LUCA SBUELZ

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PROFILE

Physicist with a PhD in Condensed Matter Physics from the University of Trieste, specializing in advanced materials research, device fabrication, and experimental design. Currently working at the High Mobility Molecular Beam Epitaxy (HMMBE) Lab and the Facility of Nano Fabrication (FNF) at the CNR - Istituto Officina dei Materiali (IOM), I bring extensive experience in diverse interdisciplinary projects. My work has included upgrading and maintaining the ENAC cluster source at the Nanoscale Materials Laboratory, a collaboration between Elettra-Sincrotrone Trieste and the University of Trieste, in coordination with the SuperESCA beamline at Elettra; contributing to the design of the SPHERE-X setup for INFN in collaboration with the INFN workshop in Trieste and the SYRMEP beamline at Elettra; and fabricating and characterizing III-V semiconductor devices at the HMMBE lab and FNF. I am highly skilled in utilizing state-of-the-art equipment to conduct complex experiments, with strong expertise in data analysis and problem-solving. A quick learner and dedicated professional, I can work under pressure, consistently meeting deadlines and delivering high-quality results.

WORK EXPERIENCE

Post-Doc (assegno di ricerca) 2024-Present

CNR - Istituto Officina dei Materiali (IOM), IT

Activity performed at the High Mobility Molecular Beam Epitaxy (HMMBE) lab and the Facility of Nano Fabrication (FNF) of CNR - Istituto Officina dei Materiali (IOM) in the project "Development and study of epitaxial semiconductors structures for applications in quantum technologies" within the Research Project "Progetto PNRR – National Quantum Science and Technology Institute (NQSTI)" (Bando n. IOM AR 13/2023 TS PNRR).
Advisor: Dott. Giorgio Biasiol

Accomplishments:

- Characterization of epitaxially grown III-V semiconductors (X-ray Diffraction)
- Fabrication of devices at the Facility of Nano Fabrication (FNF) of CNR-IOM
  - Design of masks for UV lithography
  - UV lithography
  - Wet, dry and reactive ion etching
  - Electron-beam physical vapor deposition and sputter deposition
- Characterization of the fabricated devices
- Maintenance of the equipment in the HMMBE Lab and FNF.

Post-Doc (assegno di ricerca) 2022 – 2024

University of Trieste, IT

Activity, co-founded by INFN gr.V and Elettra-Sincrotrone Trieste, aiming to design and implement a setup to perform spectral X-ray imaging (SPHERE-X) and its installation at the SYRMEP beamline of Elettra.

Accomplishments:

- Preliminary design of the system to identify and purchase the materials required for the realization of the setup
- Coordination with the beamline and INFN staff to define the operating range of the system and the compatibility with the beamline infrastructure
- Definition of the system design in coordination with the INFN workshop
- Integrating the SPHERE-X hardware and software with the beamline control
- Design of experiments to characterize the system
- Successfully performed beamtimes at the SYRMEP beamline testing the SPHERE-X setup

employing Spectral imaging and Phase-contrast imaging to study different samples

EDUCATION

PhD in Condensed Matter Physics

University of Trieste, IT / 2022

Activity performed at the Nanoscale Materials Laboratory, a joint laboratory of Elettra-Sincrotrone Trieste and the University of Trieste. PhD thesis title: "Study of physical properties of mass-selected atomic nanoclusters deposited on solid surfaces". Supervisor: Prof. Alessandro Baraldi
https://arts.units.it/handle/11368/3030499
Accomplishments:

- Contribution to the commission and development of the cluster source ENAC and mechanical and electronic components
- Maintenance, operations and upgrades on Ultra High Vacuum systems, alignment and maintenance of a class 4 Nd:YAG laser
- Upgrade of the acquisition software
- Planning and coordinating the transport and installation of ENAC at the SuperESCA beamline of Elettra
- Production and characterization of exactly mass-selected clusters of different materials with sub-nanoscale size
- Successfully performed experiment connecting ENAC with the SuperESCA beamline as user and as support for external users
- Epitaxial growth and characterization of 2D materials (Graphere and MoS_2) as substrates candidates for clusters deposition

MSc Condensed Matter Physics 103/110

University of Trieste, IT / 2018

Master's thesis in condensed matter Physics: "Characterization of a mass-selected atomic cluster source". Supervisor: Prof. Alessandro Baraldi
https://thesis.units.it/handle/20.500.12072/86745

SCHOOLS, WORKSHOPS AND CONFERENCES

- Training School on the Physical Principles and Theory of Advanced Epitaxial Growth Methods and Devices, 2024, Cyprus
- Virtual DPG Spring Meeting SurfaceScience 2021, online
- Bilateral Workshop nanotechnology and nanoapplication, 2020, Ljubljana. Presented the poster: "ENAC: a source to generate atomically precise size-selected nanoclusters"
- XV School on Synchrotron Radiation "Synchrotron Radiation: Fundamentals, Methods and Applications", 2019, Trieste. Presented the poster: "ENAC: the new source of size-selected nanoclusters"
- EWinS 2016 – EUSpec Winter School on core level spectroscopies, 2016, Ajdovščina

TECHNICAL SKILLS

- Microsoft Office package
- LabVIEW, Fortran, Python
- Wavemetrics Igor Pro
- X-ray Photoelectron Spectroscopy, X-ray Photoelectron Diffraction, Time resolved - Angle Resolved PhotoEmission Spectroscopy, Low Electron Energy Diffraction, Spectral imaging, Phase-contrast imaging, X-ray Diffraction
- Chemical Vapour Deposition used to grow 2D materials (graphene and MoS_2) and carbon nanotubes, Electron-beam physical vapor deposition, sputter deposition
- Nanofabrication: UV lithography (mask and maskless), wet, dry and reactive ion etching, spin coating

SOFT SKILLS

- Problem Solving
- Teamwork
- Leadership
- Data presentation
- Efficient planning
- Science communication

SCIENCE COMMUNICATION

- Guide during visits to Elettra Sincrotrone Trieste for High school students

- Maker Faire Trieste 2020, external collaborator for the association Science Industries "Science Industries' Water Rockets Platform"
- Maker Faire Trieste 2019, external collaborator for the association Science Industries "Tra 10 secondi, svolta a destra!"
- Maker Faire Trieste 2017, external collaborator for the association Science Industries "Science Industries' Water Rocket Contest"

LANGUAGES

- Italian – Native
- English – Proficient (B2)

PUBLICATIONS IN PEER-REVIEWED JOURNALS

Citations: 105 H-index: 6

1. **"The highest oxidation state observed in graphene-supported sub-nanometer iron oxide clusters"**
   D. Perco, F. Loi, L. Bignardi, L. Sbuelz, P. Lacovig, E. Tosi, S. Lizzit, A. Kartouzian, U. Heiz, and A. Baraldi
   Commun Chem 2023 6, 61
   https://doi.org/10.1038/s42004-023-00865-x
2. **"Breakdown of the correlation between oxidation states and core electron binding energies at the sub-nanoscale"**
   F. Loi, M. Pozzo, L. Sbuelz, L. Bignardi, P. Lacovig, E. Tosi, S. Lizzit, A. Kartouzian, U. Heiz, R. Larciprete, D. Alfé, and A. Baraldi
   Appl. Surf. Sci., 2023, 619
   https://doi.org/10.1016/j.apsusc.2023.156755
3. **"Oxidation at the sub-nanoscale: oxygen adsorption on graphene-supported size-selected Ag clusters."**
   F. Loi, M. Pozzo, L. Sbuelz, L. Bignardi, P. Lacovig, E. Tosi, S. Lizzit, A. Kartouzian, U. Heiz, D. Alfe, and A. Baraldi
   J. Mater. Chem. A, 2022, 10
   https://doi.org/10.1039/D2TA02539F
4. **"Atomic Undercoordination in Ag Islands on Ru(0001) Grown via Size-Selected Cluster Deposition: An Experimental and Theoretical High-Resolution Core-Level Photoemission Study"**
   L. Sbuelz, F. Loi, M. Pozzo, L. Bignardi, E. Nicolini, P. Lacovig, E. Tosi, S. Lizzit, A. Kartouzian, U. Heiz, D. Alfé, and A. Baraldi
   J. Phys. Chem. C, 2021, 125, 17
   https://doi.org/10.1021/acs.jpcc.1c02327
5. **"Unusual reversibility in molecular break-up of PAHs: the case of pentacene dehydrogenation on Ir(111)"**
   D. Curcio, E. Sierda, M. Pozzo, L. Bignardi, L. Sbuelz, P. Lacovig, S. Lizzit, D. Alfè and A. Baraldi
   Chem. Sci., 2021,12
   https://doi.org/10.1039/D0SC03734F
6. **"Growth Mechanism and Thermal Stability of a MoS_2-Graphene Interface: A High-Resolution Core-Level Photoelectron Spectroscopy Study"**
   F. Loi, L. Sbuelz, P. Lacovig, D. Lizzit, L. Bignardi, S. Lizzit, and A. Baraldi
   J. Phys. Chem. C, 2020, 124, 38
   https://doi.org/10.1021/acs.jpcc.0c05037
7. **"Bulk diffusive relaxation mechanisms in optically excited topological insulators"**
   A. Sterzi, G. Manzoni, L. Sbuelz, F. Cilento, M. Zacchigna, Ph. Bugnon, A. Magrez, H. Berger, A. Crepaldi, and F. Parmigiani
   Phys. Rev. B, 2017, 95
   https://doi.org/10.1103/PhysRevB.95.115431
8. **"Recognizing Physisorption and Chemisorption in Carbon Nanotubes Gas Sensors by Double Exponential Fitting of the Response"**
   A. Calvi, A. Ferrari, L. Sbuelz, A. Goldoni, and S. Modesti
   Sensors, 2016, *16*(5)
   https://doi.org/10.3390/s16050731

BEAMTIMES

As a member of the research group at Elettra:

- Federico Loi 20215598; "Reactivity of size-selected Mo clusters below the nanometer scale"
- Luca Bignardi 20215116; "Reactivity of sub-nanometer carbon clusters and their role in polycyclic aromatic hydrocarbons formation"
- Luca Bignardi 20210345; "Elementary reactivity of sub-nanometer atomically precise Fe clusters"
- Luca Bignardi 20205098; "Oxidation of sub-nanometer atomically-precise Pt clusters"
- Alessandro Baraldi 20200300; "A new opportunity for the SuperESCA beamline: physical, catalytic and astrochemical properties of size-selected nanoclusters." (Long term, 2 years)
- Alessandro Baraldi 20195310; "Structure and electronic structure of graphene-supported size-selected Ag nanoclusters"

As support for external users at Elettra:

- Aras Kartouzian 20220085; "Methane activation by size-selected supported Ta clusters"
- Rosanna Larciprete 20205449; "H2 dissociation at the Gr/Ni(111) interface mediated by size selected Pt clusters."