



## Jake D Koralek

Staff Scientist, SLAC National Accelerator Laboratory

### Bio

---

#### BIO

I am a condensed matter physicist with research interests in quantum materials, ultrafast optics and X-ray science. I grew up in the Stanford neighborhood where I attended Palo Alto High School. I went on to the College of Creative Studies at UCSB where I worked in the lab of David Awschalom studying semiconductor spintronics. I got my PhD in physics from the University of Colorado, Boulder, working with Dan Dessau, where we developed the first system to perform angle-resolved photoemission spectroscopy (ARPES) using a table-top laser rather than a large synchrotron facility. I moved to Lawrence Berkeley National Lab for my postdoctoral research with Joe Orenstein where we applied a wide variety of ultrafast optical techniques to study emergent properties in quantum materials and semiconductor devices. I stayed in Berkeley to work with Bob Schoenlein developing ultrafast X-ray techniques to study quantum materials. In 2014 I moved to SLAC where I am now a staff scientist in the Materials Science Department at the Linac Coherent Light Source (LCLS), the world's first X-ray free-electron laser.

#### EDUCATION AND CERTIFICATIONS

- BS, University of California, Santa Barbara, College of Creative Studies , Physics (1999)
- PhD, University of Colorado, Boulder , Physics (2006)

### Publications

---

#### PUBLICATIONS

- **Liquid Heterostructures: Generation of Liquid-Liquid Interfaces in Free-Flowing Liquid Sheets.** *Langmuir : the ACS journal of surfaces and colloids*  
Hoffman, D. J., Bechtel, H. A., Huyke, D. A., Santiago, J. G., DePonte, D. P., Koralek, J. D.  
2022
- **Generation and characterization of ultrathin free-flowing liquid sheets** *NATURE COMMUNICATIONS*  
Koralek, J. D., Kim, J. B., Bruza, P., Curry, C. B., Chen, Z., Bechtel, H. A., Cordones, A. A., Sperling, P., Toleikis, S., Kern, J. F., Moeller, S. P., Glenzer, S. H., DePonte, et al  
2018; 9: 1353
- **Femtosecond structural dynamics drives the trans/cis isomerization in photoactive yellow protein** *SCIENCE*  
Pande, K., Hutchison, C. D. M., Groenhof, G., Aquila, A., Robinson, J. S., Tenboer, J., Basu, S., Boutet, S., DePonte, D. P., Liang, M., White, T. A., Zatsepin, N. A., Yefanov, et al  
2016; 352 (6286): 725–29
- **Tracking Cooper Pairs in a Cuprate Superconductor by Ultrafast Angle-Resolved Photoemission** *SCIENCE*  
Smallwood, C. L., Hinton, J. P., Jozwiak, C., Zhang, W., Koralek, J. D., Eisaki, H., Lee, D., Orenstein, J., Lanzara, A.  
2012; 336 (6085): 1137–39

- **From a Single-Band Metal to a High-Temperature Superconductor via Two Thermal Phase Transitions** *SCIENCE*  
He, R., Hashimoto, M., Karapetyan, H., Koralek, J. D., Hinton, J. P., Testaud, J. P., Nathan, V., Yoshida, Y., Yao, H., Tanaka, K., Meevasana, W., Moore, R. G., Lu, et al  
2011; 331 (6024): 1579-1583
- **Emergence of the persistent spin helix in semiconductor quantum wells** *NATURE*  
Koralek, J. D., Weber, C. P., Orenstein, J., Bernevig, B. A., Zhang, S., Mack, S., Awschalom, D. D.  
2009; 458 (7238): 610–U73
- **Laser based angle-resolved photoemission, the sudden approximation, and quasiparticle-like spectral peaks in Bi<sub>2</sub>Sr<sub>2</sub>CaCu<sub>2</sub>O<sub>8</sub>+ $\delta$**  *PHYSICAL REVIEW LETTERS*  
Koralek, J. D., Douglas, J. F., Plumb, N. C., Sun, Z., Fedorov, A. V., Murnane, M. M., Kapteyn, H. C., Cundiff, S. T., Aiura, Y., Oka, K., Eisaki, H., Dessau, D. S.  
2006; 96 (1): 017005
- **Surface structure of water from soft X-ray second harmonic generation.** *Nature communications*  
Hoffman, D. J., Devlin, S. W., Garratt, D., Jamnuch, S., Spies, J. A., Nebgen, B. R., Schacher, D., Do, A., Bernal, F., Riffe, E. J., Kunnus, K., Hampton, C. Y., Duris, et al  
2025; 16 (1): 10522
- **Entropy or Enthalpy? Second Harmonic Generation from Liquid Sheets Reveals Different Ion Adsorption Mechanisms for Air-Water and Oil-Water Interfaces.** *Journal of the American Chemical Society*  
Devlin, S. W., Hoffman, D. J., Koralek, J. D., Saykally, R. J.  
2025
- **Attosecond-pump attosecond-probe x-ray spectroscopy of liquid water.** *Science (New York, N.Y.)*  
Li, S., Lu, L., Bhattacharyya, S., Pearce, C., Li, K., Nienhuis, E. T., Doumy, G., Schaller, R. D., Moeller, S., Lin, M. F., Dakovski, G., Hoffman, D. J., Garratt, et al  
2024: eadn6059
- **Enhanced charge density wave coherence in a light-quenched, high-temperature superconductor.** *Science (New York, N.Y.)*  
Wandel, S., Boschini, F., da Silva Neto, E. H., Shen, L., Na, M. X., Zohar, S., Wang, Y., Welch, S. B., Seaberg, M. H., Koralek, J. D., Dakovski, G. L., Hettel, W., Lin, et al  
2022; 376 (6595): 860-864
- **Microfluidic liquid sheets as large-area targets for high repetition XFELs.** *Frontiers in molecular biosciences*  
Hoffman, D. J., Van Driel, T. B., Kroll, T., Crissman, C. J., Ryland, E. S., Nelson, K. J., Cordones, A. A., Koralek, J. D., DePonte, D. P.  
2022; 9: 1048932
- **Spontaneous fluctuations in a magnetic Fe/Gd skyrmion lattice** *PHYSICAL REVIEW RESEARCH*  
Seaberg, M. H., Holladay, B., Montoya, S. A., Zheng, X. Y., Lee, J. T., Reid, A. H., Koralek, J. D., Shen, L., Esposito, Coslovich, G., Walter, P., Zohar, S., Thampy, Lin, et al  
2021; 3 (3)
- **Observation of a highly conductive warm dense state of water with ultrafast pump-probe free-electron-laser measurements** *MATTER AND RADIATION AT EXTREMES*  
Chen, Z., Na, X., Curry, C. B., Liang, S., French, M., Descamps, A., DePonte, D. P., Koralek, J. D., Kim, J. B., Lebovitz, S., Nakatsutsumi, M., Ofori-Okai, B. K., Redmer, et al  
2021; 6 (5)
- **The Photoactive Excited State of the B12-Based Photoreceptor CarH.** *The journal of physical chemistry. B*  
Miller, N. A., Kaneshiro, A. K., Konar, A., Alonso-Mori, R., Britz, A., Deb, A., Glownia, J. M., Koralek, J. D., Mallik, L., Meadows, J. H., Michocki, L. B., van Driel, T. B., Koutmos, et al  
2020
- **Observation of Seeded Mn K beta Stimulated X-Ray Emission Using Two-Color X-Ray Free-Electron Laser Pulses** *PHYSICAL REVIEW LETTERS*  
Kroll, T., Weninger, C., Fuller, F. D., Guetg, M. W., Benediktovitch, A., Zhang, Y., Marinelli, A., Alonso-Mori, R., Aquila, A., Liang, M., Koglin, J. E., Koralek, J., Sokaras, et al  
2020; 125 (3)

- **Skyrmion fluctuations at a first-order phase transition boundary** *APPLIED PHYSICS LETTERS*  
Esposito, Zheng, X. Y., Seaberg, M. H., Montoya, S. A., Holladay, B., Reid, A. H., Streubel, R., Lee, J. T., Shen, L., Koralek, J. D., Coslovich, G., Walter, P., Zohar, S., et al  
2020; 116 (18)
- **Antivitamins B12 in a Microdrop: The Excited-State Structure of a Precious Sample Using Transient Polarized X-ray Absorption Near-Edge Structure.** *The journal of physical chemistry letters*  
Miller, N. A., Michocki, L. B., Alonso-Mori, R., Britz, A., Deb, A., DePonte, D. P., Glownia, J. M., Kaneshiro, A. K., Kieninger, C., Koralek, J., Meadows, J. H., van Driel, T. B., Krautler, et al  
2019: 5484–89
- **Author Correction: Generation and characterization of ultrathin free-flowing liquid sheets.** *Nature communications*  
Koralek, J. D., Kim, J. B., Bruza, P., Curry, C. B., Chen, Z., Bechtel, H. A., Cordones, A. A., Sperling, P., Toleikis, S., Kern, J. F., Moeller, S. P., Glenzer, S. H., DePonte, et al  
2019; 10 (1): 1615
- **Author Correction: Generation and characterization of ultrathin free-flowing liquid sheets.** *Nature communications*  
Koralek, J. D., Kim, J. B., Bruza, P., Curry, C. B., Chen, Z., Bechtel, H. A., Cordones, A. A., Sperling, P., Toleikis, S., Kern, J. F., Moeller, S. P., Glenzer, S. H., DePonte, et al  
2018; 9 (1): 2860
- **Coherent X-rays reveal the influence of cage effects on ultrafast water dynamics** *NATURE COMMUNICATIONS*  
Perakis, F., Camisasca, G., Lane, T. J., Spah, A., Wikfeldt, K., Sellberg, J. A., Lehmkuehler, F., Pathak, H., Kim, K., Amann-Winkel, K., Schreck, S., Song, S., Sato, et al  
2018; 9: 1917
- **Stimulated X-Ray Emission Spectroscopy in Transition Metal Complexes** *PHYSICAL REVIEW LETTERS*  
Kroll, T., Weninger, C., Alonso-Mori, R., Sokaras, D., Zhu, D., Mercadier, L., Majety, V. P., Marinelli, A., Lutman, A., Guetg, M. W., Decker, F., Boutet, S., Aquila, et al  
2018; 120 (13): 133203
- **Nonlinear Ultrafast Spin Scattering in the Skyrmion Phase of Cu<sub>2</sub>OSeO<sub>3</sub>** *PHYSICAL REVIEW LETTERS*  
Langner, M. C., Roy, S., Huang, S. W., Koralek, J. D., Chuang, Y., Dakovski, G. L., Turner, J. J., Robinson, J. S., Coffee, R. N., Minitti, M. P., Seki, S., Tokura, Y., Schoenlein, et al  
2017; 119 (10): 107204
- **Nanosecond X-Ray Photon Correlation Spectroscopy on Magnetic Skyrmions** *PHYSICAL REVIEW LETTERS*  
Seaberg, M. H., Holladay, B., Lee, J. T., Sikorski, M., Reid, A. H., Montoya, S. A., Dakovski, G. L., Koralek, J. D., Coslovich, G., Moeller, S., Schlotter, W. F., Streubel, R., Kevan, et al  
2017; 119 (6): 067403
- **Polarized XANES Monitors Femtosecond Structural Evolution of Photoexcited Vitamin B-12** *JOURNAL OF THE AMERICAN CHEMICAL SOCIETY*  
Miller, N. A., Deb, A., Alonso-Mori, R., Garabato, B. D., Glownia, J. M., Kiefer, L. M., Koralek, J., Sikorski, M., Spears, K. G., Wiley, T. E., Zhu, D., Kozlowski, P. M., Kubarych, et al  
2017; 139 (5): 1894–99
- **The room temperature crystal structure of a bacterial phytochrome determined by serial femtosecond crystallography** *SCIENTIFIC REPORTS*  
Edlund, P., Takala, H., Claesson, E., Henry, L., Dods, R., Lehtivuori, H., Panman, M., Pande, K., White, T., Nakane, T., Berntsson, O., Gustavsson, E., Bath, et al  
2016; 6: 35279
- **The rate of quasiparticle recombination probes the onset of coherence in cuprate superconductors** *SCIENTIFIC REPORTS*  
Hinton, J. P., Thewalt, E., Alpichshev, Z., Mahmood, F., Koralek, J. D., Chan, M. K., Veit, M. J., Dorow, C. J., Barisic, N., Kemper, A. F., Bonn, D. A., Hardy, W. N., Liang, et al  
2016; 6: 23610
- **Photoexcited states of the harmonic honeycomb iridate gamma-Li<sub>2</sub>IrO<sub>3</sub>** *PHYSICAL REVIEW B*  
Hinton, J. P., Patankar, S., Thewalt, E., Ruiz, A., Lopez, G., Breznay, N., Vishwanath, A., Analytis, J., Orenstein, J., Koralek, J. D., Kimchi, I.  
2015; 92 (11)

- **New collective mode in YBa<sub>2</sub>Cu<sub>3</sub>O<sub>6+x</sub> observed by time-domain reflectometry** *PHYSICAL REVIEW B*  
Hinton, J. P., Koralek, J. D., Lu, Y. M., Vishwanath, A., Orenstein, J., Bonn, D. A., Hardy, W. N., Liang, R.  
2013; 88 (6)
- **Time-Resolved Optical Reflectivity of the Electron-Doped Nd<sub>2-x</sub>Ce<sub>x</sub>CuO<sub>4+delta</sub> Cuprate Superconductor: Evidence for an Interplay between Competing Orders** *PHYSICAL REVIEW LETTERS*  
Hinton, J. P., Koralek, J. D., Yu, G., Motoyama, E. M., Lu, Y. M., Vishwanath, A., Greven, M., Orenstein, J.  
2013; 110 (21)
- **Doppler velocimetry of spin and charge currents in the 2D Fermi gas**  
Koralek, J. D., Yang, L., Tibbetts, D. R., Reno, J. L., Lilly, M. P., Orenstein, J.  
edited by Chergui, M., Taylor, A., Cundiff, S., DeVivier, Riedle, R., Yamagouchi, K.  
E D P SCIENCES.2013
- **Coherent Propagation of Spin Helices in a Quantum-Well Confined Electron Gas** *PHYSICAL REVIEW LETTERS*  
Yang, L., Koralek, J. D., Orenstein, J., Tibbetts, D. R., Reno, J. L., Lilly, M. P.  
2012; 109 (24): 246603
- **Observation of Coherent Helimagnons and Gilbert Damping in an Itinerant Magnet** *PHYSICAL REVIEW LETTERS*  
Koralek, J. D., Meier, D., Hinton, J. P., Bauer, A., Parameswaran, S. A., Vishwanath, A., Ramesh, R., Schoenlein, R. W., Pfeleiderer, C., Orenstein, J.  
2012; 109 (24): 247204
- **Doppler velocimetry of spin propagation in a two-dimensional electron gas** *NATURE PHYSICS*  
Yang, L., Koralek, J. D., Orenstein, J., Tibbetts, D. R., Reno, J. L., Lilly, M. P.  
2012; 8 (2): 153–57
- **Measurement of Electron-Hole Friction in an n-Doped GaAs/AlGaAs Quantum Well Using Optical Transient Grating Spectroscopy** *PHYSICAL REVIEW LETTERS*  
Yang, L., Koralek, J. D., Orenstein, J., Tibbetts, D. R., Reno, J. L., Lilly, M. P.  
2011; 106 (24): 247401
- **Low-Energy (< 10 meV) Feature in the Nodal Electron Self-Energy and Strong Temperature Dependence of the Fermi Velocity in Bi<sub>2</sub>Sr<sub>2</sub>CaCu<sub>2</sub>O<sub>8+delta</sub>** *PHYSICAL REVIEW LETTERS*  
Plumb, N. C., Reber, T. J., Koralek, J. D., Sun, Z., Douglas, J. F., Aiura, Y., Oka, K., Eisaki, H., Dessau, D. S.  
2010; 105 (4): 046402
- **Accurate theoretical fits to laser-excited photoemission spectra in the normal phase of high-temperature superconductors** *NATURE PHYSICS*  
Casey, P. A., Koralek, J. D., Plumb, N. C., Dessau, D. S., Anderson, P. W.  
2008; 4 (3): 210–12
- **Experimental setup for low-energy laser-based angle resolved photoemission spectroscopy** *REVIEW OF SCIENTIFIC INSTRUMENTS*  
Koralek, J. D., Douglas, J. F., Plumb, N. C., Griffith, J. D., Cundiff, S. T., Kapteyn, H. C., Murnane, M. M., Dessau, D. S.  
2007; 78 (5): 053905
- **Lasers emerge as a tool for the direct study of electrons in solids** *PHOTONICS SPECTRA*  
Koralek, J. D., Dessau, D. S.  
2006; 40 (6): 72-+
- **Mass-renormalized electronic excitations at (pi,0) in the superconducting state of Bi<sub>2</sub>Sr<sub>2</sub>CaCu<sub>2</sub>O<sub>8+delta</sub>** *PHYSICAL REVIEW B*  
Gromko, A. D., Fedorov, A. V., Chuang, Y. D., Koralek, J. D., Aiura, Y., Yamaguchi, Y., Oka, K., Ando, Y., Dessau, D. S.  
2003; 68 (17)