

## PERSONAL DATA

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PLACE AND DATE OF BIRTH: Tehran, Iran, 22 Dec 1981.  
CITIZENSHIP - RESIDENCE: Iran - Italy.  
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## EDUCATION

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- 2011-2014 PhD in PHYSICS, **University of Camerino**, Italy.  
First class with excellency | Major: NANOPHYSICS  
Thesis: "Synthesis and characterization of novel nanostructures based on Si and Ge."  
Advisor: Prof. Nicola Pinto.
- 2007-2009 M. Sc. in PHYSICS, **University of Pune**, India.  
Grade B First class.  
Thesis: "Synthesis and characterization of the metal nanoparticles for model catalyst."  
Advisor: Prof. S. D Sartale.
- 2000-2004 B. Sc. in ATOMIC PHYSICS, **Azad University of Tehran**, Iran.

## RESEARCH EXPERIENCE

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- DEC 2016-PRESENT | PostDoc fellow (TRIL Fellow) at Institute of material science, CNR, Elettra, Italy.  
PROJECT TITLE: OPTICAL CHARACTERIZATION OF POLYMERIC SOFT MATTERS BY SOFT X-RAY RADIATION .
- DEC 2014-DEC 2016 | PostDoc fellow in European project SIRBATT under supervision of Prof. Andrea Di Cicco, University of Camerino, Camerino, Italy.  
PROJECT TITLE: ADVANCED SPECTROSCOPY OF NOVEL ANODE NANOMATERIALS IN LITHIUM ION BATTERIES.
- JUN-DEC 2014 | Research assistant at University of Camerino, INRiM Torino, Italy.  
PROJECT TITLE: LOW DIMENSIONAL SUPERCONDUCTIVITY.
- MAR-DEC 2014 | Research assistant at University of Camerino, INRiM Torino, Italy.  
PROJECT TITLE: FABRICATION OF OPTO-MECHANICAL RESONATORS.
- JUN 2011-JUN 2014 | PhD student at University of Camerino, Camerino, Italy.  
PROJECT TITLE: SYNTHESIS AND CHARACTERIZATION OF NOVEL NANOSTRUCTURES BASED ON SI AND GE.
- 2010-2011 | Visiting researcher at National Central University, Taiwan.  
PROJECT TITLE: METAL OXIDE NANOPARTICLES AS MODEL CATALYST.
- 2009-2010 | Research assistant at University of Pune, India.  
PROJECT: SYNTHESIS AND CHARACTERIZATION OF METALLIC NANOPARTICLES.

## RESEARCH INTERESTS

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### 1- X-ray absorption spectroscopy.

Ex-situ, In-situ measurements using hard and soft x-ray sources either at synchrotron radi-

ation sources. Project definition, sample preparation, Proposal submission for synchrotron measurements. Analysis of short and long range structure by X-ray near edge structure and extended X-ray absorption spectroscopy. Data preparation and normalization using various codes based on the measurement methods and data simulation and analysis based on the various theoretical models such as muffin tin approximation, full potential approximation and ligand field multiplet approximation.

**Recent results:** Studies of the structure and phase evolution of the novel nano-materials used in lithium ion batteries (ex-situ and in-operando) by combination of several X-ray spectroscopies such as total electron yield, total fluorescence yield, X-ray photoemission and Auger electron spectroscopy using sources at ESRF, SOLEIL and Elettra under framework of the European project SIRBATT. Studies were carried out on several novel materials such as  $\text{ZnFe}_2\text{O}_4$ ,  $\text{LiMn}_2\text{O}_4$  and  $\text{Li}_4\text{Ti}_5\text{O}_{12}$  with a precise chosen stage of the lithiation process. These studies has resulted in identification of the formation and structure evolution of the active material [2,3,20,21] and furthermore solid electrolyte interface formed upon lithiation in these materials. These results introduced new mechanism occurring during formation of these superficial layers such as reversible layers formed on top and its role on the performance of the battery, while explained the previously reported questions [1,9,18,24,25]. Using soft X-ray it was possible to identify the possible effect of the binder used in these anodes as well. A complete chemical and spatial map of the different layers (formed during operation) and their evolution could be also constructed by combination of different methods such as total electron yield (TEY) and total fluorescence yield (TFY) and Auger electron yield (AEY) [18].

## 2- Fabrication and characterization of nanostructures.

Fabrication of low dimensional system such as metallic 2D films and semiconducting (and diluted semiconducting) nanowires (1D) and nano particles (quantum dots) by different methods such as sputtering, molecular beam epitaxy and electro-less deposition.

**Recent results:** The fabrication of single crystalline and defect free germanium nanowires by vapor liquid solid method and study their growth mechanism [13] as well as endotaxial growth of the semi metallic magnetic nanowires [26]. Supersaturation state phase properties and effect in growth of the nanowires [11]. These result evidenced several factors that has not been considered in the growth models and explained the resulting effect such as growth hindrance, the geometry of nanowires. Furthermore, the top down approach to have a controlled nanowire growth in a large area of silicon and germanium nanowires using colloidal lithography, metal assisted etching and an invented method of anodic metal assisted etching [6,7]. Within this study large area crystalline and porous Si nanowires was achieved while a mechanisms for the metal assisted process in presence of different doping of the wires was suggested. These results allowed for the first time to have a control over the dimension and morphology of the nanowires to be used in quantum devices.

## 3- Fabrication and characterization of quantum devices.

Fabrication of the quantum devices using semiconductor nanowires with pre-designed structures by Focused ion beam and electron beam lithography in combination with optical lithography.

**Recent results:** Quantum devices fabrication using single nanowires of Germanium and Silicon with pre-designed structures via a complicated method combining different lithography methods in several stages from optical lithography (Micro contact pad to be connected to the measurement system), Electron beam lithography (First stage contacts to be connected to the pads) and focused ion beam lithography (second stage contacts to be contacted to the first stage). Furthermore, samples of diluted magnetic semiconductors were fabricated and contacted [5,8,10].

#### 4- Electronic transport in low dimensional systems.

Electronic transport measurements in low dimensional system via different geometries such as van der paw, four contacts and hall bar, based on the properties of the structure under measurement as a function of temperature. Automation and enhancement of the control of the temperature in closed cycle cryostat. Design and fabrication of the heating system in cryostat to extend the temperature range from 4 to 700 K and utilizing virtual instrument programming based on the PID model with a resolution of 0.01 K. Analysis and modelling of the measurement data. Design and fabrication of the electronic transport measurement set up with a high signal to noise ratio (due to a low signal of the quantum devices).

**Recent results:** Single nanowire devices with different structures were measured by the designed set up. Several enhancements and novel phenomena were detected in these structures such as: strong electron-electron interaction in Au doped Ge nanowires due to introduction of a large density of the state in the gap of germanium by the oxide covering layer and acting as a compensation mechanism for the donor levels [8]. In Si nanowires with embedded quantum dots or percolative current path, thermally active tunnelling between quantum dots and variable range hopping mechanism were observed both of which resulting from the reduced dimension of the system [10].

#### 5- Superconductors and hybrid systems at low dimensions.

Fabrication of superconducting structures such as ultra thin films and nano-stripes. Controlled RF/DC magnetic sputtering up to few monolayers of metallic film. Fabrication of nanostripes by Electron beam lithography and diblock copolymers to achieve a lateral size of 10 nm. Fabrication of the superconducting hybrid structures by semiconducting or normal state metal quantum wires in junction with the superconducting state metal. Electrical properties of the fabricated structures with a designed high precision method by closed cycle cryostat and liquid He<sup>4</sup> cryostat in the range of 3-300 K and 300 mK-100 K.

**Recent results:** In the framework of FAR-CESMN project, high quality 2D Nb structures (a type II superconductor) were fabricated and measured for the critical temperature, critical current, the T<sub>c</sub> band, The upper magnetic limit and lower magnetic limit. Around d = 25 nm normal and superconducting state properties of the Nb nanofilm display an abrupt change in their behaviour. Below 25 nm of thickness, superconductivity becomes progressively 2D, realizing a 3D-2D dimensional crossover. Approaching d = 10 nm, novel quantum phenomena not yet observed in Nb nanofilms start to emerge: the overall TC drop for decreasing d, remaining oscillations of TC(d) indicate incipient quantum size effects and shape resonances emerging. Amplification of the upper critical magnetic field is also observed that is associated with a considerable shrinking of the Cooper pair size [19,23].

### TEACHING EXPERIENCE

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MAR 2012- JUL 2014 | Teaching assistant at University of Camerino, Camerino, Italy.  
COURSE: GENERAL PHYSICS.

JULY 2013 | TFA Professor at UNIVERSITY OF CAMERINO, Camerino, Italy.  
COURSE: SENSORS AND DATA ACQUISITION LABORATORY.

### AWARDS AND RECOGNITIONS

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- 2016 TRIL fellowship Grant, International institute of theoretical physics (ICTP), Italy.
- 2014 Post-Doc fellowship Grant, SIRBATT, University of Camerino, Italy.
- 2014 Borsa di studio, Regional project FAR, Regione Marche, University of Camerino, Italy.
- 2011 PhD scholarship, University of Camerino, Italy.
- 2010 Visiting researcher grant, National central university, Taiwan.
- 2009 M.R. Bhide Award, Raman memorial conference, India.

## CONFERENCES AND PRESENTATIONS

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### Talks

- 2016 SILS workshop, Bari, Italy.  
SEI dynamics in metal alloying anodes by soft x-ray absorption and photoemission spectroscopy.  
Contributed talk.
- 2016 SIRBATT semester meeting, Warsaw, Poland.  
Progress in understanding of solid electrolyte inter-phase.  
Invited speaker on behalf of Prof. A. DiCicco.
- 2016 Ultrathinsuper conference, University of Camerino, Camerino, Italy.  
Structurally induced density of states in porous Si nanowires.  
Invited Speaker.
- 2015 Understanding Lithium Battery Interfaces, Bilbao, Spain.  
Structural evolution of SEI in ZFO and graphite electrodes.  
Invited Speaker.
- 2014 Functional and advanced materials FNMA16 workshop, Camerino, Italy.  
Temperature dependence of diffusion induced Ge nanowire grown by MBE  
Invited speaker.
- 2014 Nanosea 2014, Marseilles, France.  
Effect of deposition parameters on Diffusion Induced Germanium Nanowires by MBE.  
Contributed talk.
- 2012 Nanosea 2012, Sardinia, Italy.  
Growth of diluted magnetic germanium nanowires using manganese nano-droplets  
Contributed talk.
- 2010 Raman memorial conference, BARC, Vedora, India.  
Study on TiO<sub>2</sub> thin films prepared by thermal oxidation of dc magnetron sputtered Ti thin films  
Contributed talk.

### Poster presentation

- 2015 SILS 2015 Workshop, Trento, Italy.  
SEI formation in Li-ion electrodes probed by As K-edge X-ray absorption spectroscopy.  
Poster presentation.
- 2015 8th conference in advanced batteries for automotive applications, Bilbao, Spain.  
Probing the evolution of the SEI in Li-ion cells by As K-edge X-ray absorption spectroscopy.  
Poster presentation.
- 2014 Multi-Condensate Superconductivity and Superfluidity in Solids and Ultra-cold Gases, Camerino, Italy.  
Control and enhancement of superconductivity by engineering materials at the nanoscale.  
Poster presentation.
- 2013 Scientific Day of university of Camerino, Italy.  
Sub 100 nm Si nanowires by colloidal lithography and metal assisted chemical etching.  
Poster presentation.
- 2012 Scientific Day of university of Camerino, Italy.  
Germanium nanowires grown by molecular beam epitaxy.  
Poster presentation.
- 2009 International workshop on advanced functional materials, National chemical lab, India.  
Poster presentation.
- 2009 54th Symposium of solid state physics, BARC, Vadodara, India.  
Fabrication and characterization of TiO<sub>2</sub>/P-Si heterojunction by thermal oxidation of sputtered Ti films.  
Poster presentation.

## Attendance

- 2017 Time resolved photoelectrons spectroscopy, NFFA, Area science park, Trieste, Italy.
- 2013 International school on simulation of nanomaterials, ICCMNM, Frankfurt Institute for advanced studies, Germany.
- 2013 Workshop on Semiconductor detectors for medical applications, INFN, Florence, Italy.
- 2013 International conference on radiation effect on semiconductor detector and devices, INFN, Florence, Italy.

## TECHNICAL SKILLS AND COMPETENCES

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- Ultra High Vacuum system operation, preparation and maintenance.
- Molecular Beam Epitaxy. Endotaxial nanowire fabrication. VLS nanowire fabrication.
- DC/RF magnetron sputtering systems.
- Thermal evaporation deposition.
- Electroless nano-fabrication.
- CBD nano-fabrication.
- Electron beam deposition.
- Low dimension semiconductor systems (2D,1D) fabrication and electrical measurement.
- Low temperature electrical measurements.
- Nanolithography.
- Electron beam lithography.
- Optical lithography.
- X-Ray spectroscopy such as XPS, XRD.
- Hard/Soft X-Ray absorption spectroscopy (@ Synchrotron ).
- Scanning Electron Microscopy.
- Raman and UV-Vis Spectroscopy.
- Atomic Force Microscopy.
- Electrochemical , Metal assisted and patterned etching of the semiconductors.

## PROFESSIONAL ACTIVITIES

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- Referee for Journal of Crystal Growth, Elsevier.
- Referee for Journal of Nanoresearch letters, Springer.
- Referee for Journal of Physics D, Applied Physics, IOP.
- Member of Italian synchrotron radiation society (SILS).
- Member of scientific group of BEAR beam line (Elettra).

## AFFILIATIONS

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- Istituto Officina dei Materiali (IOM), Italian National Research Council (CNR), Trieste, Italy.
- International institute of theoretical physics, Trieste, Italy.
- Istituto Nazionale di Fisica Nucleare (INFN) Sezione Perugia, Italy.
- Istituto nazionale di Ricerca metrologica (INRiM), Torino, Italy.

## COMPUTER SKILLS

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- Windows, Linux.
- Programming in C++, NI-Labview, Python.
- Mathematica, Matlab.
- Latex, MS Office.
- AutoCad
- Gnxas, Athena.

## LANGUAGES

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ITALIAN: Fair.  
ENGLISH: Fluent.  
FRENCH: Basic Knowledge.  
PERSIAN: Native.

## LIST OF PUBLICATIONS

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- 1- | Is the Solid Electrolyte Interphase an extra-charge reservoir in Li-ion batteries?  
S. J. Rezvani, R. Gunnella, A. Witkowska, F. Mueller, F. Nobili, M. Pasqualini, S. Passerini and A. Di Cicco.  
**ACS Applied materials and interfaces**, **9**, 45704576 (2017).
- 2- | Development of non-fluorinated electrode based on  $\text{Li}_3\text{V}_{1.95}\text{Ni}_{0.05}(\text{PO}_4)_3/\text{C}$  with prolonged cycle life: A comparison among Na-Alginate, Na-carboxymethyl cellulose and poly(acrylic acid) binders  
M. Secchiaroli, S. Calcaterra, H. Y. Tran, S. J. Rezvani, F. Nobili, R. Marassi, M. Wohlfahrt-Mehrensa and S. Dsokea.  
**Journal of The Electrochemical Society** **164** (4), A672-A683 (2017).
- 3- | Double-edge x-ray absorption study of  $\text{LiFe}_{1-x}\text{Ni}_x\text{PO}_4$  cathode materials  
Marco Minicucci, Lubna Tabassam, Riccardo Natali; Giorgio Mancini; S. J. Rezvani and Andrea Di Cicco.  
**Journal of materials science** **52** (9), 4886-4893 (2017)
- 4- | New Developments in HPGe Detectors for High Resolution Detection  
D.R. Napoli, G. Maggioni, Sara Carturan, J. Eberth, V. Boldrini, Davide De Salvador, Enrico Napolitani, P. Cocconi, G. Della Mea, Michele Gelain, R. Gunnella, M.G. Grimaldi, M. Loriggiola, Gino Mariotto, Nicola Pinto, W. Raniero, S. J. Rezvani, S. Riccetto, D. Rosso, F. Sgarbossa, S. Tati  
**Acta Physica Polonica Series B** **48(3):387** (2017).
- 5- | Electrical contacts on Silicon nanowires prepared by metal assisted etching: A comparative approach.  
Luca D'Ortenzi, Rosalia Monsu, Eleonora Cara, Matteo Fretto, Seifeddine Kara, S. J. Rezvani, Luca Boarino.  
**Nanoscale Research Letters** **11** (1), 468 (2016).
- 6- | Effect of carrier tunnelling on the structure of metal assisted etched Si nanowires  
S.J. Rezvani, N. Pinto, L. Boarino, F. Celegato, L. Croin, D. Antonioli, M. Fretto, P. Rizzi.  
**Nanotechnology**, **27**, 34 (2016).
- 7- | Rapid formation of single crystalline Ge nanowires by anodic metal assisted etching  
S. J. Rezvani, L. Boarino, N. Pinto.  
**CrystEngComm**, **18**, 7843 (2016).
- 8- | Geometrically induced electron-electron interaction in semiconductor nanowires  
N. Pinto, S. J. Rezvani, L. Favre, I. Berbezier, M. Fretto and L. Boarino.  
**Applied physics letter**, **109** (2016).
- 9- | Local structure and stability of SEI in graphite and ZFO electrodes probed by As K-edge absorption spectroscopy  
S. J. Rezvani, M. Ciambezi, R. Gunnella, M. Minicucci, M. A. Munoz, F. Nobili, M. Pasqualini, S. Passerini, C. Schreiner, A. Trapananti, A. Witkowska and A. Di Cicco.  
**J. Phys. Chem. C** , **120**, 42874295 (2016).
- 10- | Thermally activated tunneling in porous silicon nanowires with embedded Si quantum dots  
S. J. Rezvani, N. Pinto, E. Enrico, L. D'Ortenzi, A. Chiodoni and L. Boarino.  
**Journal of Physics D**, **49**, 10 (2016).
- 11- | Supersaturation state effect in diffusion induced Ge nanowires growth at high temperatures  
S. J. Rezvani, L. Favre, F. Celegato, L. Boarino, Isabelle Berbezier and N. Pinto.  
**Journal of Crystal Growth**, **436**, 51-55 (2015).
- 12- | Wet chemical treatments of high purity Ge crystals for  $\gamma$ -ray detectors: Surface structure, passivation capabilities and air stability  
S. Carturan, G. Maggioni, S.J. Rezvani, R. Gunnella, N. Pinto, M. Gelain, D.R. Napoli.  
**J. Material Chemistry and Physics**, **16**, 116-122 (2015).

- 13- Diffusion Induced effects on geometry of Ge nanowires by MBE  
S. J. Rezvani, F. Celegato, L. Boarino, L. Favre, I. Berbezier, N. Pinto.  
**Nanoscale**, **6**, 7469-7473 (2014).
- 14- Influence of Ti film thickness and oxidation temperature on TiO<sub>2</sub> thin film formation via thermal oxidation of sputtered Ti film  
 S. D. Sartale, A.A. Ansari, S.J. Rezvani.  
**Science in Semiconductor Processing** **16**, 2005 (2013).
- 15- Study on TiO<sub>2</sub> thin films prepared by thermal oxidation of dc magnetron sputtered Ti thin films  
S. J. Rezvani, A.A. Ansari, S.D. Sartale.  
**J. DAE Solid state physics** , Vol 54, M02, 139 (2009).
- 16- Fabrication and characterization of TiO<sub>2</sub>/P-Si heterojunction by thermal oxidation of sputtered Ti films  
 A.A. Ansari, S. J. Rezvani, S.D. Sartale.  
**J. DAE Solid state physics**, Vol 54, J40, 963 (2009).

## PUBLICATIONS UNDER REVIEW

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- 17- Binder induced structural evolutions effect on Li ion battery performance  
S. J. Rezvani, R. Gunnella, A. Witkowska, F. Nobili, M. Pasqualini, S. Passerini and A. Di Cicco.  
**Physical chemistry chemical physics**.
- 18- SEI dynamics in metal oxide conversion electrodes of Li ion batteries.  
S.J. Rezvani, R. Gunnella, F. Nobili, S. Passerini, A. Mushtaq and A. Di Cicco.  
**ACS Advanced materials and interfaces**.
- 19- Superconducting Properties of High Quality Niobium Nano-films at the 3D-2D Crossover  
 N. Pinto, S.J. Rezvani, A. Perali, L. Flammia, C. Cassiogo, N. De Leo, M. Fretto and V. Lacquaniti.  
**Nature scientific report**.
- 20- Structure reordering in metal alloying oxide spinel structures upon lithium insertion  
 S. J. Rezvani, Y. Mijiti, R. Gunnella, F. Nobili, M. Minicucci, M. Ciambezi, A. Trapananti and A. Di Cicco.  
**Physical Review B**.
- 21- Enhancement of interfacial stability of LiMn<sub>2</sub>O<sub>4</sub> cathode by Al<sub>2</sub>O<sub>3</sub> coating: electrochemical and spectroscopic characterization  
 Marta Pasqualini; Silvia Calcaterra; Fabio Maroni; S. J. Rezvani; Andrea Di Cicco; Sam Alexander; Hanna Rajantie; Roberto Tossici; Francesco Nobili.  
**Journal of The Electrochemical Society**.

## PUBLICATIONS- UNDER PREPARATION

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- 22- Optical properties of the 25 nm Si<sub>3</sub>N<sub>4</sub> membranes fabricated by wet chemical etching by soft X-ray spectroscopy.  
S.J. Rezvani, A. Giglia, K. Koshmak, L. pasquali and S. Nannarone.
- 23- Proximity effect in Nb-Si nanowire hybrid junctions.  
 A. Perali, S.J. Rezvani, M. Fretto, N. DeLeo, N. Pinto and L. Boarino.



- 24- | Effect of Alumina coating on the performance of the  $\text{LiMn}_2\text{O}_4$  cathode and its solid permeable interface.  
S.J. Rezvani, R. Gunnella, F. Nobili, F. Maroni and A. Di Cicco.
- 25- | Solid electrolyte interface evolution of LTO anodes evidenced by soft x-ray absorption spectroscopy.  
R. Gunnella, S.J. Rezvani, A. Yimin, F. Nobili, S. Calcaterrai, S. Passerini, and A. Di Cicco.
- 26- | Endotaxial growth of semi metallic nanowires by Molecular beam epitaxy.  
S.J. Rezvani, F. Celegato, L. Boarino, L. Favre, N. Pinto, I. Berbezier.
- 27- | Modulation of memory effect in crystalline  $\text{Mn}_5\text{Ge}_3$  nanoparticles.  
S.J. Rezvani, F. Celegato, G. Guilli, L. Boarino, F. D'Orazio, N. Pinto.