

Curriculum Vitæ

Dr. GIORGIO BAIOTTO

Radiation Biophysics and Radiobiology - <http://radbiophys.unipv.eu/>

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Academic positions

February 2020 - present:

Research fellow (“*Ricercatore a tempo determinato Senior – B*”), Radiation Biophysics and Radiobiology group, Head of the group: A. Ottolenghi, Department of Physics, University of Pavia (UnivPv), Pavia, Italy

January 2016 – January 2020:

Research fellow (“*Ricercatore a tempo determinato Junior – A*”), Radiation Biophysics and Radiobiology group, Head of the group: A. Ottolenghi, Department of Physics, University of Pavia (UnivPv), Pavia, Italy

January 2013 - December 2015:

Postdoc Fellow (“*Assegnista*”), same group, UnivPv

April 2012 - December 2012:

Postdoc Fellow (“*Assegnista*”), Nuclear Physics group, Head of the group: M. Bruno, Department of Physics, University of Bologna (Unibo), Bologna, Italy

Degrees

March 2, 2012:

PhD in Physics, Thesis co-direction: Unibo and the University of Caen - Lower Normandy, Caen, France: “*Towards a reconstruction of thermal properties of light nuclei from fusion-evaporation reactions*”, available online at the following link: http://amsdottorato.unibo.it/4295/1/baiocco_giorgio_tesi.pdf

October 24, 2008:

M.Sc. *cum laude* in Physics at the University of Bologna, Italy

October 13, 2006:

B.Sc. *cum laude* in Physics at the University of Bologna, Italy

Qualifications

From 12 September 2018:

National Scientific Qualification (ASN) as Associate Professor - “*Abilitazione Scientifica Nazionale - Professore di II fascia*”, SSD FIS/07 - Applied physics – “*Fisica Applicata*”

Scientific production and contribution to workshops/conferences, lectures

The complete list of publications, contributions to Conferences, workshops, lectures and dissemination activities also for the general public is available at: http://fisica.unipv.it/personale/PersFiles/Publ_333.pdf

Selected scientific publications are cited in the following.

My research activity is mainly focused on the effects of ionizing radiation on biological structures, particularly in the development of theoretical models and simulations, experiment design and data analysis. Applications go from radiation therapy to diagnostics, from radiation protection to risk, especially for the effects of low doses and also for space radiation.

In brief (see the list of projects below for more details):

The *leitmotif* of many of my works has been the idea of carrying on studies on the effects of ionizing radiation on biological structures starting from physical interactions, in the further attempt to build the bridge between the information on such “initial events” and the early and late response of the complex biological system (see e.g. [Baiocco et al., 2019](#)). This includes Monte Carlo calculations of radiation interactions with tissues, both at the macroscopic level (with transport codes) and at the microscopic sub-cellular level (with micro-/nanodosimetry approaches, and in particular with biophysical track structure codes as PARTRAC, in direct collaboration with the main code developer W. Friedland). Track-structure codes coupled to a description of the biological targets allow predictions of different cellular endpoints, see e.g. [Friedland et al., 2017](#) and [Friedland et al. 2018](#), respectively for nuclear DNA and mitochondria as radiation targets. Nuclear DNA damage induced by different qualities of radiation, though certainly not exhaustive of cellular endpoints, show a good correlation with late biological effects, as demonstrated for neutrons in [Baiocco et al., 2016](#), in the general context of risk induced by secondary neutrons in particle therapy (see [ANDANTE](#) below). There is great potential for such approaches also in terms of direct application in therapy (see [Bertolet et al. 2019](#), with the proposal of a microdosimetry-based estimation of linear energy transfer - LET - for further implementation in proton treatment planning systems, and [Schneider et al., 2016](#), for the estimation of out-of-field neutron relative biological effectiveness - RBE - in proton treatments). Track structure approaches are also well-suited to characterize the effectiveness of different sub-cellular distributions of radioactive sources, taking account of the possible associated dishomogeneity (e.g. for internal electron emitters and their medical use, [Siragusa et al., 2017](#), or more specifically following contamination with tritiated products - see [TRANSAT](#) below, an ongoing H2020-funded project for which I act as local scientific responsible for UniPv). Finally, results obtained with these modeling approaches have to be integrated with specific measurements of radiobiological endpoints, for which I contribute to experiment design and analysis of biological data (e.g. image analysis, more recently flow-cytometry data), which also allows me to be aware of and take into account in the modeling the effects of laboratory procedures (see [Barbieri et al., 2019](#)).

Within the research activities of the Radiation Biophysics and Radiobiology group of the Physics Department in Pavia I also contribute in particular to the theoretical aspects of the investigation of the perturbation of cell mechanisms, as cell cycle progression (as mentioned above e.g. with flow-cytometry analysis, with a paper in preparation), cellular signaling cascades (e.g. inflammatory response mediated by NF-κB signaling, see [Babini et al., 2016](#) or interplay between tumour cells and immune system, see [Babini & Morini et al., 2017](#)), modulated by low up to moderate doses of ionizing radiation of different qualities, and to the interpretation and analysis of biological data (e.g. for studies of individual radiosensitivity, also for rare diseases - [Morini et al., 2015](#), statistical analysis, image analysis, etc.).

My research activities in space radiation include: actions for improving knowledge on the effects of Galactic Cosmic Rays ([Norbury et al. 2016](#)); the coordination of projects funded by the European and Italian Space Agencies (see [Vuolo & Baiocco et al., 2017](#), and the [PERSEO](#) project, see below, with project results in [Baiocco et al., 2018](#)), for the development of innovative radiation protection systems for deep space exploration missions, with an important involvement of industrial partners; specific studies on the activation of astronauts' visual system by space radiation (see [VISAIR](#) below, an ASI-funded project for which I act as local scientific responsible for UniPv);

I'm also currently active in [EURADOS](#) (European Radiation Dosimetry Group), particularly in WG6: *Computational dosimetry*, where I act as deputy for the Task on *Computational Micro- and Nanodosimetry*. Comparing different codes and setting standards is an essential step with the aim of reducing overall uncertainties particularly affecting results in low-dose radiation research, see e.g. [EURADOS](#) intercomparison activities and the work on DNA damage standard ([Schuemann et al., 2019](#)).

Finally, thanks to an ongoing collaboration with my previous research group of the University of Bologna ([NUCL-EX](#), see below) I still carry on research on low and intermediate energy nuclear reactions (both on the theoretical and experimental side), for fundamental studies of nuclear structure, and also of great importance for applications in radiation detection, radiation protection and therapy. Latest results have been recently published e.g. in [Morelli et al., 2019](#), [Bruno et al., 2019](#).

Research projects and personal contributions (underlined when with coordination / leadership roles)

[VISAIR](#) (funded by the Italian Space Agency, November 2018 - ongoing, Local Scientific Responsible for UniPv): leading the Task on modeling mechanisms for the activation of astronauts' visual system by ionizing radiation, using track-structure codes and characterizing radical production after passage of ions in the space radiation environment;

- TRANSAT** (H2020, September 2017 - ongoing, Local Scientific Responsible for UniPv): leading the Task on Tritium Dosimetry (with dosimetry at organ/tissue/(sub)cellular scale) in the WP *Impact of tritiated products on environment and human health*;
- Progetto di Ricerca Corrente 2017** (2017, San Matteo Hospital Foundation - Pavia, Italian Ministry of Health, PI: GR. Corazza), implementation of a vectorial model to define patients' clinical complexity – programming of the data collection tool;
- PERSEO** (funded by the Italian Space Agency, June 2016 – June 2019, Principal Investigator together with A. Ottolenghi): coordination of the project involving industrial partners for the realization of a radiation shielding water-filled spacesuit prototype, successfully tested on board the International Space Station; leading the WP on modeling dose reduction due to shielding in the space radiation environment; main project achievements in [Baiocco et al., 2018](#);
- ANDANTE** (EU-Fp7, concluded in January 2016, coordinated by UniPv): project focus on the cancer risk from neutrons relative to photons using stem cells and the induction of second malignant neoplasms following pediatric radiation therapy. Coordination on behalf of UniPv of the work-package on Physical measurement and modelling of neutron fields; combination of radiation transport and track structure modeling to derive the *ab-initio* neutron RBE model published in [Baiocco et al. 2017](#), [2016](#), [2015](#), and applied to secondary neutrons in proton pencil beam scanning at PSI ([Schneider et al., 2016](#)); conception, design and characterization of experimental set-ups for neutron irradiations e.g. at PTB Braunschweig, set-up assembly, dosimetry ([Buttler & Zwar et al., 2017](#)). *Awards for activities related to this project*: Young Investigator Travel Award by the European Radiation Research Society to participate to the ICRR 2015, Kyoto, Japan; best young contributor award by the Italian Radiation Research Society at the 2014 SIRR congress in Pavia;
- SOPRANO** (EU-Fp7, concluded in June 2016): *Systems Oriented Prediction of Radiation Risk*, bioinformatic data analysis and interpretation for dose- and time- dependent mirnome responses;
- Innovative Radiation Shielding Approaches - Ariadna** (call for ideas funded by the European Space Agency, concluded in July 2015): contractor's Representative for UniPv (for technical matters, together with A. Ottolenghi); coordination of the research activities involving scientists from Thales Alenia Space - Italy; material and design and design study for a wearable radiation protection spacesuit ([Vuolo & Baiocco et al., 2017](#));
- (DoReMi) INITIUM** (EU-Fp7, concluded, DoReMi internal call 2012): modeling track structures and initial events to assess the issue of radiation quality dependence and to explore different initial radiation targets (results also in [Alloni et al. 2015](#), [Friedland et al., 2018](#), respectively for DNA damage induced by fragmenting carbon beams and damage to mitochondria) and **(DoReMi) TREND** (EU-Fp7, concluded, DoReMi internal call 2014): modeling damage at ions' track ends, with results also in [Friedland et al., 2017](#);
- Projects funded by the Associazione Italiana Sindrome di Shwachman-Diamond (A.I.S.S.)** (2014 - 2015): interpretation and analysis of biological data for the two projects: *Mechanisms underpinning the DNA-damage response in lymphoblastoid cell lines from Shwachman-Diamond patients*; and *Susceptibility to oxidative stress caused by ionizing radiation exposure in Shwachman-Diamond syndrome affected patients' lymphocytes*, UniPv coordination by Dr. J. Morini, with results also in - [Morini et al., 2015](#);
- MERIDIAN** (funded by INFN, 2014, concluded): project focus on the effects of radiation on immunity and differentiation; data analysis and interpretation, results also in [Babini & Morini et al. 2017](#);
- RADIOSTEM** (funded by INFN, 2013 – 2014, concluded): project focus on mechanisms of the radiobiological response to photons and charged particles of cancer and healthy stem cells; results also in [Morini et al., 2019](#); coordination of simulation activities of the UniPv Unit;
- NUCL-EX** (funded by INFN, ongoing): continuing collaboration on modeling nuclear reactions at low and intermediate energy; analysis and interpretation of data for measurement campaigns at e.g. Legnaro National Laboratories (LNL) ([Bruno et al. 2013](#)), particularly aiming at investigating the interplay between nuclear structure and reactions in light nuclei reactions and at benchmarking of radiation transport codes, also adopted in applications to radiation protection. Development of the Monte Code HFI ([Baiocco et al. 2013](#), [Morelli et al. 2014](#)); latest results published in [Bruno et al., 2019](#), [Morelli et al., 2019](#). Past: spokesperson of measurements at Laboratori Nazionali di Legnaro – INFN, and first author of a Letter of Intent for the exotic beam facility SPES@LNL.

Education and Training / Teaching Activities (underlined when with coordination/role of responsibility)

- 2019 USTC Training course: Space Radiation Effects and Radiation Modeling Approaches** (University of Science and Technology China, Hefei-Anhui) – invited lecturer for the topics: *Radiation-matter Interaction: an overview*; *Biological effects of space radiation and countermeasures*.

Scuola Polvani – Monte Carlo 2020 (funded by AIRP – Italian Association for Radiation Protection): appointed member of the Scientific Committee and lecturer, general topic of the lectures: transport and track structure codes; school foreseen in 2020;

CONCERT (H2020, ongoing): activities in E&T also led to: **Ottolenghi et al., 2019**; co-director of the Concert Training Course (funded upon successful application): *Modeling radiation effects from initial physical events* (Pavia, together with A. Ottolenghi, for the 2019, 2018 and 2017 Editions - 2020 edition already approved for funding); Lecturer in all course editions since 2016, topics of the lectures: *Interaction Radiation Matter; Nuclear Interactions; Transport Codes; Modeling DNA Damage; Cell Cycle models; Space Radiation*; integrated in the course: *Ionizing Radiation and Biological Structures: Theory and Applications*, for the PhD school in physics, UniPv and *Radiobiologia* (“*Radiobiologia*”) for the MSc. courses in physics and biology;

EUTEMPE-RX (Eu-Fp7, concluded): coordination activities for the course: *Radiation Biology for Medical Physicists*, Pavia, April 2015, in particular for the sessions: *Interventional Radiology and Radiobiology; Diagnostics and Radiobiology - Discussion of clinical situations / cases presented by radiologists and medical physicists*;

DoReMi (Eu-Fp7, concluded): Lecturer at the DoReMi Training Course: *Modeling radiation effects from initial physical events*, Pavia, Editions 2013, 2014, 2015.

Lecturer at University of Pavia (“*docente titolare*”)

Radiobiologia (*Radiobiology*) (1ECTS, 8hours) for M.Sc. in Physics, Biology, Biotechnology (AY. 2019/2020 – present);

Fisica Applicata (*Applied Physics*) (6ECTS, 48hours) for *Odontoiatria e Protesi Dentaria* (*Dentistry and Dental Prosthetics*) (AY. 2018/2019 – present);

Semeiotica strumentale (1ECTS, 8hours), module in *Semeiotica medica e chirurgica*, for *Medicina e Chirurgia* (2015 - present);

Instrumental Semeiotics – Traineeship in Radiology (1ECTS, 8hours), module in *Clinical Foundations*, for *Medicine & Surgery* (2015 - present);

Fisica Applicata (*Applied Physics*) (1ECTS, 6hours) for *Scuola di specializzazione in Radiodiagnostica* (AY. 2018/2019 – present);

Tecniche Diagnostiche (*Diagnostic Techniques*) (3ECTS, 24hours) for the M.Sc. in Physics (AY. 2014/2015).

Lectures for the CONCERT training course are given also in the framework of the PhD school of Physics and of the MSc. Courses in Physics and Biology at UniPv (see *Activities at the European/national level* above for details).

Specific lectures given upon invitations are listed under: *Contributions to workshops, conferences and lectures*

Supervision/co-supervision of theses

PhD theses in Physics

* L. Lonati, UniPv, November 2020 - ongoing

M.Sc. theses in Physics

* *An integrated experimental/theoretical approach to unravel cell cycle transitions in human fibroblasts irradiated with photons* – L. Lonati, UniPv, 2019

* *FRAP and super resolution microscopy to investigate GFP-REV7 mobility after low LET radiation-induced DNA damage* – M. Siragusa, UniPv, 2014

B.Sc. theses in Physics

* *Secondary tumors after photon and charged particle radiotherapy* (M. El Ais, UniPv, 2015)

* *Energy dependence of neutron biological effectiveness - Monte Carlo characterization of the experimental setup for mono-energetic irradiations at PTB* (S. Barbieri, UniPv, 2013)

Organization of conferences / workshops and society memberships with active role

European Radiation Protection Week 2019, Stockholm, Sweden, October 2019,

Chair of the the *Early career researcher Committee*;

3rd International Conference on Dosimetry and Applications (ICDA-3), Lisbon, Portugal, May 2019, member of the scientific committee for the satellite workshop: *4th International BioQuaRTWorkshop "From Micro- and nanodosimetry to biological effectiveness*;

EURADOS - European Radiation Dosimetry Group associate membership; deputy for the Task *Computational Micro- and Nanodosimetry* in Working Group 6: *Computational dosimetry*.

Awards

COSPAR 2021 Zeldovich Medal given to young scientists who have demonstrated excellence and achievement in their research, conferred by COSPAR (Committee on Space Research) and the Russian Academy of Sciences

MELODI Award 2019 awarded from MELODI – Multidisciplinary European LOw Dose Initiative to a young researcher active in the domain of low-dose radiation research, including invitation to present the work during the *European Radiation Protection Week 2019*, Stockholm, Sweden, October 2019

Young Investigator Travel Award from the European Radiation Research Society to take part to the ICRR 2015, Kyoto, May 2015, for the presentation: *A comprehensive modeling approach to shed light on the physical origin of neutron biological effectiveness*

Best young contributor award by the Italian Radiation Research Society for the presentation at the SIRR congress, Pavia, November 2014: *Characterization of the physical origin of neutron biological effectiveness*

ANDANTE Exchange Program award for the stay at Chalmers University of Technology, Göteborg, Sweden, 25 February - 9 March 2013, for the collaboration with L. Sihver - *transport calculations with PHITS for the ANDANTE project*

Continuing education (latest, selection)

12th EURADOS Winter School "Radon: Dosimetry, Metrology and Regulation", 14th February 2019, Łódź, Poland;

11th EURADOS Winter School "Application of physical and computational phantoms in dose assessment" 8th February 2018, Lisbon, Portugal;

9th EURADOS Winter School "Dosimetry for epidemiological cohorts", 11th February 2016, Milano, Italy

NASA Space Radiation Summer School 2015 (stay financed by Universities Space Research Association - upon successful application for 16 candidates worldwide), June 8th - 26th 2015, Brookhaven National Laboratory, Upton, NY – USA;

Geant4-DNA 2014 Tutorial 7th November, ESA-ESTEC, Noordwijk, Holland

EPIRADIO Training Modeling in Radiation Epidemiology and Radiation Biology, April 8th - 19th 2013, Herrsching (Ammersee), Germany.

Visiting periods abroad

Helmholtz Zentrum, München, Germany, 25 – 29 November 2019; 24 - 28 August 2015, collaboration with W. Friedland, track structure calculations with PARTRAC;

Chalmers University of Technology, Göteborg, Sweden, 25 February - 9 March 2013, collaboration with L. Sihver, transport calculations with PHITS (ANDANTE, with ANDANTE Exchange Program award)

Horia Hulubei National Institute of Physics and Nuclear Engineering - IFIN HH Bucharest, Romania, 21 - 31 August 2011, collaboration with Dr. A. Raduta, nuclear reaction calculations with the Micro-Canonical Multifragmentation Model - MMM

Laboratoire de Physique Corpusculaire - LPC Caen, Caen, France, September 2012 - December 2012 Visiting Research Fellow (*"Assegnista di ricerca"*) in the group *Physique Théorique et Phénoménologie*

Laboratoire de Physique Corpusculaire - LPC Caen, Caen, France, December 2009 - July 2010 and March 2011 - July 2011, *PhD thesis in co-direction with the University of Caen - Lower Normandy, supervision of Prof. F. Gulminelli*

Freie Universität Berlin, Berlin, Germany *ERASMUS Project, AY 2006/07* - October 2006 - July 2007

Personal and Technical Skills

Written and oral proficiency in English (also with certificate of attendance of an English-Italian translator course, Herzog Literary Agency, Milan, 2014), French and German.

Programming skills in C/C++, computing skills in software for data (e.g. ROOT, gnuplot) and image analysis (e.g. Image J), familiar with Windows, Mac OSs and Linux OSs.

Manager of the website of the research group: <http://radbiophys.unipv.eu/>

Activity as reviewer for scientific journals

Among others: *Scientific Reports*; *Radiation Research*; *Radiation and Environmental Biophysics*; *The British Journal of Radiology*; *Radiation Protection Dosimetry*; *Life Sciences in Space Research*.