

Curriculum Vitae

Dr. Elisa Borfecchia

PERSONAL INFORMATION

Family name, First name: Borfecchia, Elisa
Researcher unique identifier(s): ORCID: 0000-0001-8374-8329,
 Research ID: M-2568-2015
Date of birth: 12 January 1985
Nationality: Italian
Address: Department of Chemistry, University of Turin
 Via P. Giuria 7, 10125 Torino (Italy)
E-mail: elisa.borfecchia@unito.it



EDUCATION

01/01/2010 – 31/12/2012	PhD in Science and Technology of Materials and Nanosystems Disputation date: 22/01/2013 Department of Chemistry, University of Turin, Italy Title: <i>“Synchrotron radiation time and space resolved characterization of materials: a new frontier in Material Science”</i> . PhD Supervisor: Prof. Carlo Lamberti
01/10/2006 – 22/07/2009	Master in Physics of the Advanced Technologies (110/110 cum laude) Faculty of Physics, University of Turin, Italy Title: <i>“Characterization of metallorganic complexes investigated by pump and probe experiment in the ns and μs time delay regime”</i> .

CURRENT POSITION(S)

28/12/2021 – now	Associate professor, Physical Chemistry Department of Chemistry, University of Turin, Italy
------------------	---

PREVIOUS POSITIONS

28/12/2018 – 27/12/2021	Assistant professor, Physical Chemistry Department of Chemistry, University of Turin, Italy Marie Skłodowska-Curie Fellow
01/07/2018 – 26/12/2018	Center for Materials Science and Nanotechnology (SMN), Chemistry Department, University of Oslo, Norway
01/07/2016 – 30/06/2018	Industrial Scientist R&D, Atomic Scale Analysis Department, Haldor Topsøe A/S, Denmark
01/10/2017 – 30/06/2018	Adjunct Professor , ‘Elements of Biochemistry – Physical Chemistry Module’ BSc Degree in Science of Sport Activities, University of Turin, Italy
01/07/2015 – 30/06/2016	Post-doctoral Fellow Department of Chemistry, University of Turin, Italy
07/01/2015 – 30/06/2015	Research Trainee National Institute for Materials Science and Technology (INSTM), Italy
01/01/2013 – 31/12/2014	Post-doctoral Fellow , Department of Chemistry, University of Turin, Italy

FELLOWSHIPS

01/07/2018 – 30/06/2020	Marie Skłodowska-Curie Individual Fellowship , call H2020-MSCA-IF-2017. Project title: <i>‘CASCADE-X - CO₂ to light olefins conversion by cascade reactions over bifunctional nanocatalysts: an ‘all X-ray’ approach’</i> . Host institution: University of Oslo (Chemistry Department). EU funding: 196 K€/2 Yr.
-------------------------	---

01/07/2016 – 30/06/2018	<p>Industrial Post-Doc Fellowship, Innovation Fund Denmark, Denmark. Project: 'SYNCHRO-M2M: Synchrotron-enhanced characterization of Cu-based heterogeneous catalysts for the direct conversion of methane to methanol'. Partners: Company: Haldor Topsøe A/S (Denmark), Research Institution: University of Turin, (Italy). Funding: ca. 100 K€/2 Yr (fellow salary, project-related costs and travel expenses)</p>
01/07/2015 – 30/06/2016	<p>Italian Ministerial Post-Doc Fellowship ('Assegno Co-finanziato MIUR') to fund research at the Department of Chemistry, University of Turin, Italy. Project: 'Characterization of advanced materials using synchrotron radiation techniques'. Funding: 20 K€/1 Yr (fellow salary).</p>
01/01/2010 – 22/01/2013	<p>PhD fellowship, National Institute for Materials Science and Technology, Project: 'Synchrotron radiation time and space resolved characterization of materials: a new frontier in material science'. Funding: 25 K€/3 Yr (fellow salary).</p>

PRIZES AND AWARDS

2019	<p>"2019 ESRF Young Scientist Award" (assigned every year by the Users Organisation for outstanding work done by an ESRF user at the ESRF facilities) for the impressive results on selective catalysis that Dr. Borfecchia obtained with extensive use of X-ray spectroscopy.</p>
2018	<p>"2018 Dale Sayer Outstanding Young Scientist Award for the Applications of XAFS" (assigned every three years by the International X-ray Absorption Society, iXAS) in recognition of Dr Borfecchia's application of XAFS studying the reactivity of metals sites in catalysts.</p> <p>Prize "L'ORÉAL Italia For Women in Science", edition 2017/2018 Letter of appreciation from the Evaluation Committee for being selected among the 10 top applications over ca. 450 applications received in all the fields of Life, Physical, Formal Sciences and Engineering Science.</p>
2010	<p>Award "Premio Optime" from the Italian Industrial Union for the best MSc Thesis in Physics (Academic Year 2009/2010).</p>

Italian National Scientific Qualification (ASN)

2018 – 2027	<p>After evaluation of her scientific and academic CV by a national review panel, Dr. Borfecchia has been certified as qualified for the function of Associate Professor from 05/04/2018 to 05/04/2027 in the following scientific sectors:</p> <ul style="list-style-type: none"> • Physical Chemistry (Scientific Sector 03/A2) • Inorganic Chemistry (Scientific Sector 03/B1) • Chemical Fundaments of Technologies (Scientific Sector 03/B2)
-------------	--

SUPERVISION OF MASTER and PhD STUDENTS

2013 – now	<p>Supervisor for:</p> <ul style="list-style-type: none"> • 10 Master Students, Master Degree in Materials Science, University of Turin, Italy. • 1 PhD student, PhD Course in Chemistry and Materials Science, University of Turin, Italy <p>Co-supervisor/mentor for:</p> <ul style="list-style-type: none"> • 7 Master Students, Departments of Physics, Chemistry, and Drug Science and Technology, University of Turin, Italy. • 1 Master Student in Chemistry, Department of Chemistry, University of Oslo, Norway. • 5 PhD students, PhD Course in Chemistry and Materials Science, University of Turin, Italy (in cotutelle with Southern Federal University, Rostov-on-Don, Russia). • 1 Visiting PhD student (University of Aarhus, Denmark)
------------	--

TEACHING ACTIVITIES

A.A. 2021-2022	<ul style="list-style-type: none"> • Course: <i>X-ray spectroscopy for the characterization of molecules and materials</i> (SSD: CHIM/02), Master Degree in Degree in Materials Science, University of Turin, Italy (4 CFU – 24 h frontal lesson + 16 h laboratory). • Course: <i>Structure Characterization and Modelling</i> (SSD: CHIM/02), Master Degree in Degree in Materials Science, University of Turin, Italy and MaMaSELF+ - Master in Materials Science Exploring Large Scale Facilities (4 CFU – 32 h frontal lesson). • <i>Summer school 2021, MaMaSELF+</i> - Master in Materials Science Exploring Large scale Facilities, Lecture: <i>XAFS</i> (1 CFU - 8 h frontal lesson), Montpellier, September, 2021.
A.A. 2020-2021	<ul style="list-style-type: none"> • Course: <i>X-ray spectroscopy for the characterization of molecules and materials</i> (SSD: CHIM/02), Master Degree in Degree in Materials Science, University of Turin, Italy (4 CFU – 24 h frontal lesson + 16 h laboratory). • Course: <i>Advanced Crystallography – Spectroscopy Module</i> (SSD: CHIM/02), Master Degree in Degree in Materials Science, University of Turin, Italy and MaMaSELF+ - Master in Materials Science Exploring Large Scale Facilities (3 CFU – 24 h frontal lesson). • <i>Summer school 2020, MaMaSELF+</i> - Master in Materials Science Exploring Large scale Facilities, Lecture: <i>XAFS</i> (1 CFU - 8 h frontal lesson), Montpellier, September 14, 2020.
A.A. 2019-2020	<ul style="list-style-type: none"> • Short course <i>“Synchrotron-based X-ray spectroscopy: Principles, methods and applications to metal ions in porous frameworks”</i>, Ph.D. School in Industrial Chemistry, University of Milan (0.5 CFU, 4 h frontal lesson), 07-06/02/2020. • Course: <i>X-ray spectroscopy for the characterization of molecules and materials</i> (SSD: CHIM/02), Master Degree in Degree in Materials Science, University of Turin, Italy (4 CFU – 24 h frontal lesson + 16 h laboratory). • Course: <i>Advanced Crystallography – Spectroscopy Module</i> (SSD: CHIM/02), Master Degree in Degree in Materials Science, University of Turin, Italy and MaMaSELF+ - Master in Materials Science Exploring Large Scale Facilities (3 CFU – 24 h frontal lesson). • <i>Summer school 2019, MaMaSELF+</i> - Master in Materials Science Exploring Large scale Facilities, Lecture: <i>XAFS</i> (1 CFU - 8 h frontal lesson), Montpellier, September 10, 2019.
A.A. 2018-2019	<ul style="list-style-type: none"> • Course: <i>Materials Today - Module: Metal Organic Frameworks</i> (SSD: CHIM/02), BSc Degree in Materials Science, University of Turin, Italy (8 h frontal lessons, 1 CFU). • Course: <i>Chimica Fisica II, Esercitazioni</i> (SSD: CHIM/02), BSc Degree in Materials Science, University of Turin, Italy (12 h training, 1 CFU)
01/10/2014 – 30/06/2018	<ul style="list-style-type: none"> • <i>Adjunct Professor, ‘Elements of Biochemistry – Physical Chemistry Module’</i>, BSc Degree in Science of Sport Activities, University of Turin, Italy (16 h frontal lessons, approx. 130 students per Academic Year)
01/10/2015 – 30/09/2016	<ul style="list-style-type: none"> • <i>Adjunct Professor, ‘Realignment Course in Physics and Chemistry’</i>, BSc Degree in Science of Sport Activities, University of Turin, Italy (16 h frontal lessons, ca. 180 students)
From 2012	<ul style="list-style-type: none"> • <i>Several didactic seminars</i> given at the Departments of Physics and Chemistry of the University of Torino for the students of the Master degree courses in Physics, Materials Science and MaMaSELF European Master about properties and applications of synchrotron radiation.

COMMISSIONS OF TRUST

From 2014	<ul style="list-style-type: none"> • Reviewer for the following international (ISI) journals: <i>Nature, Nature Chem., Nature Catal., Nature Comm., J. Am. Chem. Soc., Angew. Chem., -Int. Edit., ACS Catal., J. Catal., Appl. Catal. B, Catal. Sci. & Technol.; J. Phys. Chem. C, Phys. Chem. Chem. Phys.; Catalysts, React. Kinet. Mech. Cat., Appl. Surf. Sci., Mater. Sci. Eng. B, Rad. Phys. Chem., J. Environ. Sci.</i> • Reviewer for the book: 'XAS and XES; theory and applications', J. A. van Bokhoven, C. Lamberti Eds., John Wiley & Sons (2016), ISBN: 978-1-118-84423.
From 2022	<ul style="list-style-type: none"> • Coordinator for the MaMaSELF² (Master in Materials Science Powered by Large Scale Facilities) Erasmus Mundus program at UniTO and member of the students' selection panel.
From 2019	<ul style="list-style-type: none"> • Assistant coordinator for the MaMaSELF+ (Master in Materials Science Exploring Large Scale Facilities) Erasmus Mundus program at UniTO and member of the students' selection panel.
04/2022-now	<ul style="list-style-type: none"> • Member of the Beamtime Allocation Panel of the ESRF; C11 Panel (beamlines ID20, ID24, ID26)
10/2019-now	<ul style="list-style-type: none"> • Member of the Proposal Review Committee of the Photon Science Division (Paul Scherrer Institute, PSI, Switzerland); HardXAS sub-committee (beamlines: MicroXAS, SuperXAS, Phoenix).
12/2020-02/2021	<ul style="list-style-type: none"> • Project Evaluator, PSI-FELLOW-III-3i program (EC co-funded post-doctoral programme at Paul Scherrer Institute, PSI, Switzerland), https://www.psi.ch/en/psi-fellow/about-psi-fellow.
03/2020-07/2020 & 03/2021-07/2021	<ul style="list-style-type: none"> • Member of the Recruitment Advisory Board for MSCA COFUND PhD Programme INNOVAXN at the European Synchrotron Radiation Facility (ESRF) and Institute Laue Langevin (ILL), Grenoble (France).
From 2019	<ul style="list-style-type: none"> • Project Evaluator, ACS Petroleum Research Fund, American Chemical Society.
09/2019	<ul style="list-style-type: none"> • Proposal Evaluator, Stanford Synchrotron Radiation Lightsource (SSRL), California, US.
09/2018	<ul style="list-style-type: none"> • Proposal Evaluator, Swiss Norwegian Beamlines (SNBL), ESRF, France.
2016	<ul style="list-style-type: none"> • Project Evaluator, Swiss National Science Foundation (SNSF), Switzerland.

MEMBERSHIP OF SCIENTIFIC SOCIETIES

12/2020 - 12/2023	<ul style="list-style-type: none"> • Member of the Council ("Giunta"), Italian Synchrotron Radiation Society (SILS)
From 2019	<ul style="list-style-type: none"> • Member of the <i>Società Chimica Italiana</i> (Div. Chimica Fisica, Gruppo Interdivisionale di Catalisi).
From 2018	<ul style="list-style-type: none"> • Member of the <i>International X-ray Absorption Society (IXAS)</i>.

RESEARCH PROJECTS

01/01/2020 - 31/12/2026	<ul style="list-style-type: none"> • Project CUBE "Copper Based catalysts for selective C-H activation", ERC-Synergy. <u>Role: Participant</u>; PI (UniTO unit): Prof. S. Bordiga (budget UniTO unit: 2 100 000 €).
05/06/2019 - 04/06/2022	<ul style="list-style-type: none"> • Project MOSCATo "Cutting-edge X-ray methods and models for the understanding of surface site reactivity in heterogeneous catalysts and sensors", PRIN-2017, <u>Role: Participant</u>; PI (UniTO coordinator unit): Prof. G. Ricchiardi (budget UniTO unit: 209 406 €).
01/05/2019 - 30/04/2023	<ul style="list-style-type: none"> • Project COZMOS "Efficient CO₂ conversion over multisite Zeolite-Metal nanocatalysts to fuels and Olefins", H2020 RIA, H2020-LC-SC3-2018-NZE-CC. <u>Role: Participant</u>; PI (UniTO unit): Prof. S. Bordiga (overall budget: 4 752 386 €).
01/07/2018 - 27/12/2018	<ul style="list-style-type: none"> • Project CASCADE-X "CO₂ to light olefins conversion by cascade reactions over bifunctional nanocatalysts: an 'all X-ray' approach", Marie Skłodowska-Curie

01/07/2016 - 30/06/2018

Action, Individual Fellow (MSCA-IF), call H2020-MSCA-IF-2017. Host institution: Center for Materials Science and Nanotechnology (SMN) and Chemistry Dept., University of Oslo (Norway); supervisor: Prof. Unni Olsbye. **Role: PI** (funding: 196 400 € / 2 years).

- **Project SYNCHRO-M2M** “Synchrotron-enhanced characterization of Cu-based heterogeneous catalysts for the direct conversion of methane to methanol”, project n. 5190-00018B, Call “**Industrial Researcher** 07-03-2016, funded by Innovation Fund Denmark and based on the collaboration between UniTO and Haldor Topsøe A/S (<https://innovationsfonden.dk/en/investment/industrial-researcher>). **Role: PI** (funding: 102 000 € / 2 years).

MAJOR COLLABORATIONS

Collaborations with International Academic and Research Institutions

- University of Oslo and Industrial Catalysis Science and Innovation Centre, iCSI (Norway), Prof. U. Olsbye, Prof. S. Svelle; Host institution for previous MSCA-IF project (> 10 common publications).
- Southern Federal University and International Research Center “Smart Materials” (Russian Federation), Prof. A. V. Soldatov (co-supervision of 4 PhD students in co-tutelle, > 10 common publications);
- Massachusetts Institute of Technology, MIT (Boston, US), Prof. M. Dinca (4 common publications);
- University of Warwick (UK), Prof. P. J. Sadler (4 common publications);
- Elettra Synchrotron (Italy), Dr. P. Torelli, Dr. L. Braglia (beamline APE-HE), partner for the ongoing PRIN-2017 MOSCATo project.
- European Synchrotron Radiation Facility, ESRF (France), Dr. K. A. Lomachenko, Dr. G. Agostini (beamline BM23/ID24), Dr. A. Longo (beamline BM26), Dr. P. Glatzel (beamline ID26); Dr. M. Wulff (beamline ID09B), Dr. G. Martinez Criado (beamline ID16NA) (in total, > 20 common publications).

Collaboration with National and International Companies

- Umicore Denmark ApS, Automotive Catalysts (Denmark), Dr. T.V.W. Janssens (8 common publications).
- Haldor Topsøe A/S (Denmark), Dr. P. Beato, Dr. H. Falsig, Dr. L. Lundegaard, A. Puig-Molina (>10 common publications, employed in the company R&D during the previous Industrial Researcher project);
- SINTEF (Norway), Dr. B. Arstad (> 10 common publications);
- Chimet SpA (Italy), Dr. R. Pellegrini (1 common publication).

RESEARCH EXPERIENCE AND PRINCIPAL INTERESTS

Dr. Borfecchia has strong background in physical chemistry/material science and a consolidated experience on the use of **X-ray spectroscopy to characterize nanomaterials**. After a PhD project centred on data acquisition and analysis protocols for cutting-edge time- and space-resolved synchrotron experiments, her research interests become focused on **in situ/operando synchrotron-based X-ray absorption and emission spectroscopy**, combined with laboratory-based techniques (mostly FTIR, UV-Vis-NIR, EPR) to unravel the local structural and electronic properties of transition metal centres in heterogeneous catalysts. Key investigated systems/processes include Cu-exchanged zeolites for deNO_x applications and partial selective oxidation of methane to methanol, redox-active metal sites in metal organic frameworks, combined catalytic systems for CO₂ valorisation. She is also involved in **developing innovative experimental setups** (e.g., ambient pressure NEXAFS, quasi-simultaneous multi-technique collection) **and data analysis methods** (e.g., multivariate/statistical analysis, Machine Learning, EXAFS Wavelet transform) for X-ray spectroscopy.

PUBLICATIONS

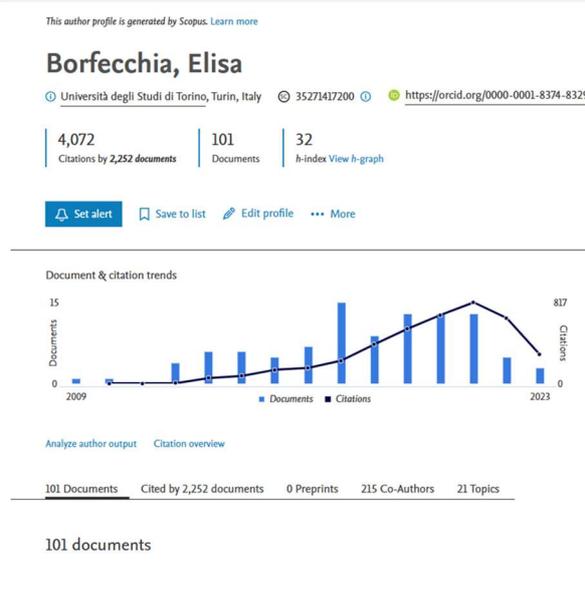
Publication summary (source: Scopus, 01/06/2023)

- **81** peer-reviewed articles;
- **6** peer-reviewed review articles;
- **10** peer-reviewed conference proceedings;
- **4** peer-reviewed book chapters;
- **9** short papers on the ESRF Highlights;
- **2** on-line “ESRF Spotlights” articles.

Bibliometric IndexesScopus ([Google Scholar](#)), updated on 01/06/2023

Sum of Times Cited 4072 (4907)

h-index 32 (32)

**Ten selected publications in the last five years**

1. Martini, A.; Negri, C.; Bugarin, L.; Deplano, G.; Abasabadi, R. K.; Lomachenko, K. A.; Janssens, T. V. W.; Bordiga, S.; Berlier, G.; **Borfecchia, E.***, Assessing the Influence of Zeolite Composition on Oxygen-Bridged Diamino Dicopper(II) Complexes in Cu-CHA DeNO_x Catalysts by Machine Learning-Assisted X-ray Absorption Spectroscopy. *Phys. Chem. Lett.* **2022**, *13*, 26, 6164-6170.
2. Negri, C.; Selleri, T.; **Borfecchia, E.**; Martini, A.; Lomachenko, K.A.; Janssens, T.V.W.; Cutini, M.; Bordiga, S.; Berlier, G.; Structure and reactivity of oxygen-bridged diamino dicopper (II) complexes in Cu-CHA catalyst for NH₃-SCR, *J. Am. Chem. Soc.* **2020**, *142*, 15884-15896.
3. Martini, A.; Signorile, M.; Negri, C.; Kvande, K.; Lomachenko, K.A.; Svelle, S.; Beato, P.; Berlier, G.; **Borfecchia, E.***; Bordiga, S., EXAFS wavelet transform analysis of Cu-MOR zeolites for the direct methane to methanol conversion, *Phys. Chem. Chem. Phys.* **2020**, *22*, 18950-18963.
4. **Borfecchia, E.***; Negri, C.; Lomachenko, K. A.; Lamberti, C.; Janssens, T. V. W.; Berlier, G., Temperature-dependent dynamics of NH₃-derived Cu species in the Cu-CHA SCR catalyst. *React. Chem. Eng.* **2019**, *4*, 1067-1080.
5. Pappas, D. K.; Martini, A.; Dyballa, M.; Kvande, K.; Teketel, S.; Lomachenko, K. A.; Baran, R.; Glatzel, P.; Arstad, B.; Berlier, G.; Lamberti, C.; Bordiga, S.; Olsbye, U.; Svelle, S.; Beato, P.; **Borfecchia, E.***, The nuclearity of the active site for methane to methanol conversion in Cu-mordenite: a quantitative assessment, *J. Am. Chem. Soc.*, **2018**, *140*, 45, 15270-15278.
6. **Borfecchia, E.**; Beato, P.; Svelle, S.; Olsbye, U.; Lamberti, C.; Bordiga, S., Cu-CHA – a model system for applied selective redox catalysis, *Chem. Soc. Rev.*, **2018**, *47*, 8097-8133.
7. Pappas, D. K.; **Borfecchia, E.***; Dyballa, M.; Pankin, I.; Lomachenko, K. A.; Martini, A.; Signorile, M.; Teketel, S.; Arstad, B.; Berlier, G.; Lamberti, C.; Bordiga, S.; Olsbye, U.; Lillerud, K. P.; Svelle, S.; Beato, P., Methane to methanol: structure-activity relationships for Cu-CHA. *J. Am. Chem. Soc.* **2017**, *139*, 14961-14975.
8. Martini, A.; **Borfecchia, E.***; Lomachenko, K. A.; Pankin, I.; Negri, C.; Berlier, G.; Beato, P.; Falsig, H.; Bordiga, S.; Lamberti, C., Composition-driven Cu-speciation and reducibility in Cu-CHA zeolite catalysts: a multivariate XAS/FTIR approach to complexity. *Chem. Sci.* **2017**, *8*, 6836-6851.
9. Andersen, C. W.; **Borfecchia, E.**; Bremholm, M.; Jørgensen, M.; Vennestrøm, P.; Lamberti, C.; Lundegaard, L.; Brummerstedt Iversen, B., Redox driven migration of Cu ions in Cu-CHA highlighted by in situ PXRD/XANES. *Angew. Chem. Int. Edit.*, **2017**, *56*, 10367-10372.
10. Lomachenko, K. A.; **Borfecchia, E.***; Negri, C.; Berlier, G.; Lamberti, C.; Beato, P.; Falsig, H.; Bordiga, S., The Cu-CHA deNO_x Catalyst in Action: Temperature-Dependent NH₃-Assisted Selective Catalytic Reduction Monitored by Operando XAS and XES. *J. Am. Chem. Soc.* **2016**, *138*, 12025-12028.

CONTRIBUTIONS TO CONFERENCES and OTHER SCIENTIFIC EVENTS

- **Presenting Author for:**
 - 7 invited oral contributions to International Conferences
 - 1 invited oral contribution to National Conferences
 - 6 oral contributions to International Conferences
 - 5 oral contributions to National/Local Conferences
 - 9 poster contributions to National & International Conferences
 - 4 invited talks to Industrial Workshops
 - 1 invited talk to Popular Science events
- **Co-Author for more than 80 oral and poster contributions**
- **Chair and/or member of the Scientific Committee for:**
 - 3 sessions/MS of National Conferences
 - 1 session of International Conference
 - 1 local Scientific Congress
- **Organizer for:**
 - 1 local Scientific Congress
 - 3 National Conferences
 - 3 International Schools

EXPERIMENTS AT LARGE SCALE SYNCHROTRON FACILITIES

From 2009	Co-proposer and/or member of the experimental team for > 60 experiments performed after acceptance of a peer-reviewed experimental proposal at international synchrotron sources, mostly at the ESRF (France) but also at the APS (US), MAX II/MAX IV (Sweden), Soleil (France) and Elettra (Italy).
From 2016	Main proposer and leader of the research expedition for 8 experiments at international synchrotron sources.

Torino, 01/06/2023

Elisa Borfecchia
