

Austin P. Spencer

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Education

University of Colorado Boulder

August 2009–August 2014

Ph.D. in Chemistry

- Courses: Advanced Topics in Physical Chemistry, Quantum Chemistry, Statistical Mechanics, Advanced Molecular Spectroscopy, Chemical Dynamics

University of North Carolina at Chapel Hill

May 2009

B.S. Chemistry with Honors and Distinction

Minor in Computer Science

- Honors thesis: A study of the thermochemistry and dissociation dynamics of trichlorosilane derivatives using Threshold Photo-Electron Photo-Ion COincidence spectroscopy (TPEPICO)¹⁷

Honors and Recognitions

Cover & Feature article in *The Journal of Physical Chemistry C*⁴

November 2018

“Four-Dimensional Coherent Spectroscopy of Complex Molecular Systems in Solution”

Featured in *Science*: 4D electronic–Raman spectroscopy⁹

June 2017

J. Goodknight, A. Aspuru-Guzik. Taking six-dimensional spectra in finite time.

Science **2017**, 356, 1333–1333; DOI: [10.1126/science.aan2842](https://doi.org/10.1126/science.aan2842)

Summer Undergraduate Research Fellowship

Summer 2008

University of North Carolina at Chapel Hill

Research

Postdoctoral Researcher

February 2018–present

Northwestern University, Department of Chemistry

Advisor: Lin X. Chen

- Investigated the role of nonadiabatic electronic–vibrational coupling for enhancing coherent dynamics in porphyrin dimers, polymers, and metal complexes.
- Studied coherent nuclear motion in bimetallic complexes using transient x-ray scattering and emission at the European X-ray Free Electron Laser (XFEL).

Postdoctoral Researcher

August 2014–February 2018

Northwestern University, Department of Chemistry

Advisor: Elad Harel

- Developed a coherent 4D spectroscopy (GAMERS) for measuring 2D Raman–2D electronic spectra of complex chemical systems.^{9, 20}
- Probed exciton–phonon coupling in CdSe quantum dots using GAMERS.⁶
- Demonstrated a compressive sensing detection scheme utilizing a digital micromirror array and a single-element detector as a sensitive alternative to 2D array detectors in multidimensional spectroscopy.^{11, 21}
- Designed and built a single-shot 2DFT spectroscopy experiment, incorporating novel spatial-spectral interferometry detection for enhanced frequency resolution.^{12, 21}

Research Assistant

August 2009–August 2014

University of Colorado Boulder, Department of Chemistry and Biochemistry

Advisor: David M. Jonas

- Simulated 2DFT spectra of atomic Rb vapor with particular emphasis on modeling experimentally-observed propagation distortions at high optical densities.^{13, 15}
- Studied carrier dynamics in colloidal InAs and PbS quantum dots using degenerate femtosecond pump–probe spectroscopy.^{3, 22, 23}
- Conceived, designed, and built a beam scanning apparatus for reducing repetitive excitation in laser spectroscopy, and utilized the setup in pump–probe studies of solution-phase and thin film samples.⁸
- Applied Cold-Target Recoil-Ion-Momentum Spectroscopy (COLTRIMS) and a femtosecond X-ray laser source to study the excited state dynamics of ozone by imaging coincident photo-electrons and photo-ions.

Undergraduate Researcher

Summer 2008

Eötvös Loránd University (Budapest, Hungary)

Advisor: Bálint Sztáray

- Inorganic synthesis of halo-silanes.
- Analyzed products using UV photoelectron spectroscopy.

Undergraduate Researcher

December 2007–May 2009

University of North Carolina at Chapel Hill

Advisor: Tomas Baer

- Investigated UV photodissociation and thermochemistry of halo-alkanes (1,2-dibromoethane, 1,2-dibromopropane, and 1,3-dibromopropane) and trichlorosilane derivatives (SiCl_3R where $\text{R} = \text{Cl}, \text{H}, \text{CH}_3, \text{C}_2\text{H}_5, \text{C}_2\text{H}_3, \text{CH}_2\text{Cl}, \text{SiCl}_3$) using TPEPICO.^{16, 17}

Publications

1. M. S. Kirschner, Y. Jeong, A. P. Spencer, N. E. Watkins, X.-M. Lin, G. C. Schatz, L. X. Chen, R. D. Schaller. Phonon-induced plasmon-exciton coupling changes probed via oscillation-associated spectra. *Appl. Phys. Lett.* **2019**, *115*, 111903; DOI: [10.1063/1.5116836](https://doi.org/10.1063/1.5116836)
2. P. E. Ohno, H. Chang, A. P. Spencer, Y. Liu, M. D. Boamah, H.-f. Wang, F. M. Geiger. Beyond the Gouy–Chapman Model with Heterodyne-Detected Second Harmonic Generation. *J. Phys. Chem. Lett.* **2019**, *10*, 2328–2334; DOI: [10.1021/acs.jpcllett.9b00727](https://doi.org/10.1021/acs.jpcllett.9b00727)
3. A. P. Spencer, W. K. Peters, N. R. Neale, D. M. Jonas. Carrier Dynamics and Interactions for Bulk-Like Photoexcitation of Colloidal Indium Arsenide Quantum Dots. *J. Phys. Chem. C* **2018**; DOI: [10.1021/acs.jpcc.8b09671](https://doi.org/10.1021/acs.jpcc.8b09671)
4. †A. P. Spencer, W. O. Hutson, E. Harel. Four-Dimensional Coherent Spectroscopy of Complex Molecular Systems in Solution. *J. Phys. Chem. C* **2018**; DOI: [10.1021/acs.jpcc.8b09184](https://doi.org/10.1021/acs.jpcc.8b09184)
5. S. Irigen-Gioro, A. P. Spencer, W. O. Hutson, E. Harel. Coherences of Bacteriochlorophyll a Uncovered Using 3D-Electronic Spectroscopy. *J. Phys. Chem. Lett.* **2018**, *9*, 6077–6081; DOI: [10.1021/acs.jpcllett.8b02217](https://doi.org/10.1021/acs.jpcllett.8b02217)
6. A. P. Spencer, W. O. Hutson, S. Irigen-Gioro, E. Harel. Exciton–Phonon Spectroscopy of Quantum Dots Below the Single-Particle Homogeneous Line Width. *J. Phys. Chem. Lett.* **2018**, 1503–1508; DOI: [10.1021/acs.jpcllett.8b00065](https://doi.org/10.1021/acs.jpcllett.8b00065)
7. W. O. Hutson, A. P. Spencer, E. Harel. Ultrafast Four-Dimensional Coherent Spectroscopy by Projection Reconstruction. *J. Phys. Chem. Lett.* **2018**, 1034–1040; DOI: [10.1021/acs.jpcllett.8b00122](https://doi.org/10.1021/acs.jpcllett.8b00122)
8. A. P. Spencer, R. J. Hill, W. K. Peters, D. Baranov, B. Cho, A. Huerta-Viga, A. R. Carollo, A. C. Curtis, D. M. Jonas. Sample exchange by beam scanning with applications to noncollinear pump-probe spectroscopy at kilohertz repetition rates. *Rev. Sci. Instrum.* **2017**, *88*, 064101; DOI: [10.1063/1.4986628](https://doi.org/10.1063/1.4986628)
9. ‡A. P. Spencer, W. O. Hutson, E. Harel. Quantum coherence selective 2D Raman–2D electronic spectroscopy. *Nat. Commun.* **2017**, *8*, 14732; DOI: [10.1038/ncomms14732](https://doi.org/10.1038/ncomms14732)
10. W. O. Hutson, A. P. Spencer, E. Harel. Isolated Ground-State Vibrational Coherence Measured by Fifth-Order Single-Shot Two-Dimensional Electronic Spectroscopy. *J. Phys. Chem. Lett.* **2016**, 3636–3640; DOI: [10.1021/acs.jpcllett.6b01733](https://doi.org/10.1021/acs.jpcllett.6b01733)
11. A. P. Spencer, B. Spokoyny, S. Ray, F. Sarvari, E. Harel. Mapping multidimensional electronic structure and ultrafast dynamics with single-element detection and compressive sensing. *Nat. Commun.* **2016**, *7*, 10434; DOI: [10.1038/ncomms10434](https://doi.org/10.1038/ncomms10434)
12. A. P. Spencer, B. Spokoyny, E. Harel. Enhanced-Resolution Single-Shot 2DFT Spectroscopy by Spatial Spectral Interferometry. *J. Phys. Chem. Lett.* **2015**, 945–950; DOI: [10.1021/acs.jpcllett.5b00273](https://doi.org/10.1021/acs.jpcllett.5b00273)

†Feature Article

‡Featured in *Science*: J. Goodknight, A. Aspuru-Guzik. Taking six-dimensional spectra in finite time. *Science* **2017**, *356*, 1333–1333; DOI: [10.1126/science.aan2842](https://doi.org/10.1126/science.aan2842)

13. A. P. Spencer, H. Li, S. T. Cundiff, D. M. Jonas. Pulse Propagation Effects in Optical 2D Fourier-Transform Spectroscopy: Theory. *J. Phys. Chem. A* **2015**, *119*, 3936–3960; DOI: [10.1021/acs.jpca.5b00001](https://doi.org/10.1021/acs.jpca.5b00001)
14. B. Cho, V. Tiwari, R. J. Hill, W. K. Peters, T. L. Courtney, A. P. Spencer, D. M. Jonas. Absolute Measurement of Femtosecond Pump–Probe Signal Strength. *J. Phys. Chem. A* **2013**, *117*, 6332–6345; DOI: [10.1021/jp4019662](https://doi.org/10.1021/jp4019662)
15. H. Li, A. P. Spencer, A. Kortyna, G. Moody, D. M. Jonas, S. T. Cundiff. Pulse Propagation Effects in Optical 2D Fourier-Transform Spectroscopy: Experiment. *J. Phys. Chem. A* **2013**, *117*, 6279–6287; DOI: [10.1021/jp4007872](https://doi.org/10.1021/jp4007872)
16. N. S. Shuman, A. P. Spencer, T. Baer. Experimental Thermochemistry of SiCl₃R (R = Cl, H, CH₃, C₂H₅, C₂H₃, CH₂Cl, SiCl₃), SiCl₃⁺, and SiCl₃•. *J. Phys. Chem. A* **2009**, *113*, 9458–9466; DOI: [10.1021/jp9054186](https://doi.org/10.1021/jp9054186)
17. A. P. Spencer, *TPEPICO Spectroscopy of SiCl₄, SiCl₃CH₃, SiCl₃CH₂Cl, SiCl₃C₂H₃, and SiCl₃C₂H₅: Thermochemistry of Trichlorosilane Derivatives*, Honors Thesis, University of North Carolina at Chapel Hill, Chapel Hill, NC, **2009**. URL

Presentations

18. A. P. Spencer, W. Helweh, D. Edwards, G. E. Bullard, M. J. Therien, L. X. Chen, *Dissecting quantum coherence in photosynthesis: lessons from porphyrin dimers*, Annual Meeting of the APS Division of Atomic, Molecular and Optical Physics; Milwaukee, WI, **2019***
19. A. P. Spencer, P. Kim, W. Helweh, L. X. Chen, *Coherent dynamics in porphyrin dimers*, Gordon Research Conference on Electron Donor–Acceptor Interactions; Newport, RI, **2018**[†]
20. A. P. Spencer, H. W. O., E. Harel, *Electronic–vibrational coupling probed by 4D Raman–electronic spectroscopy*, Gordon Research Conference on Photochemistry; Lewiston, ME, **2017**[†]
21. A. P. Spencer, B. Spokoyny, E. Harel, *Spatial Spectral Interferometry and Compressed Sensing Detection in Single-Shot 2DFT Spectroscopy*, Time-Resolved Vibrational Spectroscopy; Madison, WI, **2015**[†]
22. A. P. Spencer, W. K. Peters, V. Tiwari, B. Cho, N. R. Neale, D. M. Jonas, *Carrier dynamics in colloidal indium arsenide quantum dots in the weak excitation limit*, March Meeting of the American Physical Society; Denver, CO, **2014***
23. D. M. Buckley, A. P. Spencer, D. Baranov, T. L. Courtney, D. M. Jonas, *Degenerate Femtosecond Pump Probe Studies of Lead Sulfide Nanocrystal Colloidal Solutions and Arrays at the Band Gap*, Meeting of the Center for Advanced Solar Photophysics, an Energy Frontiers Research Center; Golden, CO, **2012**[†]
24. A. P. Spencer, *The thermochemistry and dissociation dynamics of 1,2-dibromoethane, 1,2 dibromopropane, and 1,3-dibromopropane*, Gordon Research Conference on Gaseous Ions; Galveston, TX, **2009**[†]

* Oral presentation

[†] Poster presentation

Teaching and Mentoring

Teaching Assistant, General Chemistry II
University of Colorado Boulder

Spring 2013

Teaching Assistant, General Chemistry II
University of Colorado Boulder

Summer 2012

Teaching Assistant, General Chemistry II
University of Colorado Boulder

Spring 2010

Teaching Assistant, General Chemistry for Engineers
University of Colorado Boulder

Fall 2009