

Curriculum Vitae

Bilin Zhuang

Department of Chemistry, Harvey Mudd College
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EDUCATION

- 2010 - 2016 **California Institute of Technology** Pasadena, California, USA
- Ph.D. in Chemistry, GPA 4.2
- Dissertation Title: "Dipolar Liquids and Their Mixtures: Equilibrium and Nonequilibrium Properties with Field-Theoretic Approaches"*
- Advisor: Professor Zhen-Gang Wang
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- 2006 - 2009 **Wellesley College** Wellesley, Massachusetts, USA
- B.A. in Physics and Chemistry, GPA 4.0
- Dissertation Title: "Thermodynamics of Ising Systems of the Triangular Kagome Lattice and Small-Model Approximations to Geometrically Frustrated Systems"*
- Advisor: Professor Courtney Lannert

APPOINTMENTS

- 2023 - Present **Assistant Professor of Chemistry, Harvey Mudd College**
Claremont, California, USA
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- 2020 - 2023 **Assistant Professor of Chemistry, Yale-NUS College**
Singapore
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- 2017 - 2022 **Scientist, Institute of High Performance Computing**
Singapore

AWARDS AND FELLOWSHIPS

- NSF CAREER Award, National Science Foundation, USA, 2023
- Yale-NUS Teaching Enhancement Grant, 2022
- AME Young Individual Research Grant, 2020 (Role: PI)
- Science and Engineering Research Council Career Development Award, 2018 (Role: PI)
- Leroy Apker Award, American Physical Society, 2009
- The Phyllis J. Fleming Prize for Distinction in Physics, Wellesley College, 2009
- The Jean V. Crawford Prize in Chemistry, Wellesley College, 2009
- The Jerome A. Schiff Fellowship, Wellesley College, 2008
- National Science Scholarship (BS-PhD), A*STAR, 2006
- Institute of Physics Singapore Gold Medal, 2006

TEACHING EXPERIENCE

- 01/2020 – Present ***Assistant Professor in Physical Sciences (Chemistry)***
Division of Science, Yale-NUS College, Singapore
- Developed and taught a new course *Analytical Chemistry with Laboratory* (including lectures and weekly laboratory session) despite not being an experimental analytical chemist. Received 4.94/5 in the teaching evaluation for this course.
 - Developed and taught a new course *Science of Everyday Cooking* and a one-week full-day experiential learning course for first-year students: *Baking Across Boundaries: the Culinary Art and Science of Everyday Bread*
 - Redeveloped *Statistical Thermodynamics* so that the content caters to both physics and chemistry students in the major. Received 4.89/5 in the teaching evaluation for this course.
 - Taught *Scientific Inquiry II*, a common curriculum course examining the topic of climate change required for all sophomores, in a teaching team.
- 01/2012 – 03/2013 ***Teaching Assistant***
Division of Chemistry and Chemical Engineering, California Institute of Technology
- For the graduate course on statistical mechanics. Held weekly recitation sessions and graded weekly assignments. Delivered lectures when the instructor was absent.

RESEARCH EXPERIENCE

- 01/2020 – 06/2023 ***Assistant Professor in Physical Sciences (Chemistry)***
Division of Science, Yale-NUS College, Singapore
- Have built a research effort that involved students from many different countries and majors. To date, I have worked with 24 students in various majors including physical sciences, life sciences, math, computer science, economics, and history
 - Published a manuscript with our students (Gabriele Ramanauskaite in Physical Sciences, Koa Zhao Yuan in MCS) in *Science Advances*
 - Established a strong collaboration with Jing Yu at Nanyang Technological University, working on the physics of polymer brushes in electrolytes
- 04/2017 – 04/2022 ***Scientist (joint appointment since 01/2020)***
Department of Material Science and Chemistry, Institute of High Performance Computing, Singapore
- Investigated the intrinsic properties of water, in collaboration with Prof. Liu Xiaogang at NUS and Prof Luis Carlos at University of Aveiro, Portugal
 - Studying the conformation of polyelectrolyte in water, in collaboration with Asst. Prof Yu Jing at NTU and Dr. Daniel Daniel at Institute of Materials Research and Engineering (IMRE)
 - Studying the condition for encapsulation of drugs by block polymers, in collaboration with Dr Thoniyot Praveen at Institute of Chemical and Engineering Sciences (ICES) and Dr Freda Lim at Institute of High Performance Computing (IHPC)

- 09/2010 – 06/2016 ***Doctoral Research***
Theory of Soft Matters Group, California Institute of Technology
- Developed an analytical theory for calculating the dielectric constants of liquids using field-theoretic methods; among field-theoretic treatments of liquids, the effects of reaction field is naturally accounted for for the first time
 - Developed an analytical theory for electron transfer reorganization energy in polar solvents and mixed solvents
 - Performed computer simulations for calculating electron transfer reorganization energy
 - Derived a theoretical formula for calculating the refractive indices of liquid mixtures containing salts, giving excellent agreement with experimental measurements
 - Studied phase behavior of solutions of side-chain liquid crystal polymers in liquid crystal solvent
- Advisor: Prof. Zhen-Gang Wang
- 07/2009 – 07/2010 ***Research Engineer***
Data Storage Institute, Singapore
- Developed a model for calculating spin current in MRAM devices
- Advisor: Dr. Rachid Sbiaa
- 01/2007 – 06/2009 ***Undergraduate Honors Research***
Condensed Matter Modeling Lab, Wellesley College
- Performed theoretical studies and computer simulations on low-dimension Ising models and random-field Ising models
- Advisor: Prof. Courtney N. Lannert
- 06/2008 – 08/2008 ***Research Internship***
Max Planck Institute for Polymer Science, Mainz, Germany
- Performed ab initio calculations for the dynamics of the Fremy salt
- Advisor: Dr. Daniel Sebastiani
- 06/2007 – 08/2007 ***Research Internship***
Institute of High Performance Computing, Singapore
- Formulated 4th order molecular dynamics algorithms based on Liouville operator and Trotter expansion
- Advisor: Dr. David Whyte
- 05/2006 – 08/2006 ***Research Internship***
Institute of Materials Research and Engineering, Singapore
- Worked in an in-situ TEM lab and explored the working principles and technical details of various microscopic techniques including STM, AFM, FIM and BEEM
- Advisor: Dr. Yong Lim Foo

COURSES TAUGHT

- Science of Everyday Cooking (Fall 2022, new course I developed)
- Physical Sciences Research Seminar (Fall 2022)
- Statistical Thermodynamics (Spring 2021 and 2022, redeveloped to cater to both physics and chemistry students)
- The Culinary Art and Science of Everyday Bread (Spring 2021, a one-week experiential learning program that I developed)
- Scientific Inquiry 2 (Fall 2020)
- Analytical Chemistry with Laboratory (Fall 2020 and 2022, new course I developed)
- Mathematical Methods for Physical Sciences (Spring 2022)
- Chemistry in the Modern World (Fall 2023)
- First-year Chemistry Laboratory (Fall 2023, Spring 2024)
- Computations in Chemistry (Spring 2024)

SENIOR THESES SUPERVISED

- Garima Chib (2023) “Liquid-Liquid Phase Separation in Confined Geometry under an Electric Field”
- Phoebe Rosa Virginia (2023) “Unravelling Peptide Self-Assembly: Experiments and Simulations”
- Devendra Neupane (2021) “Thermodynamics of Aggregates Formation”
- Alexander Reeves (2021) “The Feasibility of Using Granular Flows for Energy Storage” (Co-supervised with Herbert Huppert and James Taylor of Cambridge University, UK)

SERVICES

- **Residential Faculty**
Yale-NUS College, 2021-2023
- **Committee on Academic Standards member**
Yale-NUS College, 2020-2021
- **Kingfisher Awards Selection Committee member**
Yale-NUS College, 2020
- **Corporate Wellness Committee member**
Institute of High Performance Computing, 2018 – present
- **Chemical Physics Seminar Committee student co-chair**
California Institute of Technology, 2013-2016

- PUBLICATIONS** M. Li, X. Xu, **S. Yasar**[#], H. A. Klok, **B. Zhuang**^{*}, J. Yu^{*}, Ion Adsorption Enhances Apparent Nonelectrostatic Attraction between Monomers in Polyelectrolyte Brushes, *Macromolecules* 57, 3026-3036 (2024). [link](#) (*co-corresponding authors, [#]students)
- F. E. Maturi, R. S. Raposo Filho, C. D. S. Brites, J. Fan, R. He, **B. Zhuang**, X. Liu, L. D. Carlos, Deciphering Density Fluctuations in the Hydration Water of Brownian Nanoparticles via Upconversion Thermometry, *The Journal of Physical Chemistry Letters* 15, 2606-2615 (2024). [link](#)
- J. Tong**, X. Liang^{*}, N. von Solms, F. Huo^{*}, **B. Zhuang**^{*}, Ion Correlations in Quaternary Ionic Liquids Electrolytes. *Journal of Physics: Materials* 7, 025006 (2024). [link](#) (*co-corresponding authors)
- V. Mesilov**^{*}, **B. Zhuang**^{*}, S. Xi, S. L. Bernasek, Poisoning of Copper Chabazite Catalyst by Biodiesel Metal Contaminants: Effect of Alkali and Alkaline Earth Metals, *J. Phys. Chem. C*, 127, 11490-11505 (2023). [link](#) (*co-corresponding authors)
- M. Li, **B. Zhuang**^{*}, J. Yu^{*}, Effects of Ion Valency on Polyelectrolyte Brushes: A Unified Theory, *Macromolecules*, 55, 10450–10456 (2022). [link](#) (*co-corresponding authors)
- B. Mei, **B. Zhuang**, Y. Lu, L. An, Z.-G Wang, Local-Average Free Volume Correlates with Dynamics in Glass Formers, *J. Phys. Chem. Lett.* 13, 3957 (2022). [link](#)
- M. Li, **B. Zhuang**^{*}, J. Yu^{*}, Sequence-conformation relationship of zwitterionic peptide brushes: theory and simulations, *Macromolecules*, 54, 9565–9576 (2021). [link](#) (*co-corresponding authors)
- B. Zhuang**^{*}, **G. Ramanaukaite**[#], **Z. Y. Koa**[#], Z.-G. Wang^{*}, Like dissolves like: a first-principle theory for predicting liquid miscibility and mixture dielectric constant, *Science Advances*, 7, eabe7275 (2021). [link](#) (*co-corresponding authors, [#]students)
- M. Li[†], **B. Zhuang**[†], Y. Lu, L. An, Z.-G Wang, Salt-induced liquid–liquid phase separation: combined experimental and theoretical investigation of water–acetonitrile–salt mixtures, *Journal of the American Chemical Society*, 143, 773 (2021). [link](#). († co-first authors)
- C. D. S. Brites[†], **B. Zhuang**^{†*}, M. L. Debasu, D. Ding, X. Qin, F. E. Maturi, **W. Y. Lim**[#], D. W. Soh, J. Rocha, Z. Yi, X. Liu^{*} and L. D. Carlos^{*}, Decoding a percolation phase transition of water at ~330 K with a nanoparticle ruler, *J. Phys. Chem. Lett.* 11, 4704 (2020) [link](#). († co-first authors, ^{*}co-corresponding authors, [#]students)

M. Li, **B. Zhuang***, J. Yu*, Functional zwitterionic polymers on surface: structures and applications, *Chem. Asian J.*, 15, 1 (2020). [link](#) (*co-corresponding authors)

S. Chen, M. Yang, B. Liu, M. Xu, T. Zhang, **B. Zhuang**, D. Ding, X. Huai, and H. Zhang, Enhanced thermal conductance at the graphene–water interface based on functionalized alkane chains, *RSC Advances*, 9, 4563 (2019). [link](#)

B. Zhuang and Z.-G. Wang, Statistical field theory for polar fluids, *J. Chem. Phys.*, 149, 124108 (2018). [link](#)

M. Li, **B. Zhuang**, L. An, Y. Lu, Z.-G. Wang, and L. An, Accurate determination of ion polarizabilities in aqueous solutions, *J. Phys. Chem. B*, 121, 6416 (2017). [link](#)

B. Zhuang and Z.-G. Wang, Molecularly-based theory for electron-transfer reorganization energy in solvent mixtures, *J. Phys. Chem. B*, 120, 6373 (2016). [link](#)

B. Zhuang and Z.-G. Wang, A Molecularly based theory for electron transfer reorganization energy, *J. Chem. Phys.*, 143, 224502 (2015). [link](#)

N. An,* **B. Zhuang**,* M. Li, Y. Lu, and Z.-G. Wang, Combined theoretical and experimental study of refractive indices of water-acetonitrile-salt systems, *J. Phys. Chem. B*, 119, 10701 (2015). (*co-first authors) [link](#)

B. Zhuang and Z.-G. Wang, Anomalous concentration effects on phase behavior and nematic order in mixtures of side-chain liquid crystal polymers and low-molecular-weight liquid crystal, *Macromolecules*, 45, 6220, (2012). [link](#)

B. Zhuang and C. Lannert, Small-network approximations for geometrically frustrated Ising systems. *Phys. Rev. E*, 85, 031107 (2012). [link](#)

R. Sbiaa, **Z. Bilin**, M. Ranjba, H. K. Tan, S. J. Wong, S.N. Piramanayagam, T. C. Chong, Effect of magnetostatic energy on domain structure and magnetization reversal in (Co/Pd) multilayers. *J. Appl. Phys.*, 107, 103901 (2010). [link](#)

J. Heller, H. Elgabarty, **B. Zhuang**, D. Sebastiani, D. Hinderberger, Solvation of small disulfonate anions in water/methanol mixtures characterized by high-field pulse electron nuclear double resonance and MD simulations. *J. Phys. Chem. B*, 114, 7429 (2010). [link](#)

PRESENTATIONS “Elucidating water's underlying local structures by decomposing the orientational order parameter distribution”, APS March Meeting, Minneapolis, USA, 2024.

“Self-Assembly and Phase Transition in Peptide Solutions” (*invited talk*), International Workshop on Biophysics and Soft Matter, Hong Kong, 2023.

“Statistical Field Theory for Polar Liquids” (*invited talk*), Departmental Symposium at the City University of Hong Kong, 2021.

“Uncovering the Rules of Liquid Mixtures: the Obvious and the Not-So-Obvious” (*invited talk*), Chemistry Departmental Seminar at the University of Science and Technology, Hong Kong, 2020.

“Accelerating Simulations of Polyelectrolyte in Solution with an Adaptive Hybrid Particle-Continuum Approach” (*invited talk*), Pacific Polymers Conference, Singapore, 2019.

“Design Diblock Copolymers for More Efficient Encapsulation”, APS March Meeting, Boston, MA, USA, 2019.

“Like Dissolves Like: How Like Need They Be? A Statistical Field Theory for Polar Liquid Mixtures” (*invited talk*), Chinese Chemical Society Meeting on Soft Matter Theory, Computation, and Simulation, Shanghai, China, 2018.

“A Variational Statistical-Field Theory for Polar Liquid Mixtures”, APS March Meeting, Baltimore, MD, USA, 2016.

“Dipolar Mean-Field Theory and Molecular Dynamics Simulations for Electron Transfer Reorganization Energy in Solvent Mixtures”, Gordon Research Conference for Chemistry and Physics of Liquids, Holderness, NH, USA, 2015.
“A Molecularly-Based Theory for Electron Transfer in Polar Solvents”, APS March Meeting, Denver, CO, USA, 2014.

“A Self-Consistent-Field Theory for the Reorganization Energy in Solvent Mixtures”, Faraday Discussion 167: Mesosstructure and Dynamics in Liquids and Solutions, Bristol, UK, 2013.

“Non-Monotonic Concentration Effects in the Phase Behavior and Nematic Orders: Mixtures of Side-Chain Liquid Crystalline Polymers and Low-Molecular-Weight Liquid Crystals”, APS March Meeting, Boston, USA, 2012.

“Small-Model Approximations to Ising Models of Two-Dimensional Geometrically Frustrated Systems” (*invited talk*), APS March Meeting, Portland, USA, 2010.

“Thermodynamics of Ising Spins on the Triangular Kagome Lattice”, APS March Meeting, Pittsburg, USA, 2009.