



**AL MAGNIFICO RETTORE  
DELL'UNIVERSITA' DEGLI STUDI DI MILANO**

**COD. ID: 6324**

Il sottoscritto chiede di essere ammesso a partecipare alla selezione pubblica, per titoli ed esami, per il conferimento di un assegno di ricerca presso il Dipartimento di Fisica Aldo Pontremoli

Responsabile scientifico: Prof. D'Angelo Davide

**Elizabeth Long**

**CURRICULUM VITAE**

Le dichiarazioni rese nel presente curriculum sono da ritenersi rilasciate ai sensi degli artt. 46 e 47 del DPR n. 445/2000.

Il presente curriculum, non contiene dati sensibili e dati giudiziari di cui all'art. 4, comma 1, lettere d) ed e) del D.Lgs. 30.6.2003 n. 196.

Luogo e data: Roma, 24/1/24

# Dr. Elizabeth Long

PHD IN PHYSICS

*Sapienza University, Piazzale Aldo Moro 5, 00185 Rome, Italy*

## About Me

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In Sept. 2023 I completed my PhD in Particle Physics at Sapienza Università di Roma. My PhD was on the PADME experiment, where I developed and tested a reconstruction algorithm for the charged particle veto detectors, which are crucial for the nominal dark sector searches for which the detector was designed. I then used this reconstruction for my thesis analysis which used these detectors to measure the Bhabha scattering cross-section at  $\sqrt{s} = \mathcal{O}(10)$  MeV. This achievement comes at the end of a long process of training, starting with my undergraduate degree at the University of Birmingham, during which time I focused on sub-atomic physics courses. Between graduating from my Masters at the University of Birmingham and starting my PhD, I moved to Rome where I taught English as a foreign language and also studied the Italian language. This experience has greatly improved my communication skills and understanding of the benefits of cultural exchange, as well as sparking in me an interest in the study of languages. The opportunity to study Italian meant that for most of my PhD I worked in Italian allowing me to give a talk in Italian to the Italian Society of Physics in 2022.

I am committed, enthusiastic and hard-working, and keen to apply the transferable skills I have learned from my PhD, undergraduate degree, previous work experience, extracurricular activities and my experience teaching English as a foreign language. I am very eager to improve my practical physics skills and gain experience in this field.

## Skills & qualities

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### MANAGEMENT

- Enjoy being an active team member
- Strong leadership qualities and communication skills
- Demonstrate initiative, flexibility and problem solving
- Confident in delivering individual and group presentations

### PERSONAL

- Enthusiastic, hard-working, committed and reliable
- Enjoy travel and experiencing new cultures
- Experienced in working with children & young people

## Education

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### PhD • **Thesis: Measurement of Bhabha scattering cross section at PADME**

SUPERVISOR: PROFESSOR MAURO RAGGI • CO-SUPERVISOR: DR. TOMMASO SPADARO

*Sapienza Università di Roma*

*Nov. 2019 - Sept. 2023*

### PhD • **Courses**

METHODS OF ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING IN PHYSICS

LHC PHYSICS

GENERAL RELATIVITY

### Master of Science • **Physics with International Study** • **Thesis: Search for Rare Decays of the Higgs Boson**

WITH ERASMUS YEAR AT LUNDS UNIVERSITET, SWEDEN

*University of Birmingham, UK*

*Sept. 2013 - Sept. 2017*

## University · Course Highlights

MODERN EXPERIMENTAL PARTICLE PHYSICS

CURRENT TOPICS IN PARTICLE PHYSICS

MODERN SUBATOMIC PHYSICS

ATOMIC PHYSICS

PHYSICS AND COMMUNICATION SKILLS

## Professional Experience

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November 2019 - September 2023      **PhD on PADME**

- Measured the **Bhabha scattering cross-section** at the Positron Annihilation to Dark Matter Experiment (PADME) at the National Laboratories of Frascati (LNF), Italy.
- Active involvement in the **detector commissioning** of the Veto detectors
- Wrote and tested the **reconstruction algorithm** used to determine physical quantities for events in these detectors
- Developed **physics analyses** to search for processes resulting in charged particles entering the vetoes, particularly Bremsstrahlung and Bhabha scattering
- Performed fundamental studies which led to the **upgraded design** of PADME Run 3
- Developed a **Convolutional Neural Network** to count peaks in toy Monte Carlo simulation of a digitised signal
- Contributed to **experimental data-taking**, doing shifts, interfacing with beam staff and communicating with expert colleagues from the collaboration
- Lived and worked in a foreign country, working in my **second language** (Italian)

July 2022      **SHERPA Data Taking at CERN**

Spent 1 week at CERN Participating in the Slow High-efficiency Extraction from Ring Positron Accelerator (SHERPA) test beam, investigating the use of bent crystals to extract positrons from beams, such as that at the DAΦNE complex in Frascati.

- Wrote monitoring software in Python to have an online visualisation of the beam from the output of the MiniPIX detector
- Assisted in data taking and communication with beam staff
- Developed preliminary analysis software for offline data analysis

November 2018 – August 2019      **Intern at PADME**      LNF/University of Sofia

Employed as a “Young Scientist” at the University of Sofia to undertake an internship with PADME, work which I continued during my PhD.

- Developed computing and physics abilities in commissioning the veto subdetectors
- Collaborated with a multinational and multilingual group.

Summer 2016      **Intern at MICE**      Rutherford Appleton Laboratory

Spent 6 weeks comparing the effect of different selections on beam analysis data.

- Performed statistical analysis of beam data
- Self- taught use of C++ ROOT

Summer 2013      **Intern at MicroBooNE**      Fermi National Accelerator Laboratory

5-week internship on R&D project at Fermilab to design a system to study high voltage breakdown in Liquid Argon Time Projection Chambers (LArTPCs) for MicroBooNE experiment.

- Designed and undertook preliminary experiments to evaluate use of insulated webcam in cryogenics to observe high voltage breakdown in LArTPCs
- Wrote Software Requirements Specification for software used for webcam testing
- First experience of working in a team to solve a hardware problem

## Presentations

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### INVITED

#### March 2023 **57th Rencontres de Moriond Electroweak Session**

Presented [talk](#) on status and prospects of PADME, discussing experimental design for all 3 Runs, data taking from Runs 1 and 2 (2018-2020), presenting the cross section measurement  $\sigma(e^+e^- \rightarrow \gamma\gamma)$  from Run 2 and data-quality plots from Run 3.

### NON-INVITED

#### July 2023 **XII International Conference on New Frontiers in Physics**

Presented [talk](#) on status and prospects of PADME, discussing experimental design for all 3 Runs, data taking from Runs 1 and 2 (2018-2020), presenting the cross section measurement  $\sigma(e^+e^- \rightarrow \gamma\gamma)$  from Run 2 and data-quality plots from Run 3.

#### September 2022 **Italian Society of Physics National Congress**

Presented [talk](#) in Italian on the plans for Run III of PADME, dedicated to the search of the X17 particle (English language slides in second half of pdf).

#### July 2022 **Identification of Dark Matter Conference**

Presented [talk](#) on the measurement of the inclusive cross section  $\sigma(e^+e^- \rightarrow \gamma\gamma)$ , the first physics measurement of the PADME experiment, as well as the plans for Run III of PADME, dedicated to the search of the X17 particle.

Summarised talk in [proceedings](#).

#### June 2021 **Invisibles21 Virtual Workshop**

Presented [talk](#) and [poster](#) on the status of PADME.

#### May 2021 **14th International Conference on Interconnections between Particle Physics and Cosmology**

Presented [talk](#) on invisible decay searches at PADME.

## Schools

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#### June 2022 **XIX Seminar on Software for Nuclear, Subnuclear and Applied Physics**

Followed interactive lessons on software. Gained confidence in the use of Python and learned the basics of GEANT4 simulations.

#### May 2022 **INFN School of Statistics 2022**

Followed lectures on statistical methods and techniques used in high energy physics.

#### July 2021 **Dark Matter from Theory to Detection**

Presented [poster](#) on the status of PADME.

#### June 2021 **XXXII International Seminar of Nuclear and Subnuclear Physics “Francesco Romano”**

Presented [talk](#) on the status of PADME.

#### May 2020 **Advanced Graduate Lectures on practical Tools, Applications and Techniques in HEP**

Followed lectures on high energy physics from statistics to simulations and detector design.

#### September 2018 **Pisa School on Future Colliders**

One-week long summer school at the University of Pisa on the state of the art of and future plans for next-generation particle colliders. Attended lectures on a variety of topics including the physics goals of various types of particle colliders and the challenges associated with building such machines.

## Publications

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### **Status and Prospects of PADME**

PADME Collaboration • Susanna Bertelli et al.

e-Print: [2305.08684\[hep-ex\]](#)

Contribution to: [Moriond EW 2023](#)

### **Dark sector studies with the PADME experiment**

PADME Collaboration • Anna Paola Caricato (INFN, Lecce and Salento U.) et al.

DOI: [10.21468/SciPostPhysProc.12.050](https://doi.org/10.21468/SciPostPhysProc.12.050)

Published in: SciPost Phys.Proc. 12 (2023), 050

### **Searching for light dark matter with the PADME experiment**

PADME Collaboration • Isabella Oceano et al.

DOI: [10.22323/1.406.0040](https://doi.org/10.22323/1.406.0040)

Published in: PoS CORFU2021 (2022), 040

### **Cross-section measurement of two-photon annihilation in-flight of positrons at $\sqrt{s} = 20$ MeV with the PADME detector**

PADME Collaboration • F. Bossi (Frascati) et al.

DOI: [10.1103/PhysRevD.107.012008](https://doi.org/10.1103/PhysRevD.107.012008) (publication)

Published in: Phys.Rev.D 107 (2023) 1, 012008

### **Commissioning of the PADME experiment with a positron beam**

P. Albicocco (Frascati), R. Assiro (INFN, Lecce), F. Bossi (Frascati), P. Branchini (INFN, Rome3), B. Buonomo (Frascati) et al.

DOI: [10.1088/1748-0221/17/08/P08032](https://doi.org/10.1088/1748-0221/17/08/P08032)

Published in: JINST 17 (2022) 08, P08032

### **The PADME beam line Monte Carlo simulation**

PADME Collaboration • F. Bossi (Frascati) et al.

DOI: [10.1007/JHEP09\(2022\)233](https://doi.org/10.1007/JHEP09(2022)233)

Published in: JHEP 09 (2022), 233

### **Search for a Dark Photon with the PADME experiment**

Stefania Spagnolo, A.P. Caricato, M. Martino, I. Oceano, F. Oliva et al.

DOI: [10.22323/1.398.0186](https://doi.org/10.22323/1.398.0186)

Published in: PoS EPS-HEP2021 (2022), 186

### **The physics program of the PADME experiment**

PADME Collaboration • A.P. Caricato (INFN, Lecce and Salento U.) et al.

DOI: [10.1088/1402-4896/ac41eb](https://doi.org/10.1088/1402-4896/ac41eb)

Published in: Phys.Scripta 97 (2022) 2, 024003

### **The PADME detector**

PADME Collaboration • J. Alexander (Cornell U., Phys. Dept.) et al.

DOI: [10.1088/1402-4896/ac2542](https://doi.org/10.1088/1402-4896/ac2542)

Published in: Phys.Scripta 96 (2021) 12, 124026

### **The Physics Program of the PADME Experiment**

PADME Collaboration • P. Gianotti (Frascati) et al.

DOI: [10.5506/APhysPolBSupp.14.35](https://doi.org/10.5506/APhysPolBSupp.14.35)

Published in: Acta Phys.Polon.Supp. 14 (2021), 35

### **Characterisation and performance of the PADME electromagnetic calorimeter**

P. Albicocco (Frascati), J. Alexander (Cornell U., Phys. Dept.), F. Bossi (Frascati), P. Branchini (INFN, Rome), B. Buonomo (Frascati) et al.

DOI: [10.1088/1748-0221/15/10/T10003](https://doi.org/10.1088/1748-0221/15/10/T10003)

Published in: JINST 15 (2020) 10, T10003

## Employment

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February-March 2018     **Darby School of Languages**, English and science teacher *Rome*

- 5 weeks' experience teaching a variety of subjects to Italian children and teenagers, working alongside students' Italian school teachers.
- Planned and delivered lessons on subjects including physical geography, chemistry, maths and English as a foreign language.

Summers 2015-2018     **Associazione Culturale Linguistica Educational**, English teacher *Italy*

- A total of 12 weeks' experience teaching English to Italian children in 1-2 week long English immersion camps, focussing on building their confidence in speaking and listening.
- Worked with a different team of tutors and camp-organisers each camp to plan and run lessons and activities, learning flexibility and the ability to communicate with non-native English speakers of different levels.

## Other qualifications

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2017     **Trinity CertTESOL**, Trinity College London

Trained to teach English as a Foreign Language in a 4-week course. Gained intercultural communication skills.

2013     **Grade 8 French Horn**, Associated Board of the Royal Schools of Music

Organised my time between academic studies and musical practice to achieve distinction in the highest amateur grade French Horn exam.

## Fellowships

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Spring-Autumn 2022     **Advising and supporting International Master's Students in their integration to learning at Sapienza**, Call number DD. 301/2021

Was awarded a 6 month fellowship to assist international Master's students in their transition to studying at Sapienza. Dealt with queries ranging from the curriculum to problems with the Covid-19 vaccination Green Pass.

## Outreach & Student-Centred Projects

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### OUTREACH

2020 – 2021     **Not Yet a Dr. Podcast**, Co-host

Co-hosted science podcast [Not Yet a Dr.](#) with a PhD student in chemistry and a PhD student in biology. Researched and presented various topics related to physics.

- Improved research skills in the preparation of episodes, finding and interpreting online resources including recent research papers and historical letters
- Developed skills in communicating physics to interested people with a background in other scientific fields
- Handled the social media accounts for the podcast, focussing particularly on [Instagram](#) and [Facebook](#)

2011-2013     **School Science Club & Senior Science Club**, Sixth Form Assistant

Discussed design, performance and results of experiments with students, ages 11-15. Planned, set up and introduced tasks in a manner appropriate to students' levels

## STUDENT-CENTRED PROJECTS AT SAPIENZA

### **PhD Student Seminar Series**

Set up and managed a series of seminars given by PhD students for an audience of PhD and Master's students and early post docs. The projects' aims are to give students opportunities to practice public speaking and to facilitate the exchange ideas and knowledge within the department.

- Gained skills in managing a team of other organisers & interfacing with the department to establish the project
- Improved communication skills in interfacing with potential speakers and advertising the project to students
- Organised four workshops on professional development/life in academia ([1][2][3][4])

### **Gender Balance Working Group**

Worked with other students & early-career researchers in the Physics Department to understand and improve the gender balance within the Department and the experience of all students in the department, particularly as relating to gender identity.

- Organised a seminar with an external speaker on the problem of gender-based violence in society in general and in the university context in particular
- Wrote surveys to investigate the wellbeing of students and early career researchers in the Department
- Set up an informal monthly gathering for women and non-binary people in the Physics Department
- Collaborated to collect information relating to services and protections provided by Sapienza and to present this information in an accessible way for people who study and/or work in the university in the following [book-let](#)