ALL. B
Decreto Rettore Università di Roma "La Sapienza" n. 981/2023 con avviso pubblicato sulla G.U. – IV serie speciale n. 39 in data 23-05-2023, codice concorso 2023RTTR023.

Giovanni Batignani

Curriculum Vitæ

Roma,
June 21, 2023

Content

Autocertificazione: Quanto dichiarato nel Curriculum vitae corrisponde al vero ed e' conforme alle seguenti normative: Legge 04/01/1968 n. 15; Legge 15/05/1997 n. 127 art. 3; D.P.R. 20/10/1998 n. 403.

Part I – General Information

Full Name Giovanni Batignani

Place of birth Siena (Italy)

Citizenship Italian

Homepage `http://www.roma1.infn.it/~batignag/`

Spoken languages

- Italian: native
- English: fluent
- French: good comprehension, basic speaking
- Portoguese: good comprehension, basic speaking

Part II – Education

PhD 2017, 13 April - Università degli studi dell'Aquila, PhD in Physical and Chemical Sciences awarded cum laude.
Title of the thesis: "Probing Ultrafast Processes by Femtosecond Time-Resolved Raman Spectroscopies".

Master's degree 2013, 22 October - "Sapienza" University of Rome", Degree in Physics full marks with honors (110/110 cum laude).
Title of the thesis: "Ultrafast Dynamics in Photoexcited Neuroglobin Revealed by Femtosecond Stimulated Raman Scattering".

Bachelor's degree 2011, 6 October - Università degli studi di Siena, Degree in Physics and Advanced Technologies full marks with honors (110/110 cum laude).
Title of the thesis: "Rivelazione di Transizioni Eccitate per Esperimenti di Violazione della Parità Atomica in Trappole Magneto-Ottiche".

High school 2008 - Liceo Classico Enea Silvio Piccolomini (Siena), Diploma full marks (100/100).

Part III – Appointments

IIIA Academic Appointments

Current Position

- Since 04/04/2019, RTDA (ricercatore a tempo determinato di tipologia A) at the Physics Department of "Sapienza" University of Rome, Italy.

Previous positions

- 01/04/2018 – 31/03/2019, PostDoc at the Physics Department of "Sapienza" University of Rome, Italy, type A research grant.
- 02/01/2017 – 31/03/2018, PostDoc at the Physics Department of "Sapienza" University of Rome, Italy, type B research grant.

IIIB Other Appointments

- Since 01/06/2021, Center for Life Nano Science @Sapienza, Istituto Italiano di Tecnologia.

Part IV – Teaching experience

Summary:
5 Laurea courses
24 Bachelor thesis supervisor (tesi triennali)
9 Master thesis supervisor (tesi magistrali)
4 Honours Programmes supervisor
1 Post-graduate school
Lectures for 11 Laurea courses

Courses

- AA 2023-2024 "Laboratorio di Calcolo" class for the Bachelor degree in Physics, "Sapienza" University of Rome, Co-chair (3CFU).
- AA 2022-2023 "Laboratorio di Calcolo" class for the Bachelor degree in Physics, "Sapienza" University of Rome, Co-chair (3CFU).
- AA 2021-2022 "Laboratorio di Calcolo" class for the Bachelor degree in Physics, "Sapienza" University of Rome, Co-chair (3CFU).

- AA 2020-2021: "Ottica e Laboratorio" class for the Bachelor degree in Physics, "Sapienza" University of Rome, Co-chair (3CFU).
- AA 2019-2020: "Ottica e Laboratorio" class for the Bachelor degree in Physics, "Sapienza" University of Rome, Co-chair (3CFU).

Postgraduate schools

- Lecturer at an international postgraduate school (International sChool On Nonlinear vibrational Spectro-microscopy, on line, 30 July-1 August 2020).

Lectures

- Since 2014: Several lectures for the "Photonics" class, Master degree in Physics, "Sapienza" University of Rome.
- AA 2017-2018: Teaching assistant for the "Mechanics Laboratory" class, Bachelor degree in Physics, "Sapienza" University of Rome.

Laboratory supervisor

- Since 2014, laboratory supervisor of 27 master students for the "Physics Laboratory II" Master course in Condensed Matter Physics, Physics Department, "Sapienza" University of Rome.

Bachelor thesis advisor

- AA 2016-2017 Eleonora Polini "Stabilizzazione di perovskiti fotovoltaiche attraverso intercalazione di gas nobili ad alta pressione", degree in Physics at "Sapienza" University of Rome (co-relatore).
- AA 2017-2018 Giovanni Caldarelli "Metodo Hartree-Fock molecolare: implementazione Matlab per molecole biatomiche a due elettroni", degree in Physics at "Sapienza" University of Rome (co-relatore).
- AA 2018-2019 Amer Omar "Raffreddamento atomico e condensati Bose-Einstein", degree in Physics at "Sapienza" University of Rome (co-relatore).
- AA 2018-2019 Nicola Fiorente "Laser cooling di atomi neutri", degree in Physics at "Sapienza" University of Rome (co-relatore).
- AA 2018-2019 Francesco Macchioni "Doppler cooling e trappole magneto-ottiche per atomi neutri", degree in Physics at "Sapienza" University of Rome (relatore).
- AA 2019-2020 Irene Gaiardoni "Studio dello scattering Raman spontaneo e stimolato tramite formalismo di seconda quantizzazione", degree in Physics at "Sapienza" University of Rome (relatore).

- AA 2019-2020 Giorgio Minati “Spettroscopia vibrazionale impulsiva nel dominio del tempo”, degree in Physics at “Sapienza” University of Rome (co-relatore).
- AA 2020-2021 Fabrizio Fatelli “Spettroscopia Raman con offset spaziale, principi ed applicazioni”, degree in Physics at “Sapienza” University of Rome (relatore).
- AA 2020-2021 Alessandro Petrini “Laser cooling e trappole magneto-ottiche di atomi e molecole biatomiche”, degree in Physics at “Sapienza” University of Rome (relatore).
- AA 2020-2021 Nicolò Prosperi “Effetto Raman nel formalismo della seconda quantizzazione”, degree in Physics at “Sapienza” University of Rome (relatore).
- AA 2021-2022 Dalila Di Serio “Spettri di assorbimento e Raman in funzione del displacement molecolare”, degree in Physics at “Sapienza” University of Rome (co-relatore).
- AA 2021-2022 Fabrizio Spera “Laser Cooling e Trappole Magneto Ottiche”, degree in Physics at “Sapienza” University of Rome (co-relatore).
- AA 2021-2022 Francesco Costantini “Spettroscopia Raman Risonante e dipendenza dai displacement molecolari”, degree in Physics at “Sapienza” University of Rome (co-relatore).
- AA 2021-2022 Luca Pancione “Intrappolamento magneto-ottico e condensazione di Bose-Einstein”, degree in Physics at “Sapienza” University of Rome (relatore).
- AA 2021-2022 Pietro Todesco “Spettroscopia Raman impulsiva nel dominio temporale”, degree in Physics at “Sapienza” University of Rome (relatore).
- AA 2021-2022 Francesco Vergari “Dispersione cromatica e propagazione di impulsi laser ultracorti”, degree in Physics at “Sapienza” University of Rome (co-relatore).
- AA 2021-2022 Matteo Cacioppo “Spettroscopia Raman nel dominio delle frequenze ed in trasformata di Fourier”, degree in Physics at “Sapienza” University of Rome (co-relatore).
- AA 2022-2023 Giovanni Presutti “Beam Propagation Method applicato alla propagazione della luce”, degree in Physics at “Sapienza” University of Rome (relatore).
- AA 2022-2023 Lorenzo Fiordaliso “Effetti non lineari nella propagazione di impulsi di luce”, degree in Physics at “Sapienza” University of Rome (co-relatore).
- AA 2022-2023 Carlo Sabatini “Metodo di Hartree-Fock applicato al trimero omonucleare”, degree in Physics at “Sapienza” University of Rome (co-relatore).

- AA 2022-2023 Pietro Todesco "Approccio numerico alla propagazione della luce: Beam Propagation Method", degree SSAS (Scuola Superiore di Studi Avanzati) at "Sapienza" University of Rome (relatore).
- AA 2022-2023 Filippo Maccarone "Effetto Raman impulsivo nel dominio del tempo: Principi e Applicazioni", degree in Physics at "Sapienza" University of Rome (relatore).
- AA 2022-2023 Matteo Spaziani "Beam Propagation Method applicato alla propagazione della luce in mezzi turbolenti", degree in Physics at "Sapienza" University of Rome (relatore).
- AA 2022-2023 Luigi Graziano "Spettroscopia Raman Stimolata al Femtosecondo: principi e applicazioni", degree in Physics at "Sapienza" University of Rome, to be discussed (relatore).

Master thesis supervisor

- AA 2013-2014 Nicola Di Palo, "Ultrafast photoinduced dynamics in an Heisenberg antiferromagnet probed by Femtosecond Stimulated Raman Scattering", degree in Physics at "Sapienza" University of Rome (co-relatore).
- AA 2015-2016 Lorenzo Monacelli "Deciphering the non resonant response in impulsive raman spectroscopy", degree in Physics at "Sapienza" University of Rome (co-relatore).
- AA 2016-2017 Luana Olivieri "Stimulated Raman Scattering in albumin", degree in Physics at "Sapienza" University of Rome (co-relatore).
- AA 2017-2018 Gaia Giovannetti "Broadband Stimulated Raman spectroscopy in electronically resonant biomolecules", degree in Physics at "Sapienza" University of Rome (co-relatore).
- AA 2020-2021 Carlotta Sansone "Mapping potential energy surfaces trough Raman excitation profiles measured by impulsive vibrational spectroscopy", degree in Physics at "Sapienza" University of Rome (co-relatore).
- AA 2020-2021 Emanuele Mai "Measuring the phase of Raman susceptibilities by Impulsive Vibrational Spectroscopy reveals excited-state displacements", degree in Physics at "Sapienza" University of Rome, (co-relatore).
- AA 2021-2022 Paolo Fachin "Raman Induced Kerr Effect: a study on the polarization dependent non linear vibrational responses", Master Degree in Physics at "Sapienza" University of Rome (co-relatore).

- AA 2022-2023 Alfredo Tarantino "Excited state dynamics of Fucoxanthin studied by femtosecond stimulated Raman scattering", Master Degree in Physics at "Sapienza" University of Rome (co-relatore).
- AA 2022-2023 Assia Mariani "Accessing molecular vibrations by chirped impulsive stimulated Raman scattering", degree in Physics at "Sapienza" University of Rome, to be discussed (co-relatore).

Honours Programmes ("Percorsi di Eccellenza") supervisor

- AA 2020-2021 Ferruccio Castellini "Studio della propagazione di luce impulsata in materiali dispersivi tramite approcci numerici e sperimentali", Bachelor Degree in Physics at "Sapienza" University of Rome (tutor).
- AA 2020-2021 Emanuele Mai "Theoretical and experimental characterization of the Raman signatures measured in impulsive vibrational spectroscopy experiments", Master Degree in Physics at "Sapienza" University of Rome (co-tutor).
- AA 2021-2022 Paolo Fachin "Carrier relaxation in transition metal dichalcogenides studied by ultrafast pump probe optical spectroscopy", Master Degree in Physics at "Sapienza" University of Rome (tutor).
- AA 2021-2022 Carlo Giorgetti "Raman Induced Kerr Effect Spectroscopy: studio teorico/sperimentale della risposta vibrazionale nonlineare in funzione della polarizzazione", Master Degree in Physics at "Sapienza" University of Rome (tutor).

Part V - Service Activities, Memberberships, Awards and Honors

Referee for 17 International journals
Chair of 1 International School
Committee of 2 International Conferences

Referee

- Nature Communications, Physical Review Letters, Physical Review A, Physical Review B, Physical Review Applied, Journal of Raman Spectroscopy, Journal of Chemical Physics, The Journal of Physical Chemistry Letters, The Journal of Physical Chemistry A, The Journal of Physical Chemistry B, Optics Letters, Nanoscale Advances, Journal of Biophotonics, International Journal of Optics, Crystals, Chemosensor, Molecules, Symmetry.

Academic

- 2019-2022, assistant for the lectures of Cattedra Fermi at the Physics Department, "Sapienza" University of Rome.
- In 2021-2022, Tutor for the "A History of the science of light from Galileo's telescope to the laser and the quantum information revolution" PCTO ("Percorsi per le Competenze Trasversali e l'Orientamento") course at "Sapienza" University of Rome (5 high schools, 36 students).

International conferences and schools organization

- Chair of the international school ICONS (International sChool On Nonlinear vibrational Spectroscopy), 2020, July 30-August 1, online (more than 100 participants). Link: https://www.roma1.infn.it/ batignag/icons.html.
- Scientific Program Committee of the XXVII edition of the International Conference on Raman Spectroscopy (ICORS-XXVII), 14-19 August 2022, Long Beach, California (USA). Held every two years, this is the reference event for the related community, gathering above 800 people.
- Local Organizing Committee of the XXVIII edition of the International Conference on Raman Spectroscopy (ICORS-XXVIII), 28 July-2 August 2024, Rome (Italy). Held every two years, this is the reference event for the related community, gathering above 800 people

Awards

- Presented with the Junior Researcher Raman Award 2022 for the results achieved in the field of Raman spectroscopy at the ICORS meeting in 2022 (USA): Link to the news.

- I have been awarded a € scholarship ′ € per year for three years) after a national merit-based selection by the Società Italiana di Fisica for the Progetto Lauree Scientifiche (October 2008 – September 2011).

Part VI - Funding Information

Attracted funding for over as PI for research projects
Awarded funding for over for researcher positions
(Since 2017, as detailed below)

PI - Principal Investigator, I - Investigator

PRIN 2022 funded by Ministero dell'Università e della Ricerca for the "Ultrafast dynamics in next generation sustainable materials (DynaMAT)" Research project, Co-PI ("responsabile unità", €), 2 Years Research project.

PRIN 2020 € funded by Ministero dell'Università e della Ricerca for the "Photoreactive Systems upon Irradiation: Modelling and Observation of Vibrational Interactions with the Environment (PSI-MOVIE)" Research project, Co-PI ("responsabile unità", €), 3 Years Research project. Project Ranked at first position in the National Panel PE4, Score 100/100.

Progetti di Ricerca Ateneo 2022 € funded by "Sapienza" University of Rome for the "Chirp-based Impulsive Raman sPectroscopY (CHIRPY)" Research project, PI, 3 Years (2022).

Partenariati Estesi 2022, PE 4, Spoke 7 "Towards Quantum Light Spectroscopy" research line of the "Complete photonic-quantum systems" Research project (Partenariato Esteso 4 - Spoke 7), funded by Unione europea - NextGenerationEU, component.

Partenariati Estesi 2022, PE 2, Spoke 6 € "Advanced spectro-microscopy for battery materials" research line of the "Energy Storage Technologies: from materials to prototypes (EST)" Research project (Partenariato Esteso 2 - Spoke 6), funded by Unione europea - NextGenerationEU, component.

Rome Technopole - Progetto Flagship 2022 € "Collegamento ottico avanzato in spazio libero nel Campus Sapienza per comunicazioni quantistiche" research line of the "Comunicazioni ottiche quantistiche e elaborazione del segnale per radar AESA" Research project, funded by Unione europea - NextGenerationEU, component.

Progetti di Ricerca Ateneo 2021 funded by "Sapienza" University of Rome for the "Harnessing giant-refraction super-continuum-generation for versatile pump-and-probe spectroscopy" Research project, I, 1 Year (2021).

Progetti di Ricerca Ateneo 2020 funded by "Sapienza" University of Rome for the "Mapping Excited State Molecular Couplings by 2-Dimensional Femtosecond Coherent Raman Spectroscopy" Research project, PI, 1 Year (2020).

Progetti di Ricerca Ateneo 2019 funded by "Sapienza" University of Rome for the "Ultrafast energy transfer in photosynthetic materials" Research project, I, 1 Year (2019).

Progetti per Avvio alla Ricerca Ateneo 2018 funded by "Sapienza" University of Rome for the "Unravelling excited-state wavepackets by femtosecond pulse-shaped impulsive vibrational scattering" Research project, PI, 1 Year (2018).

Progetti per Avvio alla Ricerca Ateneo 2017 funded by "Sapienza" University of Rome for the "Flowing liquid jet nozzle for 10 fs-time-resolution pump-probe experiments" Research project, PI, 1 Year (2017).

Professori Visitatori Ateneo 2021 funding Prof. S. Ruhman from Jerusalem University (1 month).

CINECA-ISCRA computing grant 2022 node hours on Galileo100 funded by the Italian SuperComputing Resource Allocation (Cineca) for the "'VINCIPSI - : VIbroNic Couplings In Photoreactive Systems" ISCRA class C project. PI, 6 Months Research project (from 18/10/2022 to 17/04/2023).

CINECA-ISCRA computing grant 2021 64.000 node hours on Galileo100 funded by the Italian SuperComputing Resource Allocation (Cineca) for the "MESPES: Mapping Excited State Potential Energy Surcafes" ISCRA class C project. PI, 9 Months Research project (from 10/08/2021 to 10/05/2022).

"RTDA" position 2019-2022 (gross cost) funded by "Sapienza" University of Rome.

"RTDA" position 2022-2024 (gross cost) funded by "Sapienza" University of Rome.

"Assegno di Ricerca Categoria A" 2018-2019 € grant (gross cost) funded by "Sapienza" University of Rome, c/o Physics Department and Femtoscopy group.

Part VII – Research Activities

Papers from each research activity are reported and refer to the Full Publication List (Part XIII).

Ultrafast dynamics in molecules by Femtosecond stimulated Raman spectroscopy

Using Femtosecond stimulated Raman spectroscopy (FSRS), I investigated the ultrafast dynamics of photo-excited biological compounds, such as thiophene-based molecules and heme proteins, which have represented elusive systems for ultrafast spectroscopies. In fact, several concurring processes, such as structural reconfiguration, energy redistribution and relaxation on intermediate excited states, contribute to their photo-physics and occur on sub-picosecond timescales. Building a FSRS setup able to access vibrational spectroscopy on picosecond and sub-picosecond time regimes, we have addressed how these different aspects syncretize on the coherent picture of the reaction pathway in different hemes, namely Neuroglobin, Myoglobin and Cytochrome [**5**,**8**,**16**,**24**]. I have also shown how to combine FSRS with ab initio quantum chemistry methods to extract a detailed mapping of the excited-state dynamics in thiophene-based compounds, building blocks for photoactive devices [**6**,**27**].

Ultrafast magnetism and exchange interaction dynamics

I have studied how femtosecond light pulses can be exploited for manipulating and controlling magnetic properties in solid state systems, a topic of great interest for information processing technologies. Accessing the photoinduced magnon excitations dynamics in antiferromagnetic systems, I have investigated the fundamental and practical limits of the manipulation speed of the magnetic ordering, demonstrating how femtosecond pulses can be exploited for modifying the exchange energy in antiferromagnets on a 40 fs timescale [**4**,**13**,**25**].

Theoretical and computational nonlinear spectroscopy

The investigation of extremely short-lived species often implies deciphering complex signals and is ultimately hampered by undesired nonlinear effects once the femtosecond time resolution limit is approached. In particular, deciphering coherent Raman signals requires a careful modelling for retrieving the structural information encoded in transient measurements. The need for interpretative schemes to understand such signals has motivated me to develop the theoretical tools to numerically calculate the nonlinear Raman response of molecular compounds, disentangling and assigning the concurring nonlinear effects that are generated in ultrafast pump probe measurements [**2**,**3**,**10**,**13**,**21**,**26**]. In this respect, a deeper theoretical understanding of the scattering phenomena underlying nonlinear Raman experiments has been the key to improve [**7**,**17**] or introduce novel experimental techniques [**14**,**23**].

Photo-carrier induced dynamics in Lead Halide Perovskite

Understanding the nonlinear optical properties of solid state materials represent a crucial requirement for improving efficiencies and performances of optoelectronic and photonics devices. In order to tackle the highly debated case of Lead halide perovskites, I developed a time-resolved impulsive vibrational scattering (IVS) setup, which has been used to access the ultrafast dynamics of the low frequency modes in these systems. This has been the key for unravelling the phonon modes that provide the pathway to the photo-induced lattice modification occurring upon photo-carrier generation [**9**].

Nonlinear Raman microscopy

I have applied Coherent Raman Spectroscopy (CRS) as a method for non-invasive label-free imaging of biological systems. CRS-imaging has been exploited for monitoring the metabolism and lipid storage in the Caenorhabditis elegans nematode and for mapping the Poly lactic-co-glycolic acid diffusion in Arabidopsis roots, providing high intrinsic 3D resolution [**22**].

Nonlinear Spectroscopy applied to 2D-materials

I applied coherent anti-Stokes Raman Scattering (CARS) to characterize single and multi-layer graphene samples. Specifically, we demonstrated that the vibrationally resonant CARS peak can be measured by reducing the temporal overlap of the laser excitation pulses, suppressing the vibrationally non-resonant background. Modelling the spectra, for taking into account the electronically resonant nature of both, we have shown how CARS can be used for graphene imaging with vibrational sensitivity [**12**]. Recently, I have addressed the out-of-equilibrium dynamics of transition metal dichalcogenide-graphene heterostructures, studied using picosecond laser excitation [**20**].

Measuring absolute excited-State geometries

Photo-reactions activated by light absorption are determined by multidimensional excited-state (ES) potential energy surfaces (PESs), displaced with respect to the ground-state along specific nuclear reaction coordinates. Such displacements are encoded in the Franck-Condon overlap integrals, but conventional spectroscopic approaches only probe their square moduli, and hence cannot access the sign of ES displacements. To tackle this issue, I introduced a time-domain Raman experiment able to directly measure both their magnitude and sign. The key to achieve this task is in the signal linear dependence on the Frank-Condon overlaps. This is brought about by using non-degenerate resonant probe and off-resonant pump pulses, which ultimately enables time-domain sensitivity to the phase of the stimulated vibrational coherences. [**19**, **23**].

Multidimensional Raman spectroscopies We have developed a 2-Dimensional coherent Raman scattering scheme able to selectively probe vibrational mode couplings in molecular compounds [**15**]. The technique has been applied to examine the photoinduced dynamics of green fluorescent protein, providing the chance to disclose its different reaction stages. Another multidimensional Raman setup has been introduced building on the use of a chirped probe: acquiring a time-domain Raman spectrum as a function the probe chirp introduces an additional dimension to the detected spectra, providing the chance to disentangle spectral components arising from different excited states [**7**]. Recently, I introduced a Chirped-based Impulsive Stimulated Raman Scattering (CISRS) scheme, which is able to record the time-domain Raman map without scanning the pump-probe temporal delay. CISRS ensures improved signal-to-noise ratios, acquisition times 2 orders of magnitude faster with respect to previous schemes and has the potential to access the ultrafast response of irreversible processes, where conventional pump-probe schemes cannot be applied [**14**].

Nonlinear light-matter interactions in the X-Ray regime Building on the extreme ultraviolet femtosecond pulses delivered by the FERMI FEL facility in Trieste, we provided experimental evidence for self-phase modulation (SPF) in the soft X-Ray regime. SPM has been exploited for tuning the spectral properties of FEL pulses by a nonlinear interaction with submicrometric foils of selected monoatomic materials [**18**]. The experiment demonstrates an ideal control knob for spectral shaping of FEL pulses, a key milestone towards the development of new protocols for femtosecond core electrons spectroscopies.

Research activities in qualified Italian or foreign institutes (papers outcoming from each collaboration are indicated)

- Istituto Italiano di Tecnologia, Center for Life Nano Science @Sapienza: coherent Raman spectroscopy (since 2019) [12, 20, 22].
- Elettra-Sincrotrone Trieste: XAFS measurements at the XAFS Beamline (2013).
- Elettra-Sincrotrone Trieste: nonlinear processes in the soft x-ray regime and spectral tuning of extreme ultraviolet femtosecond pulses at the EIS-TIMEX Beamline (2017-2022) [18, 30].

Part VIII - Summary of scientific achievements

Papers 23 papers on International peer reviewed journals; 13 of them as main and/or corresponding author.
7 conference proceedings.
2 papers on National journals.

Total impact Factor 229.65 (Clarivate, computed with current IFs);
210.96 (Clarivate, calculated using IFs on the publication date).

Weigthed impact Factor 10.0 (Clarivate, computed with current IFs);
9.3 (Clarivate, calculated using IFs on the publication date).

Total citations 461 (Scopus); 415 (WOS) ; 582 (SCHOLAR)

Average Citations per Product 20.0 (Scopus); 18.0 (WOS) ; 25.3 (SCHOLAR)

Most cited paper as first author 95 citations (Scopus); 93 citations (WOS); 122 citations (SCHOLAR);

Hirsch (H) index 14 (SCOPUS); 12 (WOS); 14 (SCHOLAR)

Normalized H index* 2.33 (SCOPUS); 2 (WOS); 2.33 (SCHOLAR).
*(Normalized H index divided by academic seniority, intended as since the Phd-awarded year)

Papers with large impact factor (>6) 1x Nature Photonics (main author), 3x Nature Communications (2 of them as the main author, 1 as the corresponding author), 1x PNAS, 5x The Journal of Physical Chemistry Letters (4 of them as the main author, 1 as the corresponding author), Physical Review X (1x), 1x ACS Photonics (main author), 1x Light: Science & Applications, 1x J. Am. Chem. Soc. (main and corresponding author), 1x Frontiers in Molecular Biosciences.

Comunications 14 oral contributions at international conferences and schools (see section "Conferences and Invited Talks" for further details.)

Direction/coordination of national research groups

- co-PI of the "Ultrafast dynamics in next generation sustainable materials (DynaMAT)" Research project, which includes 2 research units (Pavia University and "Sapienza" University)

- co-PI of the "Photoreactive Systems upon Irradiation: Modelling and Observation of Vibrational Interactions with the Environment (PSI-MOVIE)" Research project, which includes 4 research units (Bologna University, Pisa University, "Sapienza" University and Scuola Normale Superiore at Pisa.)

Habilitation Associate professor in experimental condensed matter physics, 02/B1, from 06/02/2023 to 06/02/2034.

Note The scientific production, computed considering only the last 15 years, corresponds with the total scientific production.

Part IX - Selected publications

* Equal contribution.

† Corresponding author.

1. *Probing ultrafast photo-induced dynamics of the exchange energy in a Heisenberg antiferromagnet.*
   G. Batignani, D. Bossini, N. Di Palo, C. Ferrante, E. Pontecorvo, G. Cerullo, A. Kimel and T. Scopigno.
   Nature Photon. **9**, 506 (2015).
   IF 31.167 (Clarivate). Citations: 47 (Scopus) 42 (WOS), 64 (Scholar).
   Media: `https://www.repubblica.it/tecnologia/2015/07/08/news/hard_disk_futuro-118651020/`, `https://www.nature.com/articles/nphoton.2015.135`

2. *Visualizing Excited-State Dynamics of a Diaryl Thiophene: Femtosecond Stimulated Raman Scattering as a Probe of Conjugated Molecules.*
   G. Batignani, E. Pontecorvo, C. Ferrante, M. Aschi, C. G. Elles and T. Scopigno.
   J. Phys. Chem. Lett. **7**, 2981 (2016).
   IF 9.353 (Clarivate). Citations: 29 (Scopus) 28 (WOS), 33 (Scholar).

3. *Probing femtosecond lattice displacement upon photo-carrier generation in lead halide perovskite.*
   G. Batignani, G. Fumero, A. R. S. Kandada, G. Cerullo, M. Gandini, C. Ferrante, A. Petrozza and T. Scopigno.
   Nat. Commun. **9**, 1971 (2018).
   IF 11.878 (Clarivate). Citations: 95 (Scopus), 93 (WOS), 122 (Scholar).

4. *Genuine dynamics vs cross phase modulation artefacts in Femtosecond Stimulated Raman Spectroscopy.*
   G. Batignani, G. Fumero, E. Pontecorvo, C. Ferrante, S. Mukamel and T. Scopigno.
   ACS Photonics **6**, 492 (2019).
   IF 6.864 (Clarivate). Citations: 23 (Scopus), 21 (WOS), 27 (Scholar).

5. *Coherent anti-Stokes Raman Spectroscopy of single and multi-layer graphene.*
   A. Virga, C. Ferrante, G. Batignani, D. De Fazio, A. D. Nunn, A. C. Ferrari, G. Cerullo and T. Scopigno.
   Nat. Commun. **10**, 3658 (2019).
   IF 12.121 (Clarivate). Citations: 29 (Scopus), 28 (WOS), 40 (Scholar).

6. *Broadband Impulsive Stimulated Raman Scattering based on a Chirped Detection.*
   G. Batignani, C. Ferrante, G. Fumero and T. Scopigno.
   J. Phys. Chem. Lett. **10**, 7789 (2019).
   IF 6.710 (Clarivate). Citations: 19 (Scopus), 14 (WOS), 23 (Scholar).

7. *Two-dimensional impulsively stimulated resonant Raman spectroscopy of molecular excited-states.*
   G. Fumero, C. Schnedermann, G. Batignani, T. Wende, M. Liebel, G. Bassolino, C. Ferrante, S. Mukamel, P. Kukura, T. Scopigno.
   Phys. Rev. X **10**, 011051 (2020).
   IF 15.762 (Clarivate). Citations: 20 (Scopus), 18 (WOS), 24 (Scholar).

8. *Ultrafast dynamics and vibrational relaxation in six-coordinate heme proteins revealed by Femtosecond Stimulated Raman Spectroscopy.*
   C. Ferrante* and G. Batignani*,†, E. Pontecorvo, L.C. Montemiglio, M. H. Vos, T. Scopigno.
   J. Am. Chem. Soc. **142**, 2285 (2020).
   IF 15.419 (Clarivate). Citations: 15 (Scopus), 13 (WOS), 15 (Scholar).

9. *Non-linear self-driven spectral tuning of Extreme Ultraviolet Femtosecond Pulses in monoatomic materials.*
   C. Ferrante, E. Principi , A. Marini, G. Batignani, G. Fumero, A. Virga, L. Foglia, R. Mincigrucci, A. Simoncig, C. Spezzani, C. Masciovecchio, T. Scopigno.
   Light: Sci. Appl. **10**, 92 (2021).
   IF 20.257 (Clarivate). Citations: 2 (Scopus), 1 (WOS), 3 (Scholar).

10. *Excited-State Energy Surfaces in Molecules Revealed by Impulsive Stimulated Raman Excitation Profiles.*
    G. Batignani†, C. Sansone, C. Ferrante, G. Fumero, S. Mukamel and T. Scopigno.
    J. Phys. Chem. Lett. **12**, 9239 (2021).
    IF 6.888 (Clarivate). Citations: 10 (Scopus), 6 (WOS), 12 (Scholar).

11. *Picosecond energy transfer in a transition metal dichalcogenide-graphene heterostructure revealed by transient Raman spectroscopy.*
    C. Ferrante, G. Di Battista, L. E. Parra Lopez, G. Batignani, E. Lorchat, A. Virga, S. Berciaud and T. Scopigno.
    PNAS. **119**, 15, e2119726119 (2022).
    IF 12.779 (Clarivate in 2021). Citations: 4 (Scopus), 4 (WOS), 11 (Scholar).

12. *Absolute excited state molecular geometries revealed by resonance Raman signals.*
G. Batignani†, E. Mai, G. Fumero, S. Mukamel and T. Scopigno.
NAT. COMMUN. **13**, 7770 (2022).
IF 17.694 (Clarivate in 2021). Citations: 2 (Scopus), 2 (Scholar).

Additional Information

Part X - Main Collaborations

Papers outcoming from each collaboration are indicated

Femtoscopy Project T. Scopigno (Ultrafast spectroscopy)) [2-30].

Irvine University, USA S. Mukamel (Theory of non-linear and time-resolved spectroscopies) [2, 3, 7, 10, 13, 15, 19, 26, 29].

Politecnico Milano, Italy G. Cerullo (Ultrafast Optics) [4, 8, 9, 12, 13, 25].

Radbound University of Nijmegen, Netherlands A. Kimel (Femtomagnetism) [4, 13, 25].

Ecole Polytechnique, Paris M. Vos (Raman spectrocopy in Heme proteins)[8, 16].

University of L'Aquila M. Aschi (Excited states dynamics, ab initio simulations) [6, 27].

University of Cambridge A. Ferrari (Non-linear spectroscopy of Graphene)[12].

Kansas University C.G. Elles (Ultrafast processes in conjugated molecules) [6, 27].

IIT-Polimi Annamaria Petrozza (ultrafast spectroscopy in Perovskites) [9].

Oxford University Philip Kukura (multidimensional Raman spectroscpy) [15, 29].

Elettra Sincrotrone Trieste C. Masciovecchio (Nonlinear Phenomena in the X-Ray regimes) [18, 30].

Hebrew University of Jerusalem S. Ruhman (time-domain Raman spectroscopy) [in preparation].

University of Strasbourg S. Berciaud (2D materials) [20].

Part XI - Computer skills and competences

hardware Good knowledge of PC architecture and assembling.

OS Good knowledge of Windows/Unix: System configuration and administration.

Instrument controls Good knowledge of Matlab and Labview.

Programming Advanced knowledge of Matlab. Basics of programming in C, C++, Perl, Java, Python.

Scientific softwares Advanced knowledge of numerical computing environments: Matlab, Mathematica, Origin.
Good knowledge of computational chemistry and molecular dynamics softwares: Gaussian, Dalton, Orca, Gromacs.

Text and image editing Advanced knowledge of document and images preparation systems: Latex, vi, Word, html, Power Point, Photoshop, Gnuplot, CorelDraw, Avogadro, Chimera.

Part XII - Conferences and Invited Talks

14 talks at International events

Oral Contributions at International Conferences/School

O1 2023, June 11-16, Time Resolved Vibrational Spectroscopy, Amsterdam, Nederlands: oral presentation "*Measuring the sign of excited-state displacements by impulsive vibrational spectroscopy*".

O2 2022, August 14-19, International Conference on Raman Spectroscopy 2022, Long Beach, California, USA: invited oral presentation "*Excited-state surfaces in molecules revealed by impulsive stimulated Raman excitation profiles*".

O3 2022, July 18-22, XXIII International Conference on Ultrafast Phenomena, hybrid meeting (in presence and virtual): oral presentation "*Spectral tuning of Extreme Ultraviolet Femtosecond Pulses driven by ultrafast nonlinear light-matter interactions*".

O4 2021, October 14-15, EuPRAXIA@SPARC_LAB user workshop, Online: Invited oral presentation "*Time-resolved nonlinear spectroscopy at FEL sources*".

O5 2021, August 23-26, 11^{th} International Conference On Advanced Vibrational Spectroscopy (ICAVS11), Online: oral presentation "*Broadband Impulsive Stimulated Raman Scattering based on a Chirped Detection*".

O6 2020, July 30-August 1, International School On Nonlinear Vibrational Spectro-microscopy (ICONS), Online: lecture on "*Experiments and Theory: Simulating Nonlinear Raman Responses.*

O7 2020, July 30-August 1, International School On Nonlinear Vibrational Spectro-microscopy (ICONS), Online: lecture on "*Virtual Lab Tour: Time-domain and frequency-domain Raman spectroscopies.*

O8 2019, January 4-6, International Symposium of Nonlinear Optical Spectroscopy, Hefei, China, invited talk "*Manipulating Impulsive Stimulated Raman Spectroscopy with a Chirped Probe Pulse*.

O9 2018, August 26-31, International Conference on Raman Spectroscopy, Jeju, South Korea, oral presentation "*Probing Femtosecond Lattice Displacement upon Photo-Carrier Generation in Lead Halide Perovskites*".

O10 2018, July 15-20, XXI International Conference on Ultrafast Phenomena, Hamburg, Germany, oral presentation "*Visualizing excited state dynamics of conjugated molecules trough femtosecond stimulated Raman scattering*".

O11 2016, August 13-19, International Conference on Raman Spectroscopy, Fortaleza, Brazil, oral presentation "*Probing ultrafast photo-induced dynamics of the exchange energy in a Heisenberg antiferromagnet*".

O12 2016, January 10-15, Young Investigator Workshop, Winklmoos-Alm, Reit im Winkl, Germany, oral presentation "*Probing ultrafast photo-induced dynamics of the exchange energy in a Heisenberg antiferromagnet by Femtosecond Stimulated Raman Scattering*".

O13 2015, October 12-14, 6^{th} Youth Researcher Meeting (YRM), L'Aquila, Italy, oral presentation "*Probing ultrafast photo-induced dynamics of the exchange energy in a Heisenberg antiferromagnet by Femtosecond Stimulated Raman Scattering*".

O14 2015, July 12-17, 6^{th} 8^{th} International Conference On Advanced Vibrational Spectroscopy (ICAVS8), Wien, Austria, oral presentation "*Snapshots of ultrafast dynamics in Neuroglobin captured by Femtosecond Stimulated Raman Scattering*".

Poster Contributions P1 2020, November 16-19, Ultrafast Phenomena, online, poster presentation "*Disentangling genuine dynamics from cross phase modulation artefacts in Femtosecond Stimulated Raman Spectroscopy*"

P2 2016, September 5-8, International Science@FELs Conference, Trieste, Italy: poster presentation "*Visualizing excited state dynamics of conjugated molecules trough femtosecond stimulated Raman scattering*".

Part XIII - Full publications list

1. *Detection of excited level population transfer in an MOT through the measurement of trapped atom number.*
   L. Moi, G. Batignani, A. Khanbekyan, K. Khanbekyan, C. Marinelli, E. Mariotti, *et al.*.
   Meas. Sci. Technol. **24**, 015201 (2013).

2. *Energy flow between spectral components in 2d broadband stimulated raman spectroscopy.*
   G. Batignani, G. Fumero, S. Mukamel, and T. Scopigno.
   Phys. Chem. Chem. Phys. **17**,10454 (2015).

3. *On the resolution limit of Femtosecond Stimulated Raman Spectroscopy: modelling fifth-order signals with overlapping pulses.*
   G. Fumero, G. Batignani, K. E. Dorfman, S. Mukamel and T. Scopigno.
   Chem. Phys. Chem. **16**, 3438 (2015).

4. *Probing ultrafast photo-induced dynamics of the exchange energy in a Heisenberg antiferromagnet.*
   G. Batignani, D. Bossini, N. Di Palo, C. Ferrante, E. Pontecorvo, G. Cerullo, A. Kimel and T. Scopigno.
   Nature Photon. **9**, 506 (2015).

5. *Electronic resonances in broadband stimulated raman spectroscopy.*
   G. Batignani, E. Pontecorvo, G. Giovannetti, C. Ferrante, G. Fumero, and T. Scopigno.
   Sci. Rep. **6**, 18445 (2016).

6. *Visualizing Excited-State Dynamics of a Diaryl Thiophene: Femtosecond Stimulated Raman Scattering as a Probe of Conjugated Molecules.*
   G. Batignani, E. Pontecorvo, C. Ferrante, M. Aschi, C. G. Elles and T. Scopigno.
   J. Phys. Chem. Lett. **7**, 2981 (2016).

7. *Manipulating Impulsive Stimulated Raman Spectroscopy with a Chirped Probe Pulse.*
   L. Monacelli, G. Batignani, G. Fumero, C. Ferrante, S. Mukamel and T. Scopigno.
   J. Phys. Chem. Lett. **8**, 966 (2017).

8. *Resonant Broadband Stimulated Raman scattering in Myoglobin.*
   C. Ferrante, G. Batignani, G. Fumero, E. Pontecorvo, A. Virga, L. C. Montemiglio, G. Cerullo, M. H. Vos, and T. Scopigno.
   J. Raman Spectrosc. **49**, 913 (2018).

9. *Probing femtosecond lattice displacement upon photo-carrier generation in lead halide perovskite.*
G. Batignani, G. Fumero, A. R. S. Kandada, G. Cerullo, M. Gandini, C. Ferrante, A. Petrozza and T. Scopigno.
Nat. Commun. **9**, 1971 (2018).

10. *Genuine dynamics vs cross phase modulation artefacts in Femtosecond Stimulated Raman Spectroscopy.*
G. Batignani, G. Fumero, E. Pontecorvo, C. Ferrante, S. Mukamel and T. Scopigno.
ACS Photonics **6**, 492 (2019).

11. *The Potential of EuPRAXIA@SPARC_LAB for Radiation Based Techniques.*
A. Balerna, S. Bartocci, G. Batignani et al..
Condensed Matter **4**, 30 (2019).

12. *Coherent anti-Stokes Raman Spectroscopy of single and multi-layer graphene.*
A. Virga, C. Ferrante, G. Batignani, D. De Fazio, A. D. Nunn, A. C. Ferrari, G. Cerullo and T. Scopigno.
Nat. Commun. **10**, 3658 (2019).

13. *Modelling the ultrafast response of two-magnon Raman excitations in antiferromagnets on the femtosecond timescale.*
G. Batignani, E. Pontecorvo, D. Bossini, C. Ferrante, G. Fumero, G. Cerullo, S. Mukamel and T. Scopigno.
Ann. Phys. **12**, 1900439 (2019).

14. *Broadband Impulsive Stimulated Raman Scattering based on a Chirped Detection.*
G. Batignani, C. Ferrante, G. Fumero and T. Scopigno.
J. Phys. Chem. Lett. **10**, 7789 (2019).

15. *Two-dimensional impulsively stimulated resonant Raman spectroscopy of molecular excited-states.*
G. Fumero, C. Schnedermann, G. Batignani, T. Wende, M. Liebel, G. Bassolino, C. Ferrante, S. Mukamel, P. Kukura, T. Scopigno.
Phys. Rev. X **10**, 011051 (2020).

16. *Ultrafast dynamics and vibrational relaxation in six-coordinate heme proteins revealed by Femtosecond Stimulated Raman Spectroscopy.*
C. Ferrante[a] and G. Batignani[a], E. Pontecorvo, L.C. Montemiglio, M. H. Vos, T. Scopigno.
J. Am. Chem. Soc. **142**, 2285 (2020).

[a]equal contribution

17. *Accessing Excited State Molecular Vibrations by Femtosecond Stimulated Raman Spectroscopy.*
G. Batignani, C. Ferrante and T. Scopigno.
J. Phys. Chem. Lett. **11**, 7805 (2020).

18. *Non-linear self-driven spectral tuning of Extreme Ultraviolet Femtosecond Pulses in monoatomic materials.*
C. Ferrante, E. Principi, A. Marini, G. Batignani et al..
Light: Sci. Appl. **10**, 92 (2021).

19. *Excited-State Energy Surfaces in Molecules Revealed by Impulsive Stimulated Raman Excitation Profiles.*
G. Batignani, C. Sansone, C. Ferrante, G. Fumero, S. Mukamel and T. Scopigno.
J. Phys. Chem. Lett. **12**, 9239 (2021).

20. *Picosecond energy transfer in a transition metal dichalcogenide-graphene heterostructure revealed by transient Raman spectroscopy.*
C. Ferrante, G. Di Battista, L. E. Parra Lopez, G. Batignani, E. Lorchat, A. Virga, S. Berciaud and T. Scopigno.
PNAS, **119**, 15, e2119726119, (2022).

21. *Stimulated Raman lineshapes in the large light-matter interaction limit.*
G. Batignani, G. Fumero, E. Mai, M. Martinati and T. Scopigno.
Opt. Mater.: X, **13**, 100134, (2022).

22. *2-hydroxyisobutyrate (2-HIBA), an unspecified mammalian metabolite, modulates ageing and fat deposition depending on the high glucose diet in C. elegans animal model.*
E. Schifano, G. Conta, A. Preziosi, C. Ferrante, G. Batignani, A. Tomassini, F. Sciubba, T. Scopigno, D. Uccelletti and A. Miccheli.
Front. Mol. Biosci. , **9**, 986022, (2022).

23. *Absolute excited state molecular geometries revealed by resonance Raman signals.*
G. Batignani, E. Mai, G. Fumero, S. Mukamel and T. Scopigno.
Nat. Commun., **13**, 7770, (2022).

Conference Proceedings

24. *Snapshots of sub-picosecond dynamics in heme-proteins captured by Femtosecond Stimulated Raman Scattering.*
C. Ferrante, E. Pontecorvo, G. Batignani and T. Scopigno.
Springer Proceedings in Physics (OSA) (2014).

25. *Probing ultrafast photo-induced dynamics of the exchange energy in a Heisenberg antiferromagnet.*
G. Batignani, D. Bossini, N. Di Palo, C. Ferrante, E. Pontecorvo, G. Cerullo, A. Kimel and T. Scopigno.
OSA Technical Digest (2016).

26. *Probing ultrafast processes by fifth order Stimulated Raman Scattering with overlapping pulses.*
G. Fumero, G. Batignani, K. E. Dorfman, S. Mukamel and T. Scopigno.
Journal of Physics: Conference Series, **689**, 012023 (2016).

27. *Visualizing excited state dynamics of conjugated molecules trough femtosecond stimulated Raman scattering.*
G. Batignani, E. Pontecorvo, C. Ferrante, M. Aschi, C. G. Elles and T. Scopigno.
EPJ Web Conf, **205**, 09015 (2019).

28. *Disentangling genuine dynamics from cross phase modulation artefacts in Femtosecond Stimulated Raman Spectroscopy.*
G. Batignani, C. Ferrante, G. Fumero, and Tullio Scopigno.
OSA Technical Digest (2020).

29. *2D Impulsively Stimulated Resonant Raman Spectroscopy of Molecular Excited States.*
G. Fumero, C. Schnedermann, G. Batignani, T. Wende, M. Liebel, G. Bassolino, C. Ferrante, S. Mukamel, P. Kukura, and T. Scopigno.
OSA Technical Digest (2022).

30. *Spectral tuning of Extreme Ultraviolet Femtosecond Pulses driven by ultrafast nonlinear light-matter interactions.*
C. Ferrante, E. Principi, A. Marini, G. Batignani, G. Fumero, A. Virga, L. Foglia, R. Mincigrucci, A. Simoncig, C. Spezzani, C. Masciovecchio, and T. Scopigno.
OSA Technical Digest (2022).

Other publications

31. *L'esperimento di Pacini sull'origine dei raggi cosmici*
G. Cerretani, G. Batignani, R. Paoletti, M. Bitossi and A. De Angelis.
Giornale di Fisica (2011).

32. *Magneto-Optical Traps for fundamental measurements*
E. Mariotti, L. Moi, G. Batignani, A. Khanbekyan, C. Marinelli, *et al.*
Journal of the Siena Academy of Sciences (2011).