Stanford

Roberto Alonso-Mori

Lead Scientist, SLAC National Accelerator Laboratory

Bio

BIO

Roberto Alonso-Mori is a Lead Scientist and Head of the Biological Sciences (BIO) Department at the Linac Coherent Light Source (LCLS) at SLAC National Accelerator Laboratory. The BIO department supports a broad range of structural biology and biochemistry research by enabling high-impact user experiments and developing advanced capabilities for X-ray science at the frontiers of biological discovery. He also serves as the Lead for the Biochemistry and Condensed Phase Chemistry (B&CPC) Group. This group leads experiments focused on ultrafast photochemical dynamics in the condensed phase across multiple LCLS instruments using cutting-edge spectroscopy and scattering techniques. The department and group play key roles in driving scientific innovation through the LCLS Scientific Research and Development (SRD) Division, leading and contributing to the development of new experimental approaches, multimodal capabilities, and emerging applications in ultrafast bioscience and chemistry. He also serves as a Principal Investigator at the Stanford PULSE Institute, where he contributes to interdisciplinary programs advancing ultrafast science and enabling the study and control of dynamical processes in complex systems.

Dr. Roberto Alonso-Mori joined SLAC in 2009 after earning a Bachelor's degree in Physics from the University of Oviedo (Spain), a Master of Science in Physics from the University of Grenoble (France), and a Ph.D. in Earth Sciences from the University of Camerino (Italy). His graduate research was conducted at the European Synchrotron Radiation Facility (ESRF) in Grenoble, France. He began his SLAC career as a Research Associate supporting both SSRL and LCLS, and has since held various roles leading to his current positions in departmental and scientific leadership.

CURRENT ROLE AT STANFORD

Lead Scientist, Biological Sciences Department Head, and Group Lead of the Biochemistry and Condensed Phase Chemistry Group at LCLS (SLAC National Accelerator Laboratory)

LINKS

- Google Scholar Link To Publications: https://scholar.google.com/citations?hl=en&user=Ut8gtycAAAAJ&view_op=list_works&pagesize=100

Professional

PROFESSIONAL INTERESTS

I'm interested in the use of X-ray spectroscopy techniques for the study of the electronic structure in material science, chemical and biological systems. In particular on the development and application of time-resolved based techniques to a variety of projects in different areas of science including :

- the study of electronic and structural dynamics of geochemical systems at high P/T condition at the MEC instrument of LCLS

- the study of ultrafast photochemical dynamics in condensed phase chemical systems.Transition metal complexes have interesting applications in photocatalysis and solar energy conversion. Time-resolved X-ray methods present intriguing opportunities to investigate the photochemical mechanisms at play in such reactions. By combining Hard X-ray scattering measurements with sensitivity to the structural evolution of photoexcited transition metal complexes to X-ray absorption and emission spectroscopy we can gain complementary information about electronic structure changes during photochemical dynamics.

- the use of time resolved hard X-ray diffraction and spectroscopy at XFELs to study the electronic and geometric structure of biological systems like the catalytically sun induced photosynthetic system PSII, and other metalloproteins.

- the development of advanced X-ray emission and absorption spectroscopy instrumentation and optics at synchrotron radiation and X-ray free electron laser sources.

Publications

PUBLICATIONS

- **Shock compression of FeOOH and implications for iron-water interactions in super-earth magma oceans.** *Nature communications*
  Zhang, Y., Bali, K., Dorn, C., Ravasio, A., Yang, H., Pandolfi, S., Chen, A. J., Wei, X., Libon, L., Che, Q., Zheng, D., Boulard, E., Benuzzi-Mounaix, et al
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- **Determination of Thiol Protonation States by Sulfur X-ray Spectroscopy in Biological Systems** *JOURNAL OF PHYSICAL CHEMISTRY LETTERS*
  Ribson, R. D., Follmer, A. H., Babicz, J. T., Alfaro, V., Hadt, R. G., Hunter, M. S., Wilson, M. A., Sokaras, D., Alonso-Mori, R.
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- **Structural evolution of liquid silicates under conditions in Super-Earth interiors.** *Nature communications*
  Morard, G., Hernandez, J. A., Pege, C., Nagy, C., Libon, L., Lacquement, A., Sokaras, D., Lee, H. J., Galtier, E., Heimann, P., Cunningham, E., Glenzer, S. H., Vinci, 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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- **Ultrafast x-ray detection of low-spin iron in molten silicate under deep planetary interior conditions.** *Science advances*
  Shim, S. H., Ko, B., Sokaras, D., Nagler, B., Lee, H. J., Galtier, E., Glenzer, S., Granados, E., Vinci, T., Fiquet, G., Dolinschi, J., Tappan, J., Kulka, et al
  2023; 9 (42): eadi6153
- **Ferricyanide photo-aquation pathway revealed by combined femtosecond Kβ main line and valence-to-core x-ray emission spectroscopy.** *Nature communications*
  Reinhard, M., Gallo, A., Guo, M., Garcia-Esparza, A. T., Biasin, E., Qureshi, M., Britz, A., Ledbetter, K., Kunnus, K., Weninger, C., van Driel, T., Robinson, J., Glownia, et al
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- **Ultrafast structural response of shock-compressed plagioclase** *METEORITICS & PLANETARY SCIENCE*
  Gleason, A. E., Park, S., Rittman, D. R., Ravasio, A., Langenhorst, F., Bolis, R. M., Granados, E., Hok, S., Kroll, T., Sikorski, M., Weng, T., Lee, H., Nagler, et al
  2022
- **Excited state charge distribution and bond expansion of ferrous complexes observed with femtosecond valence-to-core x-ray emission spectroscopy.** *The Journal of chemical physics*

Ledbetter, K. n., Reinhard, M. E., Kunnus, K. n., Gallo, A. n., Britz, A. n., Biasin, E. n., Glownia, J. M., Nelson, S. n., Van Driel, T. B., Weninger, C. n., Zederkof, D. B., Haldrup, K. n., Cordones, et al

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- **Femtosecond electronic structure response to high intensity XFEL pulses probed by iron X-ray emission spectroscopy.** *Scientific reports*

  Alonso-Mori, R. n., Sokaras, D. n., Cammarata, M. n., Ding, Y. n., Feng, Y. n., Fritz, D. n., Gaffney, K. J., Hastings, J. n., Kao, C. C., Lemke, H. T., Maxwell, T. n., Robert, A. n., Schropp, et al

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  Alonso-Mori, R., Sokaras, D., Zhu, D., Kroll, T., Chollet, M., Feng, Y., Glownia, J. M., Kern, J., Lemke, H. T., Nordlund, D., Robert, A., Sikorski, M., Song, et al

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- **Energy-dispersive X-ray emission spectroscopy using an X-ray free-electron laser in a shot-by-shot mode** *PROCEEDINGS OF THE NATIONAL ACADEMY OF SCIENCES OF THE UNITED STATES OF AMERICA*

  Alonso-Mori, R., Kern, J., Gildea, R. J., Sokaras, D., Weng, T., Lassalle-Kaiser, B., Rosalie Tran, R., Hattne, J., Laksmono, H., Hellmich, J., Gloeckner, C., Echols, N., Sierra, et al

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- **Sulfur-Metal Orbital Hybridization in Sulfur-Bearing Compounds Studied by X-ray Emission Spectroscopy** *INORGANIC CHEMISTRY*

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  2009; 81 (15): 6516-6525

- **Ultrafast Population and Structural Dynamics of a Ni-Bipyridine Photoredox Catalyst Reveal a Significant Deactivation Pathway.** *The journal of physical chemistry letters*

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- **Reconciling the Different Apparent Decay Pathways for Iron(III) Tetraphenylporphyrin Chloride: Evidence for Excited State Branching.** *The journal of physical chemistry. A*

  Lamb, R. M., Smith, L. E., Natan, A., Burke, J. H., Alonso-Mori, R., Gee, L. B., Kramer, P. L., McClain, T. P., Ribson, R. D., Song, S., van Driel, T. B., Penner-Hahn, J. E., Vura-Weis, et al

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- **Attosecond inner-shell lasing at ångström wavelengths.** *Nature*

  Linker, T. M., Halavanau, A., Kroll, T., Benediktovitch, A., Zhang, Y., Michine, Y., Chuchurka, S., Abhari, Z., Ronchetti, D., Fransson, T., Weninger, C., Fuller, F. D., Aquila, et al

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- **Serial-femtosecond crystallography reveals how a phytochrome variant couples chromophore and protein structural changes** *SCIENCE ADVANCES*

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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*

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- **Ultrafast magnetostructural dynamics of MnAs** *PHYSICAL REVIEW B*
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- **Structural Evolution of Photoexcited Methylcobalamin toward a CarH-like Metastable State: Evidence from Time-Resolved X-ray Absorption and X-ray Emission** *JOURNAL OF PHYSICAL CHEMISTRY B*
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- **Time-Resolved X-ray Emission Spectroscopy and Synthetic High-Spin Model Complexes Resolve Ambiguities in Excited-State Assignments of Transition-Metal Chromophores: A Case Study of Fe-Amido Complexes.** *Journal of the American Chemical Society*
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- **Observation of a Picosecond Light-Induced Spin Transition in Polymeric Nanorods.** *ACS nano*
  Reinhard, M., Kunnus, K., Ledbetter, K., Biasin, E., Zederkof, D. B., Alonso-Mori, R., van Driel, T. B., Nelson, S., Kozina, M., Borkiewicz, O. J., Lorenc, M., Cammarata, M., Collet, et al
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- **Ultrafast X-ray Absorption Spectroscopy Reveals Excited-State Dynamics of B12Coenzymes Controlled by the Axial Base.** *The journal of physical chemistry. B*
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- **Structural evidence for intermediates during O₂ formation in photosystem II(Vol <bold>617</bold>, pg 629, 2023)** *NATURE*
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  2024: E12

- **Seeded stimulated x-ray emission at 5.9 keV (vol 10, pg 513, 2023)** *OPTICA*
  Doyle, M. D., Halavanau, A., Zhang, Y., Michine, Y., Everts, J., Fuller, F., Alonso-Mori, R., Yabashi, M., Inoue, I., Osaka, T., Yamada, J., Inubushi, Y., Hara, et al
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  Nguyen, R. C., Davis, I., Dasgupta, M., Wang, Y., Simon, P. S., Butryn, A., Makita, H., Bogacz, I., Dornevil, K., Aller, P., Bhowmick, A., Chatterjee, R., Kim, et al
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- **Solution phase high repetition rate laser pump x-ray probe picosecond hard x-ray spectroscopy at the Stanford Synchrotron Radiation Lightsource** *STRUCTURAL DYNAMICS-US*
  Reinhard, M., Skoien, D., Spies, J. A., Garcia-Esparza, A. T., Matson, B. D., Corbett, J., Tian, K., Safranek, J., Granados, E., Strader, M., Gaffney, K. J., Alonso-Mori, R., Kroll, et al
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- **Unraveling Metal-Ligand Bonding in an HNO-Evolving {FeNO}6 Complex with a Combined X-ray Spectroscopic Approach.** *Journal of the American Chemical Society*
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- **Watching Excited State Dynamics with Optical and X-ray Probes: The Excited State Dynamics of Aquocobalamin and Hydroxocobalamin** *JOURNAL OF THE AMERICAN CHEMICAL SOCIETY*
  Sension, R. J., McClain, T. P., Lamb, R. M., Alonso-Mori, R., Lima, F., Ardana-Lamas, F., Biednov, M., Chollet, M., Chung, T., Deb, A., Dewan Jr, P. A., Gee, L. B., En, et al
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- **Revealing core-valence interactions in solution with femtosecond X-ray pump X-ray probe spectroscopy.** *Nature communications*
  Weakly, R. B., Liekhus-Schmaltz, C. E., Poulter, B. I., Biasin, E., Alonso-Mori, R., Aquila, A., Boutet, S., Fuller, F. D., Ho, P. J., Kroll, T., Loe, C. M., Lutman, A., Zhu, et al
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- **Structural evidence for intermediates during O-2 formation in photosystem II** *NATURE*
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- **Seeded stimulated X-ray emission at 5.9 keV** *OPTICA*
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- **Room temperature X-ray absorption spectroscopy of metalloenzymes with drop-on-demand sample delivery at XFELs** *PURE AND APPLIED CHEMISTRY*
  Bogacz, I., Makita, H., Simon, P. S. S., Zhang, M., Doyle, M. D. D., Chatterjee, R., Fransson, T., Weninger, C., Fuller, F., Gee, L., Sato, T., Seaberg, M., Alonso-Mori, et al
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  Tobin, J. G., Nowak, S., Yu, S. W., Alonso Mori, R., Kroll, T., Nordlund, D., Weng, T., Sokaras, D.
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- **Local Structure of Sulfur Vacancies on the Basal Plane of Monolayer MoS2.** *ACS nano*
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  2021; 4 (84): 84

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- **Operando Study of Thermal Oxidation of Monolayer MoS2.** *Advanced science (Weinheim, Baden-Wurttemberg, Germany)*
  Park, S., Garcia-Esparza, A. T., Abroshan, H., Abraham, B., Vinson, J., Gallo, A., Nordlund, D., Park, J., Kim, T. R., Vallez, L., Alonso-Mori, R., Sokaras, D., Zheng, et al
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- **Revealing the bonding of solvated Ru complexes with valence-to-core resonant inelastic X-ray scattering** *CHEMICAL SCIENCE*
  Biasin, E., Nascimento, D. R., Poulter, B. I., Abraham, B., Kunnus, K., Garcia-Esparza, A. T., Nowak, S. H., Kroll, T., Schoenlein, R. W., Alonso-Mori, R., Khalil, M., Govind, N., Sokaras, et al
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- **Sulfur K beta X-ray emission spectroscopy: comparison with sulfur K-edge X-ray absorption spectroscopy for speciation of organosulfur compounds** *PHYSICAL CHEMISTRY CHEMICAL PHYSICS*
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  Reinhard, M. E., Mara, M. W., Kroll, T., Lim, H., Hadt, R. G., Alonso-Mori, R., Chollet, M., Glownia, J. M., Nelson, S., Sokaras, D., Kunnus, K., Driel, T. B., Hartsock, et al
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- **The Photoactive Excited State of the B12-Based Photoreceptor CarH.** *The journal of physical chemistry. B*

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2020

- **High-Resolution XFEL Structure of the Soluble Methane Monooxygenase Hydroxylase Complex with its Regulatory Component at Ambient Temperature in Two Oxidation States** *JOURNAL OF THE AMERICAN CHEMICAL SOCIETY*

  Srinivas, V., Banerjee, R., Lebrette, H., Jones, J. C., Aurelius, O., Kim, I., Pham, C. C., Gul, S., Sutherlin, K. D., Bhowmick, A., John, J., Bozkurt, E., Fransson, et al

  2020; 142 (33): 14249–66

- **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

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