Stanford

Takahiro Sato

Lead Scientist, SLAC National Accelerator Laboratory

Bio

BIO

My research interest is to develop new methodologies combining ultrafast X-rays, lasers and advanced X-ray optics. Especially, overcoming the current limitations related to resolutions, experimental difficulties by introducing new methodologies and technologies is my lifework as instrument scientist of scientific user facility. I started my research career by developing high pulse energy laser system, and then, switched to AMO physics studying non-linear interaction between atoms or molecules and intense EUV laser and the development of seeded EUV-FEL by developing high pulse energy femtosecond laser system and sub-uJ class laser HHG in EUV region to seed SASE-FEL as my Ph. D works.

After working at the Japanese XFEL facility SACLA as a beamline scientist in charge of time resolved experiments and at the University of Tokyo as an assistant professor studying about AMO physics and soft X-ray microscope combining laser HHG and advanced soft X-ray optics, I joined LCLS as an instrument scientist.
Today, I have been working on developing new methodologies to maximize the scientific capabilities in order to keep the XPP Instrument at the forefront of ultrafast X-ray science.

CURRENT ROLE AT STANFORD

Staff Scientist of Material Science Department, LCLS.
Instrument lead scientist of the XPP instrument.

Principal Investigator, Stanford PULSE Institute

HONORS AND AWARDS

- Users' Recognition Award 2024, LCLS UEC
- Encouragement Award, Laser Society of Japan

EDUCATION AND CERTIFICATIONS

- Ph. D, The University of Tokyo , Science (2013)

Professional

PROFESSIONAL INTERESTS

- Advanced X-ray optics
- Ultrafast X-ray measurements, methodology
- Ultrafast laser developments

WORK EXPERIENCE

- Assistant Professor - The Unviersity of Tokyo

- Beamline Scientist (Postdoctoral researcher) - RIKEN (10/1/2010 - 3/31/2013)
- Industry-academia-government collaboration researcher - The Unviersity of Tokyo (1/1/2007 - 9/30/2010)

Publications

PUBLICATIONS

- **Impulsive excitation of squeezed phonons in single crystal germanium by an x-ray laser** *APPLIED PHYSICS LETTERS*
  Wang, N., Li, H., Sun, Y., Hanlon, D., Huang, Y., Sun, P., She, B., Ornelas-Skarin, C., Teitelbaum, S. W., Sutton, M., Fuoss, P. H., Hastings, J. B., Sato, 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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- **Femtosecond x-ray photon correlation spectroscopy enables direct observations of atomic-scale relaxations of glass forming liquids.** *The Journal of chemical physics*
  Fujita, T., Sun, Y., Li, H., Albert, T. J., Song, S., Sato, T., Moesgaard, J., Cornet, A., Sun, P., Chen, Y., Mo, M., Amini, N., Yang, et al
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- **Coupled order parameters and photoinduced domain walls in the charge density wave of (TaSe₄)₂I** *NPJ QUANTUM MATERIALS*
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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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- **X-ray Absorption Spectroscopy of Dilute Metalloenzymes at X-ray Free-Electron Lasers in a Shot-by-Shot Mode.** *The journal of physical chemistry letters*
  Bogacz, I., Szilagyi, E., Makita, H., Simon, P. S., Zhang, M., Doyle, M. D., Chatterjee, K., Kretzschmar, M., Chernev, P., Croy, N., Cheah, M. H., Dasgupta, M., Nangca, et al
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- **Nanofocused attosecond hard x-ray free-electron laser with intensity exceeding 1019 W/cm2** *OPTICA*
  Inoue, I., Sato, T., Robles, R., Seaberg, M. H., Sun, Y., Zhu, D., Cesar, D., Ding, Y., Esposito, V., Franz, P., Guo, V., Halavanau, A., Sudar, et al
  2025; 12 (3): 309-310

- **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
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- **Dynamically patterning x-ray beam by a femtosecond optical laser.** *Science advances*
  Tamasaku, K., Sato, T., Osaka, T., Osawa, H., Zhu, D., Ishikawa, T.
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- **Author Correction: Non-equilibrium pathways to emergent polar supertextures.** *Nature materials*
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- **Non-equilibrium pathways to emergent polar supertextures.** *Nature materials*
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- **Dynamical decoding of the competition between charge density waves in a kagome superconductor.** *Nature communications*
  Ning, H., Oh, K. H., Su, Y., von Hoegen, A., Porter, Z., Capa Salinas, A., Nguyen, Q. L., Chollet, M., Sato, T., Esposito, V., Hoffmann, M. C., White, A., Melendrez, et al
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- **X-ray optics for the cavity-based X-ray free-electron laser.** *Journal of synchrotron radiation*
  Liu, P., Pradhan, P., Shi, X., Shu, D., Kauchha, K., Qiao, Z., Tamasaku, K., Osaka, T., Zhu, D., Sato, T., MacArthur, J., Huang, X., Assoufid, et al
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- **The Liquid Jet Endstation for Hard X-ray Scattering and Spectroscopy at the Linac Coherent Light Source.** *Molecules (Basel, Switzerland)*
  Antolini, C., Sosa Alfaro, V., Reinhard, M., Chatterjee, G., Ribson, R., Sokaras, D., Gee, L., Sato, T., Kramer, P. L., Raj, S. L., Hayes, B., Schleissner, P., Garcia-Esparza, et al
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- **A versatile pressure-cell design for studying ultrafast molecular-dynamics in supercritical fluids using coherent multi-pulse x-ray scattering.** *The Review of scientific instruments*
  Muhunthan, P., Li, H., Vignat, G., Toro, E. R., Younes, K., Sun, Y., Sokaras, D., Weiss, T., Rajkovic, I., Osaka, T., Inoue, I., Song, S., Sato, et al
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- **Nonthermal Bonding Origin of a Novel Photoexcited Lattice Instability in SnSe.** *Physical review letters*
  Huang, Y., Teitelbaum, S., Yang, S., De la Peña, G., Sato, T., Chollet, M., Zhu, D., Niedziela, J. L., Bansal, D., May, A. F., Lindenberg, A. M., Delaire, O., Trigo, et al
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- **X-ray free electron laser observation of ultrafast lattice behaviour under femtosecond laser-driven shock compression in iron.** *Scientific reports*
  Sano, T., Matsuda, T., Hirose, A., Ohata, M., Terai, T., Kakeshita, T., Inubushi, Y., Sato, T., Miyanishi, K., Yabashi, M., Togashi, T., Tono, K., Sakata, 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*
  Nguyen, Q. L., Duncan, R. A., Orenstein, G., Huang, Y., Krapivin, V., de la Peña, G., Ornelas-Skarin, C., Reis, D. A., Abbamonte, P., Bettler, S., Chollet, M., Hoffmann, M. C., Hurley, et al
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- **Low-loss stable storage of 1.2 & ANGS; X-ray pulses in a 14 m Bragg cavity** *NATURE PHOTONICS*
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- **Room temperature X-ray absorption spectroscopy of metalloenzymes with drop-on-demand sample delivery at XFELs.** *Pure and applied chemistry. Chimie pure et appliquee*
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- **Room temperature X-ray absorption spectroscopy of metalloenzymes with drop-on-demand sample delivery at XFELs** *PURE AND APPLIED CHEMISTRY*
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- **Experimental setup for high-resolution characterization of crystal optics for coherent X-ray beam applications.** *Journal of applied crystallography*
  Halavanau, A., Margraf, R., Robles, R., MacArthur, J., Qu, Z., Marcus, G., Wu, J., Sato, T., Zhu, D., Takacs, C. J., Arthur, R., Kraynis, O., Johnson, et al
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- **Influence of local symmetry on lattice dynamics coupled to topological surface states** *PHYSICAL REVIEW B*
  Sobota, J. A., Teitelbaum, S. W., Huang, Y., Querales-Flores, J. D., Power, R., Allen, M., Rotundu, C. R., Bailey, T. P., Uher, C., Henighan, T., Jiang, M., Zhu, D., Chollet, et al
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- **Observation of a Novel Lattice Instability in Ultrafast Photoexcited SnSe** *PHYSICAL REVIEW X*
  Huang, Y., Yang, S., Teitelbaum, S., De la Pena, G., Sato, T., Chollet, M., Zhu, D., Niedziela, J. L., Bansal, D., May, A. F., Lindenberg, A. M., Delaire, O., Reis, et al
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- **A Contrast Calibration Protocol for X-ray Speckle Visibility Spectroscopy** *APPLIED SCIENCES-BASEL*
  Sun, Y., Esposito, V., Hart, P., Hansson, C., Li, H., Nakahara, K., MacArthur, J., Nelson, S., Sato, T., Song, S., Sun, P., Fuoss, P., Sutton, et al
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- **Generation of highly mutually coherent hard-x-ray pulse pairs with an amplitude-splitting delay line** *PHYSICAL REVIEW RESEARCH*
  Li, H., Sun, Y., Vila-Comamala, J., Sato, T., Song, S., Sun, P., Seaberg, M. H., Wang, N., Hastings, J. B., Dunne, M., Fuoss, P., David, C., Sutton, et al
  2021; 3 (4)

- **Nonuniform Flow Dynamics Probed by Nanosecond X-Ray Speckle Visibility Spectroscopy.** *Physical review letters*
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- **Nonuniform Flow Dynamics Probed by Nanosecond X-Ray Speckle Visibility Spectroscopy** *PHYSICAL REVIEW LETTERS*
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  Teitelbaum, S. W., Henighan, T. C., Liu, H., Jiang, M. P., Zhu, D., Chollet, M., Sato, T., Murray, E. D., Fahy, S., O'Mahony, S., Bailey, T. P., Uher, C., Trigo, et al
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  Li, Q., Stoica, V. A., Pasciak, M., Zhu, Y., Yuan, Y., Yang, T., McCarter, M. R., Das, S., Yadav, A. K., Park, S., Dai, C., Lee, H. J., Ahn, et al
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- **Visualization of dynamic polaronic strain fields in hybrid lead halide perovskites.** *Nature materials*
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- **A self-referenced in-situ arrival time monitor for X-ray free-electron lasers.** *Scientific reports*
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- **Compact hard x-ray split-delay system based on variable-gap channel-cut crystals** *OPTICS LETTERS*
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- **A simple instrument to find spatiotemporal overlap of optical/X-ray light at free-electron lasers.** *Journal of synchrotron radiation*
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- **Pump-probe experimental methodology at the Linac Coherent Light Source** *JOURNAL OF SYNCHROTRON RADIATION*
  Glownia, J. M., Gumerlock, K., Lemke, H. T., Sato, T., Zhu, D., Chollet, M.
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- **A simple instrument to find spatiotemporal overlap of optical/X-ray light at free-electron lasers** *JOURNAL OF SYNCHROTRON RADIATION*
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- **Pump-probe experimental methodology at the Linac Coherent Light Source.** *Journal of synchrotron radiation*
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- **The Macromolecular Femtosecond Crystallography Instrument at the Linac Coherent Light Source** *JOURNAL OF SYNCHROTRON RADIATION*
  Sierra, R. G., Batyuk, A., Sun, Z., Aquila, A., Hunter, M. S., Lane, T. J., Liang, M., Yoon, C., Alonso-Mori, R., Armenta, R., Castagna, J., Hollenbeck, M., Osier, et al
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  Sierra, R. G., Batyuk, A. n., Sun, Z. n., Aquila, A. n., Hunter, M. S., Lane, T. J., Liang, M. n., Yoon, C. H., Alonso-Mori, R. n., Armenta, R. n., Castagna, J. C., Hollenbeck, M. n., Osier, et al
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