

CURRICULUM VITAE ALBA CRESCENTE

Personal information

Name: Alba Crescente
Date of birth: 30/06/1995
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Education

2009-2014 Scientific High School, Scientific High School P.N.I. G.P. Vieusseux of Imperia
03.07.2014 High school diploma achievement
2014-2017 Bachelor's Degree in Physics (LT-30), University of Genoa
10.01.2018 Bachelor's Degree achievement
2017-2019 Master's Degree in Physics (LM-17), University of Genoa
05.06.2019 Master's Degree in Physics achievement (110/110 cum laude)
2019-2023 PhD Course in Physics, University of Genoa
09.03.2023 PhD in Physics achievement (grade: Excellent)

Postdoc Research

01.09.2022-31.08.2024 Research grant - D.R. n. 1724 of 22/04/2022 - Progr. 3, title "Theoretical studies of quantum batteries and devices for coherent energy transfer", Scientific-disciplinary sector FIS/03 Condensed Matter Physics, at the Physics Department of the University of Genoa.

RESEARCH ACTIVITY

My main research area is in quantum batteries, inserted within the broader branch of quantum thermodynamics. Quantum batteries are systems that, by exploiting quantum correlations, can be used to store energy with better performances compared to their classic counterpart.

In particular, during these years I have studied the most efficient ways to charge quantum batteries and how to transfer energy from a charger to a battery. In detail, I have characterized a quantum battery charged thanks to a classic drive, both considering the system as closed [1], and as open [2]. Furthermore, I have studied how the efficiency of the quantum battery could be improved thanks to the interaction with a photonic cavity, where the coupling is given by an exotic two-photon interaction [3]. For completeness I have also characterized how the initial state of the photons inside the cavity affects the charge of the quantum battery [4, 5].

Finally, I characterized the transfer of energy from a charger to a quantum battery, mediated by different quantum systems to understand which one has the best performances [6, 7, 8].

Scientific publications

Co-author of 8 scientific publications, of which 8 has been subjected to peer-review (Years 2020-2023), of which 7 indexed on ISI-WOS.

H-index: 5 (source: ISI Web of Science).

Total number of citations: 148 (source: ISI Web of Science).

In details:

[1] 2020 - Article

A. Crescente, M. Carrega, M. Sassetti, D. Ferraro, *Charging and energy fluctuations of a driven quantum battery*, New J. Phys. **22**, 063057 (2020).

doi: 10.1088/1367-2630/ab91fc.

Number of citations: 46 (source: ISI Web of Science).

[2] 2020 - Article

M. Carrega, A. Crescente, D. Ferraro, M. Sassetti, *Dissipative dynamics of an open quantum battery*, New J. Phys. **22**, 083085 (2020).

doi: 10.1088/1367-2630/abaa01.

Number of citations: 37 (source: ISI Web of Science).

[3] 2020 - Article

A. Crescente, M. Carrega, M. Sassetti, D. Ferraro, *Ultrafast charging in a two-photon Dicke quantum battery*, Phys. Rev. B **102**, 245407 (2020).

doi: 10.1103/PhysRevB.102.245407.

Number of citations: 41 (source: ISI Web of Science).

[4] 2021 - Article

A. Delmonte, A. Crescente, M. Carrega, D. Ferraro, M. Sassetti, *Characterization of a Two-Photon Quantum Battery: Initial Conditions, Stability and Work Extraction*, Entropy **23**, 612 (2021).

doi: 10.3390/e23050612.

Number of citations: 17 (source: ISI Web of Science).

[5] 2022 - Article

A. Crescente, *Advantages of two-photon processes in quantum batteries*, Il Nuovo Cimento 45 C **6**, 165 (2022).

doi: 10.1393/ncc/i2022-22165-9.

[6] 2022 - Article

A. Crescente, D. Ferraro, M. Carrega, M. Sassetti, *Enhancing coherent energy transfer between quantum devices via a mediator*, Phys. Rev. Research **4**, 033216 (2022).

doi: 10.1103/PhysRevResearch.4.033216.

Number of citations: 7 (source: ISI Web of Science)

[7] 2022 - Article

A. Crescente, D. Ferraro, M. Carrega, M. Sassetti, *Exactly solvable model for qubit mediated energy transfer between quantum batteries*, Entropy **25**, 758 (2023).

doi: 10.3390/e25050758.

[8] 2022 - Article

A. Crescente, *The power of photons: Cavity-mediated energy transfer between quantum devices*, Il Nuovo Cimento 46 C **6**, 61 (2023).

doi: 10.1393/ncc/i2023-23061-6.

Conferences and International Schools

I have presented the following talks:

1. 2021 *Ultrafast charging in a two-photon Dicke quantum battery*, International School on "Thermodynamics of quantum systems and processes", Online 22-26 March.
2. 2021 *Advantages of two-photon processes in quantum batteries*, SIF National Congress, Online 13-17 September.
3. 2022 *Enhancing coherent energy transfer between quantum batteries via a mediator*, SIF National Congress, Milan 12-16 September.
4. 2023 *Dissipative dynamics in the cavity-mediated energy transfer process between ultrastrong coupled devices*, SIF National Congress, Fisciano (Salerno) 11-15 September.

I have presented the following posters:

1. 2020 *Charging, energy fluctuations and dissipation of a two-level quantum battery*, International Conference on "Quantum Thermodynamics of Non-equilibrium systems", Online 13-16 October.
2. 2020 *Charging, energy fluctuations and dissipation of a two-level quantum battery*, International Conference on "Quantum Thermodynamics", Online 19-23 October.

3. 2020 *Ultrafast charging in a two-photon Dicke quantum battery*, International Conference on “Physique quantize mesoscopique”, Online 23-26 November.
4. 2021 *Ultrafast charging in a two-photon Dicke quantum battery*, International Conference on “Frontiers of Quantum and Mesoscopic Thermodynamics”, Online 18-24 July.
5. 2021 *Two-photon Quantum Batteries: Collective advantage and work extraction*, International Conference on “Quantum Thermodynamics”, Online 4-8 October.
6. 2023 *The power of photons: Cavity-mediated energy transfer between quantum devices*, International Conference on “Quantum Matter”, Madrid 23-25 May.
7. 2023 *The power of photons: Cavity-mediated energy transfer between quantum devices*, Workshop INFN CSN4&5 - Physics Department on Quantum Technologies, Turin 7-9 June.
8. 2023 *The power of photons: Cavity-mediated energy transfer between quantum devices*, International Conference on “Quantum Thermodynamics”, Wien 17-21 July.

Referee for International magazines as:

Communication Physics, New Journal of Physics, Physical Review A, Physical Review E, Physical Review Letters, PRX Energy, Scientific Reports, Journal of Physics A: Mathematical and Theoretical, Physica Scripta.

DIDACTIC ACTIVITY

A.A. 2018/2019

1. Tutor for the Stage PLS 2019 at the Physics Department of the University of Genoa in the project “Elasticity measure of MEMS”.
2. Lecture for the Third Age University of the University of Genoa with the title “A trip in condensed matter physics: from the first semiconductor technologies to quantum technologies”.

A.A. 2020/2021

1. Didactic tutor for the course Mathematical Institutions (semester course, holder Prof. Conca) Bachelor’s Degree in Biologic Science, University of Genoa.
Topics: Algebra and Mathematical Analysis.
Average number of students: 50. Number of frontal and supplementary teaching hours: 50.
2. Participation in the examination commission for the Quantum Information Processing course. First level course for IANUA-STSI, University of Genoa.
Exam type: Oral.

A.A. 2021/2022

1. Didactic tutor for the course General Physics (annual course, holder Prof. Celasco) Bachelor’s Degree in Naval Engineering.
Topics: Classical Mechanics and Electromagnetism.
Average number of students: 20. Number of frontal and supplementary teaching hours: 30.

A.A. 2022/2023

1. 2 hours lecture for the PhD course Energetics in the Quantum Regime on the topic “Quantum Batteries Charged Via a Classical External Field”.

A.A. 2023/2024

1. Didactic tutor for the course Physics 2 (annual course, holders Prof. Di Domizio, Prof. Rossi) Bachelor’s Degree in Physics.
Topics: Classical Mechanics and Thermodynamics.
Average number of students: 20. Number of frontal and supplementary teaching hours: 50.

ADDITIONAL INFORMATIONS

Scholarships and prizes

2014 Scholarship Enasarco for high school diploma with grade higher than 90/100.

2015 Prize for the first year students of the Bachelor’s Degree in Physics that have gained more than 20 CFU in the first exam session.

2019-2022 PhD scholarship in Physics at University of Genoa.

2021 Prize “Highlights 2020 CNR-SPIN” for the article *Dissipative dynamics of an open quantum battery*, New J. Phys. **22**, 083085 (2020) in activity F: “Electronic and thermal transport from the nanoscale to the macroscale”.

2022 First prize for the best oral talk of Section 2- Condensed Matter Physics for the talk *Enhancing coherent energy transfer between quantum batteries via a mediator*, presented at the SIF National Congress, Milan 12-16 September.

Student representation

2017-2019 Student representative elected in the following bodies of the University of Genoa:

- Council of the Physics Study Course
- High Quality Board of Physics
- Physics Department Board
- Physics Department Council

IT skills

- Excellent knowledge of Windows and MacOS operating systems
- Good knowledge of Linux operating system
- Excellent knowledge of the Office package, Wolfram Mathematica, LaTeX, ROOT, LabView
- Good knowledge of MATLAB
- Excellent knowledge of the Python programming language
- Good knowledge of the C++ and Verilog HDL programming languages

Language skills

Italian

Mother tongue

English

Advanced

French

Elementary