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Research interests

Transport in mesoscopic systems. Quantum field theory in condensed matter physics. Topological states of matter, Weyl/Dirac semimetals. Electron-phonon interaction. Interfaces, impurities and Kondo effects. Exactly solvable models in quantum mechanics and statistical physics.

Research experience

2023 - present Assistant Professor with time contract at Polytechnic University Turin, Italy

2016 - 2023 Postdoctoral researcher at the Institute for Theoretical Physics, Heinrich-Heine University, Düsseldorf, Germany

2013 - 2015 Postdoctoral researcher at the International Institute of Physics, Natal RN, Brazil

Education

2013 Visiting fellow in Wigner Institute for Nuclear Physics (Hungarian Academy of Sciences) and Eötvös Loránd University (ELTE), Budapest, Hungary

2012 Ph.D. in Statistical Physics at SISSA - Trieste. Thesis: "Matrix elements from Algebraic Bethe Ansatz: novel applications in Statistical physics". Advisor: G. Mussardo.

2008 "Laurea Specialistica" (M.Sc.) in Physics at the University of Bologna (110/110 *cum laude*). Thesis: "The integrable O(6) sigma model and the gauge-string duality". Advisor: F. Ravanini.

2006 "Laurea" (B.Sc.) in Physics at the University of Modena and Reggio Emilia (110/110 *cum laude*). Thesis: "Conduzione di una simulazione cosmologica su calcolatore parallelo al CINECA (*Running of a cosmological simulation on parallel supercomputers at CINECA*)". Advisor: C. Calandra Bonaura.

Awarded Funds

Project: "Light-matter interaction in topological semimetals", PNRR, Intelligence Research (FAIR) - CUP E13C22001800001 PNRR M4C2 - PE0000021 Network 4 Energy Sustainable Transition (NEST)

Selected publications

F. B., R. Egger and A. De Martino - [Transport, refraction and interface arcs in junctions of Weyl semimetals](#) - Phys. Rev. B 106, 045413 (2022);
F. B., A. De Martino, R. G. Pereira, P. W. Brouwer and R. Egger - [Phonon-limited transport and Fermi arc lifetime in Weyl semimetals](#) - Phys. Rev. B 105, 085410 (2022);
F. B., A. Nava, R. Egger, P. Sodano and D. Giuliano - [Violation of the Wiedemann-Franz law in the topological Kondo model](#) - Phys. Rev. B 105, L081403 (2022);
F. B., R. Egger, R. G. Pereira and F. Ramos - [Quantum spin circulator in Y junctions of Heisenberg chains](#) - Phys. Rev. B 97, 220402 (2018);
A. Zazunov, F. B. and R. Egger - [\$6\pi\$ Josephson effect in Majorana box devices](#) - Phys. Rev. Lett. 118, 057001 (2017);
F. B., H. Babujian, V. E. Korepin, P. Sodano and A. Trombettoni - [Thermodynamics of the Topological Kondo Model](#) - Nucl. Phys. B 896, 52 (2015);

Didactics

Supervision of students for their Master theses: "Magnetotransport in Weyl semimetals" (2020), "Transport in a metal/nodal-line semimetal heterostructure" (2023); "Andreev reflection in Weyl semimetals" (2023);
Supervision of Ph D. students: "Light-matter interaction in topological semimetals" (ongoing);
Lectureships: "Introduction to Conformal Field Theory" (HHU Düsseldorf, WS 2021), "Topological States of Matter" (HHU Düsseldorf, WS 2022), "Introduction to Topological Materials" (Politecnico di Torino, WS 2023);
Organizer of the online seminar series: "[Special problems in Condensed Matter Physics](#)", hosted by HHU Düsseldorf.

Communication and Dissemination

Organizer of the conference: "Gapless Topological Phases", Düsseldorf 2023;
Invited contributions at specialized conferences. Recent: "Low-dimensional emergent phenomena in correlated systems and topological quantum matter", Tbilisi, Georgia (2019); "Weyl Fermions in Condensed Matter", Natal RN, Brazil (2019); "Entangled states of matter", Berlin, Germany (2022); Great Lessons from Exact Techniques and Beyond, Tropea, Italy (2023);
Online available talks:
[Heat transport in a topological Y-junction](#) (2021),
[Interplay between the topological Kondo effect and superconductivity](#) (2017),
[Thermodynamics of the Topological Kondo model and a cold-atomic realization](#) (2016).
Physics lectures for high-school students ([Progetto Orientamento Formativo](#))

Computer skills

Python, Fortran, Mathematica. Truncated conformal space approximation (TCSA) method.

Other

Collaboration with peer-reviewed journals (EPJB, PRA, PRB, PRE, PRL, Quantum) as referee;
Associated member of [ML4Q Matter and Light for Quantum Computation](#) and collaborator of the [CRC183 - Entangled States of Matter](#) excellence cluster.