

Giuseppe Vicidomini - Curriculum Vitae

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CONTACT INFORMATION

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PERSONAL DATA

Last name: Vicidomini
First name: Giuseppe
Birth: November, 29th 1978, Savona, Italy
Nationality: Italian
Family status: Unwed with one daughter and one son (Anna Sofia born in 2009 and Matteo Évariste born in 2012)

SHORT BIOSKETCH

I studied computer science at the Department of Computer and Information Science, University of Genoa (Italy) and received my Diploma cum laude in 2003 (advised by Prof. Mario Bertero and Prof. Patrizia Boccacci). From 2003 to 2007 I worked at the Laboratory of Advance Microscopy and Spectroscopy (LAMBS, University of Genoa, Italy); where I received my Ph.D (advised by Prof. Alberto Diaspro) about image processing and analysis for fluorescence microscopy.

From 2008 to 2011 I worked as a post-doctoral fellow at the Department of NanoBiophotonics (headed by Prof. Stefan W. Hell, Nobel Laureate in 2014), Max Planck Institute for Biophysical Chemistry (MPI, Germany); where I developed a new approach, based on the temporal analysis of the fluorescence signal, which allows stimulated emission depletion (STED) microscopy to achieve tens of nanometres spatial resolution with a substantial reduction of the dose of light requested, thus opening the effective application of STED microscopy with fluorescent proteins and living cells [6]. Currently, all commercially available STED microscopes implement this method - called gated-STED. This work pioneered the use of the temporal information channel of a microscope, such as the ability of measuring the fluorescence signal dynamics at the nanoseconds scale, for improving the microscope spatial-resolution [2].

Since May 2011 I work in the Department of NanoPhysics (headed by Prof. Alberto Diaspro), Italian Institute of Technology (IIT, Italy), where in September 2013 I obtained a Researcher position, in May 2016 I became principal investigator (Tenure Track, Stage II) of the Molecular Microscopy and Spectroscopy research line, and in December 2019 I was granted tenure. I am also Adjunct Professor at the University of Genoa. While constantly working on STED microscopy [4], and on its combination with fluorescence-correlation spectroscopy (STED-FCS) [5, 3], I started also developing novel single-photon-avalanche diode (SPAD) arrays for fluorescence microscopy. This research has recently evolved in the invention of a new scanning microscopy technique able to double the spatial resolution of conventional microscopy, while maintain live-cell, multi-color, and three-dimension imaging capabilities and adding time-resolved spectroscopy/imaging (e.g., fluorescence lifetime, intensity fluctuation analysis, anti-bunching) [1]. This technique has introduced a new paradigm in fluorescence microscopy which proposes to unlock the secret carried by each single-photon, thus moving from the era of single-molecule microscopy to the era of single-photon microscopy.

My work has been supported by grants from various agencies such as the Fondazione San Paolo (Italy), the Marie Skłodowska Curie Actions (MSCA) and the European Research Council (ERC).

My most recent research grant is the five-years ERC Consolidator Grant project, entitled BrightEyes: Multi-Parameter Live-Cell Observation of Biomolecular Processes with Single-Photon Detector Array. The overall objective of the BrightEyes project is to develop a set of innovative and non-invasive imaging and spectroscopy tools able to observe a single-biomolecule at work in a living multi-cellular system. Specifically, by exploring novel SPAD arrays, the BrightEyes project will implement an optical system able to continuously (i) track in real-time a biomolecule of interest; (ii) measure its nano-environment and its structural changes; (iii) observe its interactions with other biomolecules; (iv) visualize its sub-cellular micro-environment with nanometre resolution.

I am co-founder and scientific advisor of the Genoa Instruments spin-off company. The spin-off is dedicated to launch a software and hardware add-on system which will transform any conventional confocal microscope into a high-resolution single-photon microscope.

I have authored or co-authored 63 articles in peer reviewed international journals (10 as first author, 3 as shared first author, 2 as shared last author, and 19 as last author), 5 reviews in peer reviewed international journals, 17 proceedings in international conferences, 11 chapters in books and 1 editorial. I have given 33 invited talks at international conferences, advanced schools or workshops, 16 oral communications (as speaker). I have filled 4 patents (two granted, and two licensed), and signed 1 know-how licence agreement. My bibliometrics data (source Scopus, October 2021) scores a total of 2700 citations (h-index 27).

SELECTED PUBBLICATIONS

- [1] M. Castello, G. Tortarolo, M. Buttafava, T. Deguchi, F. Villa, S. Koho, L. Pesce, M. Oneto, S. Pelicci, L. Lanzañò, P. Bianchini, C. J. Sheppard, A. Diaspro, A. Tosi, and G. Vicidomini. A robust and versatile platform for image scanning microscopy enabling super-resolution FLIM. *Nat. Methods*, 16(2):175–178, 2019. (preprint on [bioRxiv](#)).
- [2] L. Lanzañò, I. Coto Hernández, M. Castello, E. Gratton, A. Diaspro, and G. Vicidomini. Encoding and decoding spatio-temporal information for super-resolution microscopy. *Nat. Commun.*, 6:6701, 04 2015.
- [3] L. Lanzañò, L. Scipioni, M. Di Bona, P. Bianchini, R. Bizzarri, F. Cardarelli, A. Diaspro, and G. Vicidomini. Measurement of nanoscale three-dimensional diffusion in the interior of living cells by sted-fcs. *Nat. Commun.*, 8(1):65, 2017.
- [4] G. Vicidomini, P. Bianchini, and A. Diaspro. STED super-resolved microscopy. *Nat. Methods*, 15(3):173–182, 2018.
- [5] G. Vicidomini, T. Haisen, V. Mueller, A. Honigmann, M. P. Clausen, D. Waithe, E. Sezgin, A. Diaspro, S. W. Hell, and C. Eggeling. Spatio-temporal heterogeneity of lipid membrane dynamics revealed by STED-FLCS. *Nano Lett.*, 15(9):5916–5918, 2015.
- [6] G. Vicidomini, G. Moneron, K. Y. Han, V. Westphal, H. Ta, M. Reuss, J. Engelhardt, C. Eggeling, and S. W. Hell. Sharper low-power STED nanoscopy by time gating. *Nat. Methods*, 8(7):571–573, 2011.

EDUCATION

University of Genoa, Genoa, Italy

Ph.D., Sciences and Technologies for Information and Knowledge, [Department of Computer and Information Science \(DiSI\)](#), May 2008

- Thesis Title: Three-Dimensional Image Restoration in Fluorescence Microscopy
- Advisors: [Professor Alberto Diaspro](#), [Professor Patrizia Boccacci](#)
- Final grade: excellent

M.Sc., Computer Science, [Department of Computer and Information Science \(DiSI\)](#), December 2003

- Thesis Title: Web Oriented Image Processing in Three-Dimensional Microscopy
- Advisors: [Professor Alberto Diaspro](#), [Professor Patrizia Boccacci](#), [Professor Mario Bertero](#)

ACADEMIC
EXPERIENCES

- Final grade: 110/110 *cum laude*

Istituto Italiano di Tecnologia (IIT), Genoa, Italy

Senior Researcher, Tenured

December 2019 to date

- Principal investigator of the [Molecular Microscopy and Spectroscopy](#) research line at the [Department of Nanophysics](#)

Senior Researcher, Tenure-Track, Step II

May 2016 to November 2019

- Principal investigator of the [Molecular Microscopy and Spectroscopy](#) research line at the [Department of Nanophysics](#)

Researcher

September 2013 to April 2016

- Researcher at the [Department of Nanophysics](#)

PostDoctoral Research

May 2011 to August 2013

- Senior PostDoctoral fellow at the [Department of Nanophysics](#)

Max-Planck-Institute (MPI) for Biophysical Chemistry, Göttingen, Germany

PostDoctoral Research

June 2008 to April 2011

- PostDoctoral fellow at the [Department of NanoBiophotonics](#) (June 2010 to April 2011)
Theoretical design and development of novel implementations of stimulated emission depletion (STED) microscopy attaining subdiffraction spatial resolution at moderate focal intensities.
- PostDoctoral fellow at the [Department of NanoBiophotonics](#) (June 2008 to May 2010)
INVERS project: Development of new approaches to analyze data obtained by new emerging super resolution light microscopy techniques such as stimulated emission depletion (STED) microscopy, 4Pi microscopy and single molecule switching (SMS) microscopy.

Doctoral Research

February 2008 to May 2008

- Computer Science Ph.D fellow at the [Department of NanoBiophotonics](#)

University of Genoa, Genoa, Italy

Doctoral Research

January 2005 to January 2008

- Computer Science Ph.D fellow at the Laboratory Advanced Microscopy Bioimaging Spectroscopy ([LAMBS](#)) (January 2005 to January 2008)
Design and implementation of new statistical deconvolution algorithms for three-dimensional fluorescence microscopy images. Derivation of new prior-functions (using the Markov-random-field (MRF) and the fuzzy-logic (FL) frameworks) for maximum a-posteriori based deconvolution's algorithms.
- Computer Science Ph.D fellow at the Correlative Microscopy and Spectroscopy in Biomedicine and Oncology ([MicroSCoBio](#)) research center (January 2006 to January 2008)
Development of new correlative light and electron microscopy (CLEM) protocols and related data analysis tools.

Postgraduate Research

January 2004 to December 2004

- Research fellow at the Laboratory Advanced Microscopy Bioimaging Spectroscopy ([LAMBS](#))
Characterization of polyelectrolyte capsules for applications in nano-technology and bioimaging and development of new related analysis tools.

Undergraduate Student

September 1997 to December 2003

SCIENTIFIC
SERVICES

Institutional Responsibility

- **Member** of the steering committee for the [Nikon Imaging Center at the Istituto Italiano di Tecnologia \(NIC@IIT\)](#)
- **Head** of the PhD Program in Bioengineering and Robotics, Curriculum in Bionanotechnologies, DIBRIS, University of Genoa (XXXIV-XXXVII cycles)

Commission of Trust

- **Referee** for the QS-ranking system of the University of Turku
- **Remote referee** for ERC Consolidator Grant 2015

Organisation of Scientific Meeting

- **Co-organizer** for the NIC@IIT, Nanoscopy 2.0, Practical Workshop on Advanced Microscopy (2014-2018, Istituto Italiano di Tecnologia)
- **Co-organizer** for the 3rd International Practical Course on Advanced Optical Microscopy Methods (17 December 2013, Istituto Italiano di Tecnologia)
- **Co-organizer** for the 1st International Practical Course on Advanced Optical Microscopy Methods (12-16 December 2011, Istituto Italiano di Tecnologia)

Conference Committee

- **Member** of the Local Committee for the [13th Conference on Methods and Applications of Fluorescence](#) (8-11 September 2013, Genoa, Italy)
- **Member** of the Programme Committees for [CLEO/Europe 2021](#) (21-25 June 2021, on-line)

PROFESSIONAL
SOCIETIES

- [Biophysical Society \(American\)](#)
- [Società Italiana di Biofisica Pura ed Applicata](#)
- [Società Italiana di Fisica](#)
- [SPIE – The International Society for Optical Engineering](#) (former member, 2015-2018)
- [Optica, former Optical Society of America](#) (former member, 2016-2017)

EDITORIAL
ACTIVITY

- **Referee** for various journals including Nature Journals (Nature Communications, Nature Methods, Nature Photonics, and Scientific Reports), OSA Journals (Optics Express, Biomedical Optics Express, and Optics Letters), Wiley Online Library (Journal of Microscopy, and Microscopy Research and Techniques), RCS Journal (Photochemical & Photobiological Sciences, and Nanoscale), Methods, and AIP Advances.
- **Editor** of the Special Issue "Fluorescence Microscopy in the Spotlight" for Microscopy Research and Technique (Volume 77, Issue 7, July 2014)
- **Editor** of the Special Issue "Stimulated Emission Depletion Microscopy" for Journal of Physics D: Applied Physics (Volume 52-53, 2019-2020)

SUPERVISED
PERSONNEL

Bachelor Students

- May 2016 - July 2016: Matteo Moro (supervisor at IIT, current Research Fellow at University of Genoa)

Master Students

- March 2014 - August 2014: Nicolaas van der voort (supervisor at IIT, current PhD Students at Heinrich-Heine-Universität Düsseldorf)
- June 2015 - December 2015: Giorgio Tortarolo (supervisor at IIT, Master Degree Award from Società Italiana Ottica e Fotonica, current PostDoc at IIT)

Graduate Fellows

- February 2016 - July 2016: Giorgio Tortarolo (supervisor at IIT, current PhD Students at IIT)
- January 2020 - ongoing: Sabrina Zappone (supervisor at IIT)

PhD Students

- January 2012 - April 2015: Ivàn Coto Hernández (co-supervisor at IIT, current Instructor at Harvard Medical School)
- January 2014 - April 2017: Marco Castello (co-supervisor at IIT, current PostDoc at IIT and CTO at Genoa Instruments)
- November 2016 - March 2020: Giorgio Tortarolo (supervisor at IIT, current PostDoc at IIT)
- November 2018 - Ongoing: Alessandro Rossetta (co-supervisor at IIT)
- November 2019 - Ongoing: Andrea Bucci (supervisor at IIT)
- November 2020 - Ongoing: Francesco Fersini (supervisor at IIT)

Postdoctoral Fellows

- May 2010 - April 2011: Haisen Ta (co-supervisor at MPI, current PostDoc at MPI)
- May 2016 - July 2020: Takahiro Deguchi (co-supervisor at IIT, current PostDoc at EMBL)
- January 2017 - December 2018: Sami Koho (supervisor at IIT, current Software Engineer at Scandit)
- May 2017 - Ongoing: Marco Castello (co-supervisor at IIT)
- August 2018 - Ongoing: Simonluca Piazza (co-supervisor at IIT)
- January 2018 - February 2021: Eli Slenders, Fondazione San Paolo PostDoc Fellow (co-supervisor at IIT, current Researcher at IIT)
- March 2021 - Ongoing: Eleonora Perego (co-supervisor at IIT)

Researchers

- January 2019 - December 2020: Sami Koho, MSCA EF-IF Research Fellow (supervisor at IIT, current Software Engineer at Scandit)
- March 2021 - Ongoing: Eli Slenders, MSCA EF-IF Research Fellow (supervisor at IIT)

Visitors

- July 2017 - August 2017: Eli Slenders (PhD students from Hasselt University, current PostDoc at IIT)
- July 2017 - August 2017: Elena Tcarenkova (PhD from Turku University)

In addition, I have been invited to participate to 2 PhD examination committees (Dr. Sami Koho, University of Turku, May 2016, and Dr. Michele Gintoli, University of Padua, May 2018) and 1 Master Thesis examination committee (Sebastian Acuna, University of Tromsø, March 2019).

TEACHING EXPERIENCES

- **Subject Expert** (Cultore della Materia), course for the PhD program in Bioengineering and Robotics, University of Genoa, “Fluorescence Super-Resolution Microscopy: Basis, Applications and Perspectives” (June 2019, June 2020, June 2021)
- **Adjunct professor**, course for the PhD program in Bioengineering and Robotics, University of Genoa, “Fluorescence Super-Resolution Microscopy: Basis, Applications and Perspectives” (June 2019)
- **Adjunct professor**, course for the PhD program in Bioengineering and Robotics, University of Genoa, “Fluorescence Nanoscopy” (April 2018)
- **Adjunct professor**, course for the PhD program in Bioengineering and Robotics, University of Genoa, “Fluorescence super-resolution microscopy: photo-physical mechanisms underlying and combination with fluorescence dynamic investigations” (September 2014)
- **Laboratory assistant**, [Principles of Fluorescence Techniques Course](#) (June 2004, September 2005, June 2006 and June 2007)
- **Teaching assistant**, University Master in “Microscopy and Microscopy Analysis in Biology” (2004 and 2005 edition)

HONOURS & AWARDS

- Innovation Awards, SMARTcup Liguria 2016, category “industrial” (with Genoa Instruments)
- Habilitation for Associate Professor (fascia II) in Applied Physics (bando D.D. 1532/2016, settore concorsuale 02/D1, fisica applicata, didattica e storia della fisica)

SPIN-OFF

I am co-founder and scientific advisor of the Genoa Instruments spin-off company, based on the results output of the Marco Castello's and Giorgio Tortarolo's Ph.D. works (under my supervision). The spin-off will be dedicated to launch a software and hardware upgrade tool based on single-photon-avalanche-diode (SPAD) array able to transform any confocal microscope into a super-resolved time-resolved image scanning microscope (Patent Pending, IT 102018000001891).

PROJECTS

- Observation of Biomolecular Processes in Live-Cell with Nanocamera, Fondazione San Paolo, Principal Investigator, 2018-2020;
- AdaptiveSTED, H2020-MSCA-IF-2017, Supervisor (Fellowship applicant Dr Sami Koho), 2019-2021;
- BrightEyes, H2020-ERC-2018-COG, Principal Investigator, 2019-2024;
- SM-SPAD, H2020-MSCA-IF-2019, Supervisor (Fellowship applicant Dr Eli Slenders), 2021-2023;

INVITED SEMINARS AND SYMPOSIA (33)

- *Fluorescence Laser-Scanning Microscopy with Single-Photon Detector Array*, ICON Europa 2021, on-line, 8 November 2021.
- *Fluorescence Laser-Scanning Microscopy with SPAD Array Detector*, EPIC, Technology Meeting on Novel Photonic Solution for Microscopy, on-line, 28 June 2021.
- *Fluorescence Laser-Scanning Microscopy with SPAD Array Detector*, OSA, Biophotonics Congress: Optics in the Life Science, on-line, 12 April 2021.
- *Super-Resolution STED Microscopy*, Ospedale San Raffaele Ph.D. Lecture, on-line, 25 September 2020.
- *Laser-Scanning Microscopy with Single-Photon Detector Array*, 65th Biophysical Society Annual Meeting, on-line, 22 February 2020.
- *Time-Resolved STED Microscopy for better imaging: from time-gating detection to phasor analysis*, Super-Resolution Microscopy: Time-Resolved STED Nanoscopy: EMBL Course, EMBL, Heidelberg, Germany, 12-16 July 2021.
- *Fluorescence Laser-Scanning Microscopy with SPAD Array Detector*, hhmi, janelia research campus seminar, on-line, 13 May 2020.
- *Time-Resolved STED Microscopy*, LabRoot websemina sponsored by Leica Microsystems, on-line, 17 March 2020.
- *Laser Scanning Microscopy with Single-Photon Avalanche Diode Array Detector: Exploring New Spatiotemporal Dimensions*, Multimodal and Nanoscale Optical Microscopy, SIF, International School of Physics "Enrico Fermi", Varenna, Italy, 11-16 July 2020 (Postponed 2022).
- *Point-Scanning Microscopy with SPAD Array*, Super-Resolution Microscopy: EMBL Course, EMBL, Heidelberg, Germany, 8-13 July 2019.
- *Light Point-Scanning Microscopy with Single-Photon-Avalanche-Diode Array*, PhotonIcs & Electromagnetics Research Symposium, University of Rome – La Sapienza, Rome, Italy, 17-20 June 2019.
- *Point-Scanning Microscopy with SPAD Array*, International School on Nanoscale Optical Microscopy, Venice, Italy, 13 June 2019.
- *Image-Scanning Microscopy*, Inauguration Center of Excellence Amsterdam UMC/Nikon, Universitair Medische Centra, Amsterdam, Netherlands, 12 June 2019.
- *Image-Scanning Microscopy*, School of Microscopy: Deep Imaging, Istituto Scientifico Romagnolo per lo Studio e la Cura dei Tumori Meldola, Italy, 16 May 2019.
- *Moving from Confocal Microscopy to Super-Resolved Microscopy*, Workshop on Advances in label-free and fluorescence microscopy, Politecnico di Torino, Torino, Italy, 26 June 2018.
- *Fluorescence Scanning Microscopy with Single-Photon Detector Array*, International School on Nanoscale Optical Microscopy, Venice, Italy, 13 June 2018.
- *STED microscopy: from imaging to fluorescence correlation spectroscopy*, From Pictures to Numbers: Workshop on Quantitative Fluorescence Microscopy, Royal Belgian Society for Microscopy Symposium, Antwerp, Belgium, 7 September, 2017.
- *Fluorescence scanning microscopy with SPAD array*, SPIE Nanoscience + Engineering 2017, Nanoimaging and Nanospectroscopy V, San Diego, CA, USA, 6 August 2017.

- *STED microscopy: an introduction and Figure out what the microscopy is actually trying to tell you: SPAD array, TCSPC, noise*, International School, Nanoscale Optical Microscopy, Venice, Italy, 7 June 2017.
- *STED microscopy: spectral, temporal and spatial conditions to achieve effective sub-diffraction resolution images*, Nanochemistry of molecular materials for 2-photon functional applications, Parma, Italy, 12 May 2017.
- *How to boost your microscope by exploring new dimensions (temporal, spatial, spectral)*, International School of Biophysics "Antonio Borsellino", 43rd Course: Nanoscale Biophysics: Focus on Methods and Techniques, Erice, Italy, 22 April 2016.
- *Introduction to Microscopy*, 8th European Short Course on Time-resolved Microscopy and Correlation Spectroscopy, Picoquant, Berlin, Germany, 8 March 2016.
- *Laser sources for STED microscopy: a perspective*, Bioimaging: MPE User Group Meeting and Workshop, Istituto Italiano di Tecnologia, Genoa, Italy, 15 October 2015.
- *STED Microscopy*, Advanced Imaging, PhD program in systems medicine, SEMM, Milan, Italy, 20 February 2015.
- *Time-gated detection and VECSELs: A grand unison towards the wide dissemination of STED microscopy*, SPIE Photonics West LASE, Vertical External Cavity Surface Emitting Lasers (VECSELs), San Francisco, CA, USA, 10 February 2015.
- *Stimulated emission depletion microscopy: exploring the arrival times of photons to go next*, School of Photonics, Seeing sharp and further with the optical microscope, Cortona, Italy, 2 April 2014.
- *STED Microscopy by Time-Gating: when the arrival time of a photon matters*, Applied Super-Resolution Light Microscopy, Course at CGR, Barcelona, Spain, 1 October 2013.
- *At the cutting-edge of gated-STED microscopy*, 3rd European Super-Resolution User-Club Meeting, Istituto Italiano di Tecnologia, Genoa, Italy, 18 June 2013.
- *Super-resolution: STED basic and new gateable technology*, Confocal Workshop on Recent Advances Application in Confocal and Widefield Microscopy, Nencki Institute of Experimental Biology, Warsaw, Poland, 16 January 2013.
- *Reducing the power demand for STED microscopy using time-gated detection*, 2nd European Super-Resolution User-Club Meeting, Karolinska Institute Science Park, Stockholm, Sweden, 27 September 2012.
- *Sharper low-power STED microscopy by time gating*, 2nd Summer Symposium on Nanomaterials and their application to Biology and Medicine, NanoBioMedical Centre, Poznań, Poland, 21 June 2012.
- *Optical nanoscopy and super-resolution methods in protein science*, Emerging Methodologies and Applications in Protein Science, University of Milan, Milan, Italy, 24 November 2011.
- *Imaging in 3D Fluorescence Microscopy*, XI School of Pure and Applied Biophysics on Advanced Optical Microscopy Methods in Biophysics, Campo Santo Stefano, Venice, Italy, 31 January 2007.

CONFERENCE
TALKS (16)

- Società Italiana di Fisica (on-line, 2020)
- Single-Photon Workshop (SPW) (Italy, 2019)
- Applied Inverse Problem (AIP) (Austria, 2009)
- European Biophysical Societies' Association (EBSA) (Italy, 2009)
- Focus on Microscopy (FOM) (Spain, 2007; Germany, 2011; Singapore 2012; Germany 2015; Taiwan 2016; France 2017; Singapore 2018, UK 2019)
- Methods & Application in Fluorescence (MAF) (Italy, 2013)
- Optics within Life Sciences (OWLS) (Italy, 2012)
- Società Italiana di Biofisica Pura ed Applicata (SIBPA) (Italy, 2012)
- SPIE – The International Society for Optical Engineering (SPIE) (California, 2015)