Martí Checa, PhD

Born in Barcelona, Spain in 1992 (31 yo)

507 Honeycomb way, Knoxville TN, USA

RESEARCH SCIENTIST

Versatile nano-scientist with physics background and 8 years of research experience in nanoscience and nanotechnology in top-notch institutions in Europe (5 years) and US (3 years). Multidisciplinary and multiscale approaches to solve complex problems. Expertise in quantification of multidimensional datasets combining physical modelling and AI. Great communicator to expert and non-expert audiences. Passionate about solving scientifically relevant problems that have a meaningful impact in the society. Outgoing and social person. Curious traveler and beach volleyball player.

EXPERIENCE

<u>Staff Scientists (R&D Associate)</u>	12/2023 - present
Oak Ridge National Laboratory (ORNL), United States Department of Energy (DOE).	Tennessee, USA
Center of Nanophase Material Science.	
Postdoctoral Research Fellow	7/2021 - 11/2023
Oak Ridge National Laboratory (ORNL), United States Department of Energy (DOE).	Tennessee, USA
Center of Nanophase Material Science. Advisor: Dr. Liam Collins	
Postdoctoral Research Fellow	10/2020 - 6/2021
Catalan Institute of Nanoscience and Nanotechnology (ICN2).	Bellaterra, Spain
Oxide Nanophysics Group. Advisor: Dr. Neus Domingo	
Teaching Fellow	9/2016-7/2019
University of Barcelona (UB).	Barcelona, Spain
Department of Electronics and Biomedical Engineering.	
Assistant teacher in the BSc of Biomedical engineering and the MSc of Nanoscience and	Nanotechnology.
Predoctoral Research Fellow	1/2016-2/2020
Institute of Bioengineering of Catalonia (IBEC).	Barcelona, Spain
Nanoscale Bioelectrical characterization. Advisor: Prof. Gabriel Gomila	

EDUCATION

PhD Cum Laude in Nanoscience

University of Barcelona & Institute of Bioengineering of Catalonia (IBEC)Barcelona, SpainThesis: A novel Scanning Probe Microscopy Technique to study the nanoscale electrical properties of cellsThesis advisor: Prof. Gabriel Gomila

MSc in Advanced Physics

University of Barcelona & Paul-Drude-Institut für Festkörperelektronik. Barcelona, Spain & Berlin, Germany Thesis: *Study of the magnetic properties of nanoparticles interacting with surface acustic waves.*

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9/2014-7/2015

1/2016-2/2020

Thesis advisor: Prof. Javier Tejada

BSc in Physics University of Barcelona Thesis: *Microwave evaluation of in-stent restenosis.* Thesis advisor: Prof. Javier Tejada

PUBLICATIONS

Journal Articles:

- Gupta, S., Soahil, T., **Checa, M.**, Rohewal, S., Toomey, M., Kanbargi, N., Damron, J., Collins, L., Kearney, L., Naskat, A., Bowland, C., *Enhancing composite toughness through hierarchical interphase formation*. In revision (2023).
- Vlassiouk, I., Smirnov, S., Puretzky, A., Olunloyo, O., Geohegan, D., Dyck, O., Lupini, A., Uncic, R., Meyer III, H., Xiao, K., Briggs, D., Lavrik, N., Keu, J., Cakmak, E., Harris, S., Checa, M., Collins, L., Lasseter, J., Emery, R., Rayle, J. Rack, P., Sthle, Y., Chaturvedi, P., Kidambi, P., Gu, G., Ivanov, I., Armor for steel: Facile synthesis of Hexagonal Boron Nitride Films on Various Substrates. Advanced Materials Interfaces (2023).
- Dryzhakov, B., **Checa, M.**, Paladugu, S., Liu, Y., Keum, J., Page, K., Kalinin, S., Kelley, K., Hu, B., *Hybrid perovskite* polymorphic phase mixing induce enhanced ferroelectricity and light emission. In revision (2023).
- **Checa, M.,** Kelley K. P., Sun, C, Vasudevan, R., Ziatdinov, M., Yun, S., Xiao, K., Sehirlioglu, A., Kim, Y., Domingo, N., Jesse, S., Collins, L. *High speed mapping of surface charge dynamics via Spiral Scanning Kelvin Probe Force Microscopy*. Nature Communications (2023).
- **Checa, M.,** Kelley, K.P., Vasudevan, R., Collins, L., Jesse, S., *Automated piezoresponse force microscopy domain tracking during fast thermally stimulated phase transition in CuInP*₂*S*₆. Nanotechnology (2023).
- Hennessey, G., Peters, T., Tipsawat, P., **Checa, M.**, Collins, L., Trolier-McKinstry, S. *Domain wall motion across microstructural features in polycrystalline ferroelectric films*, Acta Materialia (2023).
- Peters, T., Zhou, W., **Checa, M.**, Collins, L., Trolier-McKinstry, S. *Influence of doping and thickness on domain avalanches in lead zirconate titanate thin films*, Applied Physics Letters (2023).
- **Checa, M.,** Neumayer, SM., Millan-Solsona, R., Susner, MA., McGuire, MA., Jesse, S., Gomila, G., Maksymovych, P., Collins, L., *Revealing AC Cu-ion transport at the nanoscale in CuInP₂S₆ In_{4/3} P₂S₆ flakes during ferrielectric to paraelectric phase transition. ACS Nano (2022).*
- **Checa, M.,** Ivanov, I., Neumayer, SM., Susner, MA., McGuire., Maksymovych, P., Collins, L., *Correlative Piezoresponse and Micro Raman Imaging of CuInP2S6 In4/3 P2S6 flakes unravels phase-specific phononic fingerprint via unsupervised learning*, Applied Physics Letters (2022).
- **Checa, M.,** Neumayer, SM., Susner, MA., McGuire, MA., Maksymovych, P., Collins, L., *Simultaneous mapping of* nanoscale dielectric, electrochemical, and ferroelectric surface properties of van der Waals layered ferroelectric via advanced SPM, Applied Physics Letters (2021).

Checa, M., Millan-Solsona, R. Glinkowska, A., Pujals, S.,Gomila, G., *Dielectric Imaging of Fixed HeLa Cells by In-Liquid Scanning Dielectric Force Volume Microscopy.* Nanomaterials (2021).

- **Checa, M.,** Millan-Solsona, R. Glinkowska, A., Pujals, S.,Gomila, G. Fast Label-Free Nanoscale Composition Mapping of Eukaryotic Cells Via Scanning Dielectric Force Volume Microscopy and Machine Learning. Small Methods (2021).
- Balakrishnan, H., **Checa, M.**, Millan-Solsona, R., Fabregas, R., Gomila, G. *Depth mapping of metallic nanowire polymer nanocomposites by scanning dielectric microscopy*. Nanoscale (2021).
- Kyndiah, A., **Checa, M.,** Leonardi, F. Millan-Solsona, R. Di Muzio, M., Fumagalli, F., Mas-Torrent, M., Gomila, G. Nanoscale Mapping of the Conductivity and Interfacial Capacitance of an Electrolyte-Gated Organic Field-Effect Transistor under Operation. Advanced. Functional Materials (2021)
- Millan-Solsona, R., **Checa, M.,** Fumagalli, L., Gomila, *G. Mapping the capacitance of self-assembled monolayers at metal/electrolyte interfaces at the nanoscale by in-liquid scanning dielectric microscopy*. Nanoscale, (2020).
- **Checa, M.,** Millan-Solsona, R., Fabregas, R., Gomila, G. *Mapping the dielectric constant of a single bacterial cell at the nanoscale with scanning dielectric force volume microscopy.* Nanoscale (2019).
- **Checa, M.,** Millan-Solsona, R., Gomila. G. *Frequency-dependent force between ac voltage biased plates in electrolyte solutions*. Physical Review E (2019).

Book Chapters:

Checa, M., Neumayer, SM., Tsai, WY., Collins, L., *Advanced Modes of Electrostatic and Kelvin Probe Force Microscopy for Energy Applications.* Chapter in *Atomic Force Microscopy for Energy Research.* Taylor and Francis (2022).

GitHub profile: https://github.com/mchecanu

Google Scholar profile: https://scholar.google.com/citations?user=J7MK-7wAAAAJ&hl=en&oi=ao

<u>Scientific journal reviewer at:</u> Nature Communications, Scanning, Rev. of Scientific Instruments, Computational and Structural Biotechnology Journal.

LANGUAGES

Spanish (native) Catalan (native), English (C1/C2) and Italian (Basic)

SKILLS/COMPETENCES

- **Data analysis:** quantification, fitting, regression, classification, and clustering algorithms, using both classical methods and modern machine learning techniques (i.e. neural networks, k-means, PCA, etc.).
- **Programming in Python:** main libraries used in the past NumPy, Pandas, Matplotlib, SciPy, Scikit-learn, Skimage. Contributed to add dielectric characterization scripts into the Pycroscopy environment (open-source python package for SPM and electron microscope characterization: https://github.com/pycroscopy/pycroscopy). Automatization of experiments through pythoncontrolled experimental equipment.
- <u>Scanning Probe Microscopy</u>: for topographic (tapping, contact, force-volumetric modes), mechanical (contact-resonance, force-mapping), electrical (EFM, KPFM, c-AFM) and electromechanical (PFM, ESMy) characterization, both imaging and spectroscopy. Expertise using high dimensionality characterization modes like Band Excitation or G-mode. FluidFM technology.
- <u>General experimental skills:</u> sample preparation, optical and correlative microscopy, micro-Raman spectroscopy, SEM, oscilloscope, lock in amplifier etc.
- <u>Finite element modelling:</u> expertise in electrostatic and mechanical numerical modeling with COMSOL Multiphysics.
- **<u>Communication</u>**: writing high-impact scientific articles, presenting results in small seminars and big international conferences.
- <u>**Transversal/soft skills:**</u> intellectual curiosity, adaptability, empathy, independence, critical thinking, storytelling, teamwork.

USER PROJECTS AT OAK RIDGE NATIONAL LABORATORY:

During my stay at CNMS I have been involved in the following user projects:

- **Understanding the electronic interaction at the graphene-electrolyte interface**, User Marta Delga, ICN2 Barcelona, Spain. Proposal number: CNMS2022-A-01159.
- Nonlinear domain cluster mapping with interferometric displacement sensing (IDS) PFM. User: Travis Peters, Pennsylvania State University, USA. Proposal number: CNMS2022-B-01627.
- **Exploring Fluidic Force Microscopy as a disruptive technology for energy material research**. User: Hans Gunstheimer, Nanosurf, Switzerland. Proposal number: CNMS2022-R-01108.

- Nanoscale control of ferroelectric switching in liquids by Fluidic Force Microscopy. User: Hans Gunstheimer, Nanosurf, Switzerland. Proposal number: CNMS2022-B-01493.
- Photoinduced and screening charge carrier dynamics at interfaces in halide double perovskites for photovoltaic applications. User: Andrei Karabanov, University of Duisburg-Essen. Proposal number: CNMS2020-B-00377.
- **Electromechanical response of flexible ferroelectric freestanding membranes**. User: David Pesquera, ICN2, Barcelona, Spain. Proposal number: CNMS2021-B-00968.
- Exciton Order Engineering in 2D-phase Perovskites for Ferroelectric-Optical Coupling Toward the Development of Extraordinary Excited State Dynamics. User: Bogdan Dryzhakov, University of Tennessee, USA. Proposal number: CNMS2022-A-01170
- **Enhancing composite toughness through hierarchical interphase formation.** User: Sumit Gupta, ORNL, USA. Proposal number: CNMS2023-A-01851

Electrostatic Blind Spot. User: Ryan Wagner, Purdue University, USA. Proposal number: CNMS2021-A-00580