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## Supplementary Information

1. Hirschman, Jack, Randy Lemons, Minyang Wang, Peter Kroetz, and Sergio Carbajo. "Design, tuning, and blackbox optimization of laser systems." *Optics Express* 32, no. 9 (2024): 15610-15622.
2. Lu, Brittany, et al. "High-efficiency, single-stage tunable optical parametric amplifier for visible photocathode applications." *Optics Letters* 49.3 (2024): 450-453.
3. Wong, Lee Wei Wesley, et al. "Free-electron crystals for enhanced X-ray radiation." *Light: Science & Applications* 13.1 (2024): 29.
4. Lee, Ethan, Ariel Nicole Hart, Thomas A. Searles, Marc Levis-Fitzgerald, Ramón S. Barthelemy, Shanna Shaked, Victoria Marks, and Sergio Carbajo. "Education for a Future in Crisis: Developing a Humanities-Informed STEM Curriculum." <https://escholarship.org/uc/item/8mk2w7kp> (2024)
5. Basic Research Needs Workshop on Laser Technology Report of the Department of Energy Office of Science Workshop August 15-17, 2023
6. Wolff, Alexander M., et al. "Mapping protein dynamics at high spatial resolution with temperature-jump X-ray crystallography." *Nature Chemistry* (2023): 1-10.
7. Ishigami, Izumi, et al. "Detection of a geminate photoproduct of bovine cytochrome c oxidase by time-resolved serial femtosecond crystallography." *Journal of the American Chemical Society* 145.41 (2023): 22305-22309.
8. Hutchison, C.D.M., Baxter, J.M., Fitzpatrick, A. et al. Optical control of ultrafast structural dynamics in a fluorescent protein. *Nat. Chem.* (2023). <https://doi.org/10.1038/s41557-023-01275-1>
9. Carbajo (editor), *Colonial Narratives in Urban Mapping and Dynamics*, UCLA QSTC 2023
10. Carbajo (editor), *On Linguistics of (Inclusive) STEM Education*, UCLA QSTC 2023
11. Carbajo (editor), *On the Power of Storytelling and Logics to Affect Scientific Progress*, UCLA QSTC 2023
12. Carbajo (editor), *On the Human-Machine Embodiment of Knowledge*, UCLA QSTC 2023
13. Carbajo, Sergio. "Queered Science & Technology Center: Volume 1." arXiv preprint arXiv:2304.12318 (2023)
14. V. Adam et al., Rational control of off-state heterogeneity in a photoswitchable fluorescent protein provides switching contrast enhancement, *ChemPhysChem* 2022, e202200192
15. Randy Lemons and Sergio Carbajo, Phase Retrieval and Reconstruction of Coherent Synthesis by Genetic Algorithm, *IOP Photonics* (2022)
16. R Lemons, N Neveu, J Duris, A Marinelli, C Durfee, S Carbajo, Temporal shaping of narrow-band picosecond pulses via noncolinear sum-frequency mixing of dispersion-controlled pulses, *Phys. Rev. Accel. Beams* 25, 013401 (2022)
17. Cesar, David, et al. "Electron beam shaping via laser heater temporal shaping." *Physical Review Accelerators and Beams* 24.11 (2021): 110703.
18. S. Carbajo, *Structured Photonics in Light-Matter Interactions, Accelerators, and X-ray Lasers*, IEEE IPC 2021 doi: 10.1109/IPC48725.2021.9592853. (invited)
19. Hussein, Rana, et al. "Structural dynamics in the water and proton channels of photosystem II during the S2 to S3 transition." *Nature communications* 12.1 (2021): 1-16.
20. S. Carbajo, Light by design: emerging frontiers in ultrafast photon sciences and light-matter interactions, invited perspective article in [Journal of Physics: Photonics, Volume 3, Number 3](#) (2021)
21. H. Yong et al., Ultrafast X-Ray Scattering Offers a Structural View of Excited State Charge Transfer, *PNAS* May 11, 2021 118 (19) e2021714118
22. Grünbein et al., Effect of X-ray free-electron laser-induced shockwaves on hemoglobin microcrystals delivered in a liquid jet, *Nat Commun* 12, 1672 (2021)
23. Sorigué et al., Mechanism and dynamics of light-driven decarboxylation in fatty acid photodecarboxylase, *Science* 372, eabd5687 (2021) DOI: 10.1126/science.abd5687

24. Yun, J.-H. et al., Early-stage dynamics for Chloride ion pumping rhodopsins revealed by femtosecond X-ray lasers, PNAS 2021, 118 (13) e2020486118;
25. Grünbein *et al.*, Observation of shock-induced protein crystal damage during megahertz serial femtosecond crystallography, Phys. Rev. Research 3, 013046 (2021)
26. Randy Lemons, Wei Liu, Josef C. Frisch, Steve Smith, Joseph Robinson, Alan Fry, and Sergio Carbajo, Integrated Structured Light Architectures, Scientific Reports volume 11, 796 (2021)
27. Robert Dods et al., Ultrafast Structural Response to Charge Redistribution within a Photosynthetic Reaction Centre, Nature (2020). <https://doi.org/10.1038/s41586-020-3000-7>
28. Sergio Carbajo, Jonathan C. Coopersmith, Geoffrey Cushman, Kevin Felch, John Lohr, Julie Mikula, Alan Rhodes and Edl Schamiloglu, Beamed Energy Propulsion for Low-Cost Launch to Earth Orbit: Paths for Progress, Aerospace Research Central DOI: 10.2514/6.2020-4173 (2020)
29. Jack Hirschman, Randy Lemons, Evan Chansky, Günter Steinmeyer, and Sergio Carbajo, Long-term Hybrid Stabilization of the Carrier-Envelope Phase, Opt. Express 28, 34093-34103 (2020)
30. Ibrahim et al., Untangling the Sequence of Events occurring at the Micro- to Milli-Second Time Domain during the S2 to S3 Transition in Photosystem II: Implications for the Water Oxidation Mechanism, PNAS <https://doi.org/10.1073/pnas.2000529117> (2020)
31. Sergio Carbajo, Transient Work Function Gating: A New Photoemission Regime, Journal of Applied Physics 128, 023102 (2020)
32. Haiwang Yong, Nikola Zotev, Jennifer M Ruddock, Brian Stankus, Mats Simmermacher, Andrés Moreno Carrascosa, Wenpeng Du, Nathan Goff, Yu Chang, Darren Bellshaw, Mengning Liang, Sergio Carbajo, Jason E Koglin, Joseph S Robinson, Sébastien Boutet, Michael P Minitti, Adam Kirrander, Peter M Weber, Observation of the molecular response to light upon photoexcitation, Nat. Comm. Nature Communications 11 (1), 1-6 (2020)
33. Jingyi Tang, Randy Lemons, Wei Liu, Sharon Vetter, Timothy Maxwell, Franz-Josef Decker, Alberto Lutman, Jacek Krzywinski, Gabriel Marcus, Stefan Moeller, Zhirong Huang, Daniel Ratner, and Sergio Carbajo, Laguerre-Gaussian Mode Laser Heater for Microbunching Instability Suppression in Free Electron Lasers, Phys. Rev. Lett. 124, 134801(2020)
34. Alexander M Wolff, et al., Comparing serial X-ray crystallography and microcrystal electron diffraction as methods for routine structure determination from small crystals, IUCrJ, doi: <https://doi.org/10.1101/767061> (2020)
35. Randy Lemons, Wei Liu, Irene Fernandez De Fuentes, Stefan Droste, Günter Steinmeyer, Charles G Durfee and Sergio Carbajo, Carrier-envelope phase stabilization of an Er: Yb: glass laser via feed-forward technique, Optics Letters 44, pp. 5610-5613 (2019) <https://doi.org/10.1364/OL.44.005610>
36. Sergio Carbajo, Liang Jie Wong, Jerome Faure, Arya Fallahi, Editorial: Lasers in Accelerator Science and Secondary Emission Light Source Technology, Frontiers in Physics 7, p. 162 (2019)
37. Brian Stankus, Haiwang Yong, Nikola Zotev, Jennifer M Ruddock, Darren Bellshaw, Thomas J Lane, Mengning Liang, Sébastien Boutet, Sergio Carbajo, Joseph S Robinson, Wenpeng Du, Nathan Goff, Yu Chang, Jason E Koglin, Michael P Minitti, Adam Kirrander, Peter M Weber, Ultrafast X-ray scattering reveals vibrational coherence following Rydberg excitation, Nature Chemistry 11, pages716–721 (2019).
38. Gabriela Nass Kovacs, Jacques-Philippe Colletier, Marie Grünbein, Yang Yang, Till Stensitzki, Alexander Batyuk, Sergio Carbajo, R Doak, David Ehrenberg, Lutz Foucar, Raphael Gasper, Alexander Gorel, Mario Hilpert, Marco Kloos, Jason Koglin, Jochen Reinstein, Christopher Roome, Ramona Schlesinger, Matthew Seaberg, Robert Shoeman, Miriam Stricker, Sébastien Boutet, Stefan Haacke, Joachim Heberle, Karsten Heyne, Tatiana Domratcheva, Thomas Barends, Ilme Schlichting, Three-dimensional view of ultrafast dynamics in photoexcited bacteriorhodopsin, Nature Comm. 10, Article number: 3177 (2019)
39. Ruddock JM, Minitti MP, Weber PM, Yong H, Stankus B, Du W, Goff N, Chang Y, Odate A, Carrascosa AM, Bellshaw D., Carbajo S., A Deep-UV Trigger for Ground-State Ring-Opening Dynamics of 1, 3-Cyclohexadiene, Science Advances, DOI: 10.1126/sciadv.aax6625 (2019)
40. Haiwang Yong, Jennifer M. Ruddock, Brian Stankus, Lingyu Ma, Wenpeng Du, Nathan Goff, Yu Chang, Nikola Zotev, Darren Bellshaw, Sébastien Boutet, Sergio Carbajo, Jason E. Koglin, Mengning

Liang, Joseph S. Robinson, Adam Kirrander, Michael P. Minitti, and Peter M. Weber, Scattering off Molecules far from Equilibrium, *Journal of Chemical Physics* 151, 084301 (2019); <https://doi.org/10.1063/1.5111979>

41. Stankus B, Yong H, Zotev N, Ruddock JM, Bellshaw D, Lane TJ, Liang M, Boutet S, Carbajo S, Robinson JS, Du W. Ultrafast X-ray scattering reveals vibrational coherence following Rydberg excitation. *Nature Chemistry*. 2019 Jul 8:1.
42. M. H. Seaberg et al., CXI nanofocus characterization using single 2D grating interferometry, *X-Ray Free-Electron Lasers: Advances in Source Development and Instrumentation V*
43. Ruddock JM, Zotev N, Stankus B, Yong H, Bellshaw D, Boutet S, Lane TJ, Liang M, Carbajo S, Du W, Kirrander A. Simplicity Beneath Complexity: Counting Molecular Electrons Reveals Transients and Kinetics of Photodissociation Reactions. *Angewandte Chemie*. 2019 May 6;131(19):6437-41.
44. C. Arnold, L. Inhester, S. Carbajo, R. Welsch, and R. Santra, Simulated XUV Photoelectron Spectroscopy of THz-pumped Liquid Water, *Journal of Chemical Physics* 150 (4), 044505 (2019)
45. Sierra, R.G., Batyuk, A., Sun, Z., Aquila, A., Hunter, M.S., Lane, T.J., Liang, M., Yoon, C.H., Alonso-Mori, R., Armenta, R., Carbajo S. and Castagna, J.C., 2019. The Macromolecular Femtosecond Crystallography Instrument at the Linac Coherent Light Source. *Journal of synchrotron radiation*, 26(2).
46. Y. Salamin, and S. Carbajo, *A simple model for the fields of a chirped laser pulse with application to electron laser acceleration*, *Front. Phys.* | doi: 10.3389/fphy.2019.00002 (2019)
47. Kern, J., Chatterjee, R., Young, I.D., Fuller, F.D., Lassalle, L., Ibrahim, M., Gul, S., Fransson, T., Brewster, A.S., Alonso-Mori, R., Hussein, R., Carbajo S., 2018. Structures of the intermediates of Kok's photosynthetic water oxidation clock. *Nature*, 563(7731), p.421.
48. Yong H, Zotev N, Stankus B, Ruddock JM, Bellshaw D, Boutet S, Lane TJ, Liang M, Carbajo S, Robinson JS, Du W. Determining Orientations of Optical Transition Dipole Moments Using Ultrafast X-ray Scattering. *The journal of physical chemistry letters*. 2018 (22):6556-62.
49. Liebster, N., Tang, J., Ratner, D., Liu, W., Vetter, S., Huang, Z. and Carbajo, S., 2018. Laguerre-Gaussian and beamlet array as second-generation laser heater profiles. *Physical Review Accelerators and Beams*, 21(9), p.090701. (2018)
50. Nogly P, Weinert T, James D, Carbajo S, Ozerov D, Furrer A, Gashi D, Borin V, Skopintsev P, Jaeger K, Nass K. Retinal isomerization in bacteriorhodopsin captured by a femtosecond x-ray laser, *Science* 361, eaat0094 (2018)
51. Philip Heimann, Stefan Moeller, Sergio Carbajo, Sanghoon Song, Georgi Dakovski, Dennis Nordlund and David Fritz, Laser Power Meters as X-ray Intensity Monitors for LCLS-II, *Journal of Synchrotron Radiation*, <https://doi.org/10.1107/S1600577517014096> (2018)
52. Liang Jie Wong, Kyung-Han Hong, Sergio Carbajo, Arya Fallahi, Philippe Piot, Marin Soljačić, John D. Joannopoulos, Franz X. Kärtner & Ido Kaminer, Laser-Induced Linear-Field Particle Acceleration in Free Space, *Scientific Reports*, 7: 11159 (2017)
53. Nicolas Coquelle, Michel Sliwa, Joyce Woodhouse, Giorgio Schirò, Virgile Adam, Andrew Aquila, Thomas R. M. Barends, Sébastien Boutet, Martin Byrdin, Sergio Carbajo, Eugenio De la Mora, R. Bruce Doak, Mikolaj Feliks, Franck Fieschi, Lutz Foucar, Virginia Guillon, Mario Hilpert, Mark S. Hunter, Stefan Jakobs, Jason E. Koglin, Gabriela Kovacsova, Thomas J. Lane, Bernard Lévy, Mengning Liang, Karol Nass, Jacqueline Ridard, Joseph S. Robinson, Christopher M. Roome, Cyril Ruckebusch, Matthew Seaberg, Michel Thepaut, Marco Cammarata, Isabelle Demachy, Martin Field, Robert L. Shoeman, Dominique Bourgeois, Jacques-Philippe Colletier, Ilme Schlichting & Martin Weik, Chromophore twisting in the excited state of a photoswitchable fluorescent protein captured by time-resolved serial femtosecond crystallography, *Nature Chemistry*, DOI: 10.1038/NCHEM.2853 (2017)
54. Robert Dods, Petra Båth, David Amlund, Kenneth R. Beyerlein, Garrett Nelson, Mengling Liang, Rajiv Harimoorthy, Peter Berntsen, Erik Malmerberg, Linda Johansson, Rebecka Andersson, Robert Bosman, Sergio Carbajo, Elin Claesson, Chelsie E. Conrad, Peter Dahl, Greger Hammarin, Mark S. Hunter, Chufeng Li, Stella Lisova, Despina Milathianaki, Joseph Robinson, Cecilia Safari, Amit Sharma, Garth Williams, Cecilia Wickstrand, Oleksandr Yefanov, Jan Davidsson, Daniel P. DePonte,

Anton Barty, Gisela Brändén, and Richard Neutze, From macro-crystals to microcrystals: a strategy for membrane protein serial crystallography, *Structure* 25, 1–8 (2017)

55. Frederike Ahr, Spencer W. Jolly, Nicholas H. Matlis, Sergio Carbajo, Tobias Kroh, Koustuban Ravi, Damian N. Schimpf, Jan Schulte, Hideki Ishizuki, Takunori Taira, Andreas R. Maier, and Franz X. Kärtner, Narrowband terahertz generation with chirped-and-delayed laser pulses in periodically poled lithium niobate, *Optics Letters* 42 (11), 2118-2121 (2017)
56. F. X. Kärtner, F. Ahr, A. L. Calendron, H. Çankaya, S. Carbajo, G. Chang, G. Cirmi, K. Dörner, U. Dorda, A. Fallahi, A. Hartin, M. Hemmer, R. Hobbs, Y. Hua, W. R. Huang, R. Letrun, N. Matlis, V. Mazalova, O. D. Mücke, E. Nanni, W. Putnam, K. Ravi, F. Reichert, I. Sarrou, X. Wu, A. Yahaghi, H. Ye, L. Zapata, D. Zhang, C. Zhou, R. J D Miller, K. K. Berggren, H. Graafsma, A. Meents, R. W. Assmann, H. N. Chapman, Petra Fromme, AXSIS: Exploring the frontiers in attosecond X-ray science, imaging, and spectroscopy, *Nucl. Instr. Meth. PRS A*, (2016)
57. Sergio Carbajo, Anne-Laure Calendron, Huseyin Cankaya, Paula Alcorta, Koustuban Ravi, Frederike Ahr, Xiaojun Wu, Arya Fallahi, Franz X Kärtner, Effective path towards relativistic transients at millimeter wavelengths, arxiv:1602.08136 (2016)
58. S. Carbajo, Emilio A. Nanni, Liang Jie Wong, Gustavo Moriena, Phillip D. Keathley, Guillaume Laurent, R. J. Dwayne Miller, Franz X. Kärtner, Direct longitudinal laser acceleration of electrons in free space, *PRSTAB* 19, 021303 (2016)
59. S. Carbajo, J Schulte et al, Efficient narrowband terahertz generation in cryogenically cooled periodically poled lithium niobate, *Opt. Lett.* 40 (24), 5762 (2016)
60. K Ravi, WR Huang, S Carbajo, E Nanni, D Schimpf, EP Ippen, FX Kärtner, Theory of THz generation by Optical Rectification using Tilted-Pulse-Fronts, *Opt. Expr.* (2015)
61. S. Carbajo, Advances towards the development of compact relativistic electron and bright x-ray sources, dissertation publication, Universität Hamburg (2015)
62. WS Graves, J Bessuille, P Brown, S Carbajo, V Dolgashev, K-H Hong, E Ihloff, B Khaykovich, H Lin, K Murari, EA Nanni, G Resta, S Tantawi, LE Zapata, FX Kärtner, DE Moncton, Compact X-ray Source using a High Repetition Rate Laser and Copper Linac, arXiv:1409.6954 (2014)
63. X Wu, S Carbajo, K Ravi, F Ahr, G Cirmi, Y Zhou, OD Mücke, FX Kärtner, Terahertz generation in lithium niobate driven by Ti: sapphire laser pulses and its limitations, *Optics Letters* 39 (18), 5403-5406 (2014)
64. S. Carbajo, E Granados, D Schimpf, A Sell, KH Hong, J Moses, FX Kärtner, Efficient generation of ultra-intense few-cycle radially polarized laser pulses, *Optics Letters* 39 (8), 2487-2490 (2014)
65. C. S. Menoni, S. Carbajo, I. D. Howlett, W. Chao, E. H. Anderson, A. V. Vinogradov, I. A. Artyukov, K. Buchanan, M. C. Marconi, J. J. Rocca, in *X-Ray Lasers 2012*, S. Sebban, J. Gautier, D. Ros, P. Zeitoun, Eds. (Springer International Publishing, 2014), vol. 147, chap. 30, pp. 185-192
66. S. Carbajo, I. D. Howlett, F. Brizuela, K. S. Buchanan, M. C. Marconi, W. Chao, E. H. Anderson, I. Artioukov, A. Vinogradov, J. J. Rocca, C. S. Menoni, Sequential single-shot imaging of nanoscale dynamic interactions with a table-top soft x-ray laser. *Opt. Lett.* 37, 2994-2996 (2012)
67. F. Brizuela, I. D. Howlett, S. Carbajo, D. Peterson, A. Sakdinawat, L. Yanwei, D. T. Attwood, M. C. Marconi, J. J. Rocca, C. S. Menoni, Imaging at the Nanoscale With Practical Table-Top EUV Laser-Based Full-Field Microscopes. *Selected Topics in Quantum Electronics, IEEE Journal of* 18, 434-442 (2012)
68. C. S. Menoni, F. Brizuela, S. Carbajo, Y. Wang, D. Alessi, D. H. Martz, B. Luther, M. C. Marconi, J. J. Rocca, A. Sakdinawat, W. Chao, Y. W. Liu, E. H. Anderson, K. A. Goldberg, D. T. Attwood, A. V. Vinogradov, I. A. Artioukov, B. LaFontaine, in *X-Ray Lasers 2010*, J. Lee, C. Nam, K. Janulewicz, Eds. (Springer Netherlands, 2011), vol. 136, chap. 41, pp. 359-370
69. D. Howlett, F. Brizuela, S. Carbajo, D. Peterson, A. Sakdinawat, Y. Liu, D. T. Attwood, M. C. Marconi, J. J. Rocca, C. S. Menoni, Assessment of illumination characteristics of soft x-ray laser-based full-field microscopes, *SPIE Proceedings* (2011), vol. 8140, pp. 81405
70. S. Carbajo, I. D. Howlett, M. C. Marconi, J. J. Rocca, C. S. Menoni, Laser-based aerial microscope for at-wavelength characterization of extreme ultraviolet lithography masks, in *IEEE Photonics*, pp. 698-699 (2011)

71. F. Brizuela, S. Carbajo, A. Sakdinawat, D. Alessi, D. H. Martz, Y. Wang, B. Luther, K. A. Goldberg, I. Mochi, D. T. Attwood, B. La Fontaine, J. J. Rocca, C. S. Menoni, Extreme ultraviolet laser-based table-top aerial image metrology of lithographic masks. *Opt. Express* 18, 14467-14473