GENERALITIES

Place and date of birth	Padova, 12 aprile 1964.
E-mail	alberto.quaranta@unitn.it
Citizenhood	Italian

CURSUS STUDIORUM

1982	Classical High School Diploma.
22 marzo 1989	Physics Master degree at Padua University.
1993	PhD degree in Physics at the Physics Department of Padua University. Thesis: "Study of the diffusion process of metal ions in glasses for integrated optics".
1992-1994	Scholarship at the INFM Padua section, Physics Department.
1995	Post-doc position in the field of Physical Sciences at Padua University.

ACADEMIC POSITIONS

July 1995- Sept 2006	Assistant Professor at Engineering Faculty, University of Trento, in the scientific area B03X (Matter Structure), then FIS/03 (Physics of Matter).
Sept 2006 – Feb 2016	Associate Professor at the Engineering Faculty and the at the Industrial Engineering Department of Trento University in the scientific area FIS/01 (Experimental Physics).
Feb 2016 to present	Full Professor at the Industrial Engineering Department of Trento University in the scientific area FIS/01 (Experimental Physics), sector 02/B1 (Experimental Materials Physics)

TEACHING ACTIVITIES

Between 1992 and 1995 Alberto Quaranta held lectures for the Engineering and Physics Laboratory of Padua University. Since 1995 he is teacher of the Engineering Faculty an then of the Industrial Engineering Department of Trento University. He was teacher of the courses: *Physics 3* (wave and optics), *Physics 2* (electromagnetism, wave and optics), *Physics for the Viticulture and Enology Inter-academic Course*, *Solid State Physics* e *Surface Physics*. Moreover, he gave lectures for the corse of *Materials Characterizations* and *Physics Laboratory*. Since 2001 he is teacher of the Doctorate School of Materials Engineering and, now, of the Doctorate School on Materials, Mechatronics and System Engineering, teaching at the courses *Optical Properties of Materials* and *Optical Properties of Nanomaterials*. He was tutor for 6 PhD theses, 10 Master theses, 23 Bachelor theses e co-tutor of some theses of Venice and Padua Universities.

The surveys on the teaching quality point out a high satisfaction level for courses held by Alberto Quaranta, at levels higher than the Faculty and Department averages.

At present Alberto Quaranta is coordinator of the Master Course Materials Production and Enginnering at the Department of Industrial Engineering in Trento.

THESES

Tutor of 9 PhD theses at the Industrial Engineering Department, University of Trento.

Tutor of 15 Master theses for the Materials Engineering Master course.

Tutor of 35 Bachelor theses for the Industrial Engineering Bachelor course, University of Trento.

Co-tutor of 2 Master theses for the Physics Master course, University of Padua.

Co-tutor of 2 Master theses for the Environmental and Ambiental Engineering Master course, University of Trento.

ORGANIZATION ACTIVITIES

Alberto Quaranta was member of the scientific committee of three International Congresses and on National Congress. He was also principal organizer of an International Congress and of 2 International Summer Schools. He was member of two commissions for competition for Assistant Professor and of several commissions for the assignment of PhD degrees.

At present Alberto Quaranta is **local coordinator of the 5th Commission INFN Group at TIFPA** (Trento Institute of Fundamental Physics and Applications).

ROLES IN EXPERIMENTS AND SCIENTIFIC PROJECTS

Summary

Alberto Quaranta has been:

- National scientific chairman of 2 5th Commission INFN experiments (ORIONE, HIDE).
- Local Unit scientific chairman of 4 5th Commission INFN experiments (ASTHICO, LUPO, NADIR, AXIAL).
- Scientific chairman of a Cooperation and Research project of the Trento Cooperation Federation.
- WP Coordinator of an ERA-NET Consortium for Nuclear Physics Infrastructures project , entitled NEutron DEtector developments for Nuclear Structure, Astrophysics and Applications (NEDENSAA).
- Chairperson for experiments at facilities of three foreign laboratories and a national INFN laboratory.
- Scientific chairman of 5 contracts with private companies for the Department.
- Referee of International projects.
- Members of research groups of PRIN e INFN projects.

At present he has a technological research assignment at the national scientific centre TIFPA (Trento Institute of Fundamental Physics and Applications).

CONGRESSES

Alberto Quaranta has been invited speaker at 3 international congresses and at a national congress. He was speaker at 14 international congresses and at an International School. He gave 8 invited seminars at Italian Universities and International Research Centers.

SCIENTIFIC ACTIVITY

Summary

Alberto Quaranta worked as a scientist from 1990 to 1995 at the Physics Department of University of Padua and since 1995 at the Department of Materials Engineering, then Department of Materials Engineering and Industrial Technologies and now Department of Industrial Engineering of the University of Trento.

Moreover, from 1995 to 2006 he had the Scienfic Association at the INFN – Legnaro National Laboratories, from 2006 to 2014 he had the Technological Research Nomination at the INFN – Legnaro National Laboratories and since 2015 he has the Technological Research Nomination at the INFN section of the Trento Institute of Fundamental Physics and Applications (TIFPA).

In general the research interests of Alberto Quaranta are related to the study of the optical properties of functional materials for optoelectronics, chemical sensors and ionizing radiation detectors. In particular, the activity can be summarized by the following arguments:

- Study of the production and optical properties of ceramic materials containing doping ions or nanoparticles.
- Study of organic or hybrid functional materials for the realization of optical sensors for volatile organic compounds (VOCs).
- Study of new scintillating materials for ionizing radiation and neutron detectors.
- Study of the Ion Beam Induced Luminescence (IBIL) technique for materials analysis.

- Study of hybrid or ceramic materials for Luminescent Down Shifters (LDS) or Luminescent Solar Concentrators (LSC) for solar cells.

Moreover, Alberto Quaranta followed interdisciplinary research activities with scientists of different scientific areas. In particular, he worked on optical methods for the analysis of the pasteurization capability of supercritical fluids and for the light scattering analysis of biomasses. Finally, he developed the first studies on the use of IBIL for the analysis of cultural heritage materials.

The research activity of Alberto Quaranta is described by **140 papers published on peer reviewed journals** and by more than 30 publications on congress proceedings.

h-index	**28**
Total number of citations	**2535**

List of publications on ISI journals

[1] F. Gonella and **A. Quaranta**; "Stress induced birefringence in silver-diffused glass waveguides". *Journal of Modern Optics*, Vol. 39, no. 7, 1992, pp. 1401-1405.

[2] Francesco Gonella and **Alberto Quaranta**; "On the ricovery of refractive-index profiles of ion-exchanged glass waveguides". *Pure and Applied Optics*, Vol. 2, 1993, pp. 405-409.

[3] **A. Quaranta**, F. Gonella, F.C. Caccavale, G. Brusatin; "SIMS-RBS depth profiling of silver-diffused glass systems". *SIA, Surface and Interface Analysis*, Vol. 21, 1994, pp. 210-212.

[4] F. Gonella and **A. Quaranta**; "Refractive index profiles of double-silver-exchanged glass systems". *Journal of Modern Optics*, Vol. 41, no. 1, 1994, pp. 1-4.

[5] F. Gonella, F. Caccavale and A. Quaranta; "Secondary Ion Mass Spectrometry applied to the study of ion-exchanged glass waveguides with a few modes". *International Journal of Optoelectronics*, Vol. 9, no. 4, 1994, pp. 359-363.

[6] F. Caccavale, G. De Marchi, F. Gonella, P. Mazzoldi, C. Meneghini, **A. Quaranta**, G.W. Arnold, G. Battaglin, G. Mattei; "Irradiation-induced Ag-colloid formation in ion-exchanged soda-lime glass", *Nuclear Instruments & Methods*, Vol. B96, 1995, pp. 382-386.

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Degree in Electronics Engineering, University of Trieste, 1997 (110/110)

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Solid-state radiation detectors, instrumentation for nuclear medicine, instrumentation for high-energy physics and astrophysics.

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2014 - present: Chief Scientist of the "Radiation Detection and Imaging" line at FBK

2010 - 2014: CTO of the spin-off company AdvanSiD

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2008 - 2009: senior researcher at FBK-irst, MEMSRAD unit
Main activities:
- Coordination of the activity on silicon photomultipliers and high-resistivity radiation detectors.
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2002 - 2007: researcher at ITC-irst, SRD unit
Main activities:
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1999 - 2002: Borsa di Studio at Istituto Nazionale di Fisica Nucleare, Trieste (2 years) and Assegno di ricerca at University of Trieste (1 year)
Main activity:
- development of the silicon drift detector for the ALICE experiment at CERN.

Teaching
2002 - 2004 teacher assistant of Electronics I (University of Trento)

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- *2010* Award "Luigi Stringa - Research for Innovation" given by FBK for the activity carried out on Silicon Photomultipliers that led to the creation of the spin-off company AdvanSiD, 2010.

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ISTITUTO NAZIONALE DI FISICA NUCLEARE
LABORATORI NAZIONALI DI LEGNARO

Legnaro, 25 marzo 2014

Oggetto:Curirculum vitae di Graziano Fortuna

Il Sottoscritto si è laureato nel 1973 discutendo una tesi sperimentale di Spettroscopia Gamma. Il Lavoro di tesi si era svolto presso la Technical University di Monaco di Baviera , dove a partire dal 1972, ha trascorso diversi periodi di Studio e Ricerca. Fino al 1985 , l'attività ha riguardato lo studio, da un punto di vista sperimentale, della fenomenologia delle reazioni nucleari indotte da ioni pesanti ad energie intorno e sotto la barriera di interazione. A partire dal 1985 si è occupato di acceleratori sia a temperatura ambiente che superconduttivi. E' stato Responsabile della progettazione e realizzazione del progetto ALPI presso i Laboratori Nazionali di Legnaro (LNL) dell'INFN. Dal 1991 è Dirigente di Ricerca presso i LNL dell'INFN.

Dall'inizio degli anni 90, si è occupato, essenzialmente, di attività di gestione di strutture e programmi di ricerca, sia a livello nazionale che europeo, di progettazione nell'ambito degli acceleratori ad alta intensità e di produzione ed accelerazione di fasci instabili di prossima generazione, da utilizzarsi in studi di struttura nucleare, in campi interdisciplinari che fanno uso di fasci di ioni, tecniche e metodi nucleari.

La produzione tecnico-scientifica nel periodo di riferimento è illustrata, essenzialmente, da Reports di progetti, quali:

- CNGS, in cui ha affiancato, per incarico dell'INFN, i progettisti della Divisione PS (1997-1998)
- SPES Project Study (1997-1998)
- SPES Technical Design for an advanced Exotic ion beam facility (1998-2002)
- EURISOL Project Study (2000-2002), in fase di stesura finale.
- EURISOL DESIGN STUDY

Ha diretto il gruppo di lavoro che si è occupato della costruzione del primo quadrupolo a radiofrequenza superconduttivo, costruito a livello internazionale, spianando la strada alla realizzazione del nuovo iniettore di ALPI, PIAVE dei LNL.

E' stato Membro della Commissione di Valutazione ENEA-INFN per i fondi ex L. 95/95, finanziamento 1996, destinati allo studio preliminare di un inceneritore di scorie radioattive, basato su un acceleratore ad alta intensità.

Ha costituito e coordinato un gruppo di lavoro sugli acceleratori ad alta intensità ed avviato le attività di progettazione della parte, a bassa energia, di un linac a protoni di intensità di 30 mA.

Quale delegato italiano al Mega Science Forum, ho partecipato all'attività dei due sottogruppi "Access to Large Scale Facilities" e "Radioactive Nuclear Beams".

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E' stato Membro del "Technical Committee CERN-INFN per il progetto CNGS - CERN Neutrino Beam to Gran Sasso".

Ha partecipato alla sottocommissione MURST dei delegati OCSE, presieduta da A. Bettini.

Dall'Agosto 1998 al Settembre 2004 ha assunto, per incarico del Consiglio Direttivo, la Direzione dei Laboratori Nazionali di Legnaro.

Il sottoscritto segnala inoltre di essere stato : Membro del NuPECC, Membro dell'"International Programme Committee" della "International Linac Conference", Membro del Comitato Scientifico di EPAC, Chairman del Consiglio Scientifico di GANIL, Co-Direttore Tecnico del progetto CNAO, Project Leader del progetto europeo EURISOL-DS.

Dal Luglio 2006 e' Membro della Giunta Esecutiva dell'INFN con compiti di supervisione delle attività di Fisica Nucleare e di progetti ad essa collegati quali FAIR, SPIRAL2, IFMIF, ESS. Di tali progetti è membro italiano negli organi di governo. Nell'ambito della GE si occupa inoltre di Risorse Umane .
Ha ricoperto la carica di Vice-Presidente dell'Istituto nel periodo novembre 2009 ,luglio 2012.
Per incarico del CD, è Direttore Straordinario del TIFPA dal gennaio 2013.

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- Iscrizione all'Elenco degli ***Esperti Qualificati*** di III grado

Maggio 1999 — FITA - Confindustria - ROMA
- Qualifica di "***Safety Auditor***" per i Sistemi di Gestione della Salute e Sicurezza sul Lavoro

Marzo 1996 — CUAO di Altavilla e Associazione Industriali di Vicenza
- ***Master*** per Responsabile Sicurezza e Ambiente Interno

Luglio 1994 — Università degli Studi di Padova
- ***Laurea in Fisica***

Luglio 1988 — Liceo Scientifico “Tron” - Schio
- Diploma di Maturità Scientifica

Esperienze Professionali

Dal 2015 — INFN – TIFPA - Trento
- Responsabile del Servizio di Prevenzione e Protezione
- Esperto Qualificato

Dal 1998 — INFN - Sezione di Padova
Primo Tecnologo (II livello professionale)
- Responsabile del Servizio di Prevenzione e Protezione
- Esperto qualificato
- Referente Trasferimento Tecnologico (dal 2016)

Dal 1996 al 98 — INFN - Laboratori Nazionali di Legnaro
Ricercatore
- Ricerca con il Gruppo di Radiobiologia dei L.N.L. (gruppo V)
- Collaborazione con il Servizio Prevenzione e Protezione dei L.N.L.

Dal 1996 al 97 T.N.G.-Telescopio Nazionale Galileo, Canarie - E
Collaborazione in materia di Igiene e Sicurezza

- Predisposizione del documento di valutazione dei rischi e del manuale per la sicurezza del TNG

1996 Ruote O.Z. S.p.A., San Martino di Lupari - PADOVA
Addetto Ufficio Tecnico Sicurezza

- Prevenzione e Protezione
- Collaborazione con l'Ufficio Personale per la formazione del personale

1995 M.R.C.- Radibiology Unit, Didcot - Oxon - U.K.
Ricercatore -

- Ricerca sugli Effetti Biologici delle Radiazioni.

Competenze Personali

Lingua madre ITALIANO

Altre lingue

	COMPRENSIONE		PARLATO		PRODUZIONE SCRITTA
	Ascolto	Lettura	Interazione	Produzione orale	
INGLESE	B	C	B	B	A

Competenze Comunicative

Competenze comunicative molto buone acquisite attraverso appositi corsi per formatori consolidate grazie a numerose docenze riportate in allegato.

Competenze Organizzative e Gestionali

Possiedo ottime capacità organizzative e gestionali acquisite collaborando, all'inizio dell'attività lavorativ,a con l'ufficio risorse umane di Ruote O.Z. SpA e in seguito pefezionata grazie ai numerosi incarichi di Responsabile di Servizio, Responsabile di Gruppi di Lavoro e di Progetti in ambito INFN.
Un contributo importante allo sviluppo delle competenze organizzative e gestionali è venuto dai numerosi incarichi ricoperti in ambito amministrativo tra il ruolo di Assessore al Comune di Padova ricoperto dal 2009 al 2014.

Competenze Informatiche

Padronanza degli strumenti informatici necessari per Comunicazione, Gestione ed Elaborazione dati.

Competenze Professionali

Ho acquisito riconosciute conoscenze professionali nel campo della Radiobiologia, della Sicurezza sul Lavoro e della Radioprotezione.

Elenco le principali tematiche di cui mi sono occupata:

- Dopo la laurea in fisica ho lavorato come ***ricercatrice*** presso i Laboratori Nazionali di Legnaro e il Medical Research Council - Radibiology Unit, di Didcot, UK, dove mi sono

occupata principalmente dello studio degli ***effetti biologici delle radiazioni***. (dal 1994 al 1998)

- Ho contemporaneamente iniziato ad occuparmi di ***Sicurezza sul Lavoro*** e ***Radioprotezione***.
- Ho lavorato per circa 8 mesi alla ***Ruote OZ S.p.A*** di San Martino di Lupari (PD) presso l'Ufficio Tecnico Sicurezza (1996)
- Ho iniziato nel 1996 ad occuparmi di tutela della Sicurezza e Salute dei lavoratori in Istituti di ricerca, collaborando con il ***Telescopio Nazionale Galileo*** installato dal Dipartimento di Astronomia dell'Università di Padova alle Isole Canarie.
- Dal 1998 sono dipendente della Sezione di Padova dell'***Istituto Nazionale di Fisica Nucleare*** (INFN) dove ricopro il ruolo di Responsabile del Servizio Prevenzione e Protezione e di Esperto Qualificato per la Radioprotezione.
- Ho coordinato il Gruppo di Lavoro nominato a livello nazionale dall'INFN per l'applicazione del ***Testo Unico*** in materia di tutela della salute e della sicurezza nei luoghi di lavoro
- Per l'INFN ho fatto parte di ***Commissioni*** di Gara per Appalti e di Commissioni per l'assunzione di personale, occupandomi anche di Procedure per gli Appalti Pubblici di lavori, servizi e forniture.
- Faccio parte del ***gruppo di lavoro internazionale*** che collabora nell'analisi dei rischi nei grandi laboratori di fisica nucleare e di fisica delle alte energie presenti in Europa e Nord America.
- Sono spesso invitata come relatrice a ***Seminari*** e partecipo con contributi personali a Congressi nazionali e internazionali. Sono autrice di elaborati tecnici e materiale informativo in materia di Prevenzione e Protezione
- Tengo ***corsi di formazione*** in materia di Radioprotezione, Salute e Sicurezza sul lavoro, applicazione di norme tecniche e di Direttive di prodotto, anche come docente di alcuni Master internazionali organizzati dall'Università di Padova e dalla Regione Veneto.

ALLEGATI

Allego:

- Lista Pubblicazioni
- Attività di Formazione

Autorizzo il trattamento dei miei dati personali ai sensi del Decreto Legislativo 30 giugno 2003, n. 196 "Codice in materia di protezione dei dati personali".

Aggiornamento: dicembre 2016

Curriculum Vitae

(Last updated on October 2016)

Pietro Faccioli

Date and Place of Birth:	February 14-th 1974, Verona, Italy.
Citizenship:	Italian
Present Position:	Associate Professor
Scientific Sector:	Theoretical Physics (MIUR codes: SC-02A2 & SSD-FIS02)
Working Address:	Dipartimento di Fisica, Universita' degli Studi di Trento 15 Via Sommarive, Povo (Trento), I-38050 Italy
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Email:	`pietro.faccioli@unitn.it`
URL:	pietrofaccioli.wix.com/physics
Other Affiliations :	Trento Institute for Fundamental Physics and Applications (INFN-TIFPA),

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TRAINING & ACADEMIC TITLES

Academic Titles

- PhD, SUNY at Stony Brook, USA (2002)
- MA, SUNY at Stony Brook, USA (2002)
- Laurea (Diploma Degree) in Physics from the Trento University. Final grade: "110/110 e lode" (1998).

Post-Doctoral Occupations

- 2002 - 2004 Post-doc at European Centre for Theoretical Studies in Nuclear Physics and Related Areas (ECT*)

Habilitations for Academic Position ("Abilitazione Scientifica Nazionale")

- National Habilitation for associate professor position in high-energy theoretical physics ("02/A2")
- National Habilitation for associate professor position in condensed matter theoretical physics ("02/B2")

Awards and Grants

- 2015-17: Trento University special grant for high-priority projects. Role: Co-PI.
- 2014-2016: Subcontracting from U. Maryland and the Alpha-1 Foundation
- 2009: CNRS grant supporting a long-term visit at the IPhT of CEA-Saclay (France).
- 2003, 2005, 2006, 2007, 2009: "Bruno-Rossi" grant within the INFN-MIT scientist exchange program, Cambridge (USA).
- 2001: "V. Gribov Young Talent in Theoretical Physics" prize, awarded by the "Ettore Majorana" International School in Subnuclear Physics, Erice (Italy)
- 1996: Imperial College International Diploma, London (awarded to the distinguished students at Imperial College in the academic year 1996-1997)

Extended Research Periods in Foreign Institutions

- From January through June 2009: visiting scientist at IPhT CEA-Saclay (France)
- 2003, 2005, 2006, 2007, 2009: "Bruno-Rossi" visiting scientist at MIT, Cambridge (USA)
- 1999-2002: PhD student at the SUNY at Stony Brook (USA).
- 1995-1996: Erasmus student at Imperial College (London).

PROFESSIONAL ACTIVITIES

Coordination Activities

- Coordinator for the Trento group of the "AD31" (2008-2013) and "NINPHA" (2015-2016) INFN scientific initiative for research in hadron physics
- Coordinator for the Trento group of the "BIOPHYS" INFN scientific initiative (2014-present)

Contribution to Academic Governance

- Co-organizer of the Deparment Colloquia ("Dialoghi di Dipartimento") (2006-2008).
- Member of the "Commissione Paritetica per la Didattica" (2012-present)
- Member of the "Commissione del Riesame" (2012-present)
- Co-responsible of the joint Master degree in Physics between Trento University and SISSA (2013-present)
- Co-responsible of the joint Master degree in Physics between Trento University and University of Tubingen (2014-present)
- Department Delegate for the Master Degree in Quantitative and Computational Biology (2014-present)
- Department Delegate at the University Center for Foreign Language Studies (2015-present)

Peer-Reviewing Activity

- Referee for the National Science Foundation (NSF) of USA, for grant proposals in molecular modeling.
- Referee for European Journal of Physics C, Physics Letters B, Physical Review D,C E, Physical Review Letters, Progress in Particle and Nuclear Physics, Journal of the American Chemical Society, Philosophical Magazine, Journal of Chemical Physics, Journal of Chemical Physics B, Journal of the Americal Chemical Society, New Journal of Physics, Journal of Applied Mathematics.
- External Member of the PhD Thesis Examining Committee of the Department of Applied Mathematics, Cambridge University, UK, February 2009
- External Member of the PhD Thesis Examining Committee of the Department Physics, Florence University, February 2012

Organization of Conferences and Schools

- Organizer of the 2nd International Workshop on "Applications of Theoretical Physics Methods in Biology", ECT* June 2010
- Co-organizer of the 1st International Workshop on "Applications of Theoretical Physics Methods in Biology", ECT* May 2005
- Co-organizer of the ECT* Doctoral Training Program 2006 on "Numerical Techniques in Strongly Interacting Systems".
- Co-organizer of the joint FBK-Trento University-INFN-CNR workshop on "Biophysics of Macromolecular Interactions", Trento, September 2009

Teaching and Mentoring

Academic Courses Given at the Undergraduate, Master and PhD level:

- Lectures of the Master course on *Modern Physics*, Trento University 2016
- Lectures of the Undergraduate course *Introduzione alla Meccanica Statistica*, Trento University, 2015
- Lectures of the Master course in *Statistical Field Theory*, Trento University, 2011- present.
- Lectures of the Master course in *Macro-Molecular Modeling*, CIBIO, Trento University, 2012-2015
- Lectures of the doctoral course on *Effective Field Theories*, Trento University, 2009.
- Lectures of the undergraduate course on *Computational Physics Applied to Macro-Molecules*, Trento University, 2006-2008.
- Recitations for the undergraduate course on *Nuclear and Sub-nuclear Physics*, Trento University, 2009
- Recitations for the undergraduate course on *Thermodynamics* ("Fisica Generale III UD"), Trento University, 2006-2010.
- Recitations for the undergraduate course on *Classical Mechanics* ("Fisica Generale I,II UD"), Trento University, 2006-2009.
- Lectures for the doctoral course on *Quantum Chromodynamics*, Trento University, 2005-2006.
- Recitations for the undergraduate course on *Electrodynamics and Relativity* ("Fisica Generale VI UD"), Trento University, 2005.
- Recitations for the undergraduate course on *Mathematical Calculus*, SUNY at Stony Brook, 1999.

- Recitations for the undergraduate course on *Experimental Physics*, SUNY at Stony Brook, 1999.

Master Theses Supervised:

- 2015 Fabio Mascherpa, Title: " Non-Perturbative Field-Theoretical Approach to Quantum Transport in Macromolecules"
- 2015 Simone Orioli, Title: "Renormalized Master Equation and Application to Molecular Dynamics."
- 2014 Francesco Segatta, Title: "A Mesoscopic Model of Charge Transport in Organic Semiconductors"
- 2011 Lorenzo Boninsegna, Title: "Quantum Transport in Conformationally Evolving Macromolecules"
- 2010 Guglielmo Mazzola, Title: "Thermal Fluctuations and Reaction Rates in High Dimensional Stochastic Systems"
- 2010 Matteo Bazzanella, Title: "1+1 Dimensional Quantum Field Theory Models for Thin Graphene Wires"
- 2008 Alice Lonardi, Title: "Dominant Pathways in the Folding of a β-Hairpin"
- 2008 Malte Tichy, Title: "The Scala Glueball in the Instanton Vacuum"
- 2008 Emmanuele Autieri, Title: "Dominant Reaction Pathways in Low-Dimensional Stochastic Systems"
- 2007 Raffaele Millo, Title: "Strong CP Violation in External Magnetic Fields"
- 2004 Marco Cristoforetti, Title: "Non-Perturbative QCD and Non-Leptonic Weak Decays of Hyperons" (co-adviseor)

PhD Theses Supervised:

- (2011-2014) Elia Schneider, Title: "Quantum Field Theory for Quantum Transport in Macromolecules"
- (2010-2013) Giorgia Cazzolli (co-supervising with P. Verrocchio). Title: "Dynamics of Conformational Transitions and (Un-)Folding of Proteins"
- (2010-2013) Roberto Covino Title: "Folding Pathways of Globular Proteins from All Atom Simulations"
- (2007-2010) Raffaele Millo, Title: "Instanton Theory and Stochastic Quantization"
- (2004-2007) Marco Cristoforetti, Title: "Instanton-Induced Chiral Dynamics in Hadrons"

Divulgation and Communication of Science

- "Per ogni proteina un'acrobazia", special article reporting on the LISC interdisciplinary research in biophysics, appeared on the national newspaper La Stampa (2011)
- "La danza segreta delle biomolecole", article on theoretical physics applied to biology appeared on "Sapere" (Italian magazine for science and technology for a non-specialist readership) (2011)

SCIENTIFIC RESEARCH

Summary of the Research Activity

The phenomenology of hadrons and bio-molecules display many common features, despite the huge gap in their characteristic energy/momentum scales. Most notably, in these systems the interactions cannot be treated as small perturbations, since key effective degrees of freedom are associated to collective many-body excitations. In addition, the interplay between strong correlations with quantum or statistical fluctuations gives raise to critical phenomena and can trigger the localization and confinement of quantum or classical excitations.

Realizing the existence of these analogies and common features has motivated my conviction that many powerful theoretical and computational methods originally developed in the framework of subnuclear physics could be exploited to overcome the existing limitations of the traditional computational approaches used in biophysics. For example, in my research I combine the path integral formalism, variational principles[26] and renormalization-group based approaches [23] with stochastic numerical algorithms in order to investigate the structural dynamics of proteins and RNA [14, 28]. I also develop a quantum effective field theories to investigate the dissipative transport of electronic excitations within the same biological molecules and in organic polymers [12, 7, 6].

Conversely, some numerical methods and theoretical tools which were originally developed in biological and chemical physics can be exported in context of nuclear and subnuclear physics. For example, we have recently showed that starting from a gauge theory it is possible to obtain an effective Langevin equation which describes the melting, diffusion and recombination of heavy quark mesons in super-hot plasma of light quarks and gluons [34, **?**]. Statistical mechanics and molecular dynamics algorithms have also been used to investigate the role of non-perturbative topological gluonic configurations (instantons, and dyons and monopoles) in the QCD matter, both below [46, 47, 48, 45, 44] and above the de-confinement temperature [31] and to project the complex gauge field dynamics into few slow collective dynamics, using lattice QCD simulations [33, 32].

Five-Year Research Plan

In the upcoming five years, the focus of my research activity will be on biophysics, with an emphasis on the investigation of the non-equilibrium dynamics of atomic nuclei (thermally activated conformational changes) and electronic structure (quantum energy transport) in proteins, membranes and nucleic acids.

On the one hand, part of my research will be aimed at developing the appropriate formalism and theoretical frameworks to simulate rare transitions and to describe quantum transport in open biomolecular systems. On the other hand, a significant part of the scientific effort will be devoted to phenomenological applications to realistic systems, with an emphasis of macromolecular processes

of potential biomedical or technological implications. Examples include the study of protein misfolding and conformational changes and the investigation of the quantum coherent energy transfer mechanisms in organic conjugate polymers and biological photosynthetic systems.

These research projects will be conducted in direct collaboration with several experimental groups, in particular the team led by Prof. P. Wintrode at U. of Maryland (USA) with which we have established a formal long term collaboration.

Senior Sollaborators

- Statistical and biological physics: H. Orland (CEA-Saclay), F. Pederiva (Trento), C. Micheletti (SISSA), P. Wintrode (U. Maryland at Baltimore, USA), A. Gershenson (UMass at Armhest, USA), R. Elber (U. Texas at Austin)
- Hadron structure and non-perturbative QCD: J.W. Negele (MIT), T. DeGrand (Colorado), E.V. Shuryak (Stony Brook), J.P. Blaizot (CEA-Saclay), M. Traini (Trento)

Invited Talks, Seminars and Lectures in International Schools

Invited Talks (since 2010)

- "Computational approaches to investigating allostery", CECAM CECAM-HQ-EPFL, Lausanne, October 2017
- March Meeting of the German Physical Society, Dresden March 2017.
- "The Proton Mass: At the Heart of Most Visible Matter", ECT* Workshop, Trento, February 2017
- "Challenges across Large-Scale Biomolecular and Polymer Simulations", CECAM Workshop, Vienna, Ferbuary 2017
- "Gauge Topology: from Lattice to Colliders", ECT* workshop, Trento November 2016.
- "Reaction Coordinates from Molecular Trajectories", Lorentz-CECAM Workshop, Leiden, September 2016.
- "6-th Visegrad Simposium on Structural Systems Bology" Warsaw, June 2016

- "From Trajectories to Reaction Coordinates: Making Sense of Molecular Simulation Data", CECAM Conference, Vienna September 2015
- Workshop on "Quantum Phononics", Heraklyon, Crete June 2015
- 2014 meeting of the "Italian Society for Pure and Applied Biophysics", Parlemo September 2014
- Conference on "Recent Advances in the Modeling of Rare Events" (Rare 2014), Kerala (India), June 2014.
- KITPC program on "Macromolecular dynamics: structure, function and diseases" Beijing 2014 (declined).
- Workshop on "Searching for Reaction Coordinates and Order Parameters", Telluride (USA), June 2014 (declined).
- Workshop on "The Physics of Protein Folding and Aggregation", Brixen (Italy), February 2014.
- Conference on "Energy Landscapes", Austria ,July 2012.
- Workshop on "Protein Dynamics", Telluride (USA), June 2012.
- Workshop on "The Physics of Protein Folding and Aggregation", Brixen (Italy), February 2012.
- Workshop on "Structural Bioinformatics and Computational Biophysics", SISSA Triest (Italy) July 2011.
- Conference on "Dynamics of Molecules (MOLEC2010)", Curia-Anadia (Portugal), September 2010.
- About **10 invited talks** in international conferences or workshops were delivered on topics related to Hardon Physics and QCD, in the period (2002-2013)

Lectures in International Schools

- Short course on "Statistical Field Theory", SISSA, Triest (Italy) Spring 2011.
- Lectures on "Advanced Simulation Methods for Biological Molecules", Finnish Doctoral Programme in Computational Sciences, Lammi (Finland), October 2010
- Invited lecture series on "Instantons, chiral dynamics and Lattice QCD", for the Doctoral School of Dipartimento di Fisica Teorica, Università di Torino, Spring 2004.

Invited Seminars in National or Foreign Institutions

Statistical and Biological Physics:

- Department of Chemisty, University of Padua, November 2013.
- School of Pharmacology, University of Maryland, Baltimore (USA), April 2013.
- National Institute for Health (USA), May 2013.
- Physics Department of University of Modena, February 2013.
- Physics Department of SUNY at Stony Brook (USA), June 2012.
- the Department of Chemistry, University of Cambridge (UK), February 2011.
- ETH, Lugano (Switzerland), February 2011.
- University of Texas at Austin (USA), December 2009
- Technischen Universität München (Germany), November 2009
- University of Orsay (Paris), February 2009
- University of Roma Tor Vergata (Italy), February 2009
- Stony Brook (USA), December 2008
- National Institute for Health, Bethesda (USA), December 2008
- University of Bayreuth (Germany), November 2008
- Institute de Physique Theorique, CEA-Saclay (France), February 2008
- National Institute for Health, Bethesda (USA) March 2007
- MIT, Cambridge (USA), November 2006
- Harvard University, Cambdridge (USA), November 2006
- Parma University (Italy), October 2006
- SISSA, Triest (Italy), January 2006

QCD and Hadron Structure

- Department of Applied Mathematics and Theoretical Physics (DAMPT), Cambridge University (UK), January 2010.
- Physics Department of Trieste University (Italy), May 2009

- Invited contribution to the Institute for Nuclear Theory program on " Exploration of Hadron Spectrum and Structure from Lattice QCD simulations", Seattle April 2006.
- Physics Department of the Genoa University (Italy), February 2005
- Massachussets Institute of Technology (MIT), Cambridge USA, December 2004
- Brookhaven National Laboratory (USA), November 2004
- Physics Department of the Stockholm University (Sweden), October 2004
- Department for Theoretical Physics of the Turin University, May 2004
- MIT, December 2003
- SUNY Stony Brook, December 2003
- the National Laboratory of Frascati (Rome), October 2003
- Physics Department of the Rome-3 University, February 2003
- Thomas Jefferson Laboratory, August 2002

Bibliography

Pubilshed Peer-Reviewed Papers

Statistical Mechanics, Condensed Matter and Biological Physics

[1] "Folding Mechanism of Proteins Im7 and Im9: Insight from All-Atom Simulations in Implicit and Explicit Solvent" , F. Wang, G. Cazzolli, P. Wintrode and PF, J. Phys. Chem. **B** 2016

[2] "Dimensional Reduction of Markov State Models from Renormalization Group Theory", S. Orioli and PF, J. Chem. Phys. **145** 124120 (2016)

[3] "Quantum propagation of Electronic Excitations in Macromolecules: A Computationally Efficient Multiscale Approach", E. Schneider, S. a Beccara, F. Mascherpa,, PF, Phys. Rev. **B 94**, 014306 (2016)

[4] "Variational Scheme to Compute Protein Reaction Pathways Using Atomistic Force Fields with Explicit Solvent", S a Beccara, L Fant, P Faccioli Phys. Rev. Lett. 114 (9), 098103 (2015)

[5] "Serpin Latency Transition at Atomic Resolution", G Cazzolli, F Wang, S a Beccara, A Gershenson, P Faccioli, PL Wintrode, Proc. Natl. Acad. Sci USA, 111 (43), 15414 (2014)

[6] "Long-Distance Quantum Transport Dynamics in Macromolecules", E. Schneider and PF, to appear in Phys. Rev. **B** 89, 134305 (2014)

[7] "Dissipative Quantum Transport in Macromolecules: An Effective Field Theory Approach", E. Schneider, S. a Beccara and PF, Phys. Rev. **B 88**, 085428 (2013).

[8] "The Role of Non-Native Interactions in the Folding of Knotted Proteins: Insights from Molecular Dynamics Simulations", R Covino, T ?krbi?, P Faccioli, C Micheletti Biomolecules 4 (1), 1-19 (2013)

[9] "Unfolding Thermodynamics and Molecular Adaptation of Cystein-Rich Proteins", G. Cazzolli, T.Skrbic, G. Guella and PF, Biomolecules **3**(4), 967(2013).

[10] "Folding of a Knotted Protein From with a Realistic All Atom Force Field", T. Skrbic, S. a Beccara, R. Covino, C. Micheletti and PF, PLoS Comp. Biol. **9**, e1003002 (2013).

[11] "Microscopically Computing Free-energy Profiles and Transition Path Time of Rare Macromolecular Transitions", PF and F. Pederiva, Phys. Rev. **E. 86**, 061916 (2012).

[12] " Quantum Charge Transport and Conformational Dynamics of Macromolecules", L. Boninsegna and PF, J. Chem. Phys. **136** 214111 (2012).

[13] "The Role of Non-Native Interactions in the Folding of Knotted Proteins", T. Skrbic C. Micheletti and PF, PLoS Comp. Biol. **8** e1002504 (2012).

[14] "Dominant Folding Pathways of a WW Domain", S. a Beccara, T. Skrbic, R. Covino and PF, Proc. Natl. Acad. Sci. USA **109** 2330 (2012).

[15] "Quantum Diffusive Dynamics of Macro-molecular Transitions", S. a Beccara, PF, G. Garberoglio, J. Chem. Phys. **136**, 214111 (2012).

[16] "Fluctuations in the Ensemble of Reaction Pathways", G. Mazzola, S. a Beccara, PF, H. Orland, J. Chem. Phys. **134**, 164109 (2011).

[17] "Dominant folding pathways of a peptide chain, from *ab-initio* quantum-mechanical simulations", S. a Beccara, PF, G. Garberoglio, M. Sega, F. Pederiva, H. Orland, J. Chem. Phys. **134** 024501 (2011) (selected as journal cover).

[18] "Molecular Dynamics at Low Time Resolution", PF, J. Chem. Phys. 133, 164106 (2010).

[19] "Dominant Pathways in Protein Folding: a Direct Validation Against MD Simulations", PF, A. Lonardi and H.Orland, J. Chem. Phys. **133**, 045104 (2010) .

[20] "The Effect of Interactions on the Conductance of Graphene Nanoribbons", M. Bazzanella, PF and E.Lipparini, Phys. Rev. **B 82**, 1 (2010).

[21] "Effective Field Theory for Quantum Electrodynamics of Graphene Wires", PF and E.Lipparini, Phys. Rev. **B 80**, 045405 (2009).

[22] "Communications:*Ab-initio* Dynamics of Rare Thermally Activated Reactions", S. a Beccara, G. Garberoglio,PF and F. Pederiva, J. Chem. Phys. **132** 111102 (2010).

[23] "Simulating Stochastic Dynamics Using Large Time Steps", O. Corradini, PF and H.Orland, Phys. Rev. **E80**, 061112 (2009).

[24] "Stochastic Dynamics and Dominant Protein Folding Pathways", PF, M.Sega, F.Pederiva and H.Orland, Phil. Mag. **88**, 4093 (2008).

[25] "Characterization of Protein Folding from Dominant Reaction Pathways" PF, J. Phys. Chem. **B112** 13756 (2008) .

[26] "Dominant Reaction Pathways in High Dimensional Systems", E.Autieri, PF, M.Sega, F.Pederiva and H.Orland, , J. Chem. Phys. **130** 064106 (2009).

[27] "Quantitative Protein Dynamics from Dominant Folding Pathways", M.Sega, PF, F.Pederiva, G Garberoglio and H.Orland, Phys. Rev. Lett. **99**, 118102 (2007).

[28] "Dominant Protein Folding Pathways", PF, M.Sega, F.Pederiva and H.Orland, Phys. Rev. Lett. 97, 108101 (2006).

[29] "Molecular Dynamics Simulations Suggests Possible Interaction Patterns at Early Steps of β_2-microglobulin aggregation", F.Fogolari, A. Corazza, P. Viglino, P. Zuccato, L. Pieri, PF, V. Bellotti and G. Esposito, Biophys. J. BioFAST: doi:10.1529/biophysj.106.098483 (2006).

QCD and Hadron Physics

[30] "Stochastic dynamics of Heavy Quarks in the Quark Gluon Plasma", J.-P. Blaizot, D. De Boni and PF, in press on Nucl. Phys. A (2015).

[31] "QCD Topology at Finite Temperature: Statistical Mechanics of Self-Dual Dyons", PF and E. V. Shuryak, Phys. Rev. **D 87**, 074009 (2013).

[32] "Computing the Effective Hamiltonian for Low-Energy Vacuum Gauge Fields", R. Millo and PF, Phys. Rev. **D 84**, 034504 (2011)

[33] "Quantum Interaction between Non-Perturbative Vacuum Fields", R. Millo, PF and L. Scorzato, Phys. Rev. **D 81**, 074019 (2010)

[34] "A Path Integral for Heavy Quarks in a Hot Plasma", A.Beraudo, J.P. Blaizot, PF, G.Garberoglio, Nucl. Phys. **A 846**, 104 (2010).

[35] "CP violations in low-energy photon-photon interactions", R. Millo and PF, Phys. Rev. **D 79**, 065020 (2009).

[36] "The Scalar Glueball in the Instanton Vacuum" , M.Tichy and PF, Europ. Phys. J. C **63**, 423 (2009).

[37] "Strong CP Violation in External Magnetic Fields", R.Millo and PF, Phys. Rev. **D77**, 065013 (2008).

[38] "Instantons Chiral Dynamics and Hadronic Resonances" M.Cristoforetti, PF, M. Traini , Phys. Rev. **D75** 054024 (2007).

[39] "Exploring the Chiral Regime of QCD Using the Instanton Liquid Model", M.Cristoforetti, PF, M. Traini and J.W. Negele, Phys. Rev. **D75** 034008 (2007).

[40] "Are There Diquarks in the Nucleon?",
M. Cristoforetti, PF, G. Ripka and M. Traini, Phys. Rev. **D 71** 114010 (2005).

[41] "Evidence for Instanton-Induced Dynamics, from Lattice QCD",
PF and T.A. DeGrand, Phys. Rev. Lett. **91**, 182001 (2003).

[42] "Strong CP Breaking and Quark-Antiquark Repulsion in QCD, at Finite θ",
PF Phys. Rev. **D71** (Rapid Comm.), 091502 (2005).

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