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Matthias C. Hoffmann

Lead Scientist, LCLS - Linac Coherent Light Source

CONTACT INFORMATION

- **Alternate Contact**

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Bio

BIO

Education

Physik Diplom 2001, University of Freiburg,Germany,

Studies in Physics, Technical University of Denmark, Lyngby, Denmark,

Dr. rer. Nat. in Physics 2006, University of Freiburg, Germany

Appointments

2006-2009, Massachussetts Institute of Technology, Cambridge, MA, Postdoctoral Associate

2009-2011 Research Scientist, Center for Free Electron Laser Science, Hamburg, Germany

2011-present SLAC National Accelerator Lab, Staff Scientist, LCLS,

CURRENT ROLE AT STANFORD

Lead scientist in the LCLS Laser Science Department.

Group lead for Mid-infrared and THz sources.

Develops and supports THz pump-X-ray probe experiments at LCLS and in-house research on ultrafast spectroscopy with intense THz pulses.

Professional

PROFESSIONAL AFFILIATIONS AND ACTIVITIES

- Senior Member, Optical Society of America (2016 - present)

Publications

PUBLICATIONS

- **Ultrafast Dynamics of Competing Dimethyl Disulfide Photodissociation Pathways.** *The journal of physical chemistry letters*
  Cole-Filipiak, N. C., Rishi, V., Dalton, J., Troß, J., Kliewer, C. J., Attar, A. R., Hoffmann, M. C., Ji, F., Lin, M. F., Liu, Y., Luo, D., Figueira Nunes, J. P., Reid, et al
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- **Decoding THz-Driven Dynamic Fingerprints of Ferroelectric Nanotwin Networks.** *Advanced materials (Deerfield Beach, Fla.)*
  Li, X., Ross, A., Stoica, V. A., Das, S., Hazra, S., Wang, H. H., Padma, H., Hoffmann, M. C., Kramer, P., Song, S., Nelson, S., Sato, T., Zhu, et al
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- **Strong ultrafast nonlinear optical response from megaelectronvolt electrons in semiconductors** *NATURE PHOTONICS*
  Jeong, D., Hopper, T. R., Kim, Y., Shen, X., Kramer, P. L., Hoffmann, M. C., Coffee, R., Fejer, M., Lindenberg, A. M., Levin, C. S.
  2026

- **Terahertz-Driven Parametric Excitation of Raman-Active Phonons in LaAlO₃** *PHYSICAL REVIEW LETTERS*
  Basini, M., Unikandanunni, V., Gabriele, F., Cross, M., Derrico, A. M., Gray, A. X., Hoffmann, M. C., Forte, F., Cuoco, M., Bonetti, S.
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- **THz pulse source development for high-repetition-rate pump-probe experiments at LCLS-II**
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  SPIE-INT SOC OPTICAL ENGINEERING.2026

- **Attosecond X-Ray Core-Level Chronoscopy of Aromatic Molecules** *PHYSICAL REVIEW X*
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  2025; 15 (4)

- **Ultrafast low-temperature metal-insulator interface phonon dynamics and heat transport in a Pt/Gd3Fe5O12 heterostructure.** *Structural dynamics (Melville, N.Y.)*
  Sri Gyan, D., Li, N., Chen, Z., Geprägs, S., Dietlein, M., Gross, R., Sato, T., Sun, Y., Hoffmann, M. C., Zhu, D., Haskel, D., Strempfer, J., Li, et al
  2025; 12 (6): 065101

- **Tuning chirality amplitude at ultrafast timescales in chiral CsCuCl3** *PHYSICAL REVIEW RESEARCH*
  Ueda, H., Sato, T., Nguyen, Q. L., Skoropata, E., Leroy, L., Suter, T., Abreu, E., Savoini, M., Esposito, V., Hoffmann, M., Romao, C. P., Zaccaro, J., Zhu, et al
  2025; 7 (4)

- **Terahertz-field activation of polar skyrons.** *Nature communications*
  Wang, H. H., Stoica, V. A., Dai, C., Paściak, M., Das, S., Yang, T., Gonçalves, M. A., Kulda, J., McCarter, M. R., Mangu, A., Cao, Y., Padma, H., Saha, et al
  2025; 16 (1): 8994

- **Terahertz-Induced Tunnel Ionization Drives Coherent Raman-Active Phonon in Bismuth.** *Physical review letters*
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- **Structural dynamics of laser-ionized cis-stilbene studied by ultrafast electron diffraction** *JOURNAL OF PHYSICS B-ATOMIC MOLECULAR AND OPTICAL PHYSICS*
  Saha, S. K., Nunes, J. P. F., Weir, H., Moore, B., Williams, M., Attar, A. R., Luo, D., Ji, F., Heald, L., Hoffmann, M. C., Yang, J., Lin, M., Ware, et al
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- **Observation of polarization density waves in SrTiO₃ (Apr, 10.1038/s41567-025-02874-0, 2025)** *NATURE PHYSICS*

Orenstein, G., Krapivin, V., Huang, Y., Zhang, Z., Munoz, G., Duncan, R. A., Nguyen, Q., Stanton, J., Teitelbaum, S., Yavas, H., Sato, T., Hoffmann, M. C., Kramer, et al

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- **Dynamics of nanoscale phase decomposition in laser ablation** *COMMUNICATIONS MATERIALS*

  Sun, Y., Chen, C., Albert, T. J., Li, H., Arefev, M. I., Chen, Y., Dunne, M., Glownia, J. M., Jerman, M., Hoffmann, M., Hurley, M. J., Mo, M., Nguyen, et al

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- **Observation of polarization density waves in SrTiO₃** *NATURE PHYSICS*

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  2025

- **Deviation from Debye-Waller behavior in single crystalline freestanding NiO membranes studied via ultrafast electron diffraction** *PHYSICAL REVIEW APPLIED*

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- **Dynamic motion trajectory control with nanoradian accuracy for multi-element X-ray optical systems via laser interferometry.** *Light, science & applications*

  Koehlenbeck, S. M., Lee, L., Balcazar, M. D., Chen, Y., Esposito, V., Hastings, J., Hoffmann, M. C., Huang, Z., Ng, M. L., Price, S., Sato, T., Seaberg, M., Sun, et al

  2025; 14 (1): 129

- **Excited State Covalency, Dynamics, and Photochemistry of Square Planar Ni-Thiolate Complexes Revealed by Ultrafast X-ray Absorption.** *Journal of the American Chemical Society*

  Lim, H., Yang, X., Larsen, C. B., Ledbetter, K., Zoric, M. R., Raj, S. L., Kumar, G., Powers-Riggs, N., Hoffmann, M. C., Chollet, M., Gee, L. B., van Driel, T. B., Alonso-Mori, et al

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- **Probing Electronic Coherence between Core-Level Vacancies at Different Atomic Sites** *PHYSICAL REVIEW X*

  Wang, J., Driver, T.

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- **THz-Driven Symmetry Modulation in MnPS₃**

  Cross, M. J., Ul Haque, S. R., Lindenberg, A. M., Hoffmann, M. C., IEEE

  IEEE.2025

- **Electrochemical Control of the Ultrafast Lattice Response of a Layered Semimetal.** *Advanced science (Weinheim, Baden-Wurttemberg, Germany)*

  de Quesada, F. A., Muscher, P. K., Krakovsky, E. S., Sood, A., Poletayev, A. D., Sie, E. J., Nyby, C. M., Irvine, S. J., Zajac, M. E., Luo, D., Shen, X., Hoffmann, M. C., Kramer, et al

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- **Ultrafast structural dynamics of UV photoexcited cis,cis-1,3-cyclooctadiene observed with time-resolved electron diffraction.** *Physical chemistry chemical physics : PCCP*

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- **Element-specific ultrafast lattice dynamics in FePt nanoparticles.** *Structural dynamics (Melville, N.Y.)*

  Turenne, D., Vaskivskyi, I., Sokolowski-Tinten, K., Wang, X. J., Reid, A. H., Shen, X., Lin, M. F., Park, S., Weathersby, S., Kozina, M., Hoffmann, M. C., Wang, J., Sebesta, et al

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- **Terahertz electric-field-driven dynamical multiferroicity in SrTiO3.** *Nature*
  Basini, M., Pancaldi, M., Wehinger, B., Udina, M., Unikandanunni, V., Tadano, T., Hoffmann, M. C., Balatsky, A. V., Bonetti, S.
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- **Improved temporal resolution in ultrafast electron diffraction measurements through THz compression and time-stamping.** *Structural dynamics (Melville, N.Y.)*
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  2024; 11 (2): 024311
- **Monitoring the Evolution of Relative Product Populations at Early Times during a Photochemical Reaction.** *Journal of the American Chemical Society*
  Figueira Nunes, J. P., Ibele, L. M., Pathak, S., Attar, A. R., Bhattacharyya, S., Boll, R., Borne, K., Centurion, M., Erk, B., Lin, M., Forbes, R. J., Goff, N., Hansen, et al
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- **Publisher Correction: The persistence of memory in ionic conduction probed by nonlinear optics.** *Nature*
  Poletayev, A. D., Hoffmann, M. C., Dawson, J. A., Teitelbaum, S. W., Trigo, M., Islam, M. S., Lindenberg, A. M.
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- **Femtosecond Electronic and Hydrogen Structural Dynamics in Ammonia Imaged with Ultrafast Electron Diffraction.** *Physical review letters*
  Champenois, E. G., List, N. H., Ware, M., Britton, M., Bucksbaum, P. H., Cheng, X., Centurion, M., Cryan, J. P., Forbes, R., Gabalski, I., Hegazy, K., Hoffmann, M. C., Howard, et al
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- **Ultrafast X-Ray Scattering Reveals Composite Amplitude Collective Mode in the Weyl Charge Density Wave Material (TaSe_{4})_{2}I.** *Physical review letters*
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- **Measurement of femtosecond dynamics of ultrafast electron beams through terahertz compression and time-stamping** *APPLIED PHYSICS LETTERS*
  Othman, M. A. K., Gabriel, A. E., Snively, E. C., Kozina, M. E., Shen, X., Ji, F., Lewis, S., Weathersby, S., Vasireddy, P., Luo, D., Wang, X., Hoffmann, M. C., Nanni, et al
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- **Terahertz-Driven Local Dipolar Correlation in a Quantum Paraelectric.** *Physical review letters*
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- **Ultrafast Optomechanical Strain in Layered GeS.** *Nano letters*
  Luo, D., Zhang, B., Sie, E. J., Nyby, C. M., Fan, Q., Shen, X., Reid, A. H., Hoffmann, M. C., Weathersby, S., Wen, J., Qian, X., Wang, X., Lindenberg, et al
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- **Lightwave-driven electron emission for polarity-sensitive terahertz beam profiling** *APL PHOTONICS*
  Lange, S., Hoffmann, M. C. C., Jepsen, P.
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- **Terahertz Pump/X-ray Probe Experiments At LCLS**
  Hoffmann, M. C., IEEE
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- **Spatiotemporal Imaging of Near-Fields from a Tilted Pulse Front THz Source**
  Gabriel, A. E., Othman, M. A. K., Hoffmann, M. C., Nanni, E. A., IEEE
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- **Ultrafast modification of the electronic structure of a correlated insulator** *PHYSICAL REVIEW RESEARCH*
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- **Ultrafast electron dynamics in platinum and gold thin films driven by optical and terahertz fields** *APPLIED PHYSICS LETTERS*
  Unikandanunni, V., Rigoni, F., Hoffmann, M. C., Vavassori, P., Urazhdin, S., Bonetti, S.
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- **Spatiotemporal Measurement of THz Near-Fields Using Electro-Optic Sampling**
  Gabriel, A. E., Othman, M. A. K., Hoffmann, M. C., Nanni, E. A., IEEE
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- **Subterahertz collective dynamics of polar vortices.** *Nature*
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- **Enabling high repetition rate nonlinear THz science with a kilowatt-class sub-100 fs laser source** *OPTICS EXPRESS*
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- **Generation of high-field single-cycle terahertz pulses at 100 kHz**
  Kramer, P. L., Hoffmann, M. C., Tavella, F., IEEE
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- **Nonlinear Magnetization Dynamics Driven by Strong Terahertz Fields.** *Physical review letters*
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- **An Ultrafast Symmetry Switch in a Weyl Semimetal** *Nature*
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- **THz-driven bunch compression and timing stabilization of a relativistic electron beam**
  Snively, E., Othman, M., Kozinal, M., Ofori-Okai, B., Weathersby, S., Park, S., Shen, X., Wang, X., Hoffmann, M., Li, R., Nanni, E., IEEE
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