

# Fabrizio Ferrari Ruffino

Ph.D. in Physics

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## Personal Informations

Date of Birth: 11 May 1987                      Nationality: Italian  
Birth Place: Brescia, Italy                      Languages: Italian, English  
Gender: M

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## Work Experience

- Dec. 2019–  
Present    **Technologist**, Fixed-term contract (technologist of III level) with CNR-IOM (National Council of Research), work place: S.I.S.S.A., via Bonomea 265, 34136 Trieste, Italy.  
Project: *"MaX - Materials Design at the eXascale. European Centre of Excellence in materials modelling, simulations and design"*, Supervisor: Prof. Paolo Giannozzi.
- Nov. 2018–  
Nov. 2019    **Scientific Software Developer**, Research grant founded by Quantum ESPRESSO Foundation, work place: University of Udine, Department of Mathematics, Computer Science and Physics, via delle Scienze 206, 33100 Udine, Italy.  
Subject: *"New algorithms and new architectures for material simulations from first principles."*, Supervisor: Prof. Paolo Giannozzi.
- Mar. 2018–  
Oct. 2018    **Teacher**, Modus s.r.l., Piazza Carducci 3, 20900 Monza, Italy.  
Private teacher of physics and mathematics for high school and university students (see section "Didactic Experience").
- Jun. 2017–  
Nov. 2017    **Research fellow**, University of Trento, Faculty of Mathematical, Physical and Natural Sciences, Department of Physics, via Sommarive 14, 38123 Povo - Trento, Italy.  
Subject: *"Numerical calculations on supercomputers of some properties of light hypernuclei by means of non-symmetrized hyperspherical harmonics."*, Supervisor: Prof. Giuseppina Orlandini.

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## Education and Training

- Nov. 2013–  
Apr. 2017    **Ph.D. in Physics**, University of Trento, Faculty of Mathematical, Physical and Natural Sciences, Department of Physics, via Sommarive 14, 38123 Povo - Trento, Italy.  
Dissertation: *"Non-Symmetrized Hyperspherical Harmonics Method Applied to Light Hypernuclei"*, Grade: Optimum, Supervisor: Prof. Giuseppina Orlandini, Examination board: prof. C. Forssen (Chalmers University, Göteborg), prof. A. Kievsky (University of Pisa), prof. F. Pederiva (University of Trento).

- Jan. 2010–  
Apr. 2013 **M.Sc. in Physics**, University of Padova, Faculty of Mathematical, Physical and Natural Sciences, Department of Physics and Astronomy, via Marzolo 8, 35100 Padova, Italy.  
Dissertation: *“The Geometrical Collective Model: Solution Methods, Shape Transitions and Applications”*, Grade: 110/110, Supervisor: Prof. Lorenzo Fortunato.
- Oct. 2006–  
Dec. 2009 **B.Sc. in Physics**, University of Padova, Faculty of Mathematical, Physical and Natural Sciences, Department of Physics and Astronomy, via Marzolo 8, 35100 Padova, Italy.  
Dissertation: *“End-to-End Vector Distribution in Models of Polymers that Adsorb on a Surface”*, Supervisor: Prof. Enzo Orlandini.
- Sept. 2001–  
Jul. 2006 **High School Certificate**, Liceo Scientifico N. Copernico, v.le Duca degli Abruzzi 17, 25124 Brescia, Italy.  
Science, Literature and Arts.

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## Research Interests

- General Few-body quantum methods, scientific software development.
- Specific Hyperspherical harmonics expansion method, light nuclear systems, Quantum ESPRESSO software development.

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## Publications

- 2020 P. Giannozzi, O. Baseggio, P. Bonfá, D. Brunato, R. Car, I. Carnimeo, C. Cavazzoni, S. de Gironcoli, P. Delugas, F. Ferrari Ruffino, A. Ferretti, N. Marzari, I. Timrov, A. Urru and S. Baroni; *Quantum ESPRESSO toward the exascale*, J. Chem. Phys. **152**, 154105 (2020).
- 2020 F. Ferrari Ruffino, W. Leidemann and G. Orlandini; *Hyperspherical Harmonics Method with Particle Excitation Degrees of Freedom*, Rec. Prog. in Few-Body Phys. **238**, 821 (2020).
- 2018 F. Ferrari Ruffino and L. Fortunato; *GCM Solver (ver. 3.0): a Mathematica Notebook for Diagonalization of the Geometric Collective Model (Bohr Hamiltonian) with Generalized Gneuss-Greiner Potential*, Computation **6**(3), 48 (2018).
- 2017 F. Ferrari Ruffino; *Non-Symmetrized Hyperspherical Harmonics Method Applied to Light Hypernuclei*, Ph.D. thesis, University of Trento (available on <http://eprints-phd.biblio.unitn.it/2071/>).
- 2017 F. Ferrari Ruffino, D. Lonardoni, N. Barnea, S. Deflorian, W. Leidemann, G. Orlandini and F. Pederiva; *Benchmark Results for Few-Body Hypernuclei*, Few-Body Syst. **58**, 113 (2017).
- 2016 F. Ferrari Ruffino, N. Barnea, S. Deflorian, W. Leidemann and G. Orlandini; *Non-Symmetrized Hyperspherical Harmonics Method Applied to Light Hypernuclei*, EPJ Web of Conf. **113**, 08005 (2016).

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## Didactic Experience

- Mar. 2018–  
Oct. 2018 Modus s.r.l. (Monza, Italy), private teacher of physics and mathematics for high school and university students (private tutor for the courses *Analysis I* and *Analysis II* for Computer Science and Engineering at University of Milano and Bicocca).
- Feb. 2016–  
Sept. 2016 University of Trento, Department of Physics, trainer for the course *Many-Body Theory*, 1st year of Master. Course holder: prof. Giuseppina Orlandini.
- Sept. 2014–  
Sept. 2015 University of Trento, Department of Physics, tutor for the course *General Physics I* (Mechanics and Thermodynamics), 1st year of Bachelor. Course holder: prof. Franco Dalfovo.

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## Schools

- Oct 2020 **36th VI-HPS Tuning Workshop**, hosted by CINECA Super Computing Center (Italy), course held online due to COVID19 restrictions.
- Apr 2020 **Programming Paradigms for GPU Devices**, CINECA Super Computing Center (Italy), course held online due to COVID19 lockdown.
- Oct 2019 **CODES@OEHI hackathon 2019**, hosted by CINECA Super Computing Center, Bologna (Italy).
- Oct 2019 **CINECA GPU hackathon 2019**, CINECA Super Computing Center, Roma (Italy).
- Feb 2019 **15th Advanced School on Parallel Computing**, CINECA Super Computing Center, Bologna (Italy).
- Dec 2018 **Material Science codes on innovative HPC architectures: from electronic structure to spectra with Quantum ESPRESSO and Yambo**, CINECA Super Computing Center, Bologna (Italy).
- Jul 2015 **Nuclear Talent School 2015, "Few-body methods and nuclear reactions"**, ECT\* - European Center for Theoretical Studies in Nuclear Physics and Related Areas, Trento (Italy).
- Sept 2014 **23rd Summer School on Parallel Computing**, CINECA Super Computing Center, Milano (Italy).
- Jul 2014 **Nuclear Talent School 2014, "Density functional theory and self-consistent methods"**, with final project approved (by dr. N. Schunck): *"Energy Calculations of Light Neutron Drops with Hartree-Fock-Bogoliubov Approach"*; ECT\*, Trento (Italy).

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## Seminars & Conferences

- Sept. 2019 **24th European Conference on Few Body Problems in Physics**, *"Hyperspherical Harmonics method with particle excitation degrees of freedom"*, parallel talk, University of Surrey, Guildford (UK).
- Jul. 2019 **TIFPA Seminar**, *"Hyperspherical Harmonics with particle transition degrees of freedom"*, full presentation (invited by prof. W. Leidemann), University of Trento and TIFPA, Trento (Italy).
- Aug. 2016 **23rd European Conference on Few Body Problems in Physics**, *"Benchmark results for few-body hypernuclei"*, parallel talk, Aarhus University, Aarhus (Denmark).

- Sept. 2015 **101st National Congress of the Italian Physical Society**, "*Non-Symmetrized Hyper-spherical Harmonics Method applied to light hypernuclei*", parallel talk, University of Rome "La Sapienza", Roma (Italy).
- Jun. 2015 **Nuclear Cookies 2015**, "*NSHH method for light hypernuclei*", full presentation (invited by prof. L. Fortunato), University of Padova, Padova (Italy).
- May 2015 **21st International Conference on Few Body Problems in Physics**, "*NSHH method applied to light hypernuclei*", poster session, Chicago (USA).
- Feb. 2015 **Physics Ph.D. Workshop 2014/15**, "*NSHH method applied to light hypernuclei*", short presentation, University of Trento, Trento (Italy).

## Computer Skills

- OS **Linux** (Ubuntu user), **Windows**.
- Technical **Mathematica** (advanced), **Python** (basic).
- Languages **Fortran** (good), **C/C++** (intermediate), *Fortran Experience*: my last two years of work on Quantum-ESPRESSO, my whole Ph.D. work.
- Version control **Git** (basic), *Experience*: my last two years of work on Quantum-ESPRESSO. My GitLab repository: [gitlab.com/fabrizio22/q-e/](https://gitlab.com/fabrizio22/q-e/)
- Parallel Calculus **MPI**, **OpenMP**, **Hybrid with Fortran**, *Experience*: Cineca Schools (see "Schools"), collaboration on the projects INF15\_FBS and INF16\_FBS on the CINECA Fermi supercomputer. Two years of work as developer of Quantum ESPRESSO. Some experience with **CUDA Fortran** while working on QE (see next).
- Other **LaTeX**, **Office**, **FORD** documentation generator (for fortran).
- quantum ESPRESSO My main contribution to QE.  
1st year:
- conversion of *rho* from up-down to sum-diff format for the **LSDA** case;
  - reorganization of the **XC**-functional routines (drivers in array form and functionals organized in a pseudo-internal library form);
  - incorporation of **LIBXC** functionals;
  - compatibility with **FORD** documentation generator included in PW;
  - **GPU**-parallelization of the XC part of the code.
- 2nd year:
- porting on **GPU** of the **stress** calculation in QE;
  - porting on GPU of some DFT+U routines and wave function orthogonalization;
  - various improvements of the Libxc compatibility in QE;
  - the creation of an **external library** for the **XC** part of QE;
  - the inclusion of **Ford** compatibility in **Modules**.