

Byung I. Kim, Ph. D

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(i) Professional Preparation

Korea Advanced Institute of Science and Technology	Physics	BS, 1991
Seoul National University	Physics	MS, 1993
Seoul National University	Physics	Ph. D, 1998
University of Houston	Chemical Physics	1998-2001
Sandia National Laboratories	Biophysics	2001-2004

(ii) Professional Experiences

2013 Aug.– Present : Full Professor, Boise State University
2009 Aug.– 2013 July : Associate Professor, Boise State University
2004 July– 2009 July : Assistant Professor, Boise State University
2001 Nov.– 2004. July: Postdoctoral Appointee, Sandia National Laboratories
1998 – 2001 Oct: Research Associate I, University of Houston

(iii) Courses Taught

- BMOL 603 (3-3-4) Biophysical Instrumentation and Techniques
- PHYS 395, 495 Research in Physics
- PHYS307 (3-3-4) Introduction to Biophysics
- PHYS 301 (3-3-4) Analog & Digital Electronics
- PHYS 212L (0-3-1) Physics II with Calculus Lab
- PHYS 111L (0-3-1) General Physics Lab
- PHYS 112L (0-3-1) General Physics Lab

(iv) Honor and Awards

- 2014 COAS Distinguished Research Award (Math and Sciences)

(v) Academic Services

- Member of University Faculty Senate (2017-2019).
- Undergraduate Academic Standards and Policy Committee (2016-present)
- COAS Math/Sciences Promotion to Full Professor Committee (2016-2019)
- COAS Dean Evaluation Committee (2010, 2013-14)
- Physics Tenure/Promotion committee (2009- Present)
- BMOL PhD comprehensive exam Committee (2014-present)
- Member of the Honor & Awards Committee of College of Arts and Sciences (2005, 2009, 2011).
- Member of the Institutional Biosafety Committee (IBC) of Boise State University (2004 – 2007)
- Member of the Mini Development Committee of College of Arts and Sciences (2005-2006)
- Member of the Bio/Nanophysics Faculty Search Committee of Physics Department (2005-2006).

(vi) Memberships

- Member of Biophysical Society
- Member of American Vacuum Society
- Member of American Physical Society
- Member of Korean-American Scientists and Engineers Association (KSEA)

(vii) Research Areas of Interest

- Interfacial water structure using cantilever based optical interfacial force microscope (COIFM)
- Single molecular chiral recognition using electrochemical scanning tunneling microscopy (EC-STM)

- Probing an enzymatic transition state using single molecular force spectroscopy (SMFS)
 - Development of AFM-FET Biosensor for proteomic screening
 - Separation of topographic features from magnetic force images in magnetic force microscopy (MFM)
 - Biomolecular dynamics using high-speed atomic force microscopy (HSAFM)
 - Nanotribology using friction force microscopy (FFM)
 - SPM based nanolithography
- (viii) **Outreach**
- Byung Kim, Water's amazing chain-like structure, Fifth Annual TEDx Boise, Boise ID April 20, 2019. As one of 12 speakers at TEDx Boise, I talked to the general public (~300 people) about chain-like water during 18 min at JUMP (Jack's urban meeting place), Boise Idaho.
- (ix) **Peer-reviewed Publications** (* and ** mark the applicant's undergraduate research assistants and high school interns, respectively.).
1. M.H. Korayem, B.I. Kim and A.H. Korayem, "Experimental and theoretical analysis of the DMAPS cantilever vibration behavior based on the MCS theory in moist environment." *Smart Mater. Struct.* **27**, 075059 (2018).
 2. S.H. Jeon, B.W. Ryu, W. Jhe, Z. G. Khim and B. I. Kim, "Reproducible Nanostructure Fabrication Using Atomic Force Microscopy Indentation with Minimal Tip Damage," *J. Vac. Sci. Technol. B*, **32**, 020601 (2014)..
 3. J. Kim, B. Sung, B. I. Kim, and W. Jhe, "Optimization of force sensitivity in Q-controlled amplitude-modulation atomic force microscopy", *J. Appl. Phys.* **114**, 054302 (2013).
 4. B. I. Kim, R. D. Boehm*, J. R. Bonander*, "Direct Observation of Self-assembled Chain-like Water Structures in a Nanoscopic Water Meniscus", *J. Chem. Phys.* **139**, 054701 (2013).
 5. B. I. Kim, L. Smith*; T. Tran*, S. Rossland*, E. Parkinson**, "Cantilever-Based Optical Interfacial Force Microscope in Liquid Using and Optical-Fiber Tip", *AIP Advances* **3**, 032126 (2013).
 6. B. I. Kim and R.D Boehm*, "Imaging Stability in Force-Feedback High-Speed Atomic Force Microscopy", *Ultramicroscopy* **125**, 29-34 (2013).
 7. B. I. Kim and R. D. Boehm*, "Mechanical Property Investigation of Soft Materials by Cantilever-Based Optical Interfacial Force Microscopy," *Scanning* **35**, 59–67 (2013).
 8. B. I. Kim, J. O. Holmes*, M. S. Ryu**, and P. Deschateletes "An AFM-FET Biosensor for Proteomic Screening," *International Journal of Bioscience, Biochemistry and Bioinformatics* **2**, 168 (2012).
 9. B. I. Kim, "Effects of long range tip-sample interaction on magnetic force imaging: A comparative study between bimorph driven system and electrostatic force modulation", *J. Appl. Phys.* **111**, 104313 (2012).
 10. B. I. Kim and S. Kim*, "Self-Assembled Trimer Structures Highlight the Competitive Roles of Intermolecular and Adsorbate-substrate Interactions: PVBA Trimer on Pd(111)," *Langmuir*, **28**, 8010–8016 (2012).
 11. B. I. Kim, J. Hanson*, M. Turner*, and L. Reeder**, "Influence of Solvent on the Chiral Resolution of Organic Molecules on Au(111): EC-STM Study of Biphenyl Dicarboxylic Acid on Au(111) in Aqueous Environment," *Surf. Sci.* **606**, 1340–1344 (2012).
 12. B. I. Kim and R.D. Boehm*, "Force-Feedback High-Speed Atomic Force Microscope for Studying Large Biological Systems," *Micron* **43**, 1372-1379 (2012).
 13. B. I. Kim, J.A. Rasmussen*, and E. J. Kim*, "Large oscillatory forces generated by interfacial water under lateral modulation between two hydrophilic surfaces," *Appl. Phys. Lett.* **99**, 201902 (2011).

14. B. I. Kim, Reilly Clark*,**, and Tyler Clark**, “Long-Term Structural Changes of Plasmid DNA Studied by Atomic Force Microscopy,” *Scanning* **33**, 405 (2011).
15. B. I. Kim, J. R. Bonander*, and J. A. Rasmussen*, “Simultaneous measurement of normal and friction forces using a cantilever-based optical interfacial force microscope,” *Rev. Sci. Instrum.* **82**, 053711 (2011).
16. B. I. Kim, “Nanotribology and nanoindentation using advanced scanning probe techniques,” *Scanning*, **32**: v–vi. (2010).
17. B. I. Kim, “Separation of Topographic Features from Magnetic Force Images using Capacitive Coupling Effect,” *Rev. Sci. Instrum.* **80**, 023702 (2009).
18. J. R. Bonander* and B. I. Kim, “Cantilever Based Optical Interfacial Force Microscope”, *Appl. Phys. Lett.* **92**, 103124 (2008).
19. J. Philip, A. Punnoose, B. I. Kim, K. M. Reddy, S. Layne1, J. O. Holmes*, B. Satpati, P. R. Leclair, T. S. Santos and J. S. Moodera, “Carrier-controlled ferromagnetism in transparent oxide semiconductors,” *Nature Materials* **5**, 298-304 (2006).
20. B. I. Kim, “Chiral Recognition of PVBA on Pd(111) and Ag(111) Surfaces”, *Langmuir* **22**, 9272-9280 (2006).
21. B. I. Kim, “Direct Comparison Between Phase Locked Oscillator And Direct Resonance Oscillator In The Noncontact Atomic Force Microscopy Under Ultrahigh Vacuum”, *Rev. Sci. Instrum.* **75**, 5035(2004).
(before joining BSU)
22. B. C. Bunker, B. I. Kim, J. E. Houston, S. T. Picraux, R. Rosario, A. A. Garcia, M. Hayes, and D. Gust, “Observations of Photo-Switching in Tethered Spiropyran Using the Interfacial Force Microscope” *Nano Letters* **3**, 1723 (2003).
23. B. C. Bunker, D. L. Huber, R. P. Manginell, B. -I. Kim, A. K. Boal, G. D. Bachand, S. B. Rivera, J. M. Bauer, C. M. Matzke, “Incorporation of Bioactive Materials into Integrated Systems”, *Proc. SPIE* **5220** 28 (2003).
24. D. L. Huber, R. P. Maginell, M. A. Samara, B. -I. Kim, and B. C. Bunker, “Programmed Adsorption and Release of Proteins in a Microfluidic Device”, *Science* **301**, 352 (2003).
25. B.-I. Kim, C. Cai, X. Deng, S. S. Perry, “Adsorption-induced chirality influences surface orientation in organic self-assembled structures: an STM study of PVBA on Pd(111)”, *Surf. Sci.* **538**, 45 (2003).
26. L. C. Fernandez-Torres, B.-I. Kim, S. S. Perry, The frictional response of VC(100) surfaces: Influence of 1-octanol and 2,2,2-trifluoroethanol adsorption, *Tribology Letters* **15**, 43 (2003).
27. X. Chen, S. Wang, Y. L. Yang, L. Smith, N. J. Wu, B.-I. Kim, S. S. Perry; A. J. Jacobson, A. Ignatiev, Electrical conductivity relaxation studies of an epitaxial $\text{La}_{0.5}\text{Sr}_{0.5}\text{CoO}_{3-\text{delta}}$ thin film, *Solid State Ionics* **146**, 405 (2002).
28. R. L. Guenard, L. C. Fernandez-Torres, B.-I. Kim, S.S. Perry, P. Frantz, S. V. Didziulis, Selective surface reactions of single crystal metal carbides: alkene production from short chain alcohols on titanium carbide and vanadium carbide, *Surf. Sci.* **515**, 103 (2002)
29. B. I. Kim, S. Lee, R. L. Guenard, L. C. Fernandez-Torres, S. S. Perry P. Frantz and S. V. Didziulis, "Chemical Modification of the Interfacial Frictional Properties of Vanadium Carbide Through Ethanol Adsorption", *Surf. Sci.*(2001) **481**, 185 (2001)
30. C. A. Mims, N. I. Joos, P. A.W. van der Heide, A. J. Jacobson, C. Chen, C. W. Chu, B.-I. Kim, S. S. Perry, Oxygen transport in oxide thin film structures oriented $\text{La}_{0.5}\text{Sr}_{0.5}\text{CoO}_{3-x}$ on single-crystal yttria-stabilized zirconia, *Electrochemical and Solid State Letters* **3**, 59 (2000).

31. H. Lee, S. M. Lee, E. T. Ada, B.-I. Kim, M. Weiss, S. S. Perry, J. W. Rabalais, Shallow implantation of Ti⁺ ions in sapphire [a-Al₂O₃(0001)], Nucl. Instrum. Meth. B **157**, 226 (1999).
32. B. I. Kim, U. H. Pi, S. Yoon and Z. G. Khim, "Lithography by tapping mode atomic force microscope with electrostatic force modulation", Appl. Phys. A **66**, s95 (1998).
33. B. I. Kim, J. W. Hong, J. I. Kye, Z. G. Khim and S. Yoon, "Construction of Magnetic Force Microscope and its Application to Magnetic Multilayer Films" J. Kor. Phys. Soc. **31**, S79 (1997).
34. J. W. Hong, B. I. Kim, J. I. Kye and Z.G. Khim, "Effect of electrostatic force and tapping mode operation of atomic force microscope" J. Kor. Phys. Soc. **31**, S83 (1997).
35. J. I. Kye, W. K. Park, B. I. Kim, Z. G. Khim, G. T. Jeong, D. H. Lee, T. E. Shim, and J. G. Lee, Single Electron Tunneling Effect in YBCO Film, J. Kor. Phys. Soc. **29**, 354 (1996).
36. B. I. Kim, J. W. Hong, G. T. Jeong, S. H. Moon, D. H. Lee, T. U. Shim and Z. G. Khim, "Effect of Mg(OH)₂ On YBa₂Cu₃O₇ thin film on MgO by AFM", J. Vac. Sci. Technol. **B12(3)**, 1631 (1994).
37. W. Jo, H-J. Cho, T. W. Noh, B.-I. Kim, D. Y. Kim, Z. G. Khim, and S-I. Kwun, Structural and electro-optic properties of pulsed laser deposited Bi₄Ti₃O₁₂ thin films on MgO, Appl. Phys. Lett. **63**, 2199 (1993)

(x) **Book Chapter Publications**

1. Byung I. Kim, "Chapter 55. Magnetic Force Images Using Capacitive Coupling Effect," in Handbook of Measurement in Science and Engineering, Volume 3, Myer Kutz (Ed.), Wiley 2001-2024 (2016).
2. Byung I. Kim and Ryan D. Boehm, "Chapter 4. Force-Feedback High-Speed Atomic Force Microscope," Atomic Force Microscopy (AFM): Principles, Modes of Operation and Limitations by H. Yang (Ed.) Nova Science Publishers, Inc. (2014)
3. Byung I. Kim. "Chapter 6. Cantilever-Based Optical Interfacial Force Microscopy," Molecular Interactions, Prof. Aurelia Meghea (Ed.), ISBN: 978-953-51-0079-9, InTech, Available from: <http://www.intechopen.com/books/molecular-interactions/cantilever-based-optical-interfacial-force-microscope> (2012).

(xi) **Patent Pending and Invention Disclosure**

1. Inventor: Byung Kim, Invention Title: "Feedback controller in probe microscope utilizing a switch and a inverter" US 9140720. issued on 2015-09-22.
2. Inventor: Byung Kim, Invention Title: "System and method for high-speed atomic force microscopy with switching between two feedback loops," US9091705 issued on 2015-07-28.
3. Inventor: Byung Kim, Invention Title: "Cantilever-based optical fiber probe interfacial force microscope for partial immersion in liquid," US08549660, issued on 2013-10-01

(xii) **Supports (~\$900,000) (since joining BSU)**

1. NSF Wider Persist Project, as co-PI with his colleague and co-instructor Dr. Ferguson, to work on the redesign of the Physics CID course PHYS 301 Analog and Digital Electronics, to incorporate ePortfolios and EBIPs (**\$21,930**), 1 year (September 2016-August 2017)
2. Brain Pool Program Award, Project type: Grant, Total Amount Awarded: **\$21,150**, Agency: Korean Ministry of Education, Science and Technology, Time Periods: 5 months (March 2013 – July 2013): **PI: B. Kim (sabbatical leave research at Seoul National University).**
3. INBRE Summer 2012 INBRE UG Fellowship Prospective Mentor; "Summer Undergraduate Fellowship Mentor"; Agency: Idaho BRIN/INBRE Program; Amount : **\$6,000 (\$5,000 for UG Salary)**; Time Periods: 10 weeks (summer 2012); **PI: B. Kim**

4. National Science Foundation: “MRI: Development of a COIFM with Lateral Modulation for Studying Interfacial Water,” Amount: **\$342,001**; Time Period:10/01/11-09/30/15; **PI: Byung Kim**
 5. INBRE Summer 2011 INBRE UG Fellowship Prospective Mentor; “Summer Undergraduate Fellowship Mentor“; Agency: Idaho BRIN/INBRE Program; Amount : **\$6,000 (\$5,000 for UG Salary)**; Time Periods: 10 weeks (summer 2011); **PI: B. Kim**
 6. NSF STEP UG Researcher Sponsor: “Biophysics and Condensed Matter Physicist”; **\$1,000 + UG Salary**; Time Periods: 1 year (academic year 2011-2012); **Mentor: B. Kim**
 7. National Science Foundation: “IDBR: RUI: Development of a Cantilever Based Optical Interfacial Force Microscope,” Amount: **\$240,181** Time Period: 06/01/09 - 05/31/12; **PI: Byung Kim**
 8. The Petroleum Research Fund: “Chiral Recognition of PVBA on fcc(111) Surfaces in Electrochemical Solutions”; Agency: PRF AMERICAN CHEMICAL SOCIETY, Amount: **\$40,000**; Time Periods:6/1/2007-8/31/2009; **PI: Byung Kim**.
 9. Cottrell College Science Awards; “Scanning Probe Microscopy of Interfacial Water Confined between Silica Surfaces”; Agency: Research Corporation; Amount: **\$45,683**; Time Periods: 05/11/07 - 05/12/09; **PI: Byung Kim**.
 10. Travel Grant for Gordon Research Conference on TRIBOLOGY: Time periods: 06/18/2006 - 06/23/2006, Conference Place: Colby College, Waterville, ME. Agency: Gordon Research Conference ; Amount: **\$660**; **Traveler: Byung Kim**.
 11. INBRE Summer 2006 INBRE UG Fellowship Prospective Mentor; “Summer Undergraduate Fellowship Mentor“; Agency: Idaho BRIN/INBRE Program; Amount : **\$6,000 (\$5,000 for UG Salary)**; Time Periods: 10 weeks (summer 2005); **PI: B. Kim**
 12. NSF EPSCoR Startup Augmentation funding; “Development of Interfacial Force Microscope for Water Study”; Agency: University of Idaho; Time Periods : 1 year (June 1, 2005 to May 31, 2006); Amount: **\$10,000**; PIs: **Byung Kim (PI)**
 13. NIH-SBIR I - Subcontract; “Bypassing Fluidics in Proteomic Screening”, Agency : Potentia Pharmaceuticals, Inc., Amount : **\$100,814** ; Time Periods : 1 year (June 1, 2005 to Nov 30, 2006); PIs: **Byung Kim (PI)** and Russell, Dale
 14. Collaborative Grant Improvement Initiative (CGII); Achieving excellence in research and scholarship “Biophysical and Biochemical Characterization of Protein Structure and Molecular Interactions in Cell Signaling”, Agency : Boise State University; Amount: **\$22,000** (out of \$150,000) for 2 year. Time periods :2 years (June 2005 to May 2007); PIs: J. Oxford (**PI**), H. Charlier, N. Hazeki-Taylor, **B. Kim**, B. Knowlton, J. Peloquin, A. Punnoose, and S. Smith (co -PIs).
 15. Faculty Research Initiation Grants (FRIG);“High-Speed AFM For Biomolecular Studies,”; Agency : Boise State University –ORA; Time Periods: 1 year (July 2005-June 2006), Amount:**\$15,000**; PIs: **Byung Kim (PI)**
 16. Faculty Research Grants (FRG); “Single molecular studies of chiral recognition on fcc(111) surfaces,”; Agency : Boise State University –ORA; Time Periods: 1 year (July 2005 - June 2006), Amount:**\$5,000**; PIs: **Byung Kim (PI)**
- (xiii) **Recent Conference and Workshop Presentations (out of 77 since joining BSU)**
 (* and ** marks the applicant’s undergraduate research assistants and high school interns, respectively)
1. S. Jung*, and **B.I. Kim**, “Origin of Friction Generated by Chain-like water Between Two Surfaces,” 2017 Idaho Conference on Undergraduate Research (ICUR). July 2017, Student Union Building at Boise State University.

2. S. Kim**, and B. I. Kim, “Water Bridge Forces in Ambient Environments Studied by Interfacial Force Microscopy,” 2017 Idaho Conference on Undergraduate Research (ICUR). July 2017, Student Union Building at Boise State University.

(xiv) **Recent Invited Seminars** (out of 26 since joining BSU)

1. B. I. Kim, “Coexistence of Chain-like Water and Liquid Water in a Nanoscopic Water Junction.” Physics Faculty Lightning Talks. Department of Physics (2018).
2. B. I. Kim, “Is Chain-like Water Involved in Liquid-Liquid Phase Separation in Cell?” BMOL Ph.D. faculty mini-research talks (2018).

(xv) **List of Supervised Students and Their Professional Experience** (since joining BSU)

Recent Graduate Students

1. Alireza Habibnezhad Korayem (Visiting PhD Student from Iran University of Science and Technology, February 2017- August 2017) Modeling and analysis of the vibration behavior of cantilever in the application of surface topography. .

Matthew Turner (PhD candidate of Biomolecular Sciences PhD program, September 2014- December 2014): Bio-AFM training (Lab rotation).

3. SeungHee Jeon (PhD candidate at SNU, September 2012-Aug 2013): PhD Thesis advising during sabbatical leave at Seoul National University.

Recent Undergraduate Students (out of 45)

1. Tragon McFall (Physics Major, April 2018-present), Atomic Force Microscopy
2. Trevor Robertson (Physics Major, May 2018- August 2018), Atomic Force Microscopy

Recent High School Interns (out of 19)

1. Serrin Kim (Boise High School) (February 2017- November 2017) *Water Bridge Forces in Ambient Environments*.
2. Michael Brown (Idaho Art Charter School, Nampa ID) (May 2014-August 2014) Manuscript preparation

(xvi) **Professional Services** (since joining BSU)

- Peer-Reviewing Service of 124 research manuscripts (since joining BSU) submitted to the following journals: Scientific Reports, Langmuir, Nanotechnology, Applied Physics Letters, Journal of Micromechanics and Microengineering, Journal of Applied Physics, IEEE Sensors, Journal of Adhesion Science and Technology, Review of Scientific Instruments, Scanning, Ultramicroscopy, Scientific Research and Essays, Hindawi Publishing. Physical Chemistry Chemical Physics, Journal of Physics D: Applied Physics, Energy and Buildings, Science China Materials, IEEE Transactions on Mechatronics, Applied Surface Science, Analyst, Journal of Chemical Physics, Smart Materials and Structures.
- Textbook Review Service of three book manuscripts in Biophysics and Analog Electronics since joining BSU: John Wiley & Sons, Inc., Addison Wesley, and Jones and Bartlett Publishers
- Guest Editor of Journal Scanning (2009-2010).
- NSF MRI, NSF IDBR Review panelist (2009, 2010).
- Session Chair at 2012 World Gene/Cell Therapy Online Symposium, May 7, 2012.
- Proposal Reviewer of NSF MRI, NSF IDBR, Research Corporation, Romanian National Research Council, Louisiana Board of Regents Research Competitiveness Subprogram (RCS), BSU Faculty Research Grants (2005-2006), and others.