# ALESSANDRO ZUNINO

## CONTACT INFO


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## ABOUT ME

I am a physicist with a deep interest in optics – both classical and quantum – and its applications to light shaping and imaging. I obtained a B.Sc. in Physics (2015) and an M.Sc. in Physics (2018) from the University of Milan (Italy). From 2018 to 2021, I worked as a Ph.D. student at the Italian Insitute of Technology (IIT) in Genoa (Italy), under the supervision of Prof. Martí Duocastella and Prof. Alberto Diaspro. In February 2022, I started working as a post-doctoral researcher in the Molecular Microscopy and Spectroscopy laboratory of IIT under the supervision of Dr. Giuseppe Vicidomini. My current research efforts are dedicated to developing a microscope exploiting non-classical properties of light and designing innovative image processing techniques.

## RESEARCH

### POST DOCTORAL FELLOW

**February 2022 - Now**

*Istituto Italiano di Tecnologia (IIT)* | *Genoa, Italy*

- Developed new image processing techniques for super-resolution microscopy.

### Ph.D. FELLOW

**November 2018 - January 2022**

*Istituto Italiano di Tecnologia (IIT)* | *Genoa, Italy*

- Developed a new optical beam shaping tool for advanced material processing.
- Developed a new microscopy technique, built the instrument, and coded the control system.
- Performed mathematical modeling and quantitative analysis of data and images.

### VISITING RESEARCHER
*Durham University* | *Durham, UK*
**June 2016 - August 2016**

- Performed experimental activities to investigate the mechanical properties of artificial tissues.

## TEACHING

### SUPERVISOR
*Istituto Italiano di Tecnologia (IIT)* | *Genoa, Italy*
**March 2022 - Now**

- Mentored and supervised a MSc student, now a Ph.D. student.

### LECTURER
*University of Genoa - DIBRIS department* | *Genoa, Italy*
**March 2023 - April 2023**

- Lecturer of the Ph.D. course entitled *Optics for Microscopy and Spectroscopy*.

### WINTER SCHOOL INSTRUCTOR
*Istituto Italiano di Tecnologia (IIT)* | *Genoa, Italy*
**November 2021 - November 2022**

- Instructor at the 6$^{th}$ and 7$^{th}$ edition of the *NIC@IIT Advanced Microscopy practical workshop*. Held theoretical lectures and practical demonstrations.

### TEACHER ASSISTANT
*University of Genoa - Physics department* | *Genoa, Italy*
**April 2019 - July 2020**

- Taught classes and prepared exercises for first-year students as part of the course General Physics 1.

## EDUCATION

### DEEP LEARNING AND COMPUTER VISION
*Summer school* | *Genoa, Italy*
**June 2023**

### QUANTUM OPTICAL TECHNOLOGIES
*Summer school* | *Trani, Italy*
**September 2022**

### MACHINE LEARNING CRASH COURSE
*Summer school* | *Genoa, Italy*
**June 2019**

### MASTER OF SCIENCE IN PHYSICS
*University of Milan* | *Milan, Italy*
**January 2016 - April 2018**

- Grade: 110/110 with honors

### BACHELOR OF SCIENCE IN PHYSICS
*University of Milan* | *Milan, Italy*
**November 2012 - December 2015**

- Grade: 110/110 with honors

## PUBLICATIONS

**Articles** : The symbol † indicates equal contribution.

Colin J. R. Sheppard, Marco Castello, Giorgio Tortarolo, **Alessandro Zunino**, Eli Slenders, Paolo Bianchini, Giuseppe Vicidomini, and Alberto Diaspro. "Back-

ground Rejection in Two-Photon Fluorescence Image Scanning Microscopy". In: *Photonics* 10.5 (2023). DOI: 10.3390/photonics10050601.

**Alessandro Zunino**†, Eli Slenders†, Francesco Fersini, Andrea Bucci, Mattia Donato, and Giuseppe Vicidomini. "Open-source tools enable accessible and advanced image scanning microscopy data analysis". In: *Nature Photonics* 17 (6 June 2023). Correspondence, pp. 457–458. DOI: 10.1038/s41566-023-01216-x.

Colin J. R. Sheppard, Marco Castello, Giorgio Tortarolo, **Alessandro Zunino**, Eli Slenders, Paolo Bianchini, Giuseppe Vicidomini, and Alberto Diaspro. "Signal strength and integrated intensity in confocal and image scanning microscopy". In: *Journal of the Optical Society of America A* 40 (1 2023), p. 138. DOI: 10.1364/JOSAA.477240.

**Alessandro Zunino**, Marco Castello, and Giuseppe Vicidomini. "Reconstructing the image scanning microscopy dataset: an inverse problem". In: *Inverse Problems* 39.6 (Apr. 2023), p. 064004. DOI: 10.1088/1361-6420/accdc5.

Giorgio Tortarolo†, **Alessandro Zunino**†, Francesco Fersini, Marco Castello, Simonluca Piazza, Colin J.R. Sheppard, Paolo Bianchini, Alberto Diaspro, Sami Koho, and Giuseppe Vicidomini. "Focus image scanning microscopy for sharp and gentle super-resolved microscopy". In: *Nature Communications* 13 (1 2022). DOI: 10.1038/s41467-022-35333-y.

Purnima N. Manghnani, Valentina Di Francesco, Carlo Panella La Capria, Michele Schlich, Marco Elvino Miali, Thomas Lee Moore, **Alessandro Zunino**, Martí Duocastella, and Paolo Decuzzi. "Preparation of anisotropic multiscale microhydrogels via two-photon continuous flow lithography". In: *Journal of Colloid and Interface Science* 608 (2022), pp. 622–633. DOI: 10.1016/j.jcis.2021.09.094.

Fabio Callegari, Aymeric Le Gratiet, **Alessandro Zunino**, Ali Mohebi, Paolo Bianchini, and Alberto Diaspro. "Polarization Label-Free Microscopy Imaging of Biological Samples by Exploiting the Zeeman Laser Emission". In: *Frontiers in Physics* 9 (2021). DOI: 10.3389/fphy.2021.758880.

**Alessandro Zunino**, Francesco Garzella, Alberta Trianni, Peter Saggau, Paolo Bianchini, Alberto Diaspro, and Martí Duocastella. "Multiplane Encoded Light-Sheet Microscopy for Enhanced 3D Imaging". In: *ACS Photonics* 8.11 (2021), pp. 3385–3393. DOI: 10.1021/acsphotonics.1c01401.

Martí Duocastella, Salvatore Surdo, **Alessandro Zunino**, Alberto Diaspro, and Peter Saggau. "Acousto-optic systems for advanced microscopy". In: *Journal of Physics: Photonics* 3.1 (2021), p. 012004. DOI: 10.1088/2515-7647/abc23c.

Salvatore Surdo, **Alessandro Zunino**, Alberto Diaspro, and Martí Duocastella. "Acoustically-shaped laser: a machining tool for Industry 4.0". In: *ACTA IMEKO* 9.4 (2020), p. 60. DOI: 10.21014/acta_imeko.v9i4.740.

**Alessandro Zunino**, Salvatore Surdo, and Martí Duocastella. "Dynamic Multifocus Laser Writing with Acousto-Optofluidics". In: *Advanced Materials Technologies* 4.12 (2019), pp. 1–7. DOI: 10.1002/admt.201900623.

Fabio Perissinotto, Valeria Rondelli, Pietro Parisse, Nicolò Tormena, **Alessandro Zunino**, László Almásy, Dániel Géza Merkel, László Bottyán, Szilárd Sajti, and Loredana Casalis. "GM1 Ganglioside role in the interaction of Alpha-synuclein with lipid membranes: Morphology and structure". In: *Biophysical Chemistry* 255 (2019), p. 106272. DOI: 10.1016/j.bpc.2019.106272.

## Proceedings

**Alessandro Zunino**, Salvatore Surdo, and Martí Duocastella. "Design, implementation, and characterization of a fast acousto-optofluidic multi-focal laser system". In: *Fourteenth School on Acousto-Optics and Applications*. Ed. by Ireneusz Grulkowski, Bogumił B. J. Linde, and Martí Duocastella. SPIE, 2019, p. 23. DOI: 10.1117/12.2540976.

Davide Bazzanella, Sebastiano Bontorin, Fabio Callegari, Bruno Degli Esposti, Sara Rabaglia, Louise Wolswijk, and **Alessandro Zunino**. "Physical Based Simulation of a Real-time Lidar Sensor within a Rendering Environment Based on Unreal Engine 4". In: *Proceedings of the event IPSP2021: Industrial Problem Solving with*

*Physics*. Ed. by Mattia Mancinelli, Michele Orlandi, and Luca Tubiana. Università degli Studi di Trento, 2021, pp. 1–29. ISBN: 978-88-8443-965-9.

### Ph.D. Thesis

**Alessandro Zunino**. "Fast control of light through acousto-optics". PhD thesis. University of Genoa, 2022. DOI: 10.15167/zunino-alessandro_phd2022-06-17.

## CONFERENCES

### Invited contributions

**Alessandro Zunino**, Giorgio Tortarolo, Francesco Fersini, Giacomo Garrè, and Giuseppe Vicidomini. "Extending the Three-Dimensional Resolution with Focus-ISM". In: *Optica Biophotonics Congress: Optics in the Life Sciences*. 2023.

**Alessandro Zunino**. "Image Scanning Microscopy". In: *napari workshop: multidimensional optical microscopy*. 2023. URL: https://github.com/andreabassi78/napari_workshop_milan.

### Oral contributions

**Alessandro Zunino**, Giorgio Tortarolo, Francesco Fersini, Giacomo Garrè, and Giuseppe Vicidomini. "Focus-ISM enhances optical sectioning in super-resolution microscopy". In: *2023 Conference on Lasers and Electro-Optics Europe & European Quantum Electronics Conference (CLEO/Europe-EQEC)*. 2023.

**Alessandro Zunino**, Marco Castello, Giacomo Garrè, and Giuseppe Vicidomini. "Multi-image deconvolution improves the speed and quality of Image Scanning Microscopy". In: *Focus On Microscopy*. 2023.

**Alessandro Zunino**, Giorgio Tortarolo, Francesco Fersini, Colin J.R. Sheppard, Paolo Bianchini, Alberto Diaspro, and Giuseppe Vicidomini. "Focus-ISM: a universal tool to enhance optical sectioning in super-resolution microscopy". In: *Congresso Nazionale – Società Italiana di Fisica*. 2022.

**Alessandro Zunino**, Francesco Garzella, Alberta Trianni, Peter Saggau, Paolo Bianchini, Alberto Diaspro, and Martí Duocastella. "Parallelized Light-sheet Microscopy with Flexible and Encoded Illumination". In: *2021 Conference on Lasers and Electro-Optics Europe & European Quantum Electronics Conference (CLEO/Europe-EQEC)*. IEEE, 2021, pp. 1–1. DOI: 10.1109/CLEO/Europe-EQEC52157.2021.9541789.

Martí Duocastella, **Alessandro Zunino**, and Salvatore Surdo. "On-The-Fly Laser Beam Shaping With Acousto-Optofluidics". In: *2021 Conference on Lasers and Electro-Optics Europe & European Quantum Electronics Conference (CLEO/Europe-EQEC)*. IEEE, 2021, pp. 1–1. DOI: 10.1109/CLEO/Europe-EQEC52157.2021.9542393.

**Alessandro Zunino**, Francesco Garzella, Alberta Trianni, Peter Saggau, Paolo Bianchini, Alberto Diaspro, and Martí Duocastella. "Multi-plane encoded light-sheet microscopy with acousto-optics". In: *Photonics West – High-Speed Biomedical Imaging and Spectroscopy VI*. Ed. by Keisuke Goda and Kevin K. Tsia. SPIE, 2021, p. 29. DOI: 10.1117/12.2577559.

**Alessandro Zunino**, Francesco Garzella, Alberta Trianni, Peter Saggau, Paolo Bianchini, Alberto Diaspro, and Martí Duocastella. "Multi-plane Encoded Light-sheet Microscopy for Fast Volumetric Imaging". In: *Conference on Lasers and Electro-Optics*. OSA, 2021, AM3C.3. DOI: 10.1364/CLEO_AT.2021.AM3C.3.

Salvatore Surdo, **Alessandro Zunino**, Alberto Diaspro, and Martí Duocastella. "Rapid parallelization of tailored laser beams with acousto-optofluidics". In: *2020 International Conference Laser Optics (ICLO)*. IEEE, 2020, pp. 1–1. DOI: 10.1109/ICLO48556.2020.9285579.

**Alessandro Zunino**, Salvatore Surdo, and Martí Duocastella. "Parallelized Laser Writing with Acousto-Optofluidics". In: *International Congress on Applications of Lasers and Electro-Optics (ICALEO)*. LIA, 2019.

**Alessandro Zunino**, Salvatore Surdo, and Martí Duocastella. "Acousto-Optofluidic Multi-spot Generation for High-throughput Laser Material Processing". In: *Fourteenth School on Acousto-Optics and Applications*. SPIE, 2019.

Salvatore Surdo, **Alessandro Zunino**, Alberto Diaspro, and Martí Duocastella. "Acoustically shaped laser light as an enabling technology for Industry 4.0". In: *2019 II Workshop on Metrology for Industry 4.0 and IoT (MetroInd4.0&IoT)*. IEEE, 2019, pp. 360–364. DOI: 10.1109/METROI4.2019.8792853.

### Posters

**Alessandro Zunino**, Giacomo Garrè, Francesco Fersini, Giorgio Tortarolo, and Giuseppe Vicidomini. "Inverse Problems in Image Scanning Microscopy". In: *Deep Learning and Computer Vision - Summer School*. 2023.

Giorgio Tortarolo, Simonluca Piazza, **Alessandro Zunino**, Andrea Bucci, Sabrina Zappone, Paolo Bianchini, Colin J.R. Sheppard, Alberto Diaspro, Eli Slenders, Marco Castello, and Giuseppe Vicidomini. "STED-ISM enables gentler and higher-contrast super-resolution imaging". In: *Focus on microscopy*. 2022.

## ACHIEVEMENTS

### Scholarships

- Durham University - 2016:
  Winner of a student research bursary.
- OSA, 14$^{th}$ School on Acousto-Optics and Applications - 2019:
  Recipient of conference travel grant.

### Awards

- SPIE Photonics West conference - 2021:
  Best presentation award.

## EDITORIAL ACTIVITY

### Reviewer

- Acted as a reviewer for the following publishers:
  Hindawi, Elsevier, Optica, Springer Nature.

October 16, 2023