

Curriculum Vitae

Prof. Dr. Peter Baum
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Personal information

Date of birth 27.08.1973, München, Germany
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Education

2001 - 2005 PhD, Ludwig-Maximilians-Universität München (summa cum laude / highest distinction).
1994 - 2001 Diplom-Physiker, Ludwig-Maximilians-Universität München (1.0).
1993 - 1994 Military Service at air force officer's academy.
1993 Abitur at Max-Planck-Gymnasium, München (1.1).

Current and Previous Positions

Since 2018 Full Professor of Physics (W3), Universität Konstanz.
2008 - 2018 Research Group Leader, Max-Planck-Institute of Quantum Optics and
Ludwig-Maximilians-Universität München, with Prof. Krausz.
2006 - 2007 Postdoctoral Scholar, Caltech, USA, with Prof. Zewail.
2005 - 2006 Postdoctoral Scholar, Universität Wien, Austria, with Prof. Kauffmann.
2001 - 2005 PhD student, Ludwig-Maximilians-Universität München,
Chair for BioMolecular Optics, with Prof. Riedle.
2001 Student Assistant, Ludwig-Maximilians-Universität München, BioMolecular Optics.
1997 - 2000 Student Assistant, Ludwig-Maximilians-Universität München, Medical Psychology.

Funding, Prizes and Awards

2022 Falling Walls Foundation, Winner in Physical Sciences
2021 Member of Sonderforschungsbereich SFB 1432 with two projects
2020 Dr. K. H. Eberle Prize
2019 MINT Innovation Prize, Vector Foundation
2015 ERC Consolidator Grant
2009 Rudolf-Kaiser Foundation, Project Prize
2008 Member of DFG Excellence Cluster 'Munich Centre for Advanced Photonics'
2006 Alexander von Humboldt Foundation, Feodor-Lynen Fellowship

Ten Key Publications (as first or last author)

- *Nature* 2023 Attosecond electron microscopy of sub-cycle optical dynamics
- *Nature Physics* 2023 Nonlinear-optical quantum control of free-electron matter waves
- *Nature* 2022 Polarized Phonons Carry Angular Momentum in Ultrafast Demagnetization
- *Science Advances* 2020 Attosecond metrology in a transmission electron microscope
- *Science Advances* 2020 Ultrafast electron diffraction from nanophotonic waveforms
- *Nature Physics* 2018 Diffraction and microscopy with attosecond electron pulse trains
- *Science* 2017 Laser-driven nanoparticle motion in liquids
- *Science* 2016 Electron microscopy of electromagnetic waveforms
- *Science* 2016 All-optical control and metrology of electron pulses
- *Science* 2007 4D Visualization of Transitional Structures in Phase Transformations by Electron Diffraction

Invited and Keynote Talks at International Conferences

- Nanometa Conference, Seefeld, Austria, 2024.
- Microscopy & Microanalysis, Cleveland, USA, 2024.
- ICFO school on the frontiers of light, Barcelona, Spain, 2023.
- Max-von-Laue-Kolloquium, Magnushaus, Physikalische Gesellschaft zu Berlin, Germany, 2023.
- Falling Walls Science Summit, Germany, 2022.
- WE-Heraeus-Seminar Quantum Electron Optics, Israel, 2022.
- METANANO conference, Tblisi, Georgia, 2020.
- LAP meeting, St. Johann, Italy, 2019.
- NANOP 2019, München, Germany, 2019.
- NanoMeta Conference, Seefeld, Austria, 2019.
- 19th International Microscopy Congress, Sydney, Australia, 2018.
- Gordon Conference on Multi-Photon Processes, Rhode Island, USA, 2018.
- FRIAS Junior Researcher Conference: Beyond Molecular Movies, Freiburg, Germany, 2017.
- 2nd International Workshop on Electron Beam Spectroscopy for Nanophotonics, Barcelona, Spain, 2017.
- ColdBeams conference, Eindhoven, Netherlands, 2017.
- Electron microscopy with high temporal resolution, Strasbourg, France, 2017.
- Banff Meeting on Structural Dynamics, Canada, 2017.
- NanoMeta Conference, Seefeld, Austria, 2017.
- Ahmed Zewail Memorial Symposium, Caltech, Pasadena, USA, 2017.
- Workshop on the Future of Electron Microscopy, Jülich, Germany, 2016.
- EMN Meeting on Terahertz, San Sebastian, Spain, 2016.
- Ultrafast phenomena at nanostructures: attosecond physics meets plasmonics, Les Houches, France, 2016.
- Imaging with Femtosecond Electron and X-ray pulses, Trieste, Italy, 2016.
- 5th International Conference on Attosecond Physics, Montréal, Canada, 2015.
- 16th European Symposium on Gas-phase Electron Diffraction, Frauenchiemsee, 2015.
- DFG Schwerpunktsprogramm-Workshop „Ultrafast Electron Diffraction“, Göttingen, 2014.
- Femtochemistry XI, Copenhagen, Denmark, 2013.
- Frontiers in Optics, Rochester, USA, 2012.
- Coldbeams conference, Nimes, France, 2012.
- Microscopy Conference, German Society for Electron Microscopy, Kiel, Germany, 2011.
- 3rd International Conference on Attosecond Physics, Sapporo, Japan, 2011.
- International Symposium on Ultrafast Intense Laser Science, Eisenach, Germany 2011.
- First International Conference on Ultrafast Structural Dynamics, Lausanne, Switzerland, 2010.
- OSA Laser Science Annual Meeting, San Jose, California, USA, 2009.
- Femtochemistry IX, Beijing, China, 2009.
- SPIE Photonics West, San Jose, California, USA, 2009.
- 3rd International Conference on Photoinduced Phase Transitions, Osaka, Japan, 2008.
- International Conference on Correlation Effects in Radiation Fields, Rostock, Germany, 2008.

Publication List

- 87 M. Mattes, M. Volkov, P. Baum, *Femtosecond Electron Beam Probe of Ultrafast Electronics*, Nature Comm. 15, 1743 (2024).
- 86 *Determination of the Nearest-Neighbor Interaction in VO₂ via Fractal Dimension Analysis*, J. Holder, D. Kazenwadel, P. Nielaba, P. Baum, Phys. Rev. Research 5, 043272 (2023).
- 85 *Cooling Times in Femtosecond Pump-Probe Experiments of Phase Transitions with Latent Heat*, D. Kazenwadel, N. Neathery, S. Prakash, A. Ariando, P. Baum, Phys. Rev. Research 5, 043077 (2023).
- 84 *Real-time Electron Clustering in an Event-driven Hybrid Pixel detector*, J. Kuttruff, J. Holder, Y. Meng, P. Baum, Ultramicroscopy 255, 113864 (2023).
- 83 *Attosecond Electron Microscopy of Sub-Cycle Optical Dynamics*, D. Nabben, J. Kuttruff, L. Stolz, A. Ryabov, P. Baum, Nature 619, 63 (2023).
- 82 *Nonlinear-Optical Quantum Control of Free-Electron Matter waves*, M. Tsarev, J. W. Thurner, P. Baum, Nature Physics 19, 1350-1354 (2023).
- 81 N. Sprinkart, D. Kazenwadel, R. Hartmann, P. Baum, *Liquid-diffusion-limited growth of vanadium dioxide single crystals*, Phys. Rev. Research 5, 013028 (2023).
- 80 M. Volkov, E. Ramachandran, M. Mattes, A. B. Swain, M. Tsarev, P. Baum, *Spatiotemporal Attosecond Control of Electron Pulses via Subluminal Terahertz Waveforms*, ACS Photonics 9, 3225-3233 (2022).
- 79 Y. Morimoto and P. Baum, *Free-electron tomography of few-cycle optical waveforms*, Annalen der Physik 2200193 (2022).
- 78 S. R. Tauchert, M. Volkov, D. Ehberger, D. Kazenwadel, M. Evers, H. Lange, A. Donges, A. Book, W. Kreuzpaintner, U. Nowak, P. Baum, *Polarized phonons carry the missing angular momentum in femtosecond demagnetization*, Nature 602, 73 (2022).
- 77 M. V. Tsarev, A. Ryabov, P. Baum, *Measurement of temporal coherence of free electrons by time-domain interferometry*, Phys. Rev. Lett. 127, 165501 (2021).
- 76 M. Tsarev, A. Ryabov, P. Baum, *Free-electron Qubits and temporal Talbot revivals*, Phys. Rev. Res. 3, 043033 (2021).
- 75 M. Volkov, E. Willinger, D. A. Kuznetsov, C. R. Müller, A. Fedorov, P. Baum, *Photo-Switchable Nanoripples in Ti₃C₂T_x MXene*, ACS Nano 15, 14071-14079 (2021).
- 74 J. Kuttruff, M. V. Tsarev, P. Baum, *Jitter-free terahertz pulses from LiNbO₃*, Opt. Lett. 46, 2944-2947 (2021).

- 73 Y. Morimoto, Y. Shinohara, M. Tani, B.-H. Chen, K. L. Ishikawa, P. Baum, *Asymmetric single-cycle control of valence electron motion in polar chemical bonds*, *Optica* 8, 382-387 (2021).
- 72 K. J. Mohler, D. Ehberger, I. Gronwald, C. Lange, R. Huber, P. Baum, *Ultrafast electron diffraction from nanophotonic waveforms via dynamical Aharonov-Bohm phases*, *Sci. Adv.* 6, eabc8804 (2020).
- 71 A. Ryabov, J. W. Thurner, D. Nabben, M. V. Tsarev, P. Baum, *Attosecond metrology in a continuous-beam transmission electron microscope*, *Sci. Adv.* 6, eabb1393 (2020).
- 70 Y. Morimoto and P. Baum, *Single-Cycle Optical Control of Beam Electrons*, *Phys. Rev. Lett.* 125,193202 (2020).
- 69 S. Theiss, M. Voggel, H. Kuper, M. Hoermann, U. Krings, P. Baum, J. A. Becker, V. Witmann, S. Polarz, *Ligand-Programmed Consecutive Symmetry Break(s) in Nanoparticle Based Materials Showing Emergent Phenomena: Transitioning from Sixfold to Threefold Symmetry in Anisotropic ZnO Colloids*, *Adv. Funct. Mater.* 2009104 (2020).
- 68 B.-H. Chen, C. Hofer, I. Pupeza, P. Baum, *Second-harmonic generation and self-phase modulation of few-cycle mid-infrared pulses*, *Opt. Lett.* 44, 4079 (2019).
- 67 B.-H. Chen, E. Wittmann, Y. Morimoto, P. Baum, E. Riedle, *Octave-spanning single-cycle middle-infrared generation through optical parametric amplification in LiGaS₂*, *Opt. Express* 27, 21306 (2019).
- 66 S. Sutter, B. Trepka, S. Siroky, K. Hagedorn, S. Theiß, P. Baum, S. Polarz, *Light-Triggered Boost of Activity of Catalytic Bola-Type Surfactants by a Plasmonic Metal-Support Interaction Effect*, *ACS Appl. Mat.* 11, 15936 (2019).
- 65 D. Ehberger, K. J. Mohler, T. Vasileiadis, R. Ernstorfer, L. Waldecker, P. Baum, *Terahertz compression of electron pulses at a planar mirror membrane*, *Phys. Rev. Appl.* 11, 024034 (2019).
- 64 D. Ehberger, A. Ryabov, P. Baum, *Tilted electron pulses*, *Phys. Rev. Lett.* 121, 094801 (2018).
- 63 D. Ehberger, C. Kealhofer, P. Baum, *Electron energy analysis by phase-space shaping with THz field cycles*, *Struct. Dyn.* 5, 044303 (2018).
- 62 B.-H. Chen, T. Nagy, P. Baum, *Efficient middle-infrared generation in LiGaS₂ by simultaneous spectral broadening and difference-frequency generation*, *Opt. Lett.* 43, 1742 (2018).
- 61 Y. Morimoto and P. Baum, *Attosecond control of electron beams at dielectric and absorbing membranes*, *Phys. Rev. A* 97, 033815 (2018).
- 60 Y. Morimoto and P. Baum, *Diffraction and microscopy with attosecond electron pulse trains*, *Nature Physics* 14, 252-256 (2018).
- 59 M. Tsarev and P. Baum, *Characterization of non-relativistic attosecond electron pulses by transition radiation from tilted surfaces*, *New J. Phys.* 20, 033002 (2018).
- 58 P. Baum and F. Krausz, *Capturing atomic-scale carrier dynamics with electrons*, *Chem. Phys. Lett.* 683, 57-61 (2017).
- 57 P. Baum, *Quantum dynamics of attosecond electron pulse compression*, *J. Appl. Phys.* 122, 223105 (2017).
- 56 Y. Morimoto, I. Roland, S. Rennesson, F. Semond, P. Boucaud, P. Baum, *Laser damage of free-standing nanometer membranes*, *J. Appl. Phys.* 122, 215303 (2017).
- 55 P. Baum, *Laser-driven nanoparticle motion in liquids*, *Science* 355, 458 (2017).
- 54 A. Ryabov and P. Baum, *Electron microscopy of electromagnetic waveforms*, *Science* 353, 374 (2016).
- 53 C. Kealhofer, W. Schneider, D. Ehberger, A. Ryabov, F. Krausz, P. Baum, *All-optical control and metrology of electron pulses*, *Science* 352, 429 (2016).
- 52 D.-S. Yang, P. Baum, A. H. Zewail, *Ultrafast electron crystallography of the cooperative reaction path in vanadium dioxide*, *Struct. Dyn.* 3, 034304 (2016).
- 51 A. Gliserin, M. Walbran, P. Baum, *A high-resolution time-of-flight energy analyzer for femtosecond electron pulses at 30 keV*, *Rev. Sci. Instrum.* 87, 033302 (2016).
- 50 M. V. Tsarev, D. Ehberger, P. Baum, *High-average-power, intense THz pulses from a LiNbO₃ slab with silicon output coupler*, *Appl. Phys. B* 122, 30 (2016).
- 49 A. Gliserin, M. Walbran, F. Krausz, P. Baum, *Sub-phonon-period compression of electron pulses for atomic diffraction*, *Nature Comm.* 6, 8723 (2015).
- 48 M. Walbran, A. Gliserin, K. Jung, J. Kim, P. Baum, *5-fs laser-electron synchronization for pump-probe crystallography and diffraction*, *Phys. Rev. Appl.* 4, 044013 (2015).
- 47 V. Yakovlev, M. Stockman, F. Krausz, P. Baum, *Atomic-scale diffractive imaging of sub-cycle electron dynamics in condensed matter*, *Scientific Reports* 5, 14581 (2015).
- 46 C. Kealhofer, S. Lahme, T. Urban, P. Baum, *Signal-to-noise in femtosecond electron diffraction*, *Ultramicroscopy* 159, 19-25 (2015).
- 45 L. Kasmi, D. Kreier, M. Bradler, E. Riedle, P. Baum, *Femtosecond single-electron pulses generated by two-photon photoemission close to the work function*, *New J. Phys.* 17, 033008 (2015).
- 44 W. Schneider, A. Ryabov, C. Lombosi, T. Metzger, Z. Major, J. A. Fülöp, P. Baum, *800-fs, 330- μ J pulses from a 100-W regenerative Yb:YAG thin-disk amplifier at 300 kHz and THz generation in LiNbO₃*, *Opt. Lett.* 39, 6604-6607 (2014).
- 43 S. Lahme, F. Krausz, P. Baum, *Femtosecond single-electron diffraction*, *Struct. Dyn.* 1, 034303 (2014).
- 42 F. O. Kirchner, S. Lahme, E. Riedle, P. Baum, *All-reflective UV-VIS-NIR transmission and fluorescence spectrometer for μ m-sized samples*, *AIP Advances* 4, 077134 (2014).
- 41 D. Kreier, D. Sabonis, P. Baum, *Alignment of magnetic solenoid lenses for minimizing temporal distortions*, *J. Opt.* 16, 075201 (2014).
- 40 P. Baum, *Towards ultimate temporal and spatial resolutions with ultrafast single-electron diffraction*, *J. Phys. B.* 47, 124005 (2014).
- 39 P. Dombi, P. Rácz, L. Veisz, P. Baum, *Conversion of chirp in fiber compression*, *Opt. Lett.* 39, 2232-2235 (2014).
- 38 J. Hoffrogge, J. P. Stein, M. Krüger, M. Förster, J. Hammer, D. Ehberger, P. Baum, P. Hommelhoff, *Tip-based source of femtosecond electron pulses at 30 keV*, *J. Appl. Phys.* 115, 094506 (2014).
- 37 F. O. Kirchner, A. Gliserin, F. Krausz, P. Baum, *Laser streaking of free electrons at 25 keV*, *Nature Photonics* 8, 52 (2014).
- 36 P. Baum, *On the physics of ultrashort single-electron pulses for time-resolved microscopy and diffraction*, *Chem. Phys.* 423, 55-61 (2013).
- 35 A. Gliserin, M. Walbran, P. Baum, *Passive optical enhancement of laser-microwave synchronization*, *Appl. Phys. Lett.* 103, 031113 (2013).
- 34 F. O. Kirchner, S. Lahme, F. Krausz, P. Baum, *Coherence of femtosecond single-electrons exceeds biomolecular dimensions*, *New J. Phys.* 15, 063021 (2013).
- 33 A. Gliserin, A. Apolonski, F. Krausz, P. Baum, *Compression of single-electron pulses with a microwave cavity*, *New J. Phys.* 14, 073055 (2012).

- 32 D. Kreier and P. Baum, *Avoiding temporal distortions in tilted pulses*, Opt. Lett. 37, 2373 (2012).
- 31 T. Ganz, V. Pervak, A. Apolonski, P. Baum, *16 fs, 350 nJ pulses at 5 MHz repetition rate delivered by chirped pulse compression in fibers*, Opt. Lett. 36, 1107 (2011).
- 30 C. Weninger and P. Baum, *Temporal Distortions in Magnetic Lenses*, Ultramicroscopy 113, 145 (2011).
- 29 M. Aidelsburger, F. O. Kirchner, F. Krausz, P. Baum, *Single-Electron Pulses for Ultrafast Diffraction*, PNAS 107, 19714 (2010).
- 28 P. Baum, J. Manz, A. Schild, *Quantum Model Simulations of Attosecond Electron Diffraction*, Science China 53, 987 (2010).
- 27 P. Baum and A. Zewail, *4D attosecond imaging with free electrons: Diffraction methods and potential applications*, Chem. Phys. 366, 2-8 (2009).
- 26 M. Bradler, P. Baum, E. Riedle, *Femtosecond continuum generation in laser host materials*, Appl. Phys. B 97, 561 (2009).
- 25 P. Baum and A. Zewail, *Femtosecond Diffraction with Chirped Electron Pulses*, Chem. Phys. Lett. 462, 14 (2008).
- 24 C. Homann, C. Schriever, P. Baum, E. Riedle, *Octave wide tunable UV-pumped NOPA: pulses down to 20 fs at 0.5 MHz repetition rate*, Opt. Express 16, 5746 (2008).
- 23 F. Carbone, P. Baum, P. Rudolf, A. H. Zewail, *Structural Preablation Dynamics of Graphite Observed by Ultrafast Electron Crystallography*, Phys. Rev. Lett. 100, 035501 (2008).
- 22 J. Sperling, K. Matuszna, P. Baum, A. Nemeth, F. Sanda, E. Riedle, H. F. Kauffmann, S. Mukamel, F. Milota, *Exciton Dynamics in a Disordered Conjugated Polymer: Three-Pulse Photon-Echo and Transient Grating Experiments*, Chem. Phys. 349, 244 (2008).
- 21 P. Baum and A. H. Zewail, *Attosecond Electron Pulses for 4D diffraction and microscopy*, PNAS 104, 18409 (2007).
- 20 P. Baum, D.-S. Yang, A. H. Zewail, *4D Visualization of Transitional Structures in Phase Transformations by Electron Diffraction*, Science 318, 788 (2007).
- 19 P. Baum and A. H. Zewail, *Breaking resolution limits in ultrafast electron diffraction and microscopy*, PNAS 103, 16105 (2006).
- 18 P. Baum, M. Breuer, E. Riedle, Günter Steinmeyer, *Chirped mirrors without dispersion oscillations by Brewster's angle incidence*, Ultrafast Phenomena XV (Springer, Berlin Heidelberg 2007), 163 – 165.
- 17 F. Milota, P. Baum, J. Sperling, E. Riedle, K. Matuszna, and H. F. Kauffmann, *2D optical spectroscopy of a conjugated polymer with tunable visible 15 fs-pulses from a 200 kHz NOPA*, Ultrafast Phenomena XV (Springer, Berlin Heidelberg 2007), 359 – 361.
- 16 P. Baum, E. Riedle, G. Steinmeyer, *Brewster-angled chirped mirrors for broadband pulse compression without dispersion oscillations*, Opt. Lett. 31, 2220 (2006).
- 15 P. Baum and E. Riedle, *Design and calibration of zero-additional-phase SPIDER*, J. Opt. Soc. B 22, 1875 (2005).
- 14 M. Greve, B. Bodermann, H. R. Telle, P. Baum, E. Riedle, *High-contrast chemical imaging with gated heterodyne coherent anti-Stokes Raman scattering microscopy*, Appl. Phys. B 81,875 (2005).
- 13 P. Baum, E. Riedle, M. Greve, H. R. Telle, *Phase-locked ultrashort pulse trains at separate and independently tunable wavelengths*, Opt. Lett. 30, 2028 (2005).
- 12 M. Greve, B. Bodermann, H. R. Telle, P. Baum, E. Riedle, *Gated heterodyne coherent anti-Stokes Raman scattering for high-contrast vibrational imaging*, Proc. SPIE 5856, 41 (2005).
- 11 P. Baum, S. Lochbrunner, E. Riedle, *Achromatic second harmonic generation: tunable ultraviolet pulses with sub-10 fs duration*, Ultrafast Phenomena XIV (Springer, Berlin, 2005), 79-81.
- 10 P. Baum, S. Lochbrunner, E. Riedle, *Full characterization of ultraviolet and visible 10-fs pulses with zero-additional-phase SPIDER*, Ultrafast Phenomena XIV (Springer, Berlin, 2005), 130-132.
- 9 P. Baum, S. Lochbrunner, E. Riedle, *Generation of tunable 7-fs ultraviolet pulses: achromatic phase matching and chirp management*, Appl. Phys. B 79, 1027 (2004).
- 8 P. Baum, S. Lochbrunner, E. Riedle, *Tunable sub-10-fs ultraviolet pulses generated by achromatic frequency doubling*, Opt. Lett. 29, 1686 (2004).
- 7 I. Z. Kozma, P. Baum, U. Schmidhammer, S. Lochbrunner, E. Riedle, *Compact autocorrelator for the online measurement of tunable 10-femtosecond pulses*, Rev. Sci. Instrum. 75, 2323 (2004).
- 6 P. Baum, S. Lochbrunner, E. Riedle, *Zero-additional-phase SPIDER: full characterization of visible and sub-20 fs ultraviolet pulses*, Opt. Lett. 29, 210 (2004).
- 5 I. Z. Kozma, P. Baum, S. Lochbrunner, E. Riedle, *Widely tunable sub-30 fs ultraviolet pulses by chirped sum frequency mixing*, Opt. Express 11, 3110 (2003).
- 4 R. Huber, F. Adler, A. Leitenstorfer, M. Beutter, P. Baum, E. Riedle, *12-fs pulses from a continuous-wave-pumped 200 nJ Ti:sapphire amplifier at a variable repetition rate as high as 4 MHz*, Opt. Lett. 28, 2118 (2003).
- 3 P. Baum, S. Lochbrunner, E. Riedle, *Carrier-envelope phase fluctuations of amplified femtosecond pulses: Characterization with a simple spatial interference setup*, Appl. Phys. B 77, 129 (2003).
- 2 P. Baum, S. Lochbrunner, J. Piel, E. Riedle, *Phase coherent generation of tunable visible femtosecond pulses*, Opt. Lett. 28, 185 (2003).
- 1 P. Baum, S. Lochbrunner, L. Gallmann, G. Steinmeyer, U. Keller, E. Riedle, *Real-time characterization and optimal phase control of tunable visible pulses with a flexible compressor*, Appl. Phys. B 74, S219 (2002)

Patents

- DE 10 2016 012 724, *Vorrichtung zur Beobachtung mit Ladungsteilchen, Elektronenmikroskop sowie Verfahren zur zeit-aufgelösten Beobachtung*
- WO 2018/077471A1, *Charged particle monitoring apparatus, electron microscope and methods for detection of charged particles*