics)

- 2000/2001
  - Fisica Sperimentale I (Mechanics and Thermodinamics)
  - Fisica Sperimentale II (Electromagnetism)
- 1998/1999 1999/2000
  - Fisica Generale I (Mechanics and Thermodinamics)

Since 2001 he tutored more than 100 **experimental laboratories** (Mechanics, Thermodinamics and Electromagnetism) for the courses of Physics at the Engineering School of Politecnico di Milano.

#### Text book

Co-author of the text book of mechanics and thermodinamics: L. Duò, P. Taroni: "Fondamenti di Fisica – Meccanica e Termodinamica" EdiSES 2021 (ISBN 9788836230280).

#### **GRANT AWARDS**:

- february 2023-January 2027 HORIZON-MSCA-2021-DN-01: CONcISE *COmputatioNal Imaging as a training Network for Smart biomedical dEvices* - Principal investigator of the Politecnico Research Unit - Budget to research unit 259437 €.
- May 2022-April 2025: PRIN 2020 by the Italian Ministry for Education, University and Research (MIUR): Wireless and non-genetic photostimulation of neurons by cell-specific targeting of photovoltaic nanoparticles: application to neurodegenerative diseases of retina and brain Principal investigator of the Politecnico Research Unit Budget to research unit 159200 €.
- 2016-2020 ERC Starting 2015: SOLENALGAE Improving photosynthetic solar energy conversion in microalgal cultures for the production of biofuels and high value products Partner (PI Università di Verona) Budget to research unit 100000 €.
- 2014-2016 Progetto Cariplo by Fondazione Cariplo: *Novel photocatalytic materials based on heterojunctions for solar energy conversion* - Principal investigator of the Politecnico Research Unit - Budget to research unit 63000 €.
- 2010-2014 FIRB *Futuro in Ricerca* 2008 by the Italian Ministry for Education, University and Research (MIUR): *Selective surface-mediated transfection (SAST)* Principal investigator of the Politecnico Research Unit Budget to research unit 205120 €.
- 2009-2011 Royal Society International Joint Projects 2009/R2: Optical tomography of biological tissue by time-resolved structured light Principal investigator of Italian Unit Budget to the project 12000 €. (Travel grant)
- 2008-2010 PRIN 2007 by the Italian Ministry for Education, University and Research (MIUR): Colors and balms in antiquity: from the chemical study to knowledge of technologies in cosmetics, painting and medicine Principal investigator of the Politecnico Research Unit Budget to research unit 68572 €.
- 2006-2007 British-Italian partnership programme for researchers: *Time-resolved fluorescence optical tomography* Principal investigator of Italian Unit Budget to research unit 4650 €. (Travel grant)

 2006-2007 PRIN 2005 by the Italian Ministry for Education, University and Research (MIUR): The sustainable consolidation of wet wood: new approaches of impregnation and polymerization with low environmental impact - Principal investigator of the Politecnico Research Unit - Budget to research unit 69286 €.

# SCIENTIFIC ACTIVITIES

The research activity has been mainly focused on the development and application of time-resolved optical techniques, based on innovative illumination/detection schemes and multidimensional optical imaging, for biophotonics applications. In particular:

- Time-resolved fluorescence spectroscopy/imaging;
- Time-resolved spectroscopy of diffusive media;
- Optical imaging and tomography of biological tissue.

These techniques have been exploited to study biological processes, light pulse propagation in highly scattering media and inorganic/organic materials mainly for photostimulation, photocatalytic and cultural heritage conservation applications.

# • Time-resolved fluorescence spectroscopy/imaging

This research activity is focused on the development and application of time-resolved fluorescence spectroscopy and imaging techniques to study and characterize different materials with particular attention to biological samples. Initially main applications have regarded: i) cellular imaging studies; ii) DNA microarray reading; iii) photo-physical characterization of non-viral gene delivery vectors (FIRB grant); iv) cultural heritage materials (Prin07 grant). Recently, the research has been focused towards studies, by means of ultrafast spectroscopy (e.g. time-resolved fluorescence and transient absorption techniques) and microscopy, of: i) photosynthesis and photoprotection mechanisms of photosynthetic organisms (ERC grant); ii) photocatalytic materials (Cariplo Grant)); iii) interaction between nanoparticles and cells towards their photostimulation (Prin2020); iv) material science.

## • Time-resolved spectroscopy of diffusive media

The study of the temporal propagation of a light pulse through a highly scattering medium (such as biological tissue) allows one to separately measure its absorption and scattering coefficient which can be correlated with functional and pathological states. A broadband Time-resolved diffuse spectroscopy (TRS) system, which allows simultaneous acquisition at different wavelengths, has been developed. Moreover, the optical characterization of the following highly scattering samples have been carried out: i) breast, brain and biological tissue; ii) wood (Prin05 grant); iii) fruit; iv) nanostructured powder materials.

## • Optical imaging and tomography of biological tissue

Imaging of absorbing, scattering and fluorescent heterogeneities in biological specimen is fundamental to study *in vivo* biological processes and to develop novel optical diagnostics tools. This research activity is devoted to the development and implementation of different time-resolved optical techniques for imaging and tomography in highly scattering media [Royal Society grant,

British Council grant] and, recently, by exploiting unconventional imaging schemes based on compressive sensing approaches. Experimental and theoretical studies at both mesoscopic (<1 cm) and macroscopic regime (>1 cm) have been carried out. In particular the research is currently focused on the development of novel techniques based on wide field pulsed structured illumination and data compression by exploiting Single Pixel Camera scheme. This allows one to reduce the data set (reduction of both acquisition and computational time) while preserving the information content, which is fundamental towards the study of dynamical biological processes (DN2021 grant).

## • Laser cooling and trapping of atoms

The research activity has begun in the field of laser cooling and trapping of atoms. Laser-cooled rubidium atoms have been trapped in a nondissipative optical lattice with a large lattice constant by means of an infrared standing wave near 10.6 mm. At the time of publication this represented the optical lattice employing longer wavelength radiation. This work has been carried out at Max-Planck-Institut für Quantenoptik in Garching (Germany).

Since about 10 years he is responsible for a research group focused on Time-resolved fluorescence spectroscopy/imaging and unconventional imaging activities mainly for the study of the interaction between light and biological samples. The scientific activity is carried out at the laboratories of the Physics Department of the Politecnico di Milano and the Center for Nano Science and Technology (CNST) of the Italian Institute of Technology (IIT) in Milan (Italy) where he is associated scientist since 2010. The activity by CNST is currently focused on Time Resolved Photoluminescence Spectroscopy for materials science and in particular the interaction between nanoparticles and cells towards their photostimulation and photosynthetic studies.

## International Scientific collaborations:

- University College of London (London, UK): "Diffuse Optical Tomography"
- University of Lund (Lund, Sweden): "Diffuse spectroscopy in wood"
- University of Lyon (Lyon, France): "Fluorescence-Mediated Tomography"
- Universitat Jaume I (Castellon, Spain): "Unconventional Imaging"
- German Cancer Research Center (Heidelberg, Germany): "Fluorescence-Mediated Tomography"
- Fordham University (New York, USA): "Fluorescence Lifetime Imaging (FLIM)"
- Institut für Lasertechnologien in der Medizin und Meßtechnik (Ulm, Germany): "Models of Photon Migration"
- University of Cambridge (Cambridge, UK): "Monomer uptake in woods"
- University of Eastern Finland (Kuopio, Finland): "Diffuse Optical Tomography"
- TU Wien (Wien, Austria): "Fourier-Transform spectroscopy"
- Ohio State University (Ohio, USA): "Functionalized Germanane"
- Nanyang Technological University (Singapore): "Nanoparticles for photostimulation"
- University of Berkeley (Berkeley, USA): "Non-Photochemical Quenching"
- The Courtauld Institute of Art (London, UK): "Cultural heritage conservation"
- Universidad Politécnica de Madrid (Madrid, Spain): "Diffuse spectroscopy in food products"
- Universidad de Alicante (Alicante, Spain): "Nanographene Films"

#### National Scientific collaborations:

- University of Verona: "Photosynthesis and Non-Photochemical Quenching"
- University of Bari: "Photosynthesis enhancement by a molecular antenna"
- University of Milan (Dept. Pharmacology: "Photodynamic Therapy", Dept. Bioscience: "3D microscopy", Dept. of Chemistry, "Photocatalytic materials")

- University of Milano Bicocca (Dept. of Earth and Environmental Sciences : "Cultural heritage wood conservation", Dept. of Materials Science: "Optical spectroscopy of nanocrystals")
- University of Florence: "Models of photon migration"
- University of Bologna: "Fluorescence Lifetime Imaging (FLIM)"
- University of Turin: "Cultural heritage conservation"
- Istituto di ricerche Farmacologiche Mario Negri: "In vivo fluorescence imaging"
- Istitituo Italiano di Tecnologia (IIT): "Photostimulation of cells and material science"
- CNR (Institute for Organic Synthesis and Photoreactivity: "Nanoparticles for photostimulation", Istituto di Scienze Applicate e Sistemi Intelligenti "Eduardo Caianiello": "hydra development")
- STMicroelectronics: "Analyzing integrated circuits with time-gated imager"

#### **CONGRESS AND WORKSHOP**

More than 80 contributions to national and international congresses and workshops. Hereafter the invited lectures are reported.

#### **INVITED LECTURES (author and co-author):**

- 1) C. D'Andrea. Invited lecture at the International school on bio-hybrid interfaces, organic bio-electronics and bio-photonics, that will take place in Como, Italy, 5 9 September 2022.
- C. D'Andrea, G. Leone, G. De la Cruz Valbuena, S.R. Cicco, D. Vona, E. Altamura, R. Ragni, E. Molotokaite, M. Cecchin, S. Cazzaniga, M. Ballottari, G. Lanzani, G.M. Farinola, "Photosynthesis enhancement in diatom microalgae by photoactive molecules", CIMTEC 2022 9th Forum on New Materials Symposium Biological, Biohybrid and Bioinspired Materials: From Electronics and Photonics to Medicine, that will take place in Perugia, Italy, 25 29 June 2022.
- 3) C. D'Andrea, A. Ghezzi, A. Farina, A. Bassi, G. Valentini, "Multispectral Fluorescence Lifetime Microscopy based on single pixel camera acquisition", National Congress of Società Italiana di Matematica Applicata e Industriale (SIMAI 2020+2021). Minisymposium MS-23 - New trends in tomography: From microscopy to astronomy, Parma-Online, Italy, 30 August-3 September 2021.
- 4) C. D'Andrea, A. Farina, G. Acconcia, I. Labanca, L. Di Sieno, A. Bassi, G. Valentini, I. Rech, "Time-resolved multispectral fluorescence imaging system based on compressed sensing" Defense + Commercial Sensing 2020 (Advanced Photon Counting Techniques XIII), Online, 26 30 April 2020.
- 5) A. Ghezzi, A. Farina, A. Vedda, A. Bassi, G. Valentini, I. Labanca, I. Rech, C. D'Andrea, "Multispectral FLIM microscope based on compressive sensing acquisition", European Conferences on Biomedical Optics 2021 (ECBO), Online, 20 - 24 June 2021.
- 6) C. D'Andrea, A. Farina, A. Candeo, M. Betcke, A. Dalla Mora, R. Lussana, F. A. Villa, A. Bassi, G. Valentini, S. R. Arridge, "Time-resolved imaging system based on adaptive structured light illumination and single pixel camera detection", Defense + Commercial Sensing 2019 (Advanced Photon Counting Techniques XIII), Baltimore, Maryland, USA, 14 18 April 2019.
- 7) C. D'Andrea, "Shedding light on wood: time-resolved diffuse optical spectroscopy to characterize absorption and scattering", 2nd Workshop on application of NIR spectroscopy for wood science and technology research, San Michele all' Adige, Italy, 19-21 April 2016. (Keynote lecture)
- 8) C. D'Andrea, "Photonics for health at Politecnico of Milan: from bench to bedside", JORCEP Workshop, Zhejiang University, Hangzhou, China, 12 November, 2011.
- 9) C. D'Andrea, A. Bassi, G. Valentini, R. Cubeddu, S. Arridge, "Structured Illumination and Time Gated Detection for Diffuse Optical Imaging", European Conferences on Biomedical Optics (ECBO), Munich, Germany, 14-18 June 2009.
- 10) P. Taroni, C. D'Andrea, G. Valentini, R. Cubeddu, D-N. Hu, J.E. Roberts, "Fluorescence of fullerol in human lens and retinal pigment epithelial cells", 3rd Joint Meeting of the

French Society for Photobiology and the Italian Society for Photobiology, Paris, France, 25-26 October 2010.

- 11) C. D'Andrea, P. Taroni, G. Valentini, A. Pifferi, R. Cubeddu, R. Giavazzi, J.E. Roberts, "Tecniche di imaging e spettroscopia di fluorescenza di nanoparticelle per applicazioni diagnostiche e terapeutiche", XX Congresso Annuale della Società Italiana di Fotobiologia, Locorotondo, Bari, Italy, 4-5 June 2009.
- 12) R. Cubeddu, P. Taroni, G. Valentini, C. D'Andrea and D. Comelli, "Fluorescence Lifetime Imaging as a diagnostic tool", CLEO 2001, Baltimora, Maryland, USA, 6-11 May 2001.

#### **REVIEWING ACTIVITIES**

- Referee for the following International Journals: Optics Letters, Optica, Applied Optics, Biomedical Optics Express, Optics Express, Scientific Reports, Light: Science & Applications, APL Photonics, Journal of Biomedical Optics, ACS Energy Letters, Applied Spectroscopy, Optics Communications, IEEE Sensors Journal, Measurement Science and Technology, Progress in Electromagnetics Research (PIER), Spectroscopy Letters, Photochemical & Photobiological Sciences, Journal of Cultural Heritage, Measurement, Molecular Imaging and Biology, Microchemical Journal, Wood Material Science and Engineering.
- Scientific Review Board ("Albo dei revisori") of the Italian Ministry for Education, University and Research (MIUR) for the evaluation of National research projects. *Reviewer* for the Austrian Science Fund (FWF).

#### **ORGANISATION OF SCIENTIFIC MEETINGS**

- Scientific Committee of Scuola di Biofotonica e Intelligenza Artificiale "BpAI 2022", that will take place 5 9 September 2022 in Florence, Italy.
- **Program Committee** of "Fiber Lasers and Glass Photonics: Materials through Applications III" SPIE Photonics Europe, Strasbourg (France), 3-7 April, (2022).
- **Program Committee** of "Fiber Lasers and Glass Photonics: Materials through Applications II" SPIE Photonics Europe, Strasbourg (France), 22-26 April, (2020).
- **Program Committee** of "Fiber Lasers and Glass Photonics: Materials through Applications" SPIE Photonics Europe, Strasbourg (France), 22-26 April, (2018).
- Scientific Committee of national workshop PRIN07 "Colors and balms in antiquity: from the chemical study to the knowledge of technologies in cosmetics, painting and medicine" Sansepolcro (Italy), 2-3 December, (2010).
- Local Organizing Committee of "XVI International Conference on Ultrafast Phenomena" Stresa (Italy), 9-13 June, (2008).
- Scientific Committee of national workshop PRIN05 "La diagnostica e la conservazione di manufatti lignei: il legno bagnato" Pisa (Italy), 5-7 December, (2007).

#### PATENTS

Cosimo D'Andrea, Gianluca Valentini, Andrea Farina, Simon Arridge, "Device and Method for Detecting Time-Resolved Optical Data", PCT/EP2019/069625 (2019) (filed)

# **IMPACT OF RESEARCH:**

#### **Peer-Reviewed Publications**

The research activity is documented by 114 publications on international peer-reviewed journals and 68 abstracts/proceedings of international congresses.

Report of citations to source items indexed within SCOPUS (15<sup>th</sup> November 2024): Author ID: SCOPUS: 57211534054

Documents: 209 Citations: 4055 h-index: 34

Milan, 15<sup>th</sup> November 2024

Cosimo D'Andrea