

ANDREI TOKMAKOFF – CURRICULUM VITAE

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Education

1988 B.S. in Chemistry, California State University, Sacramento
1991 M.S. in Chemistry, Stanford University
1995 Ph.D. in Chemistry, Stanford University. Research Advisor: Michael D. Fayer

Positions and Employment

1995-96 Alexander von Humboldt Research Fellow, Technical University, Munich
1996-98 NSF Postdoctoral Fellow, Univ. of Chicago and James Franck Institute, and UC Berkeley and Lawrence Berkeley National Lab
1998-03 Assistant Professor, Department of Chemistry, Massachusetts Institute of Technology
2003-07 Associate Professor, Department of Chemistry, Massachusetts Institute of Technology
2007-12 Professor of Chemistry, Department of Chemistry, Massachusetts Institute of Technology
2012 Robert T. Haslam and Bradley Dewey Professor of Chemistry, Mass. Institute of Technology
2013- Henry G. Gale Distinguished Service Professor, Department of Chemistry, James Franck Institute, and Institute for Biophysical Dynamics, University of Chicago
2018- Chair, Department of Chemistry, University of Chicago

Honors and Awards

1994 Alexander von Humboldt Foundation Research Fellowship
1995 National Science Foundation Postdoctoral Fellowship in Chemistry
1999 Research Corporation Research Innovation Award
2000 David and Lucile Packard Fellowship for Science and Engineering
2001 Richard E. Heikkila Research Scholar Award (National Parkinson Foundation)
2001 Outstanding Young Investigator (Time-Resolved Vibrational Spectroscopy Conference)
2002 National Fresenius Award (Phi Lambda Upsilon)
2002 Alfred P. Sloan Research Fellowship
2002 Coblentz Award (Coblentz Society)
2009 Fellow of the Optical Society of America
2012 Ernest K. Plyler Prize for Molecular Spectroscopy (American Physical Society)
2014 Ellis R. Lippincott Award (Optical Society of America)
2016 Ahmed Zewail Award in Ultrafast Science and Technology (American Chemical Society)
2017 Distinguished Service Award, California State University Sacramento
2018 Fellow of the American Academy of Arts and Sciences

Professional Activities and Societies

Faculty advisor to 35 graduate students, 16 postdoctoral scholars, and 19 undergraduate students
Patents: 5 granted (US 7,696,479; 7,812,311; 8,526,002; 9,222,881; 9,476,768), 1 filing
Core MIT Faculty: Harrison Spectroscopy Lab (1999-2012), Laser Biomedical Research Facility (2010-2012)
MIT Biophysics Program Committee (2009-2012)

UChicago Biophysics Graduate Program Committee (2013-2015)
 Member: American Chemical Society, Biophysical Society, Optical Society of America, Protein Society
 Ad Hoc Reviewer: DOE Site Review Panel, Argonne (1999), NIH Special Emphasis Panel/SRG (2008, 2010), RIKEN Molecular Spectroscopy Lab (2015), NSF CHE Panel (2018)
 Review Panel Chair: IBS Center for Molecular Spectroscopy and Dynamics, Seoul, South Korea (2020)
 Visiting Member: NIH MSFB Study Section (2011 and 2016)
 Symposium Organizer/Co-Organizer: OSA Frontiers in Optics/Laser Science Meeting, October 2004; APS Nat'l Meeting, March 2005; ACS Nat'l Meeting, March 2008; APS Nat'l Meeting, March 2015.
 Conference Committees: Int'l. Conf. on Ultrafast Phenomena, 2004-2008; Int'l. Conf. on Coherent Multidimensional Spectroscopy, 2004-pres.; Int'l. Conf. on Time-Resolved Vibrational Spectroscopy, 2005-pres.
 Conference Co-Organizer: Tenth International Conference on Coherent Multidimensional Spectroscopy (CMD5 2021), Chicago, IL
 Conference Chair: 14th International Conference on Time-Resolved Vibrational Spectroscopy, 2009.
 Editorial Committees: Annual Reviews of Physical Chemistry (2007-2012); Advances in Chemical Physics (2007-2016); Journal of Chemical Physics (2008-2010); Chemical Science (2012-2019); Journal of Physical Chemistry (2013-2015).
 Guest Editor/Co-Editor: Journal of Chemical Physics, Special Issue on Biological Water (2014).
 Advisory Committee: Munich-Centre for Advanced Photonics (2008-2014)
 Scientific Advisory Board: Max-Born-Institute, Berlin, Germany (2011-2015).

Publications since 2016

1. "Weakened N3 Hydrogen Bonding by 5-Formylcytosine and 5-Carboxylcytosine Reduces Their Base-Pairing Stability," Qing Dai, Paul J. Sanstead, Chunte Sam Peng, Dali Han, Chuan He, Andrei Tokmakoff, *ACS Chem Biol*, **11** (2016) 477-477.
2. "Computational Amide I 2D IR Spectroscopy as a Probe of Protein Structure and Dynamics," Mike Reppert and Andrei Tokmakoff, *Annu Rev Phys Chem*, **67** (2016) 359-386.
3. "Role of Pre-Solvation and Anharmonicity in Aqueous Phase Hydrated Proton Solvation and Transport," Rajib Biswas, Ying-Lung Steve Tse, Andrei Tokmakoff, and Gregory A. Voth, *J Phys Chem B*, **120** (2016) 1793-1804.
4. "Efficient Total Chemical Synthesis of $^{13}\text{C}=^{18}\text{O}$ Isotopomers of Human Insulin for Isotope-Edited FTIR," Balamurugan Dhayalan, Ann Fitzpatrick, Kalyaneswar Mandal, Jonathan Whittaker, Michael A. Weiss, Andrei Tokmakoff, and Stephen B. H. Kent, *ChemBioChem*, **17** (2016) 415-420.
5. "Crystallization of Enantiomerically Pure Proteins from Quasi-Racemic Mixtures: Structure Determination by X-Ray Diffraction of Isotope-Labeled Ester Insulin and Human Insulin," Kalyaneswar Mandal, Balamurugan Dhayalan, Michal Avital-Shmilovici, Andrei Tokmakoff, and Stephen B. H. Kent, *ChemBioChem*, **17** (2016) 421-425.
6. "Differences in the Vibrational Dynamics of H_2O and D_2O : Observation of Symmetric and Antisymmetric Stretching Vibrations in Heavy Water," Luigi De Marco, William Carpenter, Hanchao Liu, Rajib Biswas, Joel M. Bowman, and Andrei Tokmakoff, *J Phys Chem Lett*, **7** (2016) 1769-1774.
7. "Studying Protein-Protein Binding through T-Jump Induced Dissociation: Transient 2D IR Spectroscopy of Insulin Dimer," Xin-Xing Zhang, Kevin C. Jones, Ann Fitzpatrick, Chunte Sam Peng, Chi-Jui Feng, Carlos Baiz, and Andrei Tokmakoff, *J Phys Chem B*, **120** (2016) 5134-5145.
8. "Interplay of Ion-Water and Water-Water Interactions within the Hydration Shells of Nitrate and Carbonate Directly Probed with 2D IR Spectroscopy," Joseph A. Fournier, William Carpenter, Luigi De Marco, and Andrei Tokmakoff, *J Am Chem Soc*, **138** (2016) 9634-9645.

9. "Sequence-Dependent Mechanism of DNA Oligonucleotide Dehybridization Resolved through Infrared Spectroscopy," Paul J. Sanstead, Paul Stevenson, and Andrei Tokmakoff, *J Am Chem Soc*, **138** (2016) 11792-11801.
10. "Anharmonic exciton dynamics and energy dissipation in liquid water from two-dimensional infrared spectroscopy," Luigi De Marco, Joseph A. Fournier, Martin Thämer, William Carpenter, and Andrei Tokmakoff, *J Chem Phys*, **145** (2016) 094501-1-13.
11. "Refining Disordered Peptide Ensembles with Computational Amide I Spectroscopy: Application to Elastin-Like Peptides," Mike Reppert, Anish R. Roy, Jeremy O. B. Tempkin, Aaron R. Dinner, and Andrei Tokmakoff, *J Phys Chem B*, **120** (2016) 11395-11404.
12. "Molecular Modeling and Assignment of IR Spectra of the Hydrated Excess Proton in Isotopically Dilute Water," Rajib Biswas, William Carpenter, Gregory Voth, and Andrei Tokmakoff, *J Chem Phys*, **145** (2016).
13. "Two-Photon-Excited Fluorescence-Encoded Infrared Spectroscopy," Joseph N. Mastron and Andrei Tokmakoff, *J Phys Chem A*, **120** (2016) 9178-9187.
14. "Ultrafast Fluctuations of High Amplitude Electric Fields in Lipid Membranes," Paul Stevenson and Andrei Tokmakoff, *J Am Chem Soc*, **139** (2017) 4743-4752.
15. "IR spectral assignments for the hydrated excess proton in liquid water," Rajib Biswas, William Carpenter, Joseph A. Fournier, Gregory A. Voth, and Andrei Tokmakoff, *J Chem Phys*, **146** (2017) 154507-1-11.
16. "Time-Resolved Measurements of an Ion Channel Conformational Change Driven by a Membrane Phase Transition," Paul Stevenson and Andrei Tokmakoff, *PNAS*, **114** (2017) 10840-10845.
17. "Delocalization and Stretch-Bend Mixing of the HOH Bend in Liquid Water," William B. Carpenter, Joseph A. Fournier, Rajib Biswas, Gregory A. Voth, and Andrei Tokmakoff, *J Chem Phys*, **147** (2017) 084503-1-10.
18. "The Dynamics of Peptide-Water Interactions in Dialanine: An Ultrafast Amide I 2D IR and Computational Spectroscopy Study," Chi-Jui Feng and Andrei Tokmakoff, *J Chem Phys*, **147** (2017) 085101-1-11.
19. "Fourier Transform Fluorescence-Encoded Infrared Spectroscopy," Joseph N. Mastron and Andrei Tokmakoff, *J Phys Chem A*, **122** (2018) 554-562.
20. "Picosecond Proton Transfer Kinetics in Water Revealed with Ultrafast IR Spectroscopy," William B. Carpenter, Joseph A. Fournier, Nicholas H.C. Lewis, and Andrei Tokmakoff, *J Phys Chem B*, **122** (2018) 2792-2802.
21. "Infrared Insights into the Effect of Cholesterol on Lipid Membranes," Paul Stevenson and Andrei Tokmakoff, *Chem Phys*, **512** (2018) 146-153.
22. "Broadband 2D IR spectroscopy reveals dominant asymmetric H_5O_2^+ proton hydration structures in acid solutions," Joseph A. Fournier, William B. Carpenter, Nicholas H.C. Lewis, and Andrei Tokmakoff, *Nat Chem*, **10** (2018) 932-937.
23. "Direct Observation of Activated Kinetics and Downhill Dynamics in DNA Dehybridization," Paul J. Sanstead and Andrei Tokmakoff, *J Phys Chem B*, **122** (2018) 3088-3100.
24. "Single stage MHz mid-IR OPA using LiGaS₂ and a fiber laser pump source," Samuel Penwell, Lukas Whaley-Mayda, and Andrei Tokmakoff, *Opt Lett*, **43** (2018) 1363-1366.
25. "Refinement of Peptide Conformational Ensembles by 2D IR Spectroscopy: Application to Ala-Ala-Ala," Chi-Jui Feng, Balamurugan Dhayalan, and Andrei Tokmakoff, *Biophys J*, **114** (2018) 2820-2832.
26. "Direct Observation of Ion Pairing in Aqueous Nitric Acid Using 2D Infrared Spectroscopy," Nicholas H.C. Lewis, Joseph A. Fournier, William B. Carpenter, and Andrei Tokmakoff, *J Phys Chem B*, **123** (2019), 225-238.
27. "Length-Dependent Melting Kinetics of Short DNA Oligonucleotides Using Temperature-Jump IR Spectroscopy," Ryan J. Menssen and Andrei Tokmakoff, *J Phys Chem B*, **123** (2019) 756-767.

28. "A Lattice Model for the Interpretation of Oligonucleotide Hybridization Experiments," Paul J. Sanstead and Andrei Tokmakoff, *J Chem Phys*, **150** (2019) 185104-1-12.
29. "Fluorescence Encoded Infrared Spectroscopy: Ultrafast Vibrational Spectroscopy on Small Ensembles of Molecules in Solution," Lukas Whaley-Mayda, Samuel Penwell, and Andrei Tokmakoff, *J Phys Chem Lett*, **10** (2019) 1967-1972.
30. "Entropic Barriers in the Kinetics of Aqueous Proton Transfer," William B. Carpenter, Nicholas H.C. Lewis, Joseph A. Fournier, and Andrei Tokmakoff, *J Chem Phys*, **151** (2019) 034501-1-11.
31. "High-Level VSCF/VCI Calculations Decode the Vibrational Spectrum of the Aqueous Proton," Qi Yu, William B. Carpenter, Nicholas H. C. Lewis, Andrei Tokmakoff, Joel M. Bowman, *J Phys Chem B*, **123** (2019) 7214-7224.
32. "5-Carboxylcytosine and Cytosine Protonation Uniquely Influence Dehybridization of the DNA Duplex," Brennan Ashwood, Paul Sanstead, Qing Dai, Chuan He, Andrei Tokmakoff, *J Phys Chem B*, **124** (2020) 627-640.
33. "Signatures of Ion-Pairing and Aggregation in the Vibrational Spectroscopy of Super-Concentrated Aqueous Lithium Bistriflimide Solutions," Nicholas H. C. Lewis, Yong Zhang, Bogdan Dereka, Emily V. Carino, Edward J. Maginn, and Andrei Tokmakoff, *J Phys Chem C*, **124** (2020) 3470-3481.
34. "Oxidized Derivatives of 5-Methylcytosine Alter the Stability and Dehybridization Dynamics of Duplex DNA," Paul Sanstead, Brennan Ashwood, Qing Dai, Chuan He, Andrei Tokmakoff, *J Phys Chem B*, **124** (2020) 1160-1174.
35. "Dynamic and programmable cellular-scale granules enable tissue-like materials," Yin Fang, Endao Han, Xin-Xing Zhang, Yuanwen Jiang, Yiliang Lin, Jiuyun Shi, Jiangbo Wu, Lingyuan Meng, Xiang Gao, Philip J. Griffin, Xianghui Xiao, Hsiu-Ming Tsai, Hua Zhou, Xiaobing Zuo, Qing Zhang, Miaoqi Chu, Qingteng Zhang, Ya Gao, Leah K. Roth, Reiner Bleher, Zhiyuan Ma, Zhang Jiang, Jiping Yue, Chien-Min Kao, Chin-Tu Chen, Andrei Tokmakoff, Jin Wang, Heinrich M. Jaeger, Bozhi Tian, *Matter*, **2** (2020) 948-964.
36. "Revealing the Dynamical Role of Co-solvents in the Coupled Folding and Dimerization of Insulin," Xin-Xing Zhang and Andrei Tokmakoff, *J Phys Chem Lett* **11** (2020) 4353-4358.
37. "Vibrational Spectroscopic Map, Vibrational Spectroscopy, and Intermolecular Interaction," Carlos R. Baiz, Bartosz Błasiak, Jens Bredenbeck, Minhaeng Cho, Jun-Ho Choi, Steven A. Corcelli, Arend G. Dijkstra, Chi-Jui Feng, Sean Garrett-Roe, Nien-Hui Ge, Magnus W. D. Hanson-Heine, Jonathan D. Hirst, Thomas L. C. Jansen, Kijeong Kwac, Kevin J. Kubarych, Casey H. Londergan, Hiroaki Maekawa, Mike Reppert, Shinji Saito, Santanu Roy, James L. Skinner, Gerhard Stock, John E. Straub, Megan C. Thielges, Keisuke Tominaga, Andrei Tokmakoff, Hajime Torii, Lu Wang, Lauren J. Webb, and Martin T. Zanni, *Chem Rev*, **120** (2020) 7152-7218.
38. "Vibrational Probe of Aqueous Electrolytes: The Field Is Not Enough," Nicholas H. C. Lewis, Aysenur Iscen, Alanna Felts, Bogdan Dereka, George C. Schatz, and Andrei Tokmakoff, *J Phys Chem B*, **124** (2020) 7013-7026.
39. "Temperature-Jump 2D IR Spectroscopy with Intensity-Modulated CW Optical Heating," Brennan Ashwood, Nicholas H.C. Lewis, Paul J. Sanstead, and Andrei Tokmakoff, *J Phys Chem B*, **124** (2020) 8665-8677.
40. "Insulin Dissociates by Diverse Mechanisms of Coupled Unfolding and Unbinding," Adam Antoszewski, Chi-Jui Feng, Bodhi P. Vani, Erik H. Thiede, Lu Hong, Jonathan Weare, Andrei Tokmakoff, and Aaron R. Dinner, *J Phys Chem B*, **27** (2020) 5571-5587.
41. "DNA minor-groove binder Hoechst 33258 destabilizes base-pairing adjacent to its binding site," Xin-Xing Zhang, Shelby Brantley, Steven Corcelli, and Andrei Tokmakoff, *Commun Biol*, **3** (2020) 525.
42. "Decoding the 2D IR spectrum of the aqueous proton with high-level VSCF/VCI calculations," William B. Carpenter, Qi Yu, John H. Hack, Bogdan Dereka, Joel M. Bowman, and Andrei Tokmakoff, *J Chem Phys*, **153** (2020) 124506.