Curriculum Vitae

Personal Information

Name: **Giachero Andrea**
Date and place of birth: **April 27th, 1979, Acqui Terme (AL)**;
Nationality: **Italian**;

ORCID: **0000-0003-0493-695X**;
ResearcherID: **I-1081-2013**;
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Current Position

2022 – present	Visiting researcher at the University of Colorado Boulder and National Institute of Standards and Technology Boulder;
2021 – present	Assistant Professor at the University of Milano-Bicocca, Italy

Previous Positions

2017 – 2021	Research assistant at the University of Milano-Bicocca, Italy
2015 – 2017	Staff Researcher at the Italian Institute of Nuclear Physics (INFN), Unit of Milano-Bicocca;
2012 – 2015	Post-Doctoral Research Scientist at the University Milano-Bicocca, Italy.
2009 – 2012	Post-Doctoral Research Scientist at the Italian Institute of Nuclear Physics (INFN), Unit of Milano-Bicocca, Italy;
2008 – 2009	Post-Doctoral Research fellowship at the "Sapienza" Università di Roma, Italy;
2006 – 2008	INFN fellowship for young technologist at Laboratori Nazionali del Gran Sasso (LNGS), Italy.

Education

2008	Ph.D. in Particle Physics, Università degli Studi di Genova, Italy. Final dissertation: "*Characterization of cryogenic bolometers and data acquisition system for the CUORE experiment*". Supervisor: Prof. Marco Pallavicini;
2004	M.Sc. in Physics, Università degli Studi di Genova, Italy. Final dissertation: "*Development of an apparatus for the EUSO electronics characterization*". Supervisor: Prof. Marco Pallavicini;

Fellowships and awards

2021	Winner of the "*Marie Skłodowska-Curie Actions Global Fellow*" (H2020-MSCA-IF-2020), funded by European Union (EU);
2020	Winner of the competitive call "*Development of quantum technologies for the INFN fields of interest*", with a grant funded by Italian Institute of Nuclear Physics (INFN);
2019	Winner of the competitive call "*Fondo di Ateneo per la Ricerca* - Quota Competitiva 2019" grant funded by University of Milano Bicocca;
2017	Italian Qualification for University Associate Professor in experimental physics of fundamental interactions;
2012	First selected candidate, amongst 16 admitted, for a Post-Doctoral Research fellowship at the University of Milano Bicocca, Italy (declined);
2008 – 2009	Post-Doctoral scholarship at the "Sapienza" Università di Roma, Italy;
2006 – 2008	INFN scholarship at Laboratori Nazionali del Gran Sasso (LNGS), Italy.

Main research activities

2021 – present	qubIT project (national project funded by INFN): local coordinator for the Milano-Bicocca Unit and coordinator for the control and readout working package;
2020 – present	DARTWARS project (international project co-funded by the INFN and by the European Union): Principal Investigator and National Coordinator for the project. Chair of the Project Management Board (PMB);
2020 – present	SMQS project (international project funded by the DoE, where the INFN is the only non-US partner): member of the group in charge of the study of the impact of radioactivity on quantum circuits;

2020 – present	CUPID project (CUORE Upgrade with Particle Identification, international project co-funded by the INFN): member of the Computing Infrastructure Working Group;
2014 – present	HOLMES (ERC Advanced Grant Agreement no. 340321, PI: Prof Stefano Ragazzi): coordinator for the analysis software and coordinator for the read-out and multiplexing system. Since 2017 member of the HOLMES Publication Board (HPB);
2005 – present	CUORE experiment (international collaboration co-funded by the INFN at LNGS): development and characterization of the readout electronics, development of the main core for the acquisition system and electronics control, and development of RAD detector (RAdiation Arrays) used to investigate the radioactive background of the CUORICINO experiment. From 2012 to 2015 coordinator for the Slow Control System working group (CUORE-SCS), and from 2018 to 2020 member of the CUORE Publication Board. Since 2015 member of the CUORE Computing Infrastructure Working Group (CIWG) and since 2017 member of the CUORE Detector Response Working Group.
2018 – 2021	PTOLEMY experiment (international project co-funded by the INFN at LNGS): local coordinator for the Unit of Milano-Bicocca and coordinator for the read-out and multiplexing system;
2016 – 2020	KIDS_RD project (national project funded by INFN): Principal Investigator and National Coordinator for the project;
2012 – 2015	Project "Development of Microresonator Detectors for Neutrino Physics" (Fondazione Cariplo grant, International Recruitment Call 2010, ref. 2010-2351, PI: Prof. Angelo Nucciotti): detector development and characterization, readout and data acquisition development and data analysis;
2011 – 2015	LHCb-RICH upgrade (international upgrade activity co-funded by the INFN at CERN): characterization and readout development of a new Multianode Photomultiplier (MaPMT);
2009 – 2013	MARE-1 project (international collaboration funded by the INFN): detector characterization and development of the electronics readout and data acquisition system;

Scientific responsibilities

2021 – present	**Local Coordinator** for the qubIT project. **Total Budget: 20 k€ per year**
2020 – present	**Principal Investigator** and **National Coordinator** for the DARTWARS project. **Total Budget: 1 M€** over three years;
2019 – present	**Principal Investigator** of the "Fondo di Ateneo per la Ricerca - Quota Competitiva 2019" at the University of Milano Bicocca, granted with the intent to found promising research proposals. **Total Budget: 25 k€** over two years;
2014 – present	**Coordinator** for readout and multiplexing systems working group for the **HOLMES**. **Total Budget: 150 k€**;
2018 – 2021	**Local Coordinator** for the PTOLEMY project. **Total Budget: 15 k€ per year**;
2016 – 2020	**Principal Investigator** and **National Coordinator** for the **KIDS_RD** project. **Total Budget: 35 k€ per year**;
2012 – 2015	**Coordinator** for the Slow Control System working group for the **CUORE** experiment (CUORE-SCS). **Total Budget 25 k€** per year;

Major collaborations

2021 – present	Local coordinator for the **qubIT** project
2020 – present	National Coordinator of the **DARTWARS** project
2020 – present	Member of the **SMQS** project
2020 – present	Member of the **CUPID** experiment
2014 – present	Member of the **HOLMES** project;
2005 – present	Member of the **CUORE** experiment;
2018 – 2021	Local coordinator for the **PTOLEMY** project
2016 – 2020	National coordinator for the **KIDS_RD** project;
2012 – 2015	Member of the project **Development of Microresonator Detectors for Neutrino Physics**, at the University of Milano-Bicocca, Italy;
2010 – 2015	Member of the **LHCb-RICH** upgrade working group;
2009 – 2013	Member of the **MARE-1** R&D project;
2010 – 2015	Associated member with the European Organization for Nuclear Research (CERN);

2005 – present Associated member with the Laboratori Nazionali del Gran Sasso (LNGS), Italy;

Invited presentations at internationally established conferences

2021 "*Traveling wave parametric amplifiers*", invited presentation at the workshop Technologies and Platforms for QT within the Q@TN joint lab and their applications, Fondazione Bruno Kessler, Povo, Trento, Italy, 8-9 September 2021;

2020 "*Results of CUORE*", invited presentation at the 55th Rencontres de Moriond 2020 conference, La Thuile, Italy, 21-28 March. Cancelled due to the Covid-19 outbreak;

2018 "*Cryogenics microwave rf-SQUID multiplexing read-out for the calorimetric measurement of the neutrino mass*", invited presentation at the 13th Workshop on Low Temperature Electronics, WOLTE-13, Sorrento, Italy, 10-13 September 2018;

2018 "*Experimental challenges in neutrinoless double beta decay search*", invited presentation at the XIIIth Quark Confinement and the Hadron Spectrum conference, Maynooth University, Ireland, 1-6 August 2018;

2016 "*Assess the neutrino mass with micro and macro calorimeter approach*", invited presentation at the 7th Young Researcher Meeting 2016 (7YRM), Turin, Italy, 24 - 26 October 2016;

2014 "*The Electron Neutrino Mass Measurement by the HOLMES experiment: a Status Report*", invited presentation at the Chalonge Meudon Workshop 2014, CIAS Observatoire de Paris, Meudon campus, Château de Meudon, 4 - 6 June 2014"

Supervision of graduate students

2010 – present Advisor of 1 Ph.D student, advisor of 13 B.Sc. students (11 completed, 2 ongoing), co-advisor of 3 M.Sc. students (3 completed) and 6 B.Sc. students (all completed) at the University of Milano-Bicocca, Italy.

Teaching activities

2020 – present lecturer for the class of "***Nuclear and Subnuclear Physics Laboratory***", University of Milano-Bicocca, Italy (86 hours/year);

2018 – 2020 lecturer for the class of "***Laboratory of Physics II***", University of Milano-Bicocca, Italy (60 hours/year);

2013 – present lecturer for the class of "***Laboratory of Physics I***", University of Milano-Bicocca, Italy (60 hours/year);

2010 – 2013 lecturer for the class of "***Laboratory of Analog Electronics***", University of Milano-Bicocca, Italy (48 hours/year);

Organization of International conferences

2022 **Member** of the Scientific and Local Organization Committee for the "*vMass 2022 - Determination of the absolute electron (anti)-neutrino mass*", 7-11 February 2022, Milano. Italy;

2019 **Member** of the Scientific and Local Organization Committee for the "*18th international Workshop on Low Temperature Detectors. Cryogenic detectors for radiation and particles, and their applications, LTD18*", 22 - 26 July 2019, Milano. Italy;

2016 **Chair** of the Scientific and Local Organization Committee for the workshop "*5th Workshop on the Physics and Applications of Superconducting Microresonators, WPASM5*", 22 - 24 June 2016, University of Milano-Bicocca, Italy;

2013 **Member** of the Scientific and Local Organization Committee for the international workshop "*vMass 2013, The Future of Neutrino Mass Measurements: Terrestrial, Astrophysical, and Cosmological Measurements in the Next Decade*", 4 - 7 February 2013, University of Milano-Bicocca, Italy;

Editorial activities

2021 – present **Guest editor** for the Special Issue "*Development and Application of Particle Detectors, Volume II*" of *Applied Sciences*;

2020 – present **Member** of the *Applied Sciences* editorial board;

2020 – 2021 **Guest editor** for the Special Issue "*Development and Application of Particle Detectors, Volume I*" of *Applied Sciences* (concluded);

2019 – present **Member** of the *Instruments* editorial board;

2019 **Guest editor** for the Special Issue "*Low Temperature Detectors LTD18*" of *Journal of Low Temperature Physics* (JLTP). Volume 199, and Issue 1-2 (April 2020) and Issue 3-4 (May 2020)

Peer review activities

2018 – present **Reviewer** for Physical Review Letters (PRL), Applied Physics Letters (APL), Journal of Applied Physics (JAP), AIP Advances, IEEE Transactions on Applied Superconductivity (TAS), IEEE Access, Journal of Low Temperature Physics (JLTP), Sensors, and Instruments.

Scientific performances

- **157 publications** in peer-reviewed international journals with **2'072 citations**, **excluding self-cites** (source Web of Science, June 2021). Two paper **exceeding 200 citations** and three papers **exceeding 150 citations**, eleven papers **exceeding 50 citations**;
- **98 of 157 (62%) publications without the presence as co-author of the Ph.D. supervisor, with 926 citations excluding self-cites** (source Web of Science, June 2021);
- **More than 70 publications** in refereed conference proceedings,
- **More than 15 invited oral presentation** for seminars, conferences and workshop,
- **More than 20 presentations** at international conferences;
- **H-index**: **WoS = 24**, **Scopus = 24, Inspires = 25** (June 2021);

Early achievements track-record

My scientific interest is experimental particle physics. In this field, I have given an important contribution in the development of detectors, electronics and software. Since I started my involvement in particle physics, I have participated in several collaboration activities with scientists working in different experiments. These experiences allowed me to learn how I can face experimental challenges and allowed my skills in particle physics, detector technologies, readout systems and data handling to be improved.

Neutrinoless double beta decay: Since 2005, I am a member of CUORICINO and CUORE/CUORE0 collaborations. CUORE is a running experiment at Gran Sasso Underground Laboratories (LNGS) whose primary purpose is to search for neutrinoless double beta decay in ^{130}Te. CUORE recently provided the most stringent limit to date on this decay. CUORE is composed of 19 towers of TeO_2 for a total array of 988 macro-calorimeters. CUORICINO was a demonstrator experiment while CUORE-0 was the pilot experiment composed of a single tower of CUORE. From 2006 to the end of 2008 I worked as a staff member at LNGS laboratory where I contributed to the development of the RAD detectors (RAdiation Arrays) used to investigate the radioactive background of the CUORICINO experiment. This activity was reported in my Ph.D. thesis. In 2009 I moved to Milano-Bicocca (as postdoc and then as researcher) where I contributed to the design and to the realization of the CUORE and CUORE-0 detectors. I have also contributed to the development of the data acquisition system and the front–end electronics used in CUORE-0, and currently in CUORE. All these activities had contributions to the publications. I reported, on behalf of the CUORE collaboration, the status of the CUORE and CUORE-0 experiments at several conferences (i.e. Nuclear Physics in Astrophysics V, NPA-V 2011, Eilat, Israel, 3rd International Conference on New Frontiers in Physics, ICNFP 2014, Crete, Greece and 40th International Conference on High Energy Physics, ICHEP2020) conferences. I also reported my activities about the development of data acquisition and electronics for macro-calorimeters in several publications and at three consecutive Nuclear Science Symposiums (NSS/MIC 2012, 2011 and 2010). Currently I am collaborating to the study and optimization of the CUORE detector as a member of the CUORE Detector Response Working Group. In addition I am a member of the CUORE Computing Infrastructure Working Group (CIWG) and of the CUORE Detector Response Working Group. From 2012 to 2015 I have been coordinator for the Slow Control System working group (CUORE-SCS) and from 2018 to 2020 I have been a member of the CUORE Publication Board and member. My constant contribution to the detector's developments and optimization helped set the current best limit on the half-life of neutrinoless double-beta decay in 130Te. In 2019 I joined the CUPID (CUORE Upgrade with Particle Identification) project, a planned next-generation upgrade for the CUORE experiment. The CUPID/CUORE collaboration selects me several times as editor for reporting the CUORE-0 and CUORE performances and discovery potentials in collaboration articles.

Micro-calorimeter for the direct measurement of the Neutrino Mass: since 2009 I have been involved in the development of detectors for the estimation of the neutrino mass based on semiconductor and superconducting

sensors. From 2009 to 2013 I have been involved in the MARE-1 project. This INFN experiment, made of arrays of low temperature micro-calorimeters sensed by silicon thermistors, had the goal to constrain or measure directly the neutrino mass. My contributions in this collaboration involved several tests on the detector behaviour, the electronics characterization and the design and development of the data acquisition system. In 2012 I joined the three years project "Development of Microresonator Detectors for Neutrino Physics" (grant International Recruitment Call 2010, ref. 2010-2351 funded by Fondazione Cariplo, PI: Prof Angelo Nucciotti). The purpose of this project was to study and develop superconducting microwave microresonators (MKIDs) for X-ray detection suitable for a direct and calorimetric measurement of the neutrino mass. In this activity, I have been collaborating to study the detector's response, to optimize the detector layout and to develop a two channel data acquisition system based on the homodyne readout technique. In order to study the possibility of developing a readout system for a large detector array, in July 2013 I visited the laboratories of Caltech and University of Santa Barbara, which are involved in a range of astronomy applications using MKIDs. In a publication, in which I am the corresponding author, I reported the possibility of using Ti/TiN multilayer films to realize a superconducting microresonator suitable for low temperature detectors. I reported the obtained results on this activity at international conferences: LTD16 (Grenoble, France, July 2015), LTD15 (Pasadena, CA, USA, June 2013) and WOLTE10 (Paris, France, October 2013). In February 2014, I joined the HOLMES experiment (ERC Advanced Grant n. 340321, PI: Prof. Stefano Ragazzi). The primary goal of this experiment is the development of a new technique for the direct calorimetric measurement of the neutrino mass using the electron capture (EC) decay of 163-Holmium. This experiment employs micro-calorimeter detectors based on superconductive Mo/Cu TES (Transition Edge Sensor) on a SiN_x membrane with bismuth absorbers. In HOLMES I am coordinator of the read-out and multiplexing system of the experiment. This system will implement a microwave multiplexing (μMUX) that allows a large multiplexing factor (number of multiplexed detector signals over a given bandwidth). In July and October 2015 I visited the Quantum Sensors Group (QSG) at NIST where I have been trained in microwave readout electronics and in MKID and TES detectors development. I reported the status of the HOLMES project at the Chalonge Meudon Workshop 2014 (Paris, Meudon, France, June 2014), at the XIV International Conference on Topics in Astroparticle and Underground Physics TAUP2015 (Torino, Italy, September 2015), 14th Topical Seminar on Innovative Particle and Radiation Detectors (IPRD16, Siena, Italy, 2016), and at the XXVIII International Conference on Neutrino Physics and Astrophysics (Neutrino 2018, Heidelberg, 2018).
From 2016 to 2020, I have been the National Coordinator of the project KIDS_RD, a four years R&D activity funded by the Scientific Commission V of the INFN. The main objective of the project is to develop superconducting Thermal Kinetic Inductance Detectors (TKID) suitable for high resolution X-ray spectroscopy. Kilo-pixel arrays of such devices may have a large impact in many frontier fields like neutrino physics, rare events particle physics, astrophysics, material analysis, nuclear safety and diagnostic and archeometry. Results of this project have been presented at the 14th European Conference on Applied Superconductivity (EUCAS2019, Glasgow, Scotland, September 2019), at the 17th International Workshop on Low Temperature Detectors (LTD17, Kurume, Fukuoka, Japan, July 2017) and a the 14th Frontier Detectors for Frontier Physics conference (La Biodola, Isola d'Elba, Italy, May 2018). Since October 2017 I am Research Assistant at the University of Milano-Bicocca, maintaining the previous responsibilities and leading roles in CUORE, HOLMES and KIDS_RD.

Quantum technologies

In September 2020 I was awarded a grant from the Italian Institute of Nuclear Physics with a project selected for the competitive call "*Development of quantum technologies for the INFN fields of interest*". The project, funded for a total of 1 M€ over three years, aims to boost the sensitivity of experiments based on low-noise superconducting detectors and qubits. This goal will be reached through the development of wideband superconducting amplifiers with noise at the quantum limit and the implementation of a quantum-limited read out in different types of superconducting detectors and qubits. In September 2020 I also joined the Superconducting Quantum Materials and Systems Center (SQMS). The ambitious goal of SQMS is to build and deploy a revolutionary quantum computer and develop new quantum sensors based on superconducting technology. The INFN contributes to several key areas of the project and, in particular, I am involved in the development of a cryogenic testbed with very low environmental radioactivity levels suitable to measure the qubit performances. In February 2021 I was honoured as a talented researcher by the European Union with a Marie Skłodowska-Curie Individual Fellowships (MSCA-IF) Global Fellow (GF). The goal of this action is to enhance the international dimension of European researchers' careers by financing research projects to be carried out in two different countries. The aim of my research project is the development of a quantum limited-noise Travelling-Wave Parametric Amplifiers, based on the non-linearity of the kinetic inductance of superconducting materials, and their application of the read out of array of superconducting detectors as TESs and MKIDs. In September 2021 I joined

the qubIT project. QubIT aims to develop quantum sensing with superconducting qubits for present and future fundamental-physics experiments. In this project I am the coordinator of the working package devoted to the development of the control and readout of quantum circuits. Since October 2021 I am Assistant Professor (tenure-track) at the University of Milano-Bicocca.

Qualifications and Skills

- **Experimental physics:** particle physics, neutrino physics, search of rare events, search of neutrinoless double beta decay**,** x-ray and gamma-ray spectroscopy;
- **Detectors:** development and construction of thermistors-based large and micro low tem-perature colorimetric detectors for the study on the neutrinoless double beta decay (CUORE R&D, CUORE-0, CUORE, CUPID), direct measurement of the neutrino mass (MARE1) and for the study of radioactive contaminants. Characterization of light detectors, based on Multianode Photomultiplier (MaPMT), for single photon-electron counting (LHCb- RICH upgrade). Development of superconductive microresonator (MKIDs) and transi- tion edge sensor (TES) for the direct measurement of the neutrino mass (HOLMES);
- **Superconductivity:** design and characterization of superconducting detectors (TESs and MKIDs), readout by using dc- and rf-SQUIDs, design and characterization of Travelling Wave Parametric Amplifiers based on Josephson Junction (JTWPA) and on the non-linear kinetic inductance of disordered superconducting materials (KI-TWPA);
- **Signals theory:** good knowledge of digital signal processing, digital filtering (FIR, IIR), Fast Fourier Transform algorithm, homodyne and heterodyne readout techniques, Soft- ware defined radio (SDR) applications for micro-resonators readout and lock-in amplifier, also using DSP;
- **Data analysis**: analysis of experimental data using Python, and its numeric and scientific packages, the object oriented framework ROOT, the GNU Scientific Library (GSL), the Fastest Fourier Transform in the West Library (FFTW, for computing discrete Fourier transforms), and the computing environment Matlab;
- **Programming:** very good knowledge of the programming language C/C++, on GNU/Linux environment (gcc compiler) and on Windows environment (wxDev-C++ and Visual C++ compilers). Very good knowledge of scripting languages on GNU/Linux environments (in particular Bash and Perl). Very good knowledge of the programming languages Python and its numeric and scientific modules. Basic knowledge of the programming languages Ruby and Go;
- **Data acquisition and control**: very good knowledge in instrumentation control and data acquisition system development by using different communication protocols and differ- ent programming languages. Good knowledge of the National Instruments and CAEN acquisition systems, PXI Platform, VME bus, GPIB communications bus, standard VISA and CAN-Bus. Very good knowledge of the ANSI C programming environment Lab-Windows/CVI, developed by National Instruments. Basic knowledge of the .NET programming environment Measurement Studios, developed by National Instruments. Basic knowledge of the system-design platform LabVIEW, developed by National Instruments;
- **Electronics**: experience in design and characterization of custom boards; in particular very front-end electronics, anti-aliasing filters and calibration systems, for low tempera- ture detectors. Experience with microcontrollers (ARM, Cortex and 8051 families);
- **Operating System**: excellent knowledge of the distribution GNU/Linux, in particular Debian/Ubuntu and Scientific Linux. Good knowledge of Microsoft Windows