

Elizabeth A. Nowadnick

Assistant Professor, Department of Materials Science and Engineering
University of California, Merced
5200 N. Lake Road, Merced, CA 95343
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RESEARCH INTERESTS

Ferroelectrics, complex oxides, quantum materials, computational materials physics

EMPLOYMENT

Assistant Professor Department of Materials Science and Engineering University of California, Merced, CA	2019 - present
Assistant Professor Department of Physics New Jersey Institute of Technology, Newark, NJ	2017 - 2019
Postdoctoral Research Associate School of Applied and Engineering Physics Cornell University, Ithaca, NY Adviser: Craig J. Fennie	2014 - 2017
Postdoctoral Research Scientist Department of Physics Columbia University, New York, NY Adviser: Andrew J. Millis	2013 - 2014

EDUCATION

Ph.D. in Physics Stanford University, Stanford, CA Dissertation: <i>Phase competition in strongly correlated materials</i> Adviser: Thomas P. Devereaux	2013
B.S. in Physics (with honors) and Mathematics Stanford University, Stanford, CA	2006

PUBLICATIONS

1. *Ferroelectric switching pathways and domain structure of $SrBi_2(Ta,Nb)_2O_9$ from first principles*
Nabaraj Pokhrel and [Elizabeth A. Nowadnick](#)
Physical Review B **107**, 054108 (2023) – **Editor’s Suggestion**
2. *Real-Space Infrared Spectroscopy of Ferroelectric Domain Walls in Multiferroic $h-(Lu,Sc)FeO_3$*
Kevin A. Smith, Sriram P. Ramkumar, Kai Du, Xianghan Xu, Sang-Wook Cheong, Stephanie N. Gilbert Corder, Hans A. Bechtel, [Elizabeth A. Nowadnick](#), and Janice L. Musfeldt
ACS Applied Materials and Interfaces **15**, 7562 (2023)
3. *Double-Bilayer polar nanoregions and Mn antisites in $(Ca, Sr)_3Mn_2O_7$*
Leixin Miao, Kishwar-E Hasin, Parivash Moradifar, Debangshu Mukherjee, Ke Wang, Sang-Wook Cheong, [Elizabeth A. Nowadnick](#), and Nasim Alem
Nature Communications **13**, 4927 (2022)
4. *Manipulation of spin orientation via ferroelectric switching in Fe-doped Bi_2WO_6 from first principles*
Katherine Inzani, Nabaraj Pokhrel, Nima Leclerc, Zachary Clemens, Sriram P. Ramkumar, Sinéad M. Griffin, and [Elizabeth A. Nowadnick](#)
Physical Review B **105**, 054434 (2022)
5. *Octahedral rotations in Ruddlesden-Popper layered oxides under pressure from first principles*
Sriram P. Ramkumar and [Elizabeth A. Nowadnick](#)
Physical Review B **104**, 144105 (2021)
6. *Pressure-induced phase transition and phonon softening in $h-Lu_{0.6}Sc_{0.4}FeO_3$*
K. A. Smith, S. P. Ramkumar, N. C. Harms, A. J. Clune, S.-W. Cheong, Z. Liu, [E. A. Nowadnick](#), J. L. Musfeldt
Physical Review B **104**, 094109 (2021)
7. *Revealing pressure-driven structural transitions in hybrid improper ferroelectric $Sr_3Sn_2O_7$*
K. A. Smith, S. P. Ramkumar, N. C. Harms, A. J. Clune, X. Xu, S.-W. Cheong, Z. Liu, [E. A. Nowadnick](#), J. L. Musfeldt
Physical Review B **104**, 064106 (2021) – **Editor’s Suggestion**
8. *Charge order textures induced by non-linear couplings in a half-doped manganite*
Ismail El Baggari, David J. Baek, Michael J. Zachman, Di Lu, Yasuyuki Hikita, Harold Hwang, [Elizabeth A. Nowadnick](#), Lena F. Kourkoutis
Nature Communications **12**, 3747 (2021)
9. *Highly tunable ferroelectricity in hybrid improper ferroelectric $Sr_3Sn_2O_7$*
Xianghan Xu, Yazhong Wang, Fei-Ting Huang, Kai Du, [Elizabeth A. Nowadnick](#), Sang-Wook Cheong
Advanced Functional Materials **2020**, 2003623 (2020)

10. *Coupled structural distortions, domains, and control of phase competition in polar $\text{SmBaMn}_2\text{O}_6$*
 Elizabeth A. Nowadnick, Jiangan He, Craig J. Fennie
Physical Review B **100**, 195129 (2019) – **Editor’s Suggestion**
11. *Infrared nano-spectroscopy of ferroelastic domain walls in hybrid improper ferroelectric $\text{Ca}_3\text{Ti}_2\text{O}_7$*
 K. A. Smith, E. A. Nowadnick, S. Fan, O. Khatib, S. J. Lim, B. Gao, N. C. Harms, S. N. Neal, J. K. Kirkland, M. C. Martin, C. J. Won, M. B. Raschke, S.-W. Cheong, C. J. Fennie, G. L. Carr, H. A. Bechtel, and J. L. Musfeldt
Nature Communications **10**, 5235 (2019)
12. *Doping dependence of ordered phases and emergent quasiparticles in the doped Hubbard-Holstein model*
 C. B. Mendl, E. A. Nowadnick, E. W. Huang, S. Johnston, B. Moritz, T. P. Devereaux
Physical Review B **96**, 205141 (2017)
13. *Domains and ferroelectric switching pathways in $\text{Ca}_3\text{Ti}_2\text{O}_7$ from first principles*
 Elizabeth A. Nowadnick and Craig J. Fennie
Physical Review B **94**, 104105 (2016) – **Editor’s Suggestion**
14. *Electron doping of the parent cuprate La_2CuO_4 without cation substitution*
 H. I. Wei, C. Adamo, E. A. Nowadnick, E. B. Lochocki, S. Chatterjee, J. P. Ruf, M. R. Beasley, D. G. Schlom, K. M. Shen
Physical Review Letters **117**, 147002 (2016)
15. *Characterizing the three-orbital Hubbard model with determinant quantum Monte Carlo*
 Y. F. Kung, C.-C. Chen, Yao Wang, E. W. Huang, E. A. Nowadnick, B. Moritz, R. T. Scalettar, S. Johnston, T. P. Devereaux
Physical Review B **93**, 155166 (2016) - **Editor’s Suggestion**
16. *Quantifying electronic correlation strength in a complex oxide: A combined DMFT and ARPES study of LaNiO_3*
 E. A. Nowadnick, J. P. Ruf, H. Park, P. D. C. King, D. G. Schlom, K. M. Shen, A. J. Millis
Physical Review B **92**, 245109 (2015) - **Editor’s Suggestion**
17. *Doping evolution of spin and charge excitations in the Hubbard model*
 Y. F. Kung, E. A. Nowadnick, C. J. Jia, S. Johnston, B. Moritz, R. T. Scalettar, T. P. Devereaux
Physical Review B **92**, 195108 (2015)
18. *Quasiparticle properties of the nonlinear Holstein model at finite doping and temperature*
 Shaozhi Li, E. A. Nowadnick, S. Johnston
Physical Review B **92**, 064301 (2015)
19. *Renormalization of spectra by phase competition in the half-filled Hubbard-Holstein model*
 E. A. Nowadnick, S. Johnston, B. Moritz, T. P. Devereaux
Physical Review B **91**, 165127 (2015)

20. *Direct spectroscopic evidence for phase competition between the pseudogap and superconductivity in $\text{Bi}_2\text{Sr}_2\text{CaCu}_2\text{O}_{8+\delta}$*
M. Hashimoto, E. A. Nowadnick, R.-H. He, I. M. Vishik, B. Moritz, Y. He, K. Tanaka, R. G. Moore, D. Lu, Y. Yoshida, M. Ishikado, T. Sasagawa, K. Fujita, S. Ishida, S. Uchida, H. Eisaki, Z. Hussain, T. P. Devereaux, Z.-X. Shen
Nature Materials **14**, 37 (2015)
21. *Asymmetry of collective excitations in electron- and hole-doped cuprate superconductors*
W. S. Lee, J. J. Lee, E. A. Nowadnick, S. Gerber, W. Tabis, S. W. Huang, V. N. Strocov, E. M. Motoyama, G. Yu, B. Moritz, H. Y. Huang, R. P. Wang, Y. B. Huang, W. B. Wu, C. T. Chen, D. J. Huang, M. Greven, T. Schmitt, Z. X. Shen, T. P. Devereaux
Nature Physics **10**, 883 (2014)
22. *Persistent spin excitations in doped antiferromagnets revealed by resonant inelastic light scattering*
C. J. Jia, E. A. Nowadnick, K. Wohlfeld, Y. F. Kung, C.-C. Chen, S. Johnston, T. Tohyama, B. Moritz, T. P. Devereaux
Nature Communications **5**, 3314 (2014)
23. *Determinant quantum Monte Carlo study of the two-dimensional single-band Hubbard-Holstein model*
S. Johnston, E. A. Nowadnick, Y. F. Kung, B. Moritz, R. T. Scalettar, T. P. Devereaux
Physical Review B **87**, 235133 (2013) - **Editor's Suggestion**
24. *Measurement of Coherent Polarons in the Strongly Coupled Antiferromagnetically Ordered Iron-Chalcogenide $\text{Fe}_{1.02}\text{Te}$ using Angle-Resolved Photoemission Spectroscopy*
Z. K. Liu, R.-H. He, D. H. Lu, M. Yi, Y. L. Chen, M. Hashimoto, R. G. Moore, S.-K. Mo, E. A. Nowadnick, J. Hu, T. J. Liu, Z. Q. Mao, T. P. Devereaux, Z. Hussain, Z.-X. Shen
Physical Review Letters **110**, 037003 (2013)
25. *Competition between antiferromagnetic and charge-density-wave order in the half-filled Hubbard-Holstein model*
E. A. Nowadnick, S. Johnston, B. Moritz, R. T. Scalettar, T. P. Devereaux
Physical Review Letters **109**, 246404 (2012)
26. *Alternative route to charge density wave formation in multiband systems*
H.-M. Eiter, M. Lavagnini, R. Hackl, E. A. Nowadnick, A. F. Kemper, T. P. Devereaux, J.-H. Chu, J. G. Analytis, I. R. Fisher, L. Degiorgi
Proceedings of the National Academy of Sciences **110**, 64 (2012)
27. *Quantum Dynamics of the Hubbard-Holstein Model in Equilibrium and Nonequilibrium: Application to Pump-Probe Phenomena*
G. De Filippis, V. Cataudella, E. A. Nowadnick, T. P. Devereaux, A. S. Mishchenko, N. Nagaosa
Physical Review Letters **109**, 176402 (2012)

28. *Quasiparticle interference and the interplay between superconductivity and density wave order in the cuprates*
E. A. Nowadnick, B. Moritz, T. P. Devereaux
Physical Review B **86**, 134509 (2012)
29. *Material and doping dependence of the nodal and antinodal dispersion renormalizations in single- and multi-layer cuprates*
 S. Johnston, W. S. Lee, Y. Chen, E. A. Nowadnick, B. Moritz, T. P. Devereaux, Z.-X. Shen
Advances in Condensed Matter Physics **2010**, 968304 (2010)
30. *Correlation of anomalous normal state properties with superconductivity in $Pb_{1-x}Tl_xIn_yTe$*
 A.S. Erickson, N. P. Breznay, E. A. Nowadnick, T. H. Geballe, I. R. Fisher
Physical Review B **81**, 134521 (2010)
31. *A momentum-dependent perspective on quasiparticle interference in $Bi_2Sr_2CaCu_2O_{8+\delta}$*
 I.M. Vishik, E. A. Nowadnick, W. S. Lee, Z.-X. Shen, B. Moritz, T. P. Devereaux, K. Tanaka, T. Sasagawa, T. Fujii
Nature Physics **5**, 718 (2009)
32. *Dynamics of single vortices in grain boundaries: I-V characteristics on the femtovolt scale*
 B. Kalisky, J. R. Kirtley, E. A. Nowadnick, R. B. Dinner, E. Zeldov, Ariando, S. Wenderich, H. Hilgenkamp, D. M. Feldmann, K. A. Moler
Applied Physics Letters **94**, 202504 (2009)

RESEARCH FUNDING

University of California Office of the President (UCOP-MRPI) No. M23PL5880 \$299,628 (\$99,813 to UC Merced) over 2 years (PI) <i>Ferroelectric oxide membranes for low-energy next-generation electronics</i>	2023
National Science Foundation (NSF), No. 2223486, \$379,734 over 3 years (PI) <i>Manipulation of single spins in ferroelectric oxides from first principles</i>	2022
Multidisciplinary University Research Initiatives (MURI) program, No. FA9550-21-1-0429 \$4.5 million (\$702,750 to UC Merced) over 5 years (co-PI) <i>Tunneling phenomena in interface superconductors</i>	2021
Office of Naval Research (ONR) No. N00014-21-1-2957, \$446,957 over 3 years (PI) <i>Electromechanical properties of layered perovskite oxide ferroelectrics from first principles</i>	2021
New Jersey Institute of Technology Faculty Seed Grant, \$7500 (PI) <i>High Pressure Behavior of Hybrid Organic-Inorganic Halide Perovskites from First Principles</i>	2018
National Science Foundation East Asia and Pacific Science Institute Fellowship, \$5000 (PI) <i>Host Institution: RIKEN Center for Emergent Matter Science, Wako, Japan</i>	2011

INVITED CONFERENCE TALKS AND SEMINARS

Ferroelectric oxides: from fundamental physics to next generation electronics

Physics seminar, San Jose State University, San Jose, CA (4/2023)

Ferroelectric oxides: from fundamental physics to next generation electronics

Physics colloquium, University of California, Merced (3/2023)

Charge order textures induced by non-linear lattice couplings in a half-doped manganite

Invited Talk, Fundamental Physics of Ferroelectrics and Related Materials Workshop, Washington, DC (2/2022)

Charge order textures induced by non-linear lattice couplings in a half-doped manganite

Molecular Foundry Theory Seminar, Lawrence Berkeley National Laboratory (11/2021)

Understanding and controlling the crystal structures of correlated oxides

Materials and Biomaterials Science and Engineering Seminar, University of California, Merced (10/2019)

Structural complexity as a route to new ferroelectric and multiferroic oxides

Seminar, Centre for Advanced Materials and Related Technology, University of Victoria (2/2019)

Structural complexity as a route to new ferroelectric and multiferroic oxides

Seminar, Department of Materials Science and Engineering, University of California, Merced (2/2019)

Structural control of hidden phases in layered perovskite oxides from first principles

Seminar, Department of Materials Science and Engineering, Drexel University (1/2019)

Domain walls in hybrid improper ferroelectric $\text{Ca}_3\text{Ti}_2\text{O}_7$

Invited Talk, APS Mid-Atlantic Section Meeting, Newark, NJ (11/2017)

Domains and Ferroelectric Switching in $\text{Ca}_3\text{Ti}_2\text{O}_7$ from first principles

Seminar, Department of Physics, Rutgers University, Piscataway, NJ (6/2017)

Domains and domain switching in a structurally complex ferroelectric oxide

Seminar, Department of Physics, New Jersey Institute of Technology, Newark, NJ (5/2017)

Harnessing structural complexity to engineer new multifunctional oxides

Seminar, Stewart Blusson Quantum Matter Institute, University of British Columbia, Vancouver, BC (4/2017)

Harnessing structural complexity to engineer new multifunctional oxides

Colloquium, Department of Physics, Colorado State University, Fort Collins, CO (2/2017)

Harnessing structural complexity to engineer new multifunctional oxides

Seminar, Department of Materials Science and Engineering, University of Illinois, Urbana-Champaign, Urbana, IL (1/2017)

Domains and ferroelectric switching pathways in $\text{Ca}_3\text{Ti}_2\text{O}_7$ from first principles

Invited Talk, Materials Research Society Fall Meeting, Boston, MA (12/2016)

Phase competition in strongly correlated systems with electron-phonon coupling

Seminar, Department of Physics, University of Illinois, Urbana-Champaign, Urbana, IL (1/2014)

Phase competition in strongly correlated systems with electron-phonon coupling

Seminar, Suranaree University of Technology, Nakhon Ratchasima, Thailand (7/2013)

Phase competition in strongly correlated systems with electron-phonon coupling

Seminar, Max-Planck Institute, Stuttgart, Germany (2/2013)

Phase competition in strongly correlated systems with electron-phonon coupling

Seminar, Walther Meissner Institute, Garching, Germany (2/2013)

CONTRIBUTED CONFERENCE TALKS

Ferroelectric switching paths and domain structure of $\text{SrBi}_2(\text{Ta},\text{Nb})_2\text{O}_9$ from first principles

Materials Research Society Spring Meeting, San Francisco, CA (4/2023)

Manipulation of spin orientation in iron-doped ferroelectric oxides from first principles

APS March Meeting, Las Vegas, NV (3/2023)

Coupled structural distortions, domains, and control of phase competition in polar $\text{SmBaMn}_2\text{O}_6$

Fundamental Physics of Ferroelectrics and Related Materials, Silver Spring, MD (1/2020)

Domain boundaries in hybrid improper ferroelectric layered perovskites

APS March Meeting, Los Angeles, CA (3/2018)

Phase competition by design in RBaMn_2O_6

APS March Meeting, New Orleans, LA (3/2017)

Domains and ferroelectric switching pathways in $\text{Ca}_3\text{Ti}_2\text{O}_7$ from first principles

Fundamental Physics of Ferroelectrics and Related Materials, Williamsburg, VA (1/2017)

Ferroelectric switching pathways in $\text{Ca}_3\text{Ti}_2\text{O}_7$ from first principles

APS March Meeting, Baltimore, MD (3/2016)

Ferroelectric switching pathways in $\text{Ca}_3\text{Ti}_2\text{O}_7$ from first principles

Fundamental Physics of Ferroelectrics and Related Materials, Washington, DC (1/2016)

Tuning octahedral rotations in ABO_3 perovskites with pressure and strain from first principles
APS March Meeting, San Antonio, TX (3/2015)

Direct spectroscopic evidence for phase competition between pseudogap and superconductivity in $Bi_2Sr_2CaCu_2O_{8+\delta}$
Gordon Research Seminar on Correlated Electron Systems, South Hadley, MA (6/2014)

Doping dependence of spectral properties in strongly correlated systems with electron-phonon coupling
APS March Meeting, Denver, CO (3/2014)

Quantum Monte Carlo simulation of electron-phonon coupling in ARPES spectra on correlated materials
APS March Meeting, Baltimore, MD (3/2013)

Phase competition in strongly correlated systems with electron-phonon coupling
Workshop on Novel Materials and Superconductivity, Planeralm, Austria (2/2013)

Spectral properties of correlated systems with electron-phonon coupling
APS March Meeting, Boston, MA (2/2012)

Raman response in density wave materials
APS March Meeting, Dallas, TX (3/2011)

Quasiparticle scattering in the cuprates
Boulder School for Condensed Matter and Materials Physics, Boulder, CO (7/2010)

The role of symmetry in the Z-map
APS March Meeting, Portland, OR (3/2010)

Quasiparticle scattering from impurities in the cuprates
APS March Meeting, Pittsburgh, PA (3/2009)

Study of $B \rightarrow A_c p \pi$
APS April Meeting, Dallas, TX (4/2006)

POSTER PRESENTATIONS

Phase competition by design in $SmBaMn_2O_6$
Gordon Research Conference on Multiferroic and Magnetoelectric Materials, Lewiston, ME (8/2018)

Domains and ferroelectric switching pathways in $Ca_3Ti_2O_7$ from first principles
Gordon Research Conference on Multiferroic and Magnetoelectric Materials, Lewiston, ME (8/2016)

Tuning octahedral rotations in ABO_3 perovskites with pressure and strain from first principles
Spin-orbit Coupling and Magnetism in Correlated Transition Metal Oxides Workshop, The Ohio State University, Columbus, OH (5/2015)

Charge density wave formation near band degeneracies: a new paradigm towards broken symmetry ground states

Low Energy Electrodynamics in Solids, Napa, CA (7/2012)

Quantum Monte Carlo studies of electron-phonon coupling in strongly correlated electron materials

Japanese Society for the Promotion of Science Summer Program, Hayama, Japan (6/2011)

Raman response in density wave materials

Gordon Research Conference on Superconductivity, Waterville Valley, NH (6/2011)

TEACHING EXPERIENCE

Instructor, University of California, Merced

MSE 119: Materials Simulations

Fall 2020, Fall 2022

MSE 112: Materials Selection and Performance

Spring 2020, Spring 2021, Spring 2023, Fall 2023

Instructor, New Jersey Institute of Technology

Spring 2018, Spring 2019

Physics II: Electricity and Magnetism (calculus-based introductory physics)

Teaching Assistant, Cornell University

Summer 2016

PARADIM Summer School: "Introduction to Density Functional Theory for Experimentalists"

Teaching Assistant, Stanford University

Thermodynamics, Kinetic Theory, and Statistical Mechanics II

Winter 2010

Modern Physics Laboratory (algebra-based introductory physics)

Spring 2008

Mechanics and Heat (algebra-based introductory physics)

Fall 2007

Tutor, Stanford Undergraduate Math Organization

2003 - 2006

Topics: Multivariable Calculus, Linear Algebra, Differential Equations

SERVICE AND LEADERSHIP – UNIVERSITY

Executive Committee

2022 – 2024

Materials and Biomaterials Science and Engineering Graduate Program

University of California, Merced

Admissions Committee

2019 – 2020

Materials and Biomaterials Science and Engineering Graduate Program

University of California, Merced

Reviewer, Faculty Seed Grant Applications

2019

College of Science and Liberal Arts, New Jersey Institute of Technology

Faculty Representative, Applied Physics Major

2017 - 2018

New Jersey Institute of Technology Open Houses for Prospective Students

Organizer, Bi-weekly Seminar Series <i>Controlling Complex Electronic Materials</i> Interdisciplinary Research Group Cornell Center for Materials Research	2015 - 2017
Graduate Studies Committee Student Representative Stanford Physics Department	2010 - 2011
Teaching Mentor for First-Year Teaching Assistants Stanford Physics Department	2010
Graduate Qualifying Exam Committee Student Representative Stanford Physics Department	2008 - 2009
Undergraduate Studies Committee Student Representative Stanford Physics Department	2005 - 2006

SERVICE AND LEADERSHIP – RESEARCH COMMUNITY

Editorial Board Member, <i>Physical Review B</i>	2023-present
Co-organizer, “Complex Oxide Interfaces and Heterostructures” Focus Topic APS March Meeting 2023, Las Vegas, NV	2023
Co-organizer <i>Ferro2021: Fundamental Physics of Ferroelectrics and Related Materials Workshop</i>	2021
<i>Ferro2020: Fundamental Physics of Ferroelectrics and Related Materials Workshop</i>	2020
Co-organizer, “Dielectric and Ferroic Oxides” Focus Topic APS March Meeting 2019, Boston, MA	2019
Proposal Evaluation Board Member Center for Nanoscale Materials, Argonne National Laboratory	2018 - 2023
Referee <i>Chemistry of Materials, Physical Review Letters, Physical Review B, Physical Review Materials, Communications Physics, npj Computational Materials, Physica Status Solidi B, Journal of Low Temperature Physics</i>	2015 – present
Session Chair, R23: “Magnetic Phenomena in Bulk Nickelates and Other Oxides” APS March Meeting, Los Angeles, CA	3/2018

GRADUATE STUDENTS AND POSTDOCS SUPERVISED

Haseeb Ahmad PhD student in Physics	1/2023- present
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Md Kamal Hossain Ph.D. student in Physics	1/2020 – present
Kishwar-E Hasin Ph.D. student in Materials and Biomaterials Science and Engineering	1/2020 - present
Nabaraj Pokhrel Ph.D. student in Physics	8/2019 - present
Aneer Lamichhane Ph.D. student in Materials Science and Engineering New Jersey Institute of Technology	8/2018 – 7/2019
Dr. Bradford Barker Postdoctoral Research Fellow	2/2023-present
Dr. Kuntal Talit Postdoctoral Research Fellow	11/2022-present
Dr. Sriram Poyyapakkam Ramkumar Postdoctoral Research Fellow <i>Present position:</i> Micron Technology, Inc.	3/2018 – 12/2020

UNDERGRADUATE RESEARCHERS

Zachary Clemens Materials Science and Engineering major (UC Merced)	6/2020 – 12/2020
Gerassimos Giannoulis Engineering Physics major (Ramapo College of New Jersey)	5/2018 - 7/2018