Alessandro Barone | CV

Sex: Male (he/him) | Date of Birth: 16/05/1994 | Nationality: Italian

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- Interests: Lattice Field Theory, QCD, Heavy Quarks, Algorithms
- Skills: Python, C++, Bash, Git, HPC
- Languages: Italian (native), English (C1), French (C1)

Work Experience

2023 - now **Postdoc researcher** Johannes Gutenberg University Mainz

I am part of the Mainz Lattice QCD group. My work within the group focuses on nucleon structure, particularly the determination of form factors and nucleon charges, with a specific interest in the axial-vector case. I am also leading the computation of the electromagnetic contribution to the proton-neutron mass difference.

2019 - 2023 **Teaching Assistant** University of Southampton

As an integral part of my PhD, I worked as Teaching Assistant for two undergraduate courses, in particular "Nuclei and Particles" and "Statistical Mechanics". My tasks consisted in coordinating a pool of 3-6 demonstrators, helping the students during problem classes and marking weekly problem sheets and part of the final exams. I also demonstrated in other courses such as "Classical Mechanics", "Electricity and Magnetism" and "Electromagnetism".

09/2019 - 03/2020 **Proofreader (external collaborator)** Zanichelli editore S.p.A

Zanichelli is one of the main Italian publishing companies for textbooks for school, university and professional books. My job as an external collaborator was to write guided solutions for the physics exercises appearing in three different math high school textbooks.

Education

2019 - 2023 **PhD in Theoretical Particle Physics** University of Southampton

I carried out my PhD in the Lattice QCD group under the supervision of Prof. Andreas Jüttner. My PhD thesis, with title Inclusive semileptonic $B_{(s)}$-meson decays from Lattice QCD, focuses on the study of inclusive semileptonic decays of $B_{(s)}$ mesons through Lattice QCD simulations, where I have been the principal investigator. I took care of the generalisation of the theoretical approach to inclusive decays and inverse problems, the generation of the data for the $B_{(s)} \to X_c l \nu_l$ decays and the final analysis and preparation of publication. I also spent four months at KEK (Tsukuba, Japan) as a JSPS fellow, where I collaborated closely with Prof. Shoji Hashimoto and Prof. Takashi Kaneko on a similar project for $D_{(s)}$ mesons.

2016 - 2019 **Master's Degree, Theoretical Physics** (110/110 cum laude) University of Bologna

I carried out my dissertation under the supervision of Prof. Michele Cicoli. In particular, I focused on phenomenological and cosmological implications of 4D string compactifications. The title of my dissertation is: The cosmological moduli problem in multi-field string inflationary models.
During the whole duration of the master I was also student of the Collegio Superiore, which is an institution of excellence that offers an interdisciplinary education program to selected students enrolled in an academic degree at the University of Bologna.

2013 - 2016 **Bachelor's Degree, Physics** (110/110 cum laude) University of Pavia

Final project on hadrons physics, quark model and QCD with title "Hadronic physics: from the quark model to QCD" under the supervision of Prof. Daniela Rebuzzi.

Scholarships and awards

2022	**PI for Short-Term Fellowship for Research in Japan**	JSPS
	I have been successful in my application to the Japan Society for the Promotion of Science (JSPS) to secure 1M yen (roughly £6200) funding to spend 4 months at KEK (Tsukuba, Japan) in 2023 to work on my project "$B_{(s)}$ and $D_{(s)}$ mesons inclusive semi-leptonic decays from Lattice QCD" together with Prof. Shoji Hashimoto and Prof. Takashi Kaneko.	
2019/2023	**Mayflower Scholarship for PhD studies**	University of Southampton
2017-2018	**Scholarship for Excellent Students of Collegio Superiore**	University of Bologna
2013/2015	**Scholarship for Excellent Students**	Ministry of Education (Italy)

Publications [iNSPIRE]

- *Inclusive semileptonic decays from lattice QCD: analysis of systematic effects*, R. Kellermann, **AB**, A. Elgaziari, S. Hashimoto, Z. Hu, A. Jüttner and T. Kaneko, Phys. Rev. D 112, 014501 [arXiv:2504.03358 [hep-lat]].
- *The isoscalar octet axial form factor of the nucleon from lattice QCD*, **AB**, D. Djukanovic, G. von Hippel, J. Koponen, H. B. Meyer, K. Ottnad and H. Wittig, Phys. Rev. D 112, 014503 [arXiv:2503.18848 [hep-lat]].
- *Approaches to inclusive semileptonic $B_{(s)}$-meson decays from Lattice QCD*, **AB**, S. Hashimoto, A. Jüttner, T. Kaneko and R. Kellermann, JHEP 07 (2023) 145 [arXiv:2305.14092 [hep-lat]].

Talks, seminars and workshop organisation

18/09/2024	**CKM 2025**	Cagliary, Italy
	Invited speaker, $B_s \to D_s^{**}$ using lattice QCD.	
03/10/2024	**Lattice meets continuum**	Siegen, Germany
	Invited speaker, Inclusive semileptonic decays on the lattice.	
29/07/2024	**Lattice 2024**	Liverpool, UK
	Speaker, The isoscalar non-singlet axial form factor of the nucleon from lattice QCD.	
11/07/2024	**Lattice@CERN 2024**	CERN, Switzerland
	Invited speaker, Towards inclusive semileptonic decays from lattice QCD.	
18/06/2024	**Progress in algorithms and numerical tools for QCD**	Orsay, France
	Invited speaker, Chebyshev and Backus-Gilbert reconstruction for inclusive semileptonic $B_{(s)}$-meson decays from Lattice QCD.	
31/07/2023	**Lattice 2023**	Fermilab, USA
	Speaker, Chebyshev and Backus-Gilbert reconstruction for inclusive semileptonic $B_{(s)}$-meson decays from Lattice QCD.	
23/01/2023	**HU Berlin / NIC DESY Zeuthen joint lattice seminar (virtual)**	DESY, Germany
	Invited speaker, Inclusive semi-leptonic $B_{(s)}$ mesons decay at the physical b quark mass.	
6-7/09/2022	**From Particle Physics to Gravitation: the Crossover with Data Science**	Southampton, UK
	Leading organiser. I successfully applied for funding (£5000) to organise one of the SEPnet student-led conference. The conference addressed the necessity of Data Science and High Performance Computers in Theoretical Physics, and covered topics from particle physics - such as phenomenology and lattice QCD - to gravitation and cosmology, with a particular focus on the application of techniques from fields like artificial intelligence, ML and data generation.	
12/08/2022	**Lattice 2022**	Bonn, Germany
	Speaker, Inclusive semi-leptonic $B_{(s)}$ mesons decay at the physical b quark mass.	
21/06/2022	**TH Informal Lattice Meeting (virtual)**	CERN, Switzerland
	Invited speaker, Inclusive semi-leptonic $B_{(s)}$ mesons decay from Lattice QCD.	

17/06/2022	**Quirks in Flavour Physics**	Zadar, Croatia
	Speaker, Inclusive semi-leptonic $B_{(s)}$ mesons decay from Lattice QCD.	
13/12/2021	**BNL-HET & RBRC Joint Workshop"DWF@25" (virtual)**	BNL, USA
	Invited Speaker, A variance reduction technique for hadronic correlators with partially twisted boundary conditions.	
29/06/2021	**Lattice 2021 (virtual)**	MIT, USA
	Speaker, A variance reduction technique for hadronic correlators with partially twisted boundary conditions.	

Additional Training

18-23/09/2022	**LatticeNET School on Computing in HEP**	Benasque Center for Physics
22/08/2021 - 03/09/2021	**EuroPLex Summer School 2021 (virtual)**	University of Edinburgh
12-30/07/2021	**Methods of Effective Field Theory and Lattice Field Theory**	Bad Honnef Physics School
1-5/03/2021	**EXALAT School - binaries (virtual)**	EXALAT
15-16/02/2021	**EXALAT School - GPU coding (virtual)**	EXALAT
01/2021	**BUSSTEP 50 (virtual)**	Queen Mary University of London
02-13/03/2020	**PREFIT School**	DESY

Participation in scientific computing awards

01/04/2025 - 01/04/2027 **Precision heavy quark physics with chiral fermions** — DiRAC Call 17 (Edinburgh)

I am one of the main contributors to the allocation (Researcher co-lead). PI: Andreas Jüttner.

- Year 1: 1.02870 MGPU-hours
- Year 2: 1.04490 MGPU-hours
- 100 TB storage

Supervising and mentoring activities

01/10/2023 - now **Co-supervisor for a PhD student** — University of Southampton

Co-supervision of a student working on a project addressing systematic effects in inclusive semileptonic $B_{(s)}$-meson decays. Close mentoring in weekly meetings, including theoretical foundations of the physical process and analysis of large datasets.

Teaching

2019-2013 **Teaching assistant/demonstrator in undergraduate courses** — University of Southampton

Teaching assistant:

- Statistical Mechanics
- Nuclei and Particles

Demonstrator:

- Classical Mechanics
- Electricity and Magnetism
- Electromagnetism