Maxime Dupraz

Gagliardiweg 7
8050 Zürich
Switzerland
☎ +33 6 33 07 40 09
✉ maxime.dupraz@esrf.fr

Materials / Beamline Scientist with expertise in Synchrotron techniques and Materials Science. Proven track record in understanding the microstructure and physical properties of metallic samples through Synchrotron X-ray Diffraction and Molecular Dynamics Simulations. Adept at developing novel X-ray techniques and methods. **Seeking opportunities in the Zurich area** *to apply my extensive skills in materials characterization, data analysis, and project management.*

Google Scholar 🎓   Twitter 🐦   LinkedIn 🔗   GitHub ⭘   ResearchGate   Homepage ⌂

Citations: **627**, H-index: **15**

Education and Degrees

2012 – 2015 **Doctor of Philosophy in Mechanics and Materials Science**, *SIMaP Laboratory, PM (Metal Physics) group, Université Grenoble Alpes.*
- Advisors: Dr. Marc Verdier, Dr. Guillaume Beutier
- Major Research Topics: Mechanics, Materials Science, Metal Physics, Crystallography, X-ray Diffraction

2008 – 2011 **Engineering degree with honors**, *Grenoble-INP PHELMA (Physics, Electronic, Materials), Grenoble, France.*
- Specialization: Materials for Engineering, Materials for Microelectronics, Semiconductor Physics.

2006 – 2008 **IUT Mesures Physics**, *Grenoble, France.*
- National Diploma awarded after a two-year university course, specialization in Materials Science, Electrical Engineering and Physics.

Work Experience and Academic Positions

Jan. 2022 – June 2024 **Beamline Scientist**, *CNRS, Institut Néel, QUEST (Quantum Electronic Surfaces and spin Tronics), CRG & grands instruments pole, BM02-D2AM beamline.*
The French CRG D2AM beamline hosted by the ESRF is dedicated to in situ and operando material characterization, taking advantage of two main endstations: a high precision Kappa Diffractometer and a SAXS bench. As a Beamline Scientist I introduced new experimental techniques and analysis methods to the beamline. I also collaborated with and provided support to researchers and industry professionals from the materials science and synchrotron communities, contributing to cutting-edge research initiatives.
- Support for user experiments
  - Preparation and optimization of the experimental setup
  - Beamline alignment and fine-tuning of the experiment
  - Development of python tools (scripts, python libraries, notebooks and templates, GUIs) to facilitate the online data treatment
  - Interpretation and discussion of the experimental results with the users
- Development and implementation of coherence-based techniques
  - Bragg Coherent X-ray Diffraction Imaging (BCDI : nanoparticles, nanostructures)
  - X-ray Photon Correlation Spectroscopy (XPCS : dynamic processes in polymers...)
  - Ptychography to characterize the beam properties
- Project management, technical and instrumental development
  - In charge of the development of a new X-ray focusing device (Transfocator) in partnership with several teams from Institut Néel as part of the MAGNIFIX project
  - Co-leader of the work package: "High hroughput of samples & automated alignment procedures" for the CarAX@F-CRG project under the DIADEM program
  - Co-leader of the work package: "Machine learning assisted data collection and data analysis" under the NANOX-ML ANR
  - Contributed to the implementation of the python based beamline control software (BLISS)

Jan. 2019 – **Postdoctoral Researcher**, *CEA Grenoble, IRIG, MEM (Modeling and Exploration of Materials) Laboratory*
Dec. 2021 *, NRS (Nanostructure Synchrotron Radiation) Group.*
- Probed strain evolution and dislocation structures in Pt nanoparticles (NP) during catalytic reactions using BCDI and Molecular Dynamics (MD) simulations. This led to several publications in high impact journals, which improved our understanding of strain and defects on catalytic properties of metallic NPs.
- Applied machine learning to classify defects in NP and used deep generative networks for diffraction inversion. This work paved the way for defect recognition in complex 3D X-ray diffraction data.

Jan. 2019 – **Visiting Postdoctoral Researcher**, *ESRF the European Synchrotron, XNP (X-ray nanoprobe), ID01*
Dec. 2021 *beamline.*
In parallel with the CEA Grenoble position, I was a visiting Postdoctoral Researcher on the ID01 beamline, conducting cutting-edge synchrotron experiments.

Jan. 2016 – **Postdoctoral Researcher**, *Paul Scherrer Institut, PEM (Photons for Engineering and Manufacturing)*
Dec. 2018 *group.*
- Contributed to the development of a biaxial tensile testing machine for *in situ* studies with X-ray Diffraction and Scanning Electron Microscopy under Prof. Helena Van Swygenhoven's ERC Grant MULTIAX. This machine was used to improve our understanding of the microstural evolution under biaxial loading.
- Studied dislocation mechanisms in nanocrystalline aluminum and interactions with grain boundaries through MD simulations. This work represented a significant achievement due to its detailed insights into interactions between dislocations and grain boundaries and their potential to impact materials design and engineering.

May. 2012 – **PhD. Student**, *Université Grenoble Alpes, SIMaP Laboratory, Metal Physics (PM) group.*
Nov. 2015
- Conducted 20 synchrotron experiments on sub-micron metallic and semiconductor nanostructures using Coherent X-ray Diffraction (CXD) and BCDI. This led to several important results including the first experimental nondestructive 3D imaging of dislocations in a submicrometric crystal, showcasing the potential of BCDI for broader use in materials science.
- Conducted MD simulations of crystal defects and nanoindentation, demonstrating the unique character of the signature of defects in CXD patterns.

Selected Publications

I have published nearly 30 articles in high-impact journals, and my work has been featured at various national and international conferences and workshops in the past decade.

2024 **Unveiling Core–Shell Structure Formation in a Ni3Fe Nanoparticle with *In Situ* Multi-Bragg Coherent Diffraction Imaging**.
C. Chatelier, C. Atlan, **M. Dupraz**, S. J. Leake, N. Li, T. U. Schülli, M. Levi, E. Rabkin, L. Favre, S. Labat, J. Eymery, & M.-I. Richard, ACS Nano **18**(21), 13517-13527

2023 **Imaging the strain evolution of a platinum nanoparticle under electrochemical control**.
C. Atlan, C. Chatelier, I. Martens, **M. Dupraz**, A. Viola, N. Li, L. Gao, S. J. Leake, T. U. Schülli, J. Eymery, F. Maillard, & M.-I. Richard, Nature Mater. **22**, 754-761

2022 **Imaging the facet surface strain state of supported multi-faceted Pt nanoparticles during reaction**.
M. Dupraz, N. Li, J. Carnis, L. Wu, S. Labat, C. Chatelier, R. van de Poll, J.-P Hofmann, E. Almog, S. J. Leake, Y. Watier, S. Lazarev, F. Westermeier, M. Sprung, E. JM Hensen, O. Thomas, E. Rabkin & M.-I. Richard, Nature Comm. **13**, 3003
Nature Communications Editors' Highlight section Catalysis

2021 **A convolutional neural network for defect classification in Bragg Coherent X-ray Diffraction**.
*indicates joint first author
B. Lim*, E. Bellec*, **M. Dupraz***, S. J. Leake, A. Resta, A. Coati, M. Sprung, E. Almog, E. Rabkin, T. Schülli & M.-I. Richard, npj Comp. Mat. **7**, 115

2020 **Bragg Coherent Imaging of Nanoprecipitates: Role of Superstructure Reflections**.
M. Dupraz, S. J. Leake, & M.-I. Richard, J. Appl. Cryst. **53**(5), 135369

2019 **Large scale 3-dimensional atomistic simulations of screw dislocations interacting with coherent twin boundaries in Al, Cu and Ni under uniaxial and multiaxial loading conditions**.
M. Dupraz, S. I. Rao, & H. Van Swygenhoven, Acta Mat. **174**, 16-28

2018 **Dislocation interactions at reduced strain rates in atomistic simulations of nanocrystalline Al**.
M. Dupraz, Z. Sun, C. Brandl & H. Van Swygenhoven, Acta Mat. **144**, 68-79

2017 **3D Imaging of a dislocation loop at the onset of plasticity in an indented nanocrystal**.
M. Dupraz, G. Beutier, T. W. Cornelius, G. Parry, R. Zhe, S. Labat, M.-I. Richard, G. A. Chahine, O. Kovalenko, M. De Boissieu, E. Rabkin, M. Verdier & O. Thomas, Nano Lett. **17**(11), 6696-6701
ESRF highlights 2017

2017 **A Miniaturized Biaxial Deformation Rig for *in Situ* Mechanical Testing**.
S. Van Petegem, A. Guitton, **M. Dupraz**, A. Bollhalder, K. Sofinowski, M. V. Upadhyay & H. Van Swygenhoven,
Exp. Mech. **57**, 569-580

2015 **Signature of dislocations and stacking faults of face-centred cubic nanocrystals in coherent X-ray diffraction patterns: a numerical study**.
M. Dupraz, G. Beutier, D.Rodney, D. Mordehai & M. Verdier, J. Appl. Cryst. **48**(3), 621-644
Most downloaded article from Journal of Applied Crystallography of the year 2015

Selected Invited Talks and Seminars

2024 **Exploring Machine Learning Techniques for Data Pre-processing and Analysis on the D2AM Beamline: A First Look**.
M. Dupraz, *et al.*, GDR IAMAT, Grenoble, France, 13/03/2024

2024 **Exploring the use of coherence on the D2AM beamline**.
M. Dupraz *et al.*, GDR-CohereX, Grenoble, France, 25/01/2024

2023 **BM02, the latest news**.
M. Dupraz *et al.*, AFURS, Grenoble, France, 12/06/2023

2020 **In situ** and **operando** structural evolution of single metallic nanoparticle model catalysts.
M. Dupraz *et al.*, Institut NEEL, Grenoble, France, 04/12/2020

2018 **Interaction of screw dislocations with coherent twin boundaries in fcc metals: large scale 3D simulations**.
M. Dupraz, S. I. Rao & H. Van Swygenhoven, MMM 2018, Osaka, Japan, 26/02/2018

Awards

2016 "PhD prize from the Association Française de Crystallographie (AFC), Physics", for my PhD work on Coherent X-ray Diffraction applied to metal Physics

Personnal and Technical Skills

Languages French (native), **English (fluent)**, **German (fair working knowledge) : CLOE: B1+ writing test and B2- oral test**, Spanish (fair working knowledge)

Programming Python (advanced), Matlab (intermediate), Fortran / Labview / C (basic)

Deep Learning Tensorflow, Keras (intermediate)

Data Analysis PyMCA, pyFAI, Silx (advanced), **Profex**, Lauetools, X-SOCS (intermediate), **Topas** (basic)

Key skills **Synchrotron X-ray Diffraction**, Data analysis, Project Management