

PERSONAL INFORMATION

Filippo Troiani



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 <https://www.nano.cnr.it/researcher-profile/filippo-troiani/>

Sex Male | Date of birth 4 January 1972 | Nationality Italian

Enterprise	University	EPR
☐ Management Level	☐ Full professor	☒ Research Director and 1st level Technologist / First Researcher and 2nd level Technologist
☐ Mid-Management Level	☐ Associate Professor	☐ Level III Researcher and Technologist
☐ Employee / worker level	☐ Researcher and Technologist of IV, V, VI and VII level / Technical collaborator	☐ Researcher and Technologist of IV, V, VI and VII level / Technical collaborator

MAIN WORK EXPERIENCE

March 2020 - present

Senior Researcher

Istituto Nanoscienze del CNR (CNR – NANO), Modena (Italy)

- Simulation of hole-spin qubits in Si and Ge quantum dots, and specifically in fabricated and scaled pMOSFETs. Quantum state discrimination approaches in the context of electron microscopy.

This activity is currently being carried out within the FET-OPEN EU project *IQubits* (Integrated Qubits Towards Future High-Temperature Silicon Quantum Computing Hardware Technologies) where I am PI of Unit and leader of the work package "Qubit Design and Atomistic Modelling and Simulation".

January 2010 – February 2020

Researcher

Istituto Nanoscienze del CNR (CNR-NANO), Modena (Italy)

- Quantum sensing with individual and composite spin systems. Simulation of continuous quantum measurements by electrical and "optical" (cavities) means. Detection and characterization of entangled and highly nonclassical states in molecular nanomagnets. Role of quantum coherence in ultrafast photoinduced processes, investigated through (the simulation of) multidimensional spectroscopies.

July 2007 – January 2010

Fixed-term Researcher

Centro di ricerca nanoStructures and bioSystems at Surfaces del CNR-INFM (S3), Modena (Italy)

- Proposals for the electric manipulation of spin chirality qubits in molecular nanomagnets. Simulation of the hyperfine-induced decoherence in the molecular spin qubits.

October 2004 - February 2006

Senior Postdoc

Universidad Autonoma de Madrid, Madrid (Spain), research group of Prof. Carlos Tejedor.

- Semiconductor-based quantum optics, and in particular: deterministic generation of single photons and entangled-photon pairs from quantum-dot in semiconductor microcavities; relation between the dot dynamics and the degree of photon entanglement and indistinguishability.

February 2002 - September 2004

Senior Postdoc

Università di Modena e Reggio Emilia, Modena (Italy), research group of Prof. Elisa Molinari.

- Development of proposals for the molecular-spin based implementations of quantum computing (spin-cluster qubits). Coherent manipulation of few-particle physics in semiconductor nanostructures and phonon- induced decoherence.

EDUCATION AND TRAINING

November 1998 – October 2001

PhD in Physics

Università di Modena e Reggio Emilia (Italy)

- Completed on the 25th of February 2002, under the supervision of Prof. Elisa Molinari, by defending a thesis entitled "Optics of semiconductor quantum dots: coherent effects and quantum information processing".
- All-optical approaches to the exciton- and spin-based implementations of quantum computing in semiconductor quantum dots. Simulation of excitonic states in single and coupled quantum dots and of the related optical properties.

May 1998

Laurea (MSc Degree) in Physics

Università "La Sapienza" di Roma (Italy)

- Completed on the 25th of May 1998, under the supervision of Dr. Marco Merafina, by defending a thesis in astrophysics entitled "Gravothermal instability in the dynamical evolution of globular clusters".
- Mark:: 110/110 cum laude.

PERSONAL SKILLS

Mother tongue Italian

Other languages English, proficiency Level: C2. Spanish, proficiency level: C1. German, proficiency level B1.

- Job-related skills
- Solid-state physics: calculation of few-particle states, envelope-function, k·p, configuration-interaction.
 - Molecular magnetism: spin-Hamiltonian approaches (numerical diagonalization, irreducible tensor operator formalism).
 - Quantum optics: input-output formalism, quantum coherence functions.
 - Quantum computing and simulation: development of proposals for the qubit encoding and manipulation in molecular and solid-state platforms.
 - Decoherence: qubit interaction with realistic bosonic and spin environments, open quantum system approaches (Lindblad master equation, cluster-correlation expansion).
 - Quantum sensing: quantum parameter estimation (quantum Fisher information), quantum state discrimination.
 - Multidimensional coherent spectroscopies: model Hamiltonians, open quantum system approaches, perturbative expansion of the density matrix.

- Digital skills
- Coding in Fortran for scientific calculations.
 - Elements of coding in Python for scientific calculations and visualization.
 - Knowledge of the Latex environment for scientific written production.

ADDITIONAL INFORMATION

Publications Co-author of 100 papers on peer-reviewed international journals. According to Web of Science (full list of publications at [ResearcherID B-4787-2011](#)), these papers have been cited > 3000 times, resulting in an h-index of 25 (30 according to Google Scholar).

Relevant publication list

- 1) *"Toward Hole-Spin Qubits in Si p-MOSFETs within a Planar CMOS Foundry Technology"*
L. Bellentani, M. Bina, S. Bonen, A. Secchi, A. Bertoni, S. Voinigescu, A. Padovani, L. Larcher, and F. Troiani

- Physical Review Applied 16, 054034 (2021)
Cited 0 times (Web of Science)
- 2) ["Universal Quantum Magnetometry with Spin States at Equilibrium"](#)
F. Troiani and M. G. A. Paris,
Physical Review Letters 120, 260503 (2018)
Cited 16 times (Web of Science)
 - 3) ["Landau-Zener Transition in a Continuously Measured Single-Molecule Spin Transistor"](#)
F. Troiani, C. Godfrin, S. Thiele, F. Balestro, W. Wernsdorfer, S. Klyatskaya, M. Ruben, and M. Affronte
Physical Review Letters 118, 257701 (2017)
Cited 18 times (Web of Science)
 - 4) ["Hyperfine-induced decoherence in triangular spin-cluster qubits"](#)
F. Troiani, D. Stepanenko, and D. Loss,
Physical Review B 86, 161409 (2012)
Cited 35 times (Web of Science)
 - 5) ["Engineering the coupling between molecular spin qubits by coordination chemistry"](#)
G. A. Timco, S. Carretta, **F. Troiani**, F. Tuna, R. J. Pritchard, C. A. Muryn, E. J. L. McInnes, A. Ghirri, A. Candini, P. Santini, G. Amoretti, M. Affronte, R. E. P. Winpenny,
Nature Nanotechnology 4, 173 (2009)
Cited 321 times (Web of Science)
 - 6) ["Spin-electric coupling in molecular magnets"](#)
M. Trif, **F. Troiani**, D. Stepanenko and D. Loss
Physical Review Letters 101, 217201 (2008)
Cited 154 times (Web of Science)
 - 7) ["Proposal for quantum gates in permanently coupled antiferromagnetic spin rings without need of local fields"](#)
F. Troiani, M. Affronte, S. Carretta, P. Santini, and G. Amoretti,
Physical Review Letters 94, 190501 (2005)
Cited 104 times (Web of Science)
 - 8) ["Molecular engineering of antiferromagnetic rings for quantum computation"](#)
F. Troiani, A. Ghirri, M. Affronte, S. Carretta, P. Santini, G. Amoretti, S. Piligkos, G. Timco, R. E. P. Winpenny
Physical Review Letters 94, 207208 (2005)
Cited 252 times (Web of Science)
 - 9) ["High-finesse optical quantum gates for electron spins in artificial molecules"](#)
F. Troiani, U. Hohenester, and E. Molinari,
Physical Review Letters 90, 206802 (2003)
Cited 92 times (Web of Science)
 - 10) ["Exploiting exciton-exciton interactions in semiconductor quantum dots for quantum-information processing"](#)
F. Troiani, U. Hohenester, and E. Molinari
Physical Review B 62, R2263 (2000)
Cited 173 times (Web of Science)

Teaching

- PhD course entitled "Quantum optics"; PhD in Physics; Università di Modena e Reggio Emilia; Years: 2010, 2011, 2013.
- Master's degree course entitled "Introduction to quantum-information processing"; Master's degrees in Mathematics, Computer science, and Computer engineering; Università di Modena e Reggio Emilia; Years: 2020, 2021, 2022.

Other information

- Tutoring of 3 Master's degree, 4 PhD students.
- Reviewer of scientific journals, including: Physical Review Letters, Physical Review A,

Physical Review B, Physical Review X, Physical Review Applied, Nature Materials, Nature Physics.

According to law 679/2016 of the Regulation of the European Parliament of 27th April 2016, I hereby express my consent to process and use my data provided in this CV.

Modena, 19th April 2022

Dr. Filippo Troiani

