Guglielmo Marchese

WORK EXPERIENCE

[01/02/2023 – 16/11/2024]

University research assistant

University of Rome La Sapienza

City: Rome | **Country:** Italy

Theory of the coupling between phonons and photons with electrons (Dynamical Effective charges) in metallic materials or in doped semi-conductors

Analytical development of ab initio methods for accurate theoretical prediction of solid state material properties and their software implementation.

EDUCATION AND TRAINING

[01/11/2019 – 23/01/2024]

PhD in Physics

University of Rome La Sapienza

City: Rome | **Country:** Italy | **Field(s) of study:** Natural sciences, mathematics and statistics: ● *Physics* | **Final grade:** Cum Laude | **Level in EQF:** EQF level 8 | **NQF Level:** 8 | **Thesis:** Ab initio method for vibrational spectroscopy in conductive systems

Developing the formalism and software required for calculating theoretical prediction of vibrational spectroscopy measurement in metallic systems.

[04/2021 – 06/2021]

Internship with full prof. M. Calandra

University of Trento

City: Trento | **Country:** Italy |

LANGUAGE SKILLS

Mother tongue(s): Italian

Other language(s):

English

LISTENING C1 **READING** C1 **WRITING** C1

SPOKEN PRODUCTION C1 **SPOKEN INTERACTION** C1

French

LISTENING B1 **READING** B1 **WRITING** B1

SPOKEN PRODUCTION B1 **SPOKEN INTERACTION** B1

Spanish

LISTENING B1 **READING** B1 **WRITING** B1

SPOKEN PRODUCTION B1 **SPOKEN INTERACTION** B1

Levels: A1 and A2: Basic user; B1 and B2: Independent user; C1 and C2: Proficient user

PUBLICATIONS

[2024]

Born Effective Charges and Vibrational Spectra in Supercon- ducting and Bad Conducting Metals

Reference: Marchese et al., Nature Physics, 20, pages 88–94 (2024)

https://www.nature.com/articles/s41567-023-02203-3

[2024] [**Infrared Resonance Raman of Bilayer Graphene: Signatures of Massive Fermions and Band Structure on the 2D Peak**](#)

Reference: Graziotto et al., Nano Letters, 24, 6 (2024)

https://doi.org/10.1021/acs.nanolett.3c03502

[2024] [**Epiq: An Open-Source Software for the Calculation of Electron- Phonon Interaction Related Properties**](#)

Reference: Marini and Marchese et al.,Comp. Phys. Comm., 295, 108950 (2024)

https://doi.org/10.1016/j.cpc.2023.108950

[2020] [**Experimental Violation of N-Locality in a Star Quantum Network**](#)

Reference: Poderini et al., Nature Communications, 11, 2467 (2020)

https://doi.org/10.1038/s41467-020-16189-6

PROJECTS

[2024] **Modeling vibrational spectroscopy in crystals exhibiting cooperative phenomena**

PI of the project [n. AR223188AF44A0DC]" within the "Pro-

getti per Avvio alla Ricerca Tipo 2" initiative.

[2021 – Current] **HPC - CINECA**

Supervisor of several HPC projects awarded by the

Cineca facility:

- IscraC-HP10C8TW7J
- IscraC-HP10CSQ37Y

VOLUNTEERING

[2020 – 2023] **Medicine Sans Frontiers - Italia**   Roma

Supporting the administrative office

Scientific dissemination   Rome

Several lessons held within the Caffè Scientifico

initiative at Liceo Ginnasio Statale Virgilio

CONFERENCES AND SEM- INARS

[2023] **SSCHA School**   San Sebastian

Hands-on-session teaching

[2023] **Condensed Matter Theory CMT@Brixen**   Brixen

Poster presentation

[2023] **21st International Workshop: Total Energy and Force Methods**   Trieste

Poster presentation

[2022] **Wannier 2022 Developers Meeting**   Trieste

Invited talk

HONOURS AND AWARDS

[2019] **Excellence program for the Master degree Awarding institution:** Univ. of Rome La Sapienza

[2017] **Excellence program for the Master degree Awarding institution:** Univ. of Rome La Sapienza

COLLABORATIONS

[2021 – Current] **"EPIq" software package**

I am part of the developer team of the "EPIq" (Electron-Phonon wannier Interpolation over k and q-points) package: a post-processing software of Wannier90 and Quantum Espresso software capable to calculate several materials properties powered by a fast Wannier interpolation kernel.

Link: https://the-epiq-team.gitlab.io/epiq-site

COMPUTATIONAL SKILLS

EPIq

I am part of maintainers team of the "EPIq" package

(https://the-epiq-team.gitlab.io/epiq-site): a post-processing soft-

ware of Wannier90 and Quantum Espresso software capable to compute

several materials properties powered by a fast Wannier interpolation ker-

nel.

Quantum Espresso

During my research activities I calculated the equilibrium as well as the response properties of many compounds thanks to QuantumEspresso software (https://quantum-espresso.com). Moreover, I developed a

customize version of the PH package in order to compute different linear response functions at the finite frequency.

Wannier90

I am an active user of the Wannier90 (https://wannier.org) and I grew an in-depth knowledge of the code thanks to the discussions with the developers team.

PROGRAMMING LAN-GUAGES

Fortran90

Studying, extending and implementing new software in the Fortran90 language is part of the everyday activity of my research.

Besides computing techniques, I have years experience in parallelization as well as IO strategies and in the management of an articulated software package (EPIq).

Python

Thanks to the great availability of external library I elect the Python language as my preferred environment for data management and graphical representation.

C

Even though "c" is not my mainly employed language anymore, it was the start of my computational education and part of the computational core of a private python library I collaborated to during my master thesis.

Wolfram Mathetica

I developed good expertise of Mathematica for symbolic calculations.

REFERENCE CONTACTS

Prof. Francesco Mauri

PhD supervisor and collaborator,

Full professor of Solid State Physics, University La Sapienza;

francesco.mauri@uniroma1.it

Dr. Paolo Barone

PhD supervisor and collaborator,

Reasearcher at Centro Nazionale della ricerca, CNR-SPIN;

paolo.barone@spin.cnr.it

Rome, 12/11/2024