

UNIVERSITÀ DEGLI STUDI DI MILANO

selezione pubblica per n.1 posto/i di Ricercatore a tempo determinato ai sensi dell'art.24, comma 3, lettera b) della Legge 240/2010 per il settore concorsuale 02/D1, settore scientifico-disciplinare FIS/07 presso il Dipartimento di BIOTECNOLOGIE MEDICHE E MEDICINA TRASLAZIONALE, (avviso bando pubblicato sulla G.U. n.7 del 27/01/2023) Codice concorso 5203

Filippo Pisano

CURRICULUM VITAE

(N.B. IL CURRICULUM NON DEVE ECCEDERE LE 30 PAGINE E DEVE CONTENERE GLI ELEMENTI CHE IL CANDIDATO RITIENE UTILI AI FINI DELLA VALUTAZIONE.

LE VOCI INSERITE NEL FACSIMILE SONO A TITOLO PURAMENTE ESEMPLIFICATIVO E POSSONO ESSERE SOSTITUITE, MODIFICATE O INTEGRATE)

INFORMAZIONI PERSONALI (NON INSERIRE INDIRIZZO PRIVATO E TELEFONO FISSO O CELLULARE)

COGNOME	PISANO
NOME	FILIPPO
DATA DI NASCITA	21/09/1987

SINOSI ATTIVITA' DI RICERCA

La mia attività di ricerca verte, in maniera prevalente, sullo sviluppo di metodi dedicati allo studio delle dinamiche funzionali, bio-molecolari e strutturali del tessuto neurale vivente nel sistema nervoso centrale. In particolare, ho recentemente sviluppato approcci che utilizzano l'interazione fra il tessuto neurale e la radiazione elettromagnetica, veicolata e raccolta su scale micro e nanometriche tramite innovative interfacce bidirezionali, quale sonda minimamente invasiva.

TITOLI

TITOLO DI STUDIO

(indicare la Laurea conseguita inserendo titolo, Ateneo, data di conseguimento, ecc.)

Laurea Magistrale in Fisica

110/110 con lode

12/10/12, Università degli studi di Torino

Laurea triennale in Fisica

104/110

05/10/2010, Università degli studi di Torino

TITOLO DI DOTTORE DI RICERCA O EQUIVALENTI, OVVERO, PER I SETTORI INTERESSATI, DEL DIPLOMA DI SPECIALIZZAZIONE MEDICA O EQUIVALENTE, CONSEGUITO IN ITALIA O ALL'ESTERO

(inserire titolo, ente, data di conseguimento, ecc.)

PhD in Physics

Dottorato di ricerca in Fisica

Viva voce defense 07/01/2017, University of Strathclyde, Glasgow, UK

(Titolo e dichiarazione di equipollenza allegata)

CONTRATTI DI RICERCA, ASSEGNI DI RICERCA O EQUIVALENTI

(per ciascun contratto stipulato, inserire università/ente, data di inizio e fine, ecc.)

Researcher

Istituto Italiano di Tecnologia, Center for Biomolecular Nanotechnologies (IIT-CBN)

01/04/2021-31/03/2024

Post-Doctoral researcher

01/04/2019-31/03/2021

01/04/2017-31/03/2019

IIT-CBN

Fellow

03/10/2016-31/03/2017

IIT-CBN

PhD student

01/01/2013-30/06/2016

Institute of Photonics, University of Strathclyde, Glasgow (UK)

ATTIVITÀ DIDATTICA, DIDATTICA INTEGRATIVA E SERVIZI AGLI STUDENTI A LIVELLO UNIVERSITARIO IN ITALIA O ALL'ESTERO

(inserire periodo [gg/mm/aa inizio e fine], anno accademico, ateneo, corso laurea, numero ore, ecc.)

Commissioni di dottorato

- 2022 Revisore esterno e membro della commissione, Doctoral School of Politecnico di Torino
Candidato: Dott. M. Pezzarossa,
Tesi: "The deep AI-based JTE: development and industrialization of a novel termination design for high-power semiconductor devices"

Didattica

- | | |
|-----------|--|
| 2013-14 | Demonstrator (24 ore in laboratorio e conseguente valutazione relazioni)
Laboratory of Physics
Degree in Physics
Dept. of Physics, University of Strathclyde, Glasgow, UK |
| 2011-12 | Esercitatore (10 ore frontali)
Corso di Fisica e Matematica
Corso di laurea triennale in Biologia
Facoltà Scienze M.F.N., Università di Torino
Titolare del corso: Prof. A. Diaferio |
| 2010-2011 | Assistente di laboratorio (50 ore)
Laboratorio di Elettromagnetismo e Ottica
Corso di laurea Triennale in Fisica
Facoltà Scienze M.F.N., Università di Torino
Titolari del corso: Prof. L. Busso, Prof. S. Beol  |
| 2009-2010 | Assistente di laboratorio (50 ore)
Laboratorio di Elettromagnetismo e Ottica
Corso di laurea Triennale in Fisica
Facoltà Scienze M.F.N., Università di Torino
Titolari del corso: Prof. L. Busso, Prof. S. Beol  |

Didattica integrativa: seminari e invited lectures

- | | |
|----|---|
| 1. | Seminario Multifunctional neural interfaces combining optics, photonics and nanotechnology, Dip. di Fisica, Università di Torino, 01/10/2019 |
| 2. | Invited lecture: Neuropotonics: advanced technologies to illuminate mysteries of the brain, Rhine-Waal University of Applied Science, 22/06/2018 |
| 3. | Seminario: Neurophotonic approaches to brain research: a combination between optogenetic stimulation and high-density electrophysiological recordings
Dip. di Fisica, Università degli studi di Torino, 18/12/2013 |

Servizi agli studenti

La mie posizioni a IIT non mi consentono di essere supervisore formale di studenti di laurea magistrale o di dottorato. Ho attivamente partecipato alla supervisione informale di 1 studente magistrale (dott. Paolo Giglio) e di studenti di dottorato co-affiliati fra IIT e l'università del Salento, come testimoniato dal contributo a pubblicazioni guidate da un/a dottorando/a.

Servizi agli studenti

2014 Graduate students representative, Dept. of Physics, University of Strathclyde
2009-2011 Rappresentante degli studenti
Consiglio del Corso di Studi (C.C.S.) in Fisica Università di Torino
membro della commissione di autovalutazione

DOCUMENTATA ATTIVITÀ DI FORMAZIONE O DI RICERCA PRESSO QUALIFICATI ISTITUTI ITALIANI O STRANIERI;

(inserire anno accademico, ente, corso, periodo, ecc.)

Researcher IIT-CBN

01/04/2021-corrente

IIT-CBN

Research line: Multifunctional neural interfaces with deep brain regions

Post-Doctoral Researcher

01/04/2017-31/03/2021

IIT-CBN

Research line: Multifunctional neural interfaces with deep brain regions

Fellow

03/10/2016-31/03/2017

IIT-CBN

Research line: Multifunctional neural interfaces with deep brain regions

Visiting researcher

05/2015-07/2015

Santa Cruz Institute for Particle Physics (SCIPP), University of California Santa Cruz (CA, US)

Personal grant funded by the Scottish Universities Physics Alliance- SUPA

Biophotonics and Imaging Graduate Summer School (BIGSS)

06/2014

National University of Ireland, Galway

PhD student

01/01/2013-30/06/2016

Institute of Photonics, University of Strathclyde, Glasgow (UK)

Supported by the EPSRC Doctoral Training Grant

Thesis: Advanced technologies for spatio-temporal control of neural circuits using optogenetics

Advisor: Prof. K. Mathieson

Examiners: Prof. Tomas Cizmar (External), Dr. Antonio Hurtado (Internal)

Tesista Magistrale

01/01/2012-10/10/2012

Dip. Fisica, UniTo & INRiM

Thesis: Optical functionalization of single color centers in artificial diamond for photonics.

Advisors: Prof. P. Olivero, Dr. I.P. Degiovanni

Tesista Triennale

Stagista INFN

01/05/2010-05/10/2010

Dip. Fisica, UniTo

INFN Torino

Thesis: V-drift velocity calibration effects in the CMS muon spectrometer with early data from

proton-proton collisions
Advisor: Prof. N.C. Amapane

REALIZZAZIONE DI ATTIVITÀ PROGETTUALE

(indicare, data, progetto, ecc.)

- Progetto: DEEPER, *Deep Brain Photonic Tools for Cell-Type Specific Targeting of Neural Diseases*
2021-ongoing
Role: Co-investigator
Coordinator: Prof. M. De Vittorio, IIT-CBN
Funding entity: European Union, Horizon 2020, ICT-RIA
Responsibilities (Task)
Multiphoton microscope combined with multifunctional tapered fibers for simultaneous multiphoton excitation and fiber photometry at depths > 1mm
- Progetto NANOBRIGHT, *Bringing Nanophotonics into the brain*
2019-ongoing
Role: Post-Doc, Researcher
Coordinator: Dr. F. Pisanello, IIT-CBN
Funding entity: European Commission, FET-Open, Horizon 2020
Responsibilities: (Task) Realization of plasmonic structures on the tip of a tapered fiber
- Progetto MODEM *Multipoint Optical DEvices for Minimally invasive neural circuits interface*
2016-2022
Role: Post-Doc, Researcher
Coordinator: Dr. F. Pisanello, IIT-CBN
Funding entity: European Research Council, ERC, Horizon 2020
Responsibilities:
 - Task: Multipoint emitting optical fibers with at least four independent light delivery sites
Risultato: Pisano, F., et al., 2018, "Focused ion beam nanomachining of tapered optical fibers for patterned light delivery", *Microelectronic Engineering*, vol. 195, pp. 41-49
 - Task In vivo detection of neural activity from multiple sites of the taper edge
Risultato: Pisano, F. 2019, "Depth-resolved fiber photometry with a single tapered optical fiber implant", *Nature Methods*, vol. 16, no. 11, pp. 1185-1192
- Progetto: *A novel experimental methods for the characterization of the retinal ganglion cell layer*
2015
Role: PI
Funding entity: Scottish Universities Physics Alliance (SUPA), Short Term Visit Grant
Collaborazione internazionale: Institute of Photonics, University of Strathclyde e University of California Santa Cruz.
- Progetto: *Development of micro fabrication techniques in diamonds with applications in bio-sensing and photonics*
2012
Ruolo: tesista magistrale
Coordinator: Prof. P. Olivero, Università di Torino
Funding entity: MIUR, FIRB futuro in ricerca 2010
Risultato: tesi magistrale

ORGANIZZAZIONE, DIREZIONE E COORDINAMENTO DI GRUPPI DI RICERCA NAZIONALI E INTERNAZIONALI, O PARTECIPAZIONE AGLI STESSI

(per ciascuna voce inserire anno, ruolo, gruppo di ricerca, ecc.)

Partecipazione a gruppi di ricerca nazionali ed internazionali

- Periodo: 2021-

Ruolo: Researcher

Gruppo: Multifunctional neural interfaces with deep brain regions

Istituzione: IIT-CBN

- Periodo: 2017-2021
Ruolo: Post-Doc
Gruppo: Multifunctional neural interfaces with deep brain regions
Istituzione: IIT-CBN
Supervisore: Dr. F. Pisanello
- Periodo: 2016-2017
Ruolo: Fellow
Gruppo: Multifunctional neural interfaces with deep brain regions
Istituzione: IIT-CBN
Supervisore: Dr. F. Pisanello
- Periodo: Maggio-Luglio 2015
Ruolo: Visiting Researcher
Gruppo: Sher lab
Istituzione: University of California Santa Cruz
Supervisore: Prof. A. Sher
- Periodo: 2013-2016
Ruolo: PhD Student
Gruppo: Neurophotonics group
Istituzione: Institute of Photonics, University of Strathclyde
Supervisore: Prof. K. Mathieson
- Periodo: Gennaio-Ottobre 2012
Ruolo: Tesista Magistrale
Gruppo di Fisica dello Stato Solido, Dip. di Fisica, Università di Torino
Gruppo di Ottica Quantistica, INRiM, Torino
Supervisore: Prof. P. Olivero, Dr. I. DeGiovanni
- Periodo: Maggio-Ottobre 2010
Ruolo: Tesista Triennale
Gruppo CMS, sezione INFN di Torino, Università di Torino
Supervisore: Prof. N.C. Amato

TITOLARITÀ DI BREVETTI

(per ciascun brevetto, inserire autori, titolo, tipologia, numero brevetto, ecc.)

1. A microfabrication technique for structuring non-planar electromagnetic waveguides
Inventori: Pisanello F, De Vittorio M., Pisanello M., Balena A., Spagnolo B., Pisano F., Bianco M., Sileo L., Numero: PCT/IB2022/055986, WO2023275737A1

2. Titolo sotto embargo di confidenzialità

Inventori: Pisanello F, Collard L, Pisano F., Balena A, Pisanello M, Zhend D, De Vittorio M., De la Prida L. M., Numero: PT210620

ALTRE ATTIVITÀ DI TERZA MISSIONE

Collaborazione con la start up innovativa Optogenix s.r.l per il trasferimento dei risultati scientifici nello sviluppo di dispositivi commerciali destinati al mercato della ricerca

ATTIVITÀ DI RELATORE A CONGRESSI E CONVEGNI NAZIONALI E INTERNAZIONALI

(inserire titolo congresso/convegno, data, ecc.)

Contributi su invito a congressi e convegni internazionali

-
1. Exploring augmented neural implants: integrating optical nano modulators and volumetric

- Raman spectroscopy with tapered fibers, *Complex Media NeuroPhotonics Workshop*, Brno 24-26/10/2022
2. Capturing optical, electrical and biochemical signals from deep brain regions with tapered optical fibers, *Federation of European Neuroscience Societies (FENS) Forum 2022* Parigi, 9-13/07/2022
 3. Harnessing light-matter interactions in deep brain regions for the next generation of photonic neural interfaces, *Humboldt meets Leibniz conference*, Hannover 12-14/06/2022 [Declinato causa positive Covid-19]
 4. Collecting Raman signal with tapered optical fibers, *NanoBright project webinar*, 09/04/2021
 5. Towards label-free, implantable neuro-plasmonic probes *META 2021, 11th International Conference on Metamaterials Photonics Crystals and Plasmonics*, 23/07/2021, Online (Varsavia)
 6. Towards multipoint Raman spectroscopy in deep brain tissue with a minimally invasive multimode tapered fiber, *Photonics Online Meetup*, 13/01/2021
 7. Towards label-free, depth-resolved nano-photonic probes for deep-brain regions, *Photonics Online Meetup*, 25/06/2020
 8. Plasmonic Neural Interfaces, *ICQNM 2019*, 30/10/2019, Nice

Contributi orali a congressi e convegni nazionali e internazionali

1. Nonplanar nano-structuring of tapered optical fibers for plasmonic neural interfaces, *Micro and Nanoengineering (MNE) 2019*, Rhodes, 20/09/2019
2. Micro and Nanostructuring of tapered optical fibers with focused ion beam and two-photon lithography, *Photonics and Electromagnetics Research Symposium PIERS 2019*, Rome, 17/06/2019
3. Tapered Optical Fibers for Neurophotonic applications, *Fotonica 2018*, Lecce, 23-25/05/2018
4. V drift calibration effects on muon reconstruction, *CMS Muon Barrel Workshop*, CERN, 28/09/2010

Contributi poster a congressi e convegni nazionali e internazionali come primo o ultimo autore

1. Jurado-Parras T., [...], Pisano F. *, De* Vittorio M. *, Pisanello F. *, De La Prida L. *, Toward integration of neural probes to correlate Raman and electrophysiological signals, *FENS 2022 Parigi* *co-last author
2. Pisano F. et al., Collecting Raman signals from deep brain regions, *SfN Annual Meeting of the Society for Neuroscience 2021*, Online
3. Pisano F. et al., Nanopatterning photonic neural implants towards wavevector-encoded optical monitoring of deep brain regions, *MNE 2021*, Torino
4. Pisano F. et al., Depth-resolved fiber photometry enables simultaneous detection of dopamine transients in dorsal and ventral striatum in freely moving animals, *FENS 2020*, Glasgow (UK)
5. Pisano F. et al., Towards implantable plasmonic neural interfaces via curved nanophotonic structures on tapered fibers, *6th International Workshop on Technologies for Optogenetics and Neurophotonics Optogen 2019*, Venezia (Italy)
6. Pisano F. et al., Depth-resolved reconfigurable fiber photometry with a single tapered optical fiber, *5th International Workshop on Technologies for Optogenetics and Neurophotonics Optogen 2018*, Glasgow, UK
7. Pisano F. et al., Fiber photometry at depth with tapered optical fibers, *SfN, Annual Meeting of the Society for Neuroscience 2018*, San Diego (CA, US)
8. Pisano F. et al., Tapered optical fibers for deep tissue fiber photometry, *FENS 2018*, Berlin (Germany)
9. Pisano F. et al., Nanofabrication of extra-cellular recording electrodes on tapered optical fibers for neuroscience, *Trends in Nanotechnology TNT*, 2018, Lecce
10. Pisano F. et al., Tapered optical fibers as multifunctional interfaces with the brain, *2nd International Symposium on Photopharmacology*, 2018 Vic (Spain)
11. Pisano F. et al., Tapered optical fibers for optogenetics, *SfN, Annual Meeting of the*

- Society for Neuroscience 2017, Washington (DC, US)
12. Pisano F. et al., Tailoring light emission from tapered optical fibers for optogenetics, 4th International Workshop on Technologies for Optogenetics and Neurophotonics Optogen 2017, Lecce
 13. Pisano F. et al., Large scale matching of anatomy and function of retinal ganglion cells, 57th Association for Research in Vision and Ophthalmology ARVO Annual Meeting 2016, Seattle (WA,US)

CONSEGUIMENTO DI PREMI E RICONOSCIMENTI NAZIONALI E INTERNAZIONALI PER ATTIVITÀ DI RICERCA

(inserire premio, data, ente organizzatore, ecc.)

- 2022 Travel award come young promising researcher alla conferenza Humboldt Meets Leibniz Hannover (declinato causa positività al Covid)

La pubblicazione *Plasmonics on a neural implant Engineering Light-Matter Interactions on the Nonplanar Surface of Tapered Optical Fibers* è stata selezionata come immagine di copertina della issue 2, 2022 della rivista Advanced Optical Materials

- 2021 Promozione alla posizione di Researcher a IIT-CBN con valutazione scientifica di una commissione interna (F. De Angelis, L. Berdondini, G. Lanzani) e lettere di supporto da esperti internazionali: Prof. B.L. Sabatini (Harvard), Prof. K. Mathieson (University of Strathclyde), M. Grande (Politecnico di Bari)
- 2015 Award: Scottish University Physics Alliance Short Term Visit grant
- 2013 EPSRC Doctoral Training Grant

ABILITAZIONE SCIENTIFICA NAZIONALE

25/05/2022 Abilitazione Scientifica Nazionale alle funzioni di professore universitario di Seconda Fascia nel Settore Concorsuale 02/D1 - FISICA APPLICATA, DIDATTICA E STORIA DELLA FISICA.

PRODUZIONE SCIENTIFICA

PUBBLICAZIONI SCIENTIFICHE

(per ciascuna pubblicazione indicare: nomi degli autori, titolo completo, casa editrice, data e luogo di pubblicazione, codice ISBN, ISSN, DOI o altro equivalente)

*Pubblicazioni presentate in valutazione. Ogni pubblicazione riporta una breve sinossi e il contributo personale, in lingua inglese. * indica co-first authorship*

1. Pisano F. *, Pisanello M. *, Lee S.J., Lee J., Maglie E., Balena A., Sileo L., Spagnolo B., Bianco M., Hyun M., De Vittorio M., Sabatini B.L., Pisanello F.

Depth-resolved fiber photometry with a single tapered optical fiber implant

Nature Methods, 16, 1185-1192, 2019

10.1038/s41592-019-0581-x

Synopsis: We demonstrated the world-first experimental method to monitor neurotransmitter transients in freely moving animals targeting multiple deep-brain regions simultaneously with a single, minimally invasive optical neural implant. This approach has enabled unprecedented experiments to study the neural processes underlying reward-driven movement. Together with its significance for neurobiological research, the study also has a novelty for the optics field as we described, for the first time, the photonic properties of tapered fibers in mode selective collection of incoherent optical radiation.

Personal contribution: I was lead-author (co-first) in this study and corresponding author. I built the experimental system, proposed and conducted ex vivo experiments and analyzed the data. I drafted the manuscript and prepared the figures, with contributions from all authors. I proposed the time-division multiplexing experimental approach to collect dopamine-related fluorescence

signal from deep brain regions. I also presented the work at several international conferences (SfN, FENS, Fotonica, Optogen).

2. Pisano, F., Kashif, M. F., Balena, A., Pisanello, M., De Angelis, F., de la Prida, L. M., Valiente M, D'Orazio A, De Vittorio M, Grande M., Pisanello, F.

Plasmonics on a Neural Implant: Engineering Light-Matter Interactions on the Nonplanar Surface of Tapered Optical Fibers.

Advanced Optical Materials, 10(2), 2022

10.1002/adom.202101649

Synopsis: We demonstrate a first step towards implantable multimodal plasmonic neural interfaces. This was achieved by integrating highly-curved plasmonic nanostructures on a tapered optical fiber in order to engineer the spectral and angular patterns of optical emission and collection, with applications to fluorescence and Raman spectroscopy.

Personal contribution: I was lead-author in this study and corresponding author. I designed and performed the nano-fabrications built all the experimental systems, conducted the experiments and the data. I drafted the manuscript and prepared the figures, with contributions from all authors. I also presented the work at several international conferences (META 2021, POM 2020, POM 2021, Optogen 2019).

3. Collard L. *, Pisano F.*, Zheng D., Balena A., Kashif M. F., Pisanello M., D'Orazio A., de la Prida L.M., Ciraci C., Grande M., De Vittorio M., Pisanello F.

Holographic manipulation of nanostructured fiber optics enables spatially-resolved, reconfigurable optical control of plasmonic local field enhancement and SERS

Small, 18(23), 2200975 2022

10.1002/smll.202200975

Synopsis: The work describes, for the first time, the optical control of plasmonic nanostructures integrated on the distal fiber through a multimode fiber through the fiber itself. To do this, we developed a wavefront engineering approach that optimized the coupling of guided modes with the resonant nanostructures achieving spatially resolved SERS and extraordinary optical transmission.

Personal contribution: I am co-first author on this work. I contributed to the conceptualization of the study, to designing and performing the experiments and I developed and performed the nanofabrications. I also co-led the preparation of the manuscript.

4. Pisanello M.*, Pisano F.*, Hyun M., Maglie E., Balena A., De Vittorio M., Sabatini B.L., Pisanello F.

The three-dimensional signal collection field for fiber photometry in brain tissue

Frontiers in Neuroscience, 13, 2019.

10.3389/fnins.2019.00082

Synopsis: Optical fibers are widely used to deliver and collect light from brain tissue. However, it is not clear what is the volume and the morphology of the region of tissue that is stimulated or monitored depending on the structural properties of the fiber (e.g. core size or numerical aperture). We proposed a novel experimental method and we applied it to ex vivo brain tissue to provide guidance to the community on the volume of tissue that effectively interacts with a given probe.

Personal contribution: I was co-first author on this study. I built the experimental system, performed the experiments and contributed in designing the data analysis. I also contributed to drafting the manuscript and preparing the figures.

5. Pisanello M.*, Pisano F.*, Sileo L., Maglie E., Bellistri E., Spagnolo B., Mandelbaum G., Sabatini B.L., De Vittorio M., Pisanello F.

Tailoring light delivery for optogenetics by modal demultiplexing in tapered optical fibers

Scientific Reports, 8, 2018

10.1038/s41598-018-22790-z

***Synopsis:** Optogenetic control of neural activity requires precise and flexible light delivery with minimally invasive devices. To achieve this, we presented a study on mode-division demultiplexing strategies using tapered optical fiber to tailor the delivery of optical radiation dynamically in large brain volumes or spatially restricted regions.*

***Personal contribution:** I was co-first author on this study. I built the optical experimental systems, performed the experiments and analyzed the data. I proposed the experiments to demonstrate independent delivery of optical energy at different tissue depths. I also worked on drafting the manuscript and preparing the figures, with contributions from all authors.*

6. Pisano F.*, Pisanello M.*, Sileo L., Quattieri A., Sabatini B.L., De Vittorio M., Pisanello F.
Focused ion beam nanomachining of tapered optical fibers for patterned light delivery
Microelectronic Engineering, 195, 41-49, 2018
10.1016/j.mee.2018.03.023

***Synopsis:** This work proposed micro-structured neural implants, fabricated with Focused-Ion-Beam lithography, to control the interaction volumes between visible optical radiation for optogenetic stimulation and 3D target volumes of neural tissue.*

***Personal contribution:** I was co-first author on this study and corresponding author. I performed the nano- and micro-fabrications, ran the experiments and analyzed the data. I also drafted the manuscript and prepared the figures with contributions from all authors.*

7. Pisano F.*, Zampaglione E.*, McAlinden N., Roebber J., Dawson M.D., Mathieson K., Sher A.
Large scale matching of function to the genetic identity of retinal ganglion cells
Scientific Reports, 7, 2017
10.1038/s41598-017-15741-7

***Synopsis:** Understanding the role of neurons in encoding and transmitting information is a major goal in Neuroscience. This requires insight on the data-rich neuronal spiking patterns combined with morphology and genetic identity. We present a novel technique that combines large-scale micro-electrode array recordings with large-area optogenetic stimulation to match functional, genetic and morphological identity of retinal ganglion cells with single cell precision.*

***Personal contribution:** I was lead-author (co-first) in this work. I also secured funding through a competitive grant from the Scottish University Physics Alliance. I designed and built the optogenetic stimulation system, I performed large-scale electrophysiological recordings of the mouse retina, including the retinal surgeries, I analyzed the data from the 519 electrode array and prepared most of the figures and the manuscript. I also presented the work to ARVO, the world-leading conference in the retina field.*

8. Zheng, D., Pisano, F., Collard, L., Balena, A., Pisanello, M., Spagnolo, B., Mach-Batlle, R., Tantussi, F., Carbone, L., De Angelis, F., Valiente, M., de la Prida, L. M., Ciraci, C., De Vittorio, M., Pisanello, F.

Toward Plasmonic Neural Probes: SERS Detection of Neurotransmitters through Gold-Nanoislands-Decorated Tapered Optical Fibers with Sub-10 nm Gaps
Advanced Materials, 2200902, 2023.
<https://doi.org/10.1002/adma.202200902>

***Synopsis:** This work introduces an approach for label free detection of molecular neurotransmitters in living brain tissue, with particular attention emphasis on the optical and mechanical properties of a thin layer of gold nanoislands uniformly distributed on the fiber surface.*

***Personal Contribution:** I designed and built the optical systems to perform the SERS spectroscopy measurements through the implant. I also helped interpreting the data and writing the manuscript.*

9. Collard L., Pisano F., Pisanello M., Balena A., De Vittorio M., Pisanello F.
Wavefront engineering for controlled structuring of far-field intensity and phase patterns from multimodal optical fibers
APL Photonics, 6 (5), 051301, 2021

10.1063/5.0044666

Synopsis: We propose a wavefront shaping method to control the electric field transmitted by a multimode optical fiber in terms of spatial distribution of intensity and phase in the far-field. This method can potentially help the development of micro-endoscopes for clinical applications.

Personal contribution: I conducted preliminary proof of experiments, I helped building the experimental system. I worked on the analysis of the holographic images to extract amplitude and phase of the speckle patterns emitted by the fiber. I also helped writing the manuscript.

10. Spagnolo, B.*, Balena, A.*, Peixoto, R.T.*, Pisanello M.*, Sileo L., Bianco M., Rizzo A., Pisano F., Qualtieri A., Lofrumento D. D., De Nuccio F., Assad J.A., Sabatini B.L., De Vittorio M., Pisanello F.

Tapered fibertrodes for optoelectrical neural interfacing in small brain volumes with reduced artefacts.

Nature Materials 21, 826-835 2022

<https://doi.org/10.1038/s41563-022-01272-8>

Synopsis: This work presents a optoelectronics neural probe based on a tapered optical fiber for reconfigurable optogenetic stimulation and multipoint extracellular electrical recordings from the same microscopic tissue volume with abated photoelectric artifacts.

Personal Contribution: I performed optical characterization of the devices and supported the development of the multiphoton lithography approach. I also helped analyzing and interpreting the data from optogenetic stimulation and electrophysiological recordings and contributed to writing the manuscript.

11. Pisano F., Balena A., Kashif M.F., Pisanello M., De Marzo G., Algieri L., Qualtieri A., Sileo L., Stomeo T., D'Orazio A., De Vittorio M., Pisanello F., Grande M.

High transmission from 2D periodic plasmonic finite arrays with sub-20 nm gaps realized with Ga focused ion beam milling

Nanotechnology, 31. 2020

<https://doi.org/10.1088/1361-6528/aba57a>

Synopsis: We report on the optical properties of small-size 2D plasmonic arrays of gold nanoplatelets with sub-20 nm gaps fabricated with a single Focused Ion Beam milling process; we demonstrate that recruiting a small number of resonant element is sufficient to perform refractive index sensing in reflection and transmission domain. Our results can potentially enable exploiting plasmonic-enhanced sensing on unconventional substrates with structure as big as a biological cell.

Personal contribution: I was lead author and corresponding on this work. I optimized the fabrication process, performed the fabrications and the morphological characterization. I designed and built the system for optical characterization, performed all experiments and analyzed the data. I wrote the manuscript and prepared the figures with contributions from all authors.

12. PhD Thesis

Advanced technologies for spatio-temporal control of neural circuits in the mammalian retina using optogenetics

2017

Abstract: The progress of neuroscientific research is linked to the development of technologies able to interface with the complexity of neural circuitry. Remarkable advances in this direction have been achieved in the past decades and it is now possible to optically control the neural activity of genetically targeted cells with techniques known as optogenetic stimulation. The combination of optogenetic stimulation methods with electrophysiological recordings and advanced optical imaging is leading to promising approaches aiming at obtaining information on spiking activity, morphology and genetic identity of the many constituents of neural networks. This PhD research project focussed on the development of an experimental tool to exploit this possibility combining micro-electrode array (MEA) electrophysiological recordings with a custom two-photon microscope and optogenetic stimulation system based on a μ LED array. This thesis reports on the construction, validation and application of this tool, that was employed in retinal

recordings to link the precisely-timed spike signals detected by the MEA with the anatomical and genetic identity of the spiking neurons. The combination of large-scale MEA recordings with spatio-temporal μ LED optogenetic stimulation led to a novel method to link anatomy to functional and genetic identity in genetically-targeted retinal ganglion cells (RGCs) with a large scale approach. This method is a versatile approach that can be applied to characterise the many molecular types of RGCs. The integration of two-photon imaging and MEA recordings proved to be more arduous, yet applicable. Retinal ganglion cells were imaged in two-photon mode while mounted on the MEA and electrophysiological identification of spiking units was demonstrated notwithstanding large laser-induced artifacts. Optimisation of the system will allow to fully exploit the advantages offered by non-linear excitation.

INDICATORI BIBLIOMETRICI

Pubblicazioni indicizzate	44
di cui	
articoli su rivista	24
atti di conferenze	19
review	1
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ATTIVITA' DI REVISORE

Riviste scientifiche

Scientific Reports, IEEE Transaction on Biomedical Circuits and Systems, SPIE Neurophotonics, IOP Journal of Micromechanics and Microengineering, OPTICA Biomedical Optics Express, MDPI Sensors, Wiley Advanced Photonics Research, IEEE Micro and Nano Engineering

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