Dennis S. Kim

University of California, Los Angeles
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Citizenship

United States of America

Education

California Institute of Technology
Division of Engineering and Applied Science
PhD in Materials Science 2018

University of Massachusetts Amherst
College of Natural Science and Mathematics
BS Chemistry *with Departmental Honors* 2011

Commonwealth Honors College *honors with greatest distinction*
Graduated in 3 years with *summa cum laude*

Employment

University of California, Los Angeles
Department of Chemistry & Biochemistry
Research Scientist (Fall 2022 - *present*)

Massachusetts Institute of Technology
Department of Materials Science and Engineering
Postdoctoral Associate (Summer 2020 - Fall 2022)

University of California, Los Angeles
Department of Physics & Astronomy
STROBE Postdoctoral Research Fellow (Summer 2017 - Summer 2020)

California Institute of Technology
Department of Applied Physics and Materials Science
Graduate Research Assistant (Summer 2012 - Summer 2017)

University of Massachusetts Amherst
Department of Polymer Science and Engineering
Undergraduate Research Assistant (Summer 2010 - Summer 2011)
Part-time Teaching Assistant (Spring 2009 - Spring 2011)

Awards and Honors

STROBE Postdoctoral Fellow Award 2017

Langmuir-NSSA Outstanding Student Poster Presentation Award at the American Conference for Neutron Scattering 2014

Korean-American Scientists and Engineers Association KUSCO-KSEA Scholarship for Graduate Students 2013

Youngnak General Academic Scholarship 2012

California Institute of Technology Clark Graduate Fellowship 2011-2012

American Institute of Chemists Award 2011

George R. Richason, Jr. Award for Excellence in Undergraduate Research 2009

University of Massachusetts Amherst Commonwealth Honors College Merit Scholarship 2008-2011

Research Experiences

University of California, Los Angeles
Department of Chemistry & Biochemistry
Research Scientist
with *Prof. Prineha Narang* (Fall 2022 – *present*)

First-principles and machine-learning computational approaches to discover non-equilibrium quantum materials.

Massachusetts Institute of Technology
Department of Materials Science and Engineering
Postdoctoral Associate
with *Prof. James M. LeBeau* (Summer 2020 – Fall 2022)

Quantitative electron microscopy to understand the structure and dynamics of energy-related materials.

University of California, Los Angeles
Department of Physics & Astronomy
STROBE Postdoctoral Research Fellow
with *Prof. Jianwei (John) Miao* (Summer 2017 – Summer 2020)

Developing and utilizing atomic electron tomography (AET) to study materials structure-properties relationships.

California Institute of Technology
Department of Applied Physics and Materials Science
Research Assistant
with *Prof. Brent T. Fultz* (Summer 2012 – Summer 2017)

Thesis defended, 2017:
Silicon revisited: Understanding pure phonon anharmonicity and effects on thermophysical properties

Department of Chemistry
Research Assistant with *Prof. Nate S. Lewis* (Spring 2012)

Investigated various processing techniques to synthesize more efficient interfaces between light absorbers and catalysts in artificial photosynthesis devices.

University of Massachusetts Amherst
Department of Polymer Science and Engineering
Research Assistant with *Prof. Thomas J. McCarthy* (Summer 2009 – Spring 2011)

Senior Thesis: Novel Processing of Silicones: Thin films and Stöber composites studied hydrophobic-hydrophilic phase interactions in various silicones using various polymer processes.

Department of Chemistry
Research Assistant with *Prof. Lila Gierasch* (Summer 2008 – Spring 2009)

Studied protein misfolding in CRABP-1 proteins, involved in retinol transport for vitamin processing, in different environments.

Publications

First-authored publications

†These authors contributed equally to this work.
‡Corresponding author.

11. **D.S. Kim**‡, P. Narang, "Non-equilibrium thermal transport in amorphous carbons", *in preparation* (2023).

10. **D.S. Kim**‡, J.A. Muñoz, M.B. Stone, D.L. Abernathy, P. Narang, and B. Fultz‡, "Phonon anharmonicity and geometrical effects in carbon allotropes studied by inelastic neutron scattering and machine-learned interatomic potential based molecular dynamics", *in preparation* (2023).

9. **D.S. Kim**‡, J.H Kim, and J.M. LeBeau‡, "Phonon anharmonicity and structural dynamics determined by electron thermal diffuse scattering of Na_3OCl antiperovskite cathode material", *in preparation* (2023).

8. **D.S. Kim**, C. Harris, M.D. Hanwell, D. Chang, C. Ophus, P. Ercius, and J. Miao‡, "Materials Data Bank, a modern open-source database for experimental atomic structure dissemination", under review at *Sci. Data* (2023)

7. **D.S. Kim**‡, M. Xu, and J.M. LeBeau‡, "Validation of machine-learned interatomic potentials via temperature-dependent electron thermal diffuse scattering", *under review at Phys. Rev. Lett. [arXiv:2303.02519]* (2023).

6. X. Chen†, **D.S. Kim**†, and J.M. LeBeau, "A Comparison of Molecular Dynamics Potentials Used to Incorporate Thermal Diffuse Scattering in Multislice Simulations", *Ultramicroscopy*, **240**, 113644 (2022).

5. Y. Yuan†, **D.S. Kim**†, J. Zhou†, D.J. Chang, F. Zhu, Y. Nagaoka, Y. Yang, M. Pham, S.J. Osher, O. Chen, P. Ercius, A.K. Schmid, and J. Miao, "Three-dimensional atomic packing in amorphous solids with liquid-like structure", *Nat. Mater.* ***21****, 95-102* (2022).

4. **D.S. Kim**‡, O. Hellman, N. Shulumba, C. Saunders, J.Y.Y. Lin, H.L. Smith, J. Herriman, J.L. Niedziela, D.L. Abernathy, C.W. Li, and B. Fultz‡, "Temperature-dependent phonon lifetimes and thermal conductivity of silicon by inelastic neutron scattering and *ab initio* calculation", *Phys. Rev. B,* ***102****, 174311* (2020).

3. X. Tian†, **D.S. Kim**†, S. Yang†, C.J. Ciccarino, Y. Gong, Y. Yang, Y. Yang, Y. Yuan, B. Duschatko, P.M. Ajayan, J-C. Idrobo, P. Narang, and J. Miao, "Correlating the three-dimensional atomic defects and electronic properties of two-dimensional transition metal dichalcogenides ", *Nat. Mater.* ***19****, 867-873 (2020)*.
News & Views in Nat. Mater. ***19****, 827-828 (2020).*

2. **D.S. Kim**†‡, O. Hellman, J. Herriman, H.L. Smith, J.Y.Y. Lin, N. Shulumba, J.L. Niedziela, C.W. Li, D.L. Abernathy, and B. Fultz‡, "Nuclear quantum effect with pure anharmonicity causes the anomalous thermal expansion of silicon", *Proc. Natl. Acad. Sci. U.S.A.* 115 (9) 1992-1997 (2018).
Editor's Choice in "Silicon sheds its harmonicity" Science ,360, 6385 (2018).

1. **D.S. Kim**‡, H.L Smith, J.L. Niedziela, C.W. Li, D.L. Abernathy, and B. Fultz‡, "Phonon Anharmonicity in Silicon from 100 to 1500 K", *Phys. Rev. B* 91, 014307 (2015).

Co-authored publications

13. C.N. Saunders, V.V. Ladygin, **D.S. Kim**, D.L Abernathy, B.T Fultz, "Diffuse inelastic neutron scattering from anharmonic vibrations in cuprite", *under review at Phys. Rev. Lett.* (2023).

12. C.M. Bernal-Choban, H.L. Smith, C. Saunders, **D.S. Kim**, D.L. Abernathy, and B. Fultz, "Non-harmonic contributions to the high-temperature phonon thermodynamics of Cr", *Phys. Rev. B,* **107**, 054312 (2023).

11. H.G. Seo, A. Staerz, **D.S. Kim**, J.M. LeBeau, H.L. Tuller. "Tuning surface acidity of mixed conducting electrodes: Recovery of Si-induced degradation of oxygen exchange rate and area specific resistance", *Adv. Mater.*, **35**, 2208182 (2023).

10. H.G. Seo, A. Staerz, **D.S. Kim**, D. Klotz, C. Nicollet, M. Xu, J.M. LeBeau, H.L. Tuller. "Reactivation of chromia poisoned oxygen exchange kinetics in mixed conducting solid oxide fuel cell electrodes by serial infiltration of lithia", *Energy Environ. Sci.* ***15****, 4038-4047* (2022).
MIT News: "A simple way to significantly increase lifetimes of fuel cells and other devices" news.mit.edu (2022).

9. C. Saunders, **D.S. Kim**, O. Hellman, H.L. Smith, N.J. Weadock, S.T. Omelchenko, G.E. Granroth, C.M. Bernal, S.H. Lohaus, D.L. Abernathy, and B. Fultz, "Thermal expansion and phonon anharmonicity of cuprite (Cu_2O)", *Phys. Rev. B* **105**, 174308 (2022).

8. A. Staerz, H.G. Seo, D. Klotz, **D.S. Kim**, J.M. LeBeau, H.L. Tuller. "The influence of Cr-additives on the polarization resistance of praseodymium-doped ceria cathodes for solid oxide fuel cells", *J. Electrochem. Soc* ***169*** *044530* (2022).

7. X. Tian, X. Yan, G. Varnavides, Y. Yuan, **D.S. Kim**, C.J. Ciccarino, P. Anikeeva, P. Narang, X. Pan, and J. Miao, "Capturing 3D atomic defects and phonon localization at the 2D heterostructure interface", *Sci. Adv.* **7**, 38 (2021).

6. Y. Yang, J. Zhou, F. Zhu, Y. Yuan, D.J. Chang, **D.S. Kim**, M. Pham, A. Rana, X. Tian, Y. Yao, S. Osher, A.K. Schmid, L. Hu, P. Ercius, and J. Miao, "Determining the three-dimensional atomic structure of an amorphous solid", *Nature*, **592**, 60-64 (2021).
News & Views in Nature **592**, 31-32 (2021).

5. D. Chang, **D.S. Kim**, X. Tian, J. Zhou, P. Ercius, and J. Miao, "Ptychographic Atomic Electron Tomography: Towards 3D Imaging of Individual Light Atoms in Materials", *Phys. Rev. B.*, ***102***, *174101* (2020).

4. J. Zhou, Y.S. Yang, Y. Yang, **D.S. Kim**, A. Yuan, X. Tian, C. Ophus, F. Sun, A.K. Schmid, M. Nathanson, H. Heinz, Q. An, H. Zeng, P. Ercius, and J. Miao, "Observing crystal nucleation in four dimensions using Atomic electron tomography", *Nature*, **570**, 500-503 (2019).
News & View in Nature **570**, 450-452 (2019)

3. H.L. Smith, Y. Shen, **D.S. Kim**, F.C. Yang, C.P. Adams, C.W. Li, D.L. Abernathy, M.B. Stone and B. Fultz, "The temperature dependence of phonons in $FeGe_2$", *Phys. Rev. Mater.* 2, 103602 (2018).

2. H.L. Smith, C.W. Li, A. Hoff, G.R. Garrett, **D.S. Kim**, F.C. Yang, M.S. Lucas, T. Swan-Wood, J.Y.Y. Lin, M.B. Stone, D.L. Abernathy, M. Demetriou, and B. Fultz, "Separating the configurational and vibrational entropy contributions in metallic glasses", *Nat. Phys.* 13, 900-905 (2017)

1. T. Lan, C.W. Li, O. Hellman, **D.S. Kim**, J.A. Muñoz, H.L Smith, D.L. Abernathy, and B. Fultz, "Phonon quarticity induced by changes in phonon-tracked hybridization during lattice expansion and its stabilization of rutile TiO_2", *Phys. Rev. B* 92, 054304 (2015).

Presentations

Invited Talks

7. **D.S. Kim**, "Finding order in disorder: atomic-scale understanding of phase transformations and thermophysical properties", University of Southern California, Aerospace and Mechanical Engineering, Departmental Seminar (2023).
6. **D.S. Kim**, "Finding order in disorder: atomic-scale understanding of phase transformations", North Carolina State University, Materials Science and Engineering, Departmental Seminar (2023).
5. **D.S. Kim**, "Atomic-scale understanding of phase transformations and structure-property relationships of materials", University of California, Los Angeles, Materials Science and Engineering, Departmental Seminar (2022).
4. **D.S. Kim**, "Atomic-scale understanding of phase transformations: Finding order in atomic-scale disorder", University of Houston, Mechanical Engineering, Departmental Seminar (2022).
3. **D.S. Kim**, "Finding order in atomic-scale disorder", Carnegie Mellon University, Materials Science and Engineering, Departmental Seminar (2022).

2. **D.S. Kim**, "Atomic-scale understanding of phase transformations and structure-property relationships of materials", University of California, Irvine Mechanical Engineering, Departmental Seminar (2021).
1. **D.S. Kim**, B. Fultz, "Phonon Anharmonicity in Silicon from 100 K to 1500 K and Its Effects on Thermodynamics and Thermal Transport", EMN Open Access Week Energy Materials Nanotechnology 2015, Chengdu, China (2015).

Contributed Talks

13. **D.S. Kim**, X. Chen, and J. LeBeau, 'Spatially Resolved Phonon Dispersion Relations Throughout the Brillouin Zone from Electron Thermal Diffuse Scattering', MRS Spring 2022, Honolulu, HI (2022).
12. **D.S. Kim**, Y. Yuan, J. Zhou, and J. Miao, 'Direct Observation of 3D Atomic Packing in Amorphous Materials', MRS Spring 2022, Honolulu, HI (2022).
11. **D.S. Kim**, X. Tian, S. Yang, and J. Miao, 'Determining the 3D Atomic Coordinates and Properties of Low-Dimensional Chalcogenides with Picometer Precision', MRS Spring 2022, Honolulu, HI (2022).
10. **D.S. Kim**, X. Tian, S. Yang, and J. Miao, 'Determining the 3D Atomic Coordinates and Crystal Defects in 2D Materials with Picometer Precision', MRS Fall 2019, Boston, MA (2019).
9. **D.S. Kim** and B. Fultz, 'Nuclear Quantum Effects, Pure Anharmonicity and the Thermophysical Properties of Silicon', MRS Fall 2019, Boston, MA (2019).
8. **D.S. Kim**, O. Hellman, J. Herriman, H.L. Smith, J.Y.Y. Lin, N. Shulumba, J.L. Niedziela, C.W. Li, D.L. Abernathy, and B. Fultz, 'Temperature-dependent phonon self-energy and thermal conductivity of silicon from inelastic neutron scattering', MRS 2017, Boston, MA (2017).
7. **D.S. Kim**, O. Hellman, J. Herriman, H.L. Smith, J.Y.Y. Lin, N. Shulumba, J.L. Niedziela, C.W. Li, D.L. Abernathy, and B. Fultz, 'A Nuclear Quantum Effect with Pure Anharmonicity Causes the Anomalous Thermal Expansion of Silicon', ICNS 2017, Daejeon, South Korea (2017).
6. **D.S. Kim**, O. Hellman, J. Herriman, H.L. Smith, J.Y.Y. Lin, N. Shulumba, J.L. Niedziela, C.W. Li, D.L. Abernathy, and B. Fultz, 'Phonon Thermodynamics of Silicon', TMS 2017, San Diego, CA (2017).
5. **D.S. Kim**, O. Hellman, J.Y.Y. Lin H.L. Smith, J.L. Niedziela, C.W. Li, D.L. Abernathy, B. Fultz, 'Inelastic Neutron Scattering Help Elucidate the Driving Force Behind the Anomalous Thermal Expansion in Silicon', ACNS 2016, Nashville, TN (2016).
4. **D.S. Kim**, O. Hellman, J.Y.Y. Lin H.L. Smith, J.L. Niedziela, C.W. Li, D.L. Abernathy, B. Fultz, 'Phonon Anharmonicity in Silicon from 100 to 1500 K', TMS 2016, Nashville, TN (2016).
3. **D.S. Kim**, H.L. Smith, J.L. Niedziela, C.W. Li, D.L. Abernathy, B. Fultz, 'Phonon Anharmonicity in Silicon from 100 to 1500 K', American Physical Society March Meeting 2015, San Antonio, TX (2015).
2. **D.S. Kim**, H.L. Smith, J.L. Niedziela, C.W. Li, D.L. Abernathy, B. Fultz, 'Phonon Anharmonicities in Silicon', accepted to the proceedings of the 2014 US-Korea Conference on Science, Technology, and Entrepreneurship 'Forward Together' (2014).

1. **D.S. Kim**, J. Munoz, H. L. Smith, B. Fultz, 'Thermodynamic Effects of Phonon Anharmonicities and Electron-Phonon Interactions in Carbon Allotropes", accepted to the proceedings of the 2013 US-Korea Conference on Science, Technology, and Entrepreneurship 'Toward Harmonious World with Science, Technology,and Entrepreneurship" (2013).

Poster Presentations

1. **D.S. Kim**, Hillary L. Smith, J.L. Niedziela, D.L. Abernathy, B. Fultz, "Phonon Anharmonicity in Silicon", presented at American Conference for Neutron Scattering (2014). *Langmuir-NSSA Outstanding Student Poster Presentation Award*

Teaching and Mentoring Experiences

University of California, Los Angeles
Organization for Cultural Diversity in Science (OCDS)
Networking panel for Spring Showcase Science and Engineering (Spring 2023)

City University of Hong Kong
Croucher Summer Course on Neutron Scattering
Invited instructor for a course on Inelastic Neutron Scattering (Summer 2018)

California Institute of Technology
Applied Physics and Materials Science Department
Teaching Assistant for APh/MS 105c States of Matter (Grad course) (Spring 2014-2016)
Teaching Assistant for APh/MS 120 Diffraction and Structure (Grad course) (Fall 2013)

University of Massachusetts Amherst
Mathematics Department
Paid Teaching Assistant for Math 127: Calculus I (2009-2011)

Students Mentored
Claire Saunders, PhD (Caltech PhD → Nuclear Materials Scientist at Helion Energy, Inc.)
Yang Shen, PhD (Caltech PhD → Data Scientist at Omniscience Corp.)
Yao Yang, PhD (UCLA PhD → Assistant Professor at Westlake University, China)
Seungkyeum Kim (UCLA undergraduate student → Caltech PhD Candidate)
Abinash Kumar, PhD (MIT PhD → Postdoctoral Scholar at Oak Ridge National Laboratory)
Camille M. Bernal-Choban (Caltech PhD → Postdoc at UIUC)
Dillan J. Chang (UCLA PhD → Allstate Corporation)
Xi Chen (MIT PhD Candidate → Research Staff at the Allen Institute)
Michael Xu (MIT PhD Candidate)
Matt Shammami (UCLA PhD Student)
Jack Diab (UCLA PhD Student)

Other Relevant Experiences

Massachusetts Institute of Technology
Postdoctoral Association (PDA) DEI and Advocacy Committee Member (2021 - 2023)

The Solar Army: NSF Center for Chemical Innovation in Solar Fuels Outreach
Solar Army General (Volunteer) (2013-2015)

Korean-American Scientists and Engineers Association (KSEA)
KSEA-SC Major Fair Invited Booth Speaker (2015-2016)
National Mathematics & Science Competition Graduate Volunteer (2012, 2013, 2015)
Space Journey Science Camp Graduate Volunteer (2012)

Unite for Sight, Mt. Holyoke College Chapter
Secretary/Five College Representative (2008 - 2009)

References

Prof. Brent T. Fultz	Caltech	btf@caltech.edu	(626) 395-2170
Prof. Jianwei (John) Miao	UCLA	miao@physics.ucla.edu	(310) 206-2645
Prof. James M. LeBeau	MIT	lebeau@mit.edu	(617) 263-6889
Prof. Prineha Narang	UCLA	prineha@ucla.edu	(617) 496-4710
Prof. Chen W. Li	UC Riverside	chen.li@ucr.edu	(951) 827-5842