Scientific and Academic Curriculum

Luca Ghislotti

Università degli Studi di Bergamo

Department of Engineering and Applied Sciences

Microelectronics Laboratory

Summary

I am a Computer Engineer and a Ph.D. student in microelectronics for high-energy physics at the Microelectronics Laboratory in the Department of Engineering and Applied Sciences at the University of Bergamo. I work as a technologist at the Pavia branch of the Italian National Institute of Nuclear Physics (INFN) within the CSN2 particle physics division, and I previously served as an associate research fellow at the Astrophysics Laboratory of Columbia University. My research focuses on the design and characterization of analog integrated circuits for the readout of silicon-strip detectors employed in high-energy physics and astrophysics experiments.

I am currently contributing to the development of the General AntiParticle Spectrometer (GAPS) Antarctic balloon experiment as part of the GAPS collaboration. GAPS is a NASA, JAXA, INFN and ASI experiment that is designed to precisely measure the flux of low-energy cosmic-ray antideuterons, antiprotons, and antihelium as an indirect signature of dark matter.

Personal Details

Forename and Surname:	Luca Ghislotti
Place and Date of Birth:	Treviglio (BG), 03/02/1998
Personal Email Address:	ghislottiluca@gmail.com
Academic Email Address:	luca.ghislotti@unibg.it
Skype:	Luca Ghislotti
GitHub:	https://github.com/lucaghislo
LinkedIn:	https://www.linkedin.com/in/luca-ghislotti/
Google Scholar:	https://scholar.google.com/citations?user=Xt1_bCYAAAAJ
Personal Web Page:	https://lucaghislotti.com
Academic Web Page:	https://www.unibg.it/ugov/person/135728
Laboratory Web Page:	https://microlab-unibg.it/

Academic Education and Training

Doctor of Philosophy (Ph.D.) - Microelectronics for High Energy Physics

Università degli Studi di Bergamo, Bergamo (2022 - 2025).

Research Associate II at Columbia University

Astrophysics Laboratory - Columbia University, New York (August 1, 2023 - July 31, 2024).

Master of Science (M.Sc.) - Computer Engineering (LM-32)

Università degli Studi di Bergamo, Bergamo (2020 - 2022).

Thesis:	"Characterization of the readout electronics of the Si(Li) tracker for the first flight of the GAPS experiment"
Supervisor:	Prof. Massimo Manghisoni
Keywords:	GAPS, Dark Matter, Spectrometer, Si(Li), ASIC
Final Grade:	110/110 cum laude

Bachelor of Science (B.Sc.) - Computer Engineering (LM-8)

Università degli Studi di Bergamo, Bergamo (2017 - 2020).

Thesis:	"Data Anonymization Techniques: Implementation in the Apache Spark Environment"
Supervisor:	Prof. Stefano Paraboschi
Keywords:	Data Anonymization, Apache Spark, Apache Hadoop, Privacy, Computer Security
Final Grade:	107/110

Secondary School Diploma - IT and Telecommunications Engineering

Centro Studi Leonardo da Vinci, Bergamo (2012 - 2017).

Thesis:	"Where's my car? Sistema di localizzazione GPS"
Final Grade:	100/100

Scholarships and Certificates

Ph.D. Scholarship

Dottorato di Ricerca in INGEGNERIA E SCIENZE APPLICATE (XXXVIII ciclo)
Università degli Studi di Bergamo, Bergamo
Years: 2022 - 2025

TOP 10 Student Program

Università degli Studi di Bergamo, Bergamo
Years: 2017 - 2018, 2020 - 2021, 2021 - 2022
Fee exemption award issued by Università degli Studi di Bergamo to best students

Io e Lode - Studenti Eccellenti Scuole Bergamasche

Confindustria Bergamo, Bergamo
Years: 2013 - 2014, 2014 - 2015, 2015 - 2016, 2016 - 2017
Award issued by Confindustria Bergamo to best upper secondary school students

FCE (B2 First)

Cambridge Assessment English, Cambridge (2017)

Memberships

INFN Member

Istituto Nazionale di Fisica Nucleare, Pavia
Member of INFN CSN2 group as Technological Ph.D., section of Pavia.
Years: 2022, 2023, 2024

IEEE Student Member

IEEE Nuclear and Plasma Sciences Society Member

Institute of Electrical and Electronics Engineers
Membership number `97046986`
Years: 2023, 2024, 2025

SIE Member

Società Italiana di Elettronica
Years: 2023, 2024

ORCID Account

ORCID ID: `https://orcid.org/0000-0002-7084-5979`

Scopus Account

Scopus ID: `57939698700`
Profile: `https://www.scopus.com/authid/detail.uri?authorId=57939698700`

Web of Science Account

Web of Science ResearcherID: JUU-2100-2023
Profile: https://www.webofscience.com/wos/author/record/JUU-2100-2023

SAO/NASA Astrophysics Data System (ADS) Account

Profile: https://ui.adsabs.harvard.edu/search/q=author%3A%22Ghislotti%2C%20Luca

Language Skills

Italian: Mother tongue
English: Fluent (C1)
Spanish: Intermediate (B2)

Scientific Activity

The scientific activity and research interest of Luca Ghislotti fall mainly in the design of low-noise, low-power analogue front-end integrated circuit for semiconductor detectors readout in high energy physics and their characterization. Starting from 2022, Luca Ghislotti is part of the GAPS collaboration with University of Bergamo and INFN Pavia affiliations (https://gaps1.astro.ucla.edu/gaps/people.php).

The research activity to date encompasses the following:

1. **Design of a 65 nm CMOS readout ASIC for the second flight of the Si(Li) tracker of the GAPS experiment**
   The research work is focused on the design of an improved version of the Application Specific Integrated Circuit (ASIC) currently employed for the readout of the Si(Li) detectors of the GAPS tracker by moving from the current 180 nm CMOS technology in which the integrated circuit has been designed, to a more scaled 65 nm CMOS technology. This new chip will be used during the second long duration balloon flight experiment that will take off from the McMurdo Station in Antarctica at the end of 2025.

2. **Characterization and calibration of the readout electronics of the Si(Li) tracker of the GAPS experiment**
   The research work consists in the validation of the flight items of the Si(Li) tracker of the General AntiParticle Spectrometer (GAPS) experiment scheduled for late 2024 from the McMurdo Station in Antarctica. The Characterization work is aimed at the validation of the readout electronics of the tracker and its calibration, with great concern for ultra-low noise performance and high energy particles detection accuracy.

3. **Characterization of radiation hard bandgaps**
   Luca Ghislotti is involved in the characterization of a radiation hard bandgap voltage reference

for the ARCADIA project and a 28 nm bandgap voltage reference designed for high-energy physics applications.

On this topic, he contributed to the following work:
G. TRAVERSI, D. FALCHIERI, L. GAIONI, M. MANGHISONI, M. PEZZOLI, L. RATTI, V. RE, *"A radiation hard bandgap voltage reference for the ARCADIA project"*, TWEPP 2022 Topical Workshop on Electronics for Particle Physics, 19-23 September 2022, Bargen, Norway.

4. **DSSC bare module testing for the European XFEL**
   Luca Ghislotti is involved in the characterization of the bare modules, composed of a pixelated sensor bump-bonded to readout ASICs, developed in the context of the DSSC (DEPFET Sensors with Signal Compression) project for the European XFEL in Hamburg. The collaboration has the aim of developing a MiniSDD-based 1-Megapixel Camera, that is, a 2-D imaging detector system optimized for photon science applications in the energy range between 0.25 keV and 6 keV.

5. **Development of a wearable device for medical applications**
   The research work is focused on the development of a microcontroller-based wearable device with the aim of monitoring arteriovenous fistulas in dialysis patients. The project is carried out in collaboration with Istituto di Ricerche Farmacologiche Mario Negri IRCCS.

6. **Study and characterization of gas sensors for air quality monitoring**
   The research work is focused on the analysis and characterization of gas sensors with the aim of developing artificial intelligence algorithms for the recognition of complex odor signatures and air quality monitoring. Ongoing research is being carried out in collaboration with the University of Brescia.

Publications

V. RE, L. GHISLOTTI, P. LAZZARONI, M. MANGHISONI, E. RICEPUTI, L. RATTI, M. BOEZIO, G. ZAMPA, L. FABRIS, *"A mixed-signal processor for X-ray spectrometry and tracking in the GAPS experiment"*, Nuclear Instruments and Methods in Physics Research Section A: Accelerators, Spectrometers, Detectors and Associated Equipment, https://doi.org/10.1016/J.NIMA.2022.167617.

E. RICEPUTI, M. BOEZIO, L. FABRIS, L. GHISLOTTI, P. LAZZARONI, M. MANGHISONI, L. RATTI, V. RE, G. ZAMPA, *"The 32 analog channels readout for the long flight GAPS balloon experiment tracking system"*, Proceedings of SIE 2022: 53rd Annual Meeting of the Italian Electronics Society, Springer Nature Switzerland, https://link.springer.com/chapter/.

R. MUNINI on behalf of the GAPS Collaboration, *"Integration and Calibration of the GAPS Antarctic Balloon Payload"*, Volume 444 - 38th International Cosmic Ray Conference (ICRC2023) - Cosmic-Ray Physics (Direct, CRD), https://doi.org/10.22323/1.444.0180.

R. MUNINI on behalf of the GAPS Collaboration, *"The identification of the cosmic-ray light nuclei with the GAPS experiment"*, Volume 444 - 38th International Cosmic Ray Conference (ICRC2023) -

Cosmic-Ray Physics (Direct, CRD), https://doi.org/10.22323/1.444.0179.

S.N. FELDMAN on behalf of the GAPS Collaboration, *"The GAPS Time-of-Flight Detector"*, Volume 444 - 38th International Cosmic Ray Conference (ICRC2023) - Cosmic-Ray Physics (Direct, CRD), https://doi.org/10.22323/1.444.0120.

A. STOESSL on behalf of the GAPS Collaboration, *"The GAPS experiment - a search for light cosmic ray antinuclei"*, Volume 444 - 38th International Cosmic Ray Conference (ICRC2023) - Dark Matter Physics (DM), https://doi.org/10.22323/1.444.1440.

T. ARAMAKI et al., *"GAPS contributions to the 38th International Cosmic Ray Conference (Nagoya 2023)"*, arXiv.org, 2023, https://arxiv.org/abs/2310.10181.

N. MARCELLI on behalf of the GAPS Collaboration, *"The GAPS experiment: Low-energy antinuclei measurements for dark matter searches"*, RICAP-22, 8th Roma International Conference on Astroparticle Physic, EPJ Web Conf., Volume 280, 2023, https://doi.org/10.1051/epjconf/202328007002.
M. MANGHISONI, L. GHISLOTTI, P. LAZZARONI, V. RE, E. RICEPUTI, L. RATTI, L. FABRIS, M. BOEZIO, G. ZAMPA, *"A 32-channels readout ASIC for X-ray spectrometry and tracking in the GAPS experiment"*, IEEE Transactions on Nuclear Science, vol. 71, no. 1, pp. 96-105, Jan. 2024, 10.1109/TNS.2023.3336192.

E. RICEPUTI, M. MANGHISONI, V. RE, L. GHISLOTTI, P. LAZZARONI, L. RATTI, L. FABRIS, M. BOEZIO, G. ZAMPA, M. XIAO, E. CAVAZZUTI, V. VAGELLI, *"Experimental results from the characterization of a 32-channels mixed-signal processor for the GAPS experiment"*, 2023 IEEE Nuclear Science Symposium, Medical Imaging Conference and International Symposium on Room-Temperature Semiconductor Detectors (NSS MIC RTSD), Vancouver, BC, Canada, 2023, pp. 1-1, https://ieeexplore.ieee.org/document/10338321.

L. GHISLOTTI, M. BOEZIO, L. FABRIS, P. LAZZARONI, M. MANGHISONI, L. RATTI, V. RE, E. RICEPUTI, G. ZAMPA, *"Energy threshold calibration of the GAPS experiment Si(Li) tracker readout electronics"*, Il Nuovo Cimento C, vol. 47, no. 3, pp. 1-5, Apr. 2024, 10.1393/ncc/i2024-24121-1.

S. BOTTICINI, E. COMINI, S. DELLO IACONO, A. FLAMMINI, L. GAIONI, A. GALLIANI, L. GHISLOTTI, P. LAZZARONI, V. RE, E. SISINNI, M. VERZEROLI, D. ZAPPA, *"Index Air Quality Monitoring for Light and Active Mobility"*, Sensors 2024, 24, 3170, doi.org/10.3390/s24103170.

L. GHISLOTTI, P. LAZZARONI, M. MANGHISONI, E. RICEPUTI, *"Low-Noise Wide Dynamic Range Charge Sensitive Amplifier in 65 nm CMOS Technology for the Second Flight of the GAPS Experiment"*, 2024 19th Conference on Ph.D Research in Microelectronics and Electronics (PRIME), Larnaca, Cyprus, 2024, pp. 1-4, 10.1109/PRIME61930.2024.10559671.

M. VERZEROLI, A. GALLIANI, L. GHISLOTTI, L. GAIONI, P. LAZZARONI, V. RE, *"Empower-*

ing Smart Mobility with a Component-based Data Acquisition System for Multi-sensor Readout", 2024 19th Conference on Ph.D Research in Microelectronics and Electronics (PRIME), Larnaca, Cyprus, 2024, pp. 1-4, 10.1109/PRIME61930.2024.10559720.

M. VERZEROLI, L. GAIONI, A. GALLIANI, L. GHISLOTTI, P. LAZZARONI, V. RE, *"Advancing Sustainable Mobility: A Data Acquisition System for Light Vehicles and Active Mobility"*, Electronics, vol. 13, no. 21, Art. no. 21, Jan. 2024, 10.3390/electronics13214249.

Conference Presentations

V. RE, L. GHISLOTTI, P. LAZZARONI, M. MANGHISONI, E. RICEPUTI, L. RATTI, M. BOEZIO, G. ZAMPA, L. FABRIS, *"A 32-channels mixed-signal processor for the tracking system of the GAPS experiment"*, 15th Pisa Meeting on Advanced Detectors, La Biodola, Isola d'Elba, May 27, 2022, https://agenda.infn.it/event/22092/contributions/167321.

E. RICEPUTI, M. BOEZIO, L. FABRIS, E. CAVAZZUTI, L. GHISLOTTI, P. LAZZARONI, M. MANGHISONI, V. RE, L. RATTI, V. VAGELLI, M. XIAO, G. ZAMPA, *"Experimental results from the characterization of a 32 channels mixed signal processor for the GAPS experiment"*, 2023 IEEE Nuclear Science Symposium, Medical Imaging Conference, and Room-Temperature Semiconductor Detectors Symposium, Vancouver, Canada, November 9, 2023, https://www.eventclass.org/contxt_ieee2023/.

L. GHISLOTTI, P. LAZZARONI, M. MANGHISONI, E. RICEPUTI, *"Low-Noise Wide Dynamic Range Charge Sensitive Amplifier in 65 nm CMOS Technology for the Second Flight of the GAPS Experiment"*, PRIME 2024 - 19th International Conference On PhD Research in Microelectronics and Electronics - Photon and Particle Detection Circuits session, Larnaca, Cyprus, June 10, 2024, https://cyprusconferences.org/prime2024/.

Conference Posters

E. RICEPUTI, M. BOEZIO, L. FABRIS, L. GHISLOTTI, P. LAZZARONI, M. MANGHISONI, L. RATTI, V. RE, G. ZAMPA, *"The 32 analog channels readout for the long flight GAPS balloon experiment tracking system"*, 53rd Annual Meeting of the Associazione Società Italiana di Elettronica (SIE), Pizzo, Italy, 7-9 September 2022.

L. GHISLOTTI on behalf of the GAPS Collaboration, *"L'esperimento GAPS per l'indagine della materia oscura"*, IFAE 2023 - Incontri di Fisica delle Alte Energie, Catania, 12-14 Aprile 2023, https://agenda.infn.it/event/34702/.

E. RICEPUTI, M. BOEZIO, L. FABRIS, L. GHISLOTTI, P. LAZZARONI, M. MANGHISONI, L. RATTI, V. RE, G. ZAMPA, *"32-channels mixed-signal processor for the tracking system of the GAPS*

dark matter experiment", TWEPP 2023 Topical Workshop on Electronics for Particle Physics, Geremeas, Italy, 1-6 October 2023.

V. RE, L. GHISLOTTI, P. LAZZARONI, M. MANGHISONI, E. RICEPUTI, L. RATTI, M. BOEZIO, G. ZAMPA, L. FABRIS, *"Design and performance of the readout chip in the Si(Li) tracker module of the GAPS experiment"*, 16th Pisa Meeting on Advanced Detectors, La Biodola, Isola d'Elba, May 26-June 1, 2024, hhttps://agenda.infn.it/event/37033/contributions/poster-Elba2024_Re.pdf.

Paper Reviewing Activity

Starting from 2023, Luca Ghislotti has reviewed papers in the field of microelectronics and electronics design presented at the conferences listed below:

- *International Conference on Modern Circuits and Systems Technologies* (MOCAST) on Electronics and Communications - Athens, Greece (2023).
- *ApplePies*, International Conference on Applications in Electronics Pervading Industry, Environment and Society - Genova, Italy (2023).
- *International Conference on Modern Circuits and Systems Technologies* (MOCAST) on Electronics and Communications - Sofia, Bulgaria (2024).
- *ApplePies*, International Conference on Applications in Electronics Pervading Industry, Environment and Society - Turin, Italy (2024).

Visiting Periods

- In the context of the GAPS experiment, Luca Ghislotti visited the Space Sciences Laboratory (SSL) at the University of California, Berkeley (CA) in December 2022 and March 2023. During these visits, Luca Ghislotti contributed to the assembly and calibration of the GAPS tracker.
- In June 2023, Luca Ghislotti participated in the Thermo-Vacuum (TVAC) test of the GAPS tracker at the National Technical Systems (NTS) laboratories in Los Angeles, CA. During this test, he also worked on the instrument's thermal system in collaboration with engineers from the *Japan Aerospace Exploration Agency* (JAXA).
- In August 2023, Luca Ghislotti participated in the 2023 GAPS Collaboration Meeting held at the Pupin Physics Department of Columbia University in New York.
- In January 2024 and May 2024, Luca Ghislotti contributed to the assembly and testing of the GAPS experiment payload at Columbia University's Nevis Laboratories in Irvington, New York.
- In May 2024, he participated in the integration and testing of the GAPS experiment at the NASA Columbia Scientific Balloon Facility (CSBF) in Palestine, Texas, where he also conducted a Thermo-Vacuum (TVAC) validation test of the instrument's power supply.

- In November 2024, Luca Ghislotti was selected and qualified to participate in the launch campaign for the GAPS experiment at the Long Duration Balloon (LDB) facility at McMurdo Station, Antarctica, as part of the National Science Foundation (NSF) United States Antarctic Program (USAP). During the campaign, he contributed to the instrument integration and testing, and assisted with the balloon launch operations.

Ph.D. Schools and Courses

During his Ph.D. studies, Luca Ghislotti participated to the following Ph.D. schools and courses in the context of high energy physics detectors and associated readout electronics:

- *Giornate di Studio sui Rivelatori* - Scuola F. Bonaudi e E. Chiavassa 2023, June 26th - 30th Sala del Palazzo Comunale Cogne (AO), Italy (https://gsr.to.infn.it/).
- *EURIZON detector school 2023*, July 17th - 28th, Bergische Universität Wuppertal, Wuppertal, Germany. On this occasion, Luca Ghislotti held the talk *"The GAPS experiment for the indirect search of dark matter"* during the student presentations session "Making engaging scientific presentations" organised by Lucie Linssen (CERN) and David Barney (CERN) (https://indico.cern.ch/event/1224299/contributions/5516488/).
- *SIE Ph.D. School 2023*, September 4th - 7th, Università degli Studi di Messina, Messina, Italy. Organised by SIE, Società Italiana di Elettronica.
- *SystemVerilog for Design*, Microelectronics Support Centre, UKRI STFC Rutherford Appleton Laboratory, Harwell Campus, Didcot, UK. The course was held from March 18th to March 21st, 2024 and organised by EUROPRACTICE (https://www.europractice.stfc.ac.uk/training/).

Academic Activity

Teaching Activity

Starting from 2022, Luca Ghislotti has carried out teaching assistant activities for *Engineering and Management for Health* and *Mechatronics and Smart Technology Engineering* degrees at the University of Bergamo. A detailed list of the aforementioned activities, with the corresponding academic year, follows:

- **2022 - 2023**: Teaching assistant for the course "Biomedical Sensors" (6 CFU), master degree in Engineering and Management for Health.
- **2022 - 2023**: Teaching assistant for the course "Sensors" (3 CFU), master degree in Mechatronics and Smart Technology Engineering.
- **2022 - 2023**: Teaching assistant for the course "Industrial IOT" (3 CFU), master degree in Mechatronics and Smart Technology Engineering.

- **2023 - 2024**: Teaching assistant for the course "Biomedical Sensors" (6 CFU), master degree in Engineering and Management for Health. During this course, Luca Ghislotti held the seminar *"Tiny Technologies, Big Impact: Lab-on-Chip Devices, Microfluidics, and MEMS in Biomedical Engineering"* focused on SAW-based microfluidic and MAGFET lab-on-chip devices.
- **2023 - 2024**: Teaching assistant for the course "Sensors" (3 CFU), master degree in Mechatronics and Smart Technology Engineering.
- **2023 - 2024**: Teaching assistant for the course "Industrial IOT" (3 CFU), master degree in Mechatronics and Smart Technology Engineering.
- **2024 - 2025**: Teaching assistant for the course "Biomedical Sensors" (6 CFU), master degree in Engineering and Management for Health.
- **2024 - 2025**: Teaching assistant for the course "Sensors" (3 CFU), master degree in Mechatronics and Smart Technology Engineering.
- **2024 - 2025**: Teaching assistant for the course "Smart Sensors and Electronic Systems" (3 CFU), master degree in Mechatronics and Smart Technology Engineering.

Thesis Supervising Activity

During his Ph.D. studies, Luca Ghislotti has been co-supervisor or reviewer of the following dissertations at the department of Engineering and Applied Sciences of the University of Bergamo:

- *"Characterization and calibration of rad-hard bandgap voltage reference designed for high-energy physics application"*, master in Computer Engineering, A.Y. 2022/2023.
- *"Development of a MicroPython firmware in mbed-flash mode for a wearable platform"*, bachelor in Computer Engineering, A.Y. 2022/2023.
- *"Progetto e caratterizzazione di canali di lettura per SiPM impiegati nella rivelazione di muoni da radiazioni cosmiche"*, bachelor in Computer Engineering, A.Y. 2023/2024.

Projects and Awards

In 2023, Luca Ghislotti participated to the Bosch Sensortec Making Sensor Tec! Challenge with the project *"Exhaust gas pattern analysis for environmental monitoring and predictive maintenance"*. He and his team won first prize during the award ceremony held at Bosch Sensortec's headquarters in Milan on April 14, 2023. In this context, he and his team have been invited at Bosch Sensortec's main headquarters in Reutlingen, Germany, to present the winning project on July 4, 2023.

Interests and Activities

Electronics, Hi-Fi, analog audio reproduction, mechanical watches, analog and digital photography, aerospace.

Volunteer Experience

Contributor at Informatici Senza Frontiere ONLUS (2018 - Ongoing).

Pursuant to art. 46 and 47 of Presidential Decree 445/2000, I declare that the information included in my CV is true, being aware of the possible application of Article 76 of the same article in the event of a false declaration.

Pursuant to the Legislative Decree (D.Lgs.) no. 196/2003 and the Regulation (UE) 2016/679, the undersigned declares to be well-informed that his personal data being collected here will be treated, also in electronic form, exclusively for the scope of the procedure related to this declaration and authorizes the collection of personal data for the fulfillment of this procedure.

Bergamo, 22/11/2024