

Bio Sketch: I have been a researcher at Fondazione Bruno Kessler (FBK) since 2013, initially in the Micro-Nano Facility and, since 2022, as area manager in the Custom Radiation Sensors unit (CRS). In this role, I coordinate the development and implementation of manufacturing technologies for silicon radiation detectors and photosensors. My research interests focus on **Silicon Photomultipliers (SiPMs)** and **Low Gain Avalanche Diodes (LGADs)**. I have led the development of microfabrication technologies for several state-of-the-art radiation detectors, including the **SiPM NUV-HD**, **LGADs** for timing applications in the **CMS** and **ATLAS** experiments, and **Trench-Isolated LGADs**. Additionally, I contributed to the technology transfer of both the **NUV-HD SiPM** and **LGADs** to an external foundry for mass production and commercialization. I have been a co-investigator of several EU-funded projects, PI of the project PLASiPM (EU-H2020 ATTRACT), and partner of the ERC-Complex project. Additionally, I have led several R&D projects and provided technological services funded by private companies. My recent research interests have expanded to include **3D integration and interconnection technologies**, exploring innovative solutions like back-side illuminated (BSI) sensors and Through Silicon Vias (TSV) to improve the performance of silicon photodetectors.

WORK EXPERIENCE

from April 2022 to today

Research Scientist at Custom Radiation Sensors Unit

Sensors & Devices Centre, Fondazione Bruno Kessler, Trento, Italy

- Role: Area Manager, Coordinator of the Technology Platform group, composed of 5+ researchers and technologist working in the field of micro-nano fabrication of innovative silicon radiation sensors for scientific and industrial applications. The group manages the manufacturing technology of several silicon sensors technologies: Silicon Photomultipliers (SiPMs), Low Gain Avalanche Diodes (LGAD), Photodiodes (PD), Silicon strip and pixel detectors, 3D Silicon Detectors (3DD), Silicon Drift Detectors (SDD).
- Since 2019: Scientific coordinator of the R&D activities on "IPCEI on microelectronics" project at FBK: developments of 3d-integration technologies of silicon sensors and new cleanroom commissioning.

from April 2013 to March 2022

Research Scientist at Micro-Nano Facility (MNF)

Sensors & Devices Centre, Fondazione Bruno Kessler, Trento, Italy

- Responsible of the microfabrication technology of Silicon Photomultipliers (SiPMs) and Low Gain Avalanche Diodes (LGAD), and of the relative productions at FBK.
- Project leader and account manager of several R&D projects founded by public and private organizations (EU H2020, CERN, INFN).

from May 2017 to November 2017

Visiting Research Scientist

University of Cambridge, Cambridge, UK.

- Research Topic: "Plasmonic enhanced near-IR silicon photo-detectors"

EDUCATION AND TRAINING

November 2009 – April 2013

Ph.D. Degree in Physics

EQF level 8

University of Trento, Trento, Italy

- Silicon concentrator solar cells: development of innovative designs, microfabrication process in a CMOS-like technology and functional characterization

March 2006 – July 2009

Master Degree in Applied Physics

EQF level 7

University of Pisa, Pisa, Italy

- Characterization and image quality assessment of a GaAs pixel detectors based mammographic imaging system

September 2002 – February 2006

Bachelor Degree in Physics

EQF level 6

University of Pisa, Pisa, Italy

- Characterization of a digital mammographic system based on GaAs detectors and single photon counting read-out electronics

PERSONAL SKILLS

Mother tongue(s)	Italian
Other language(s)	English (good)
Job related expertise	<ul style="list-style-type: none"> ■ Project planning and management ■ Microelectronics cleanroom management ■ Good knowledge of the CMOS technology: equipment and process (ion implantation, CVD, lithography, cleaning, diffusion-oxidation, dry etching, wafer bonding, grinding, 3d-integration) ■ Main skill in working in a microelectronics cleanroom ■ TCAD Simulations of microelectronics devices (Silvaco suite) and of photonics devices (Lumerical)
Digital skills	Software for data analysis (matlab, R), Silvaco (TCAD), L-edit (microelectronics CAD)
Other skills	Teaching and student tutoring

Scientific Roles, Projects and Associations

Academic Qualification	<ul style="list-style-type: none"> ■ “Abilitazione Scientifica Nazionale” as Associate Professor in Electronics 09/E3 (2021)
Main Research Projects	<ul style="list-style-type: none"> ■ ERC-2023 Complex – “Doping Compensation in Thin Silicon Sensors: the pathway to Extreme Radiation Environments”. May 2024-ongoing, Role: project additional partner responsible for FBK. ■ H2020 FET-Open “EPIQUS – Electronic-photonics integrated quantum simulator platform”, Oct 2020 – ongoing, Role: participant. ■ CERN-RD50 funded project: “Development of Segmented LGAD with small pixels and high Fill-Factor”, 2019-2022. Role: Principal investigator ■ IPCEI on Microelectronics, Jan 2019-ongoing, Role: scientific coordinator for FBK. ■ H2020 ATTRACT “PlaSiPM – Plasmonic Enhanced Silicon Photomultipliers for Near Infra-red light detection”. May 2019 – December 2020, Role: Principal Investigator.
Editorial Roles	<ul style="list-style-type: none"> ■ Associate Editor for the journal “Frontiers in Physics”, section: “Radiation Detectors and Imaging”
Scientific associations and Memberships	<ul style="list-style-type: none"> ■ Member of: IEEE; DRD3 CERN collaboration (formerly RD50); DRD4 CERN collaboration; DarkSide collaboration. ■ Scientific associations: INFN-TIFPA; CERN
Committees	<ul style="list-style-type: none"> ■ Member of the organizing committee of “TREDI 2025”, 20th Workshop On Advanced Silicon Radiation Detectors, Trento (Italy), Feb. 4-6, 2025, ■ Member of the scientific committee of “IFD22: INFN Workshop on Future Detectors”, Bari (Italy), Oct 17-19, 2022 ■ Member of the organizing committee of “iWoRiD 2022”: 23rd International Workshop on Radiation Imaging Detectors, Riva del Garda (Italy), 26-30 June, 2022. ■ Member of the organizing committee of “TREDI 2021”, 16th Workshop On Advanced Silicon Radiation Detectors, Trento (Italy), Feb. 16-18, 2021, ■ Member of the programme Committee of “Nanoinnovation 2019”, Rome (Italy), June, 14-16, 2019.
Student supervising	<ul style="list-style-type: none"> ■ Supervisor of the PhD student E. Scattolo, Title: “Light management by plasmonic nanostructures enhancing Si-based photo-detector efficiency”, University of Bozen, May 2023 ■ Supervisor of the M.Sc student G. De Ceglia. Title: “Characterization of new silicon solar cells designs for concentrating photovoltaic application”, Polytechnic of Milan, November 2015.

Research Products

Talks

- Speaker and invited speaker at more than 40 international conferences on Instrumentation, sensors and microelectronics.

Journal Publications

- Author and co-author of more than 100 peer-reviewed papers in international Scopus-indexed journals. **H-index = 26 (from scopus)**
The publications below are a selection of the most relevant ones:
 - M. Centis Vignali and Giovanni Paternoster. "Low gain avalanche diodes for photon science applications." *Frontiers in Physics* 12 (2024).
 - Merzi, S., Brunner, S. E., Gola, A., Inglese, A., Mazzi, A., Paternoster, G., ... & Ruzzarin, M. "NUV-HD SiPMs with metal-filled trenches". *Journal of Instrumentation*, 18(05), P05040 (2023).
 - Scattolo, E., Cian, A., Petti, L., Lugli, P., Giubertoni, D., & Paternoster, G. (2023). Near infrared efficiency enhancement of silicon photodiodes by integration of metal nanostructures supporting surface plasmon polaritons. *Sensors*, 23(2), 856.
 - G. Paternoster et al., "Novel strategies for fine-segmented Low Gain Avalanche Diodes", *Nuclear Instruments and Methods in Physics Research Section A: Accelerators, Spectrometers, Detectors and Associated Equipment*, Volume 987, (2021).
 - Martino Bernard, Fabio Acerbi, Giovanni Paternoster, Gioele Piccoli, Luca Gemma, Davide Brunelli, Alberto Gola, Georg Pucker, Lucio Pancheri, and Mher Ghulinyan, "Top-down convergence of near-infrared photonics with silicon substrate-integrated electronics," *Optica* 8, 1363-1364 (2021)
 - G. Paternoster et al., "Trench-Isolated Low Gain Avalanche Diodes (TI-LGADs)," in *IEEE Electron Device Letters*, vol. 41, no. 6, pp. 884-887, (2020).
 - Acerbi, F., Paternoster, G., Capasso, M., Marcante, M., Mazzi, A., Regazzoni, V., ... & Gola, A. "Silicon photomultipliers: Technology optimizations for ultraviolet, visible and near-infrared range". *Instruments*, 3(1), 15. (2019).
 - M. Ferrero, R. Arcidiacono, M. Barozzi, M. Boscardin, N. Cartiglia, G.F. Dalla Betta, Z. Galloway, M. Mandurino, S. Mazza, G. Paternoster, "Radiation resistant LGAD design." *Nuclear Instruments and Methods in Physics Research Section A: Accelerators, Spectrometers, Detectors and Associated Equipment* 919 (2019).
 - F. Acerbi, A. Gola, V. Regazzoni, G. Paternoster, G. Borghi, N. Zorzi, C. Piemonte, "High Efficiency, Ultra high-density Silicon Photomultipliers", *IEEE JOURNAL OF SELECTED TOPICS IN QUANTUM ELECTRONICS*, vol. 24, (2018).
 - Paternoster, Giovanni, et al. "Developments and first measurements of Ultra-Fast Silicon Detectors produced at FBK." *Journal of Instrumentation* 12.02 (2017).
 - C. Piemonte, F. Acerbi, A. Ferri, A. Gola, G. Paternoster, V. Regazzoni, G. Zappala, N. Zorzi, "Performance of NUV-HD Silicon Photomultiplier Technology", *IEEE Transactions on Electron devices*, (2016).
 - Paternoster, Giovanni, et al. "Fabrication, Simulation, and Experimental Characterization of EWT Solar Cells With Deep Grooved Base Contact." *IEEE Journal of Photovoltaics* 6.5 (2016).
 - G. Paternoster et al. "Fabrication, characterization and modeling of a silicon solar cell optimized for concentrated photovoltaic applications." *Solar Energy Materials and Solar Cells* 134 (2015).
 - A. Calà Lesina, G. Paternoster, F. Mattedi, L. Ferrario, P. Berini, L. Ramunno, A. Paris, A. Vaccari, L. Calliari, "Modeling and Characterization of Antireflection Coatings with Embedded Silver Nanoparticles for Silicon Solar Cells", *Plasmonics*, May 2015.

Technology Transfer and Patents

- In 2015-2016 I carried out the technology transfer of the FBK-SiPM technology to an external Silicon foundry for mass production and commercialization.
- In 2024 I carried out the technology transfer of the FBK-LGAD technology to an external Silicon Foundry for mass production.
- Inventor of 6 international patents on radiation sensors and optical photodetectors: EP4324032A1, US10224450B2, WO2023161803A1, WO2023161804A1, US10811555B2, EP4324033A1

Giovanni Paternoster

07/11/2024