



## Dr. Liam Collins

R&D Staff Scientist

Center for Nanophase Materials Science  
Oak Ridge National Laboratory

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### EDUCATION

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<b>Doctor of Philosophy</b> (Physics)	University College Dublin	<b>2015</b>
<b>Masters of Science</b> (Applied Physics)	University of Limerick	<b>2009</b>
<b>Bachelor of Science</b> (Science Education)	University of Limerick	<b>2008</b>

### RELEVANT RESEARCH EXPERIENCE

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<b>Staff Scientist (R&amp;D Associate)</b>	<b>July 2018- Present</b>
Oak Ridge National Laboratory, Center of Nanophase Materials Sciences, Scanning Probe Microscopy Group	
<b>Postdoctoral Research Associate</b>	<b>2015-July 2018</b>
Oak Ridge National Laboratory, Center of Nanophase Materials Sciences, Scanning Probe Microscopy Group	
<b>Graduate Researcher</b>	<b>2010-2015</b>
University College Dublin, School of Physics & Conway Institute of Biomolecular and Biomedical Research	

### SIGNIFICANT AWARDS AND HONORS

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<b>CNMS Outstanding Staff Member Award</b>	<b>2020</b>
CNMS User Meeting	
<b>Significant Event Award</b>	<b>2020</b>
Implementation of Interferometric Scanning Probe methods	
<b>CNMS Distinguished Patent Award</b>	<b>2018</b>
For the development of Electrochemical force microscopy (EcFM)	
<b>Postdoctoral Award</b>	<b>2017</b>
CNMS Division Awards	
<b>R&amp;D 100 Award</b>	<b>2016</b>
For development of G-Mode SPM	

<b>Microscopy Today Innovation Award</b>	<b>2016</b>
Microscopy Society of America	
<b>MRS Graduate Student Gold Award</b>	<b>2014</b>
Material Research Society (Spring Meeting)	

## PATENTS

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### **Invention: Electrochemical Force Microscopy**

Inventors: [Collins L](#), Jesse S, Kalinin S K, Rodriguez B J, US Patent 9,541,576.

## SELECTED PEER REVIEW PUBLICATIONS

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**Cumulative Total Number of Articles Published in Peer Reviewed Journals: 64**

For full list follow link: [Liam Collins \(Google Scholar Profile\)](#)

### **Selected Book chapters**

- [Collins, L.](#); Somnath, S.; Kalinin, S.V.; Belianinov, A., Scanning probe microscopy in the information age; in *Handbook on Big Data and Machine Learning in the Physical Sciences; Vol 1, World Scientific, 2020*, 49-99.
- [Collins, L.](#); Weber, S.; Rodriguez, B., Applications of KPFM-based approaches for surface potential and electrochemical measurements in liquid; in *Kelvin probe force microscopy; 2<sup>nd</sup> Ed, Springer: New York, 2018*, 49-99.
- Jesse, S.; [Collins, L.](#); Kalinin, S.V., Dynamic Modes in KPFM: Band Excitation and G-Mode; in *Kelvin probe force microscopy - From Single Charge Detection to Device Characterization; 2<sup>nd</sup> Ed, Springer: New York, 2018*, 391-433.

### **Selected Review Articles**

- [Collins, L.](#); Kilpatrick, J.; Kalinin, S. V.; Rodriguez, B. J., Nanoscale Electrical Measurements in Liquids Using AFM-Progress and Outlook. *Rep. Prog. Phys.*, **2018**, *81* (8), 086101.

### **Selected Journal Articles**

- [Collins, L.](#); Celano, U., "Revealing Antiferroelectric Switching and Ferroelectric Wakeup in Hafnia by Advanced Piezoresponse Force Microscopy." *ACS Appl. Mater. & Interfaces*, **2020** (in press).
- [Collins, L.](#); Vasudevan, R. K.; & Sehirlioglu, A. Visualizing Charge Transport and Nanoscale Electrochemistry by Hyperspectral Kelvin Probe Force Microscopy. *ACS Appl. Mater. & Interfaces*, **2020**, *12*(29), 33361-33369.
- [Collins, L.](#); Liu, Y.; Ovchinnikova, O.S.; and Proksch, R., Quantitative electromechanical atomic force microscopy. *ACS nano*, **2019**, *13*(7), pp.8055-8066.
- [Collins, L.](#); Ahmadi, M.; Qin, J.; Liu, Y.; Ovchinnikova, O. S.; Hu, B., ... & Kalinin, S. V., Time resolved surface photovoltage measurements using a big data capture approach to KPFM. *Nanotechnology*, **2018**, *29* (44), 445703.
- Liu, Y.; [Collins, L.](#); Proksch, R.; Kim, S.; Watson, B. R.; Doughty, B., ... & Ovchinnikova, O., Chemical nature of ferroelastic twin domains in CH<sub>3</sub>N<sub>3</sub>Pb<sub>3</sub> perovskite. *Nat. Mat.*, **2018**, *17* (11), 1013.

- Ahmadi, M.; Collins, L.; Puretzky, A.; Zhang, J.; Keum, J. K.; Lu, W.; Ivanov, I.; Kalinin, S.V.; and Hu, B., Exploring anomalous polarization dynamics in organometallic halide perovskites. *Adv. Mat.*, **2018**, *30* (11), 1705298.
- Shi, Y.; Collins, L.; Balke, N.; Liaw, P. K.; and Yang, B., In-situ electrochemical-AFM study of localized corrosion of AlxCoCrFeNi high-entropy alloys in chloride solution. *App. Surf. Sci.*, **2018**, *439*, 533-544.
- Collins, L.; Ahmadi, M.; Wu, T.; Hu, B.; Kalinin, S. V.; Jesse, S., Breaking the Time Barrier in Kelvin Probe Force Microscopy: Fast Free Force Reconstruction Using the G-Mode Platform. *ACS Nano*, **2017**, *11* (9), 8717-8729.
- Wu, T.; Collins, L.; Zhang, J.; Lin, P.-Y.; Ahmadi, M.; Jesse, S.; Hu, B., Photoinduced Bulk Polarization and Its Effects on Photovoltaic Actions in Perovskite Solar Cells. *ACS Nano*, **2017**, *11* (11), 11542-11549.
- Collins, L.; Belianinov, A.; Somnath, S.; Rodriguez, B. J.; Balke, N.; Kalinin, S. V.; Jesse, S., Multifrequency Spectrum Analysis Using Fully Digital G Mode-Kelvin Probe Force Microscopy. *Nanotechnology*, **2016**, *27*, 105706.
- Collins, L.; Belianinov, A.; Somnath, S.; Balke, N.; Kalinin, S. V.; Jesse, S., Full Data Acquisition in Kelvin Probe Force Microscopy: Mapping Dynamic Electric Phenomena in Real Space. *Sci. Rep.*, **2016**, *6*, 30557.
- Collins, L.; Okatan, M.; Li, Q.; Kravenchenko, I.; Lavrik, N.; Kalinin, S.; Rodriguez, B.; Jesse, S., Quantitative 3D-Kpfm Imaging with Simultaneous Electrostatic Force and Force Gradient Detection. *Nanotechnology*, **2015**, *26*, 175707.
- Collins, L.; Jesse, S.; Kilpatrick, J. I.; Tselev, A.; Okatan, M. B.; Kalinin, S. V.; Rodriguez, B. J., Kelvin Probe Force Microscopy in Liquid Using Electrochemical Force Microscopy. *Beilstein J. Nanotechnol.*, **2015**, *6*, 201.
- Collins, L.; Jesse, S.; Balke, N.; Rodriguez, B. J.; Kalinin, S.; Li, Q., Band Excitation Kelvin Probe Force Microscopy Utilizing Photothermal Excitation. *App. Phy. Lett.*, **2015**, *106*, 104102.
- Collins, L.; Kilpatrick, J. I.; Vlassiouk, I. V.; Tselev, A.; Weber, S. A.; Jesse, S.; Kalinin, S. V.; Rodriguez, B. J., Dual Harmonic Kelvin Probe Force Microscopy at the Graphene-Liquid Interface. *App. Phy. Lett.*, **2014**, *104*, 133103.
- Collins, L.; Jesse, S.; Kilpatrick, J. I.; Tselev, A.; Varenky, O.; Okatan, M. B.; Weber, S. A.; Kumar, A.; Balke, N.; Kalinin, S. V., Probing Charge Screening Dynamics and Electrochemical Processes at the Solid-Liquid Interface with Electrochemical Force Microscopy. *Nat. Comm.*, **2014**, *5*, 3871.
- Collins, L.; Kilpatrick, J.; Weber, S. A.; Tselev, A.; Vlassiouk, I. V.; Ivanov, I. N.; Jesse, S.; Kalinin, S.; Rodriguez, B., Open Loop Kelvin Probe Force Microscopy with Single and Multi-Frequency Excitation. *Nanotechnology*, **2013**, *24*, 475702.

## SELECTED ORAL PRESENTATIONS

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### Invited

- International Conference on Scanning Probe Microscopy on Soft and Polymeric Materials (SPMonSPM), August 2018, Leuven, Belgium. *Title: "Probing Ultrafast charge dynamics using G-Mode KPFM"*.

- 231<sup>st</sup> Electrochemical Society (ECS) biannual meeting , May 2017, New Orleans, USA. Title: *"Probing Local Electrochemical Functionalities at Solid-Liquid Interfaces"*.

### **Contributed**

- Materials Research Society, Dec 2017, Boston, MA, USA. Title: *"Breaking the Time Barrier in Kelvin Probe Force Microscopy"*.
- Materials Research Society, Dec 2017, Boston, MA, USA. Title: *"Electrochemical Force microscopy: Nanoscale force based electrochemical measurements in-situ"*.
- Tech Connect, Dec 2017, Ann Harbour, VA, USA. Title: *"Bringing Kelvin probe force microscopy into the information age"*.
- 5<sup>th</sup> Multifrequency AFM, June 2014, Madrid, Spain. Title: *"Electrochemical force microscopy: Probing local charge screening, ion diffusion, and electrochemical processes at the solid-liquid interface"*.
- Materials Research Society, April 2014, San Francisco, Ca, USA. Title: *"Electrochemical force microscopy: Probing local charge screening, ion diffusion, and electrochemical processes at the solid-liquid interface"*. (Recipient of Gold MRS Graduate Student award.)
- Materials Research Society, Dec 2013, Boston, MA, USA. Title: *"Force volume band excitation KPFM: Combined amplitude and frequency modulated KPFM"*.
- Materials Research Society, Dec 2013, Boston, MA, USA. Title: *"Realizing Kelvin Probe Force Microscopy in Liquid Environments through Multidimensional Spectroscopic Imaging"*.
- 3<sup>rd</sup> Multifrequency AFM, March 2011, Madrid, Spain. Title: *"Open loop-Kelvin Probe force microscopy techniques in the single and multi-frequency domains"*.
- Materials Research Society, Dec 2011, Boston, MA, USA. Title: *"Dual harmonic-Kelvin probe force microscopy for characterization of surface potentials"*.
- 24<sup>th</sup> European Conference on Biomaterials, June 2011, Dublin, Ireland. Title: *"Nanoscale electrostatic characterization of biomaterials"*.