Stanford

Alfred Zong

Assistant Professor of Physics and Applied Physics

CONTACT INFORMATION

- **Admin Contact**

  Denise Jones

  Email dejones@stanford.edu

Bio

BIO

I am an assistant professor in the Departments of Physics and of Applied Physics, and my group focuses on the study of light-induced non-equilibrium phenomena in quantum materials. To capture the ultrafast dynamics on the nanoscale, we develop a variety of techniques such as ultrafast electron diffraction and microscopy, attosecond transient absorption spectroscopy, and coherent diffraction imaging. These time-resolved probes are integrated with a complex sample environment such as in-situ strain and electrostatic gating in order to design, discover, and understand non-equilibrium phases of quantum materials.

We are seeking motivated undergraduates, graduate students, and postdocs to join the group. Please email me directly to discuss opportunities.

For more details, check out the group website at https://zonglab.stanford.edu/

ACADEMIC APPOINTMENTS

- Assistant Professor, Physics
- Assistant Professor, Applied Physics
- Principal Investigator, Stanford PULSE Institute

HONORS AND AWARDS

- Miller Research Fellowship, University of California, Berkeley (2020 – 2023)
- Quantum Creators Prize, Chicago Quantum Exchange (2021)
- Springer Thesis Award, Springer (2021)

PROFESSIONAL EDUCATION

- PhD, Massachusetts Institute of Technology , Physics (2020)
- MS, Stanford University , Computer Science (2015)
- BS, Stanford University , Physics (2015)

Teaching

COURSES

2025-26

- Solid State Physics: APPPHYS 272, PHYSICS 172 (Aut)

2024-25

- Condensed Matter Seminar: APPPHYS 470 (Aut, Win, Spr)
- Solid State Physics: APPPHYS 272, PHYSICS 172 (Aut)
- Ultrafast Quantum Physics: APPPHYS 283, PHOTON 283 (Win)

STANFORD ADVISEES

Doctoral Dissertation Reader (AC)

Aarushi Khandelwal, Winslow Weiss

Doctoral Dissertation Advisor (AC)

Henry Bell, Yu-Che Chien, Noah Edmiston, Patrick Liu

Doctoral (Program)

Simon Blanch, Mason Burden, Karen Lei, Emma Rabinowitz, Aditya Srinivasan, Hari Stoyanov, Ashley Thorshov

Publications

PUBLICATIONS

- **Photoinduced correlations in stochastic dynamics of a solid-state ionic conductor.** *Nature communications*
  McClellan, J., Zong, A., Pham, K. H., Liu, H., Iton, Z. W., Guzelturk, B., Walko, D. A., Wen, H., Cushing, S. K., Zuerch, M. W.
  2026
- **Atomically Resolved Acoustic Dynamics Coupled with Magnetic Order in a Van der Waals Antiferromagnet.** *Advanced materials (Deerfield Beach, Fla.)*
  Zhou, F., Hwangbo, K., Ha, S. S., Zhang, X. W., Chun, S. H., Park, J., Eom, I., Jiang, Q., Yang, Z., Zajac, M., Kim, S., Choi, S., Chu, et al
  2026: e22280
- **Bidirectional Ultrafast Control of Charge Density Waves via Phase Competition** *PHYSICAL REVIEW LETTERS*
  Ning, H., Oh, K., Su, Y., Shi, Z., Wu, D., Liu, Q., Lv, B. Q., Zong, A., Kang, G., Choi, H., Kim, H. J., Ha, S., Kim, et al
  2025; 135 (24)
- **Bidirectional Ultrafast Control of Charge Density Waves via Phase Competition.** *Physical review letters*
  Ning, H., Oh, K. H., Su, Y., Shi, Z. D., Wu, D., Liu, Q., Lv, B. Q., Zong, A., Kang, G., Choi, H., Kim, H. J., Ha, S., Kim, et al
  2025; 135 (24): 246504
- **Large moiré superstructure of stacked incommensurate charge density waves.** *Nature materials*
  Lv, B. Q., Su, Y., Zong, A., Liu, Q., Wu, D., Yuan, N. F., Nie, Z., Li, J., Sarker, S., Meng, S., Ruff, J. P., Wang, N. L., Gedik, et al
  2025
- **Structural Contribution to Light-Induced Gap Suppression in Ta2NiSe5** *PHYSICAL REVIEW LETTERS*
  Chen, Z., Xu, C., Xie, C., Tang, W., Liu, Q., Wu, D., Xu, Q., Jiang, T., Zhu, P., Zou, X., Li, J., Wang, Z., Wang, et al
  2025; 135 (9)
- **Observation of Orbital-Selective Dual Modulations in an Anisotropic Antiferromagnetic Kagome Metal TbTi3Bi4** *PHYSICAL REVIEW X*
  Zhang, R., Yu, B., Tan, H., Cheng, Y., Shen, F., Yang, J., Mu, D., Han, X., Zong, A., Hu, Q., Chen, X., Hu, Y., Meng, et al
  2025; 15 (3)

- **Time-domain study of coupled collective excitations in quantum materials** *NPJ QUANTUM MATERIALS*
  Xu, C., Zong, A.
  2025; 10 (1)
- **Correlated spin-wave generation and domain-wall oscillation in a topologically textured magnetic film.** *Nature materials*
  Liu, C., Ai, F., Reisbick, S., Zong, A., Pofelski, A., Han, M. G., Camino, F., Jing, C., Lomakin, V., Zhu, Y.
  2025
- **Room-temperature non-volatile optical manipulation of polar order in a charge density wave** *NATURE COMMUNICATIONS*
  Liu, Q., Wu, D., Wu, T., Han, S., Peng, Y., Yuan, Z., Cheng, Y., Li, B., Hu, T., Yue, L., Xu, S., Ding, R., Lu, et al
  2024; 15 (1): 8937
- **UV-Induced Reaction Pathways in Bromoform Probed with Ultrafast Electron Diffraction.** *Journal of the American Chemical Society*
  Hoffmann, L., Toulson, B. W., Yang, J., Saladrigas, C. A., Zong, A., Muvva, S. B., Figueira Nunes, J. P., Reid, A. H., Attar, A. R., Luo, D., Ji, F., Lin, M. F., Fan, et al
  2024
- **Coexistence of Interacting Charge Density Waves in a Layered Semiconductor.** *Physical review letters*
  Lv, B. Q., Zong, A., Wu, D., Nie, Z., Su, Y., Choi, D., Ilyas, B., Fichera, B. T., Li, J., Baldini, E., Mogi, M., Huang, Y. B., Po, et al
  2024; 132 (20): 206401
- **A solid-state high harmonic generation spectrometer with cryogenic cooling.** *The Review of scientific instruments*
  Kohrell, F., Nebgen, B. R., Spies, J. A., Hollinger, R., Zong, A., Uzundal, C., Spielmann, C., Zuerch, M.
  2024; 95 (2)
- **Ultrafast formation of topological defects in a two-dimensional charge density wave** *NATURE PHYSICS*
  Cheng, Y., Zong, A., Wu, L., Meng, Q., Xia, W., Qi, F., Zhu, P., Zou, X., Jiang, T., Guo, Y., van Wezel, J., Kogar, A., Zuerch, et al
  2024; 20 (1)
- **Delamination-Assisted Ultrafast Wrinkle Formation in a Freestanding Film.** *Nano letters*
  Su, Y., Zong, A., Kogar, A., Lu, D., Hong, S. S., Freelon, B., Rohwer, T., Wang, B. Y., Hwang, H. Y., Gedik, N.
  2023
- **Intrinsic 1[Formula: see text] phase induced in atomically thin 2H-MoTe2 by a single terahertz pulse.** *Nature communications*
  Shi, J., Bie, Y. Q., Zong, A., Fang, S., Chen, W., Han, J., Cao, Z., Zhang, Y., Taniguchi, T., Watanabe, K., Fu, X., Bulović, V., Kaxiras, et al
  2023; 14 (1): 5905
- **Spin-mediated shear oscillators in a van der Waals antiferromagnet.** *Nature*
  Zong, A., Zhang, Q., Zhou, F., Su, Y., Hwangbo, K., Shen, X., Jiang, Q., Liu, H., Gage, T. E., Walko, D. A., Kozina, M. E., Luo, D., Reid, et al
  2023
- **Probing lithium mobility at a solid electrolyte surface.** *Nature materials*
  Woodahl, C., Jamnuch, S., Amado, A., Uzundal, C. B., Berger, E., Manset, P., Zhu, Y., Li, Y., Fong, D. D., Connell, J. G., Hirata, Y., Kubota, Y., Owada, et al
  2023; 22 (7): 848-852
- **Evidence for Bootstrap Percolation Dynamics in a Photoinduced Phase Transition.** *Physical review letters*
  Carbin, T., Zhang, X., Culver, A. B., Zhao, H., Zong, A., Acharya, R., Abbamonte, C. J., Roy, R., Cao, G., Kogar, A.
  2023; 130 (18): 186902
- **The spontaneous symmetry breaking in Ta2NiSe5 is structural in nature.** *Proceedings of the National Academy of Sciences of the United States of America*
  Baldini, E., Zong, A., Choi, D., Lee, C., Michael, M. H., Windgaetter, L., Mazin, I. I., Latini, S., Azoury, D., Lv, B., Kogar, A., Su, Y., Wang, et al
  2023; 120 (17): e2221688120
- **Emerging ultrafast techniques for studying quantum materials** *NATURE REVIEWS MATERIALS*
  Zong, A., Nebgen, B. R. R., Lin, S., Spies, J. A. A., Zuerch, M.
  2023; 8 (4): 224-240
- **Dynamical criticality of spin-shear coupling in van der Waals antiferromagnets** *NATURE COMMUNICATIONS*

Zhou, F., Hwangbo, K., Zhang, Q., Wang, C., Shen, L., Zhang, J., Jiang, Q., Zong, A., Su, Y., Zajac, M., Ahn, Y., Walko, D. A., Schaller, et al
2022; 13 (1): 6598

- **Periodic dynamics in superconductors induced by an impulsive optical quench** *COMMUNICATIONS PHYSICS*
  Dolgirev, P. E., Zong, A., Michael, M. H., Curtis, J. B., Podolsky, D., Cavalleri, A., Demler, E.
  2022; 5 (1)
- **Light-induced dimension crossover dictated by excitonic correlations.** *Nature communications*
  Cheng, Y., Zong, A., Li, J., Xia, W., Duan, S., Zhao, W., Li, Y., Qi, F., Wu, J., Zhao, L., Zhu, P., Zou, X., Jiang, et al
  2022; 13 (1): 963
- **Unconventional Hysteretic Transition in a Charge Density Wave.** *Physical review letters*
  Lv, B. Q., Zong, A., Wu, D., Rozhkov, A. V., Fine, B. V., Chen, S. D., Hashimoto, M., Lu, D. H., Li, M., Huang, Y. B., Ruff, J. P., Walko, D. A., Chen, et al
  2022; 128 (3): 036401
- **Polarization-Resolved Extreme-Ultraviolet Second-Harmonic Generation from LiNbO_{3}.** *Physical review letters*
  Uzundal, C. B., Jamnuch, S., Berger, E., Woodahl, C., Manset, P., Hirata, Y., Sumi, T., Amado, A., Akai, H., Kubota, Y., Owada, S., Tono, K., Yabashi, et al
  2021; 127 (23): 237402
- **Role of Equilibrium Fluctuations in Light-Induced Order** *PHYSICAL REVIEW LETTERS*
  Zong, A., Dolgirev, P. E., Kogar, A., Su, Y., Shen, X., Straquadine, J. A. W., Wang, X., Luo, D., Kozina, M. E., Reid, A. H., Li, R., Yang, J., Weathersby, et al
  2021; 127 (22)
- **Role of Equilibrium Fluctuations in Light-Induced Order.** *Physical review letters*
  Zong, A., Dolgirev, P. E., Kogar, A., Su, Y., Shen, X., Straquadine, J. A., Wang, X., Luo, D., Kozina, M. E., Reid, A. H., Li, R., Yang, J., Weathersby, et al
  2021; 127 (22): 227401
- **A versatile sample fabrication method for ultrafast electron diffraction.** *Ultramicroscopy*
  Bie, Y. Q., Zong, A., Wang, X., Jarillo-Herrero, P., Gedik, N.
  2021; 230: 113389
- **Unconventional light-induced states visualized by ultrafast electron diffraction and microscopy** *MRS BULLETIN*
  Zong, A., Kogar, A., Gedik, N.
  2021; 46 (8): 720-730
- **Second harmonic generation as a probe of broken mirror symmetry** *PHYSICAL REVIEW B*
  Fichera, B. T., Kogar, A., Ye, L., Gokce, B., Zong, A., Checkelsky, J. G., Gedik, N.
  2020; 101 (24)
- **Self-similar dynamics of order parameter fluctuations in pump-probe experiments** *PHYSICAL REVIEW B*
  Dolgirev, P. E., Michael, M. H., Zong, A., Gedik, N., Demler, E.
  2020; 101 (17)
- **High resolution time- and angle-resolved photoemission spectroscopy with 11 eV laser pulses** *REVIEW OF SCIENTIFIC INSTRUMENTS*
  Lee, C., Rohwer, T., Sie, E. J., Zong, A., Baldini, E., Straquadine, J., Walmsley, P., Gardner, D., Lee, Y. S., Fisher, I. R., Gedik, N.
  2020; 91 (4)
- **High resolution time- and angle-resolved photoemission spectroscopy with 11 eV laser pulses.** *The Review of scientific instruments*
  Lee, C., Rohwer, T., Sie, E. J., Zong, A., Baldini, E., Straquadine, J., Walmsley, P., Gardner, D., Lee, Y. S., Fisher, I. R., Gedik, N.
  2020; 91 (4): 043102
- **Amplitude dynamics of the charge density wave in LaTe₃: Theoretical description of pump-probe experiments** *PHYSICAL REVIEW B*
  Dolgirev, P. E., Rozhkov, A., Zong, A., Kogar, A., Gedik, N., Fine, B.
  2020; 101 (5)
- **Light-induced charge density wave in LaTe3** *NATURE PHYSICS*

Kogar, A., Zong, A., Dolgirev, P. E., Shen, X., Straquadine, J., Bie, Y., Wang, X., Rohwer, T., Tung, I., Yang, Y., Li, R., Yang, J., Weathersby, et al
2020; 16 (2): 159-+

- **Spontaneous gyrotropic electronic order in a transition-metal dichalcogenide.** *Nature*
  Xu, S. Y., Ma, Q., Gao, Y., Kogar, A., Zong, A., Mier Valdivia, A. M., Dinh, T. H., Huang, S. M., Singh, B., Hsu, C. H., Chang, T. R., Ruff, J. P., Watanabe, et al
  2020; 578 (7796): 545-549

- **Dynamical Slowing-Down in an Ultrafast Photoinduced Phase Transition.** *Physical review letters*
  Zong, A., Dolgirev, P. E., Kogar, A., Ergeçen, E., Yilmaz, M. B., Bie, Y. Q., Rohwer, T., Tung, I. C., Straquadine, J., Wang, X., Yang, Y., Shen, X., Li, et al
  2019; 123 (9): 097601

- **Dynamical Slowing-Down in an Ultrafast Photoinduced Phase Transition** *PHYSICAL REVIEW LETTERS*
  Zong, A., Dolgirev, P. E., Kogar, A., Ergecen, E., Yilmaz, M. B., Bie, Y., Rohwer, T., Tung, I., Straquadine, J., Wang, X., Yang, Y., Shen, X., Li, et al
  2019; 123 (9)

- **Observation of multiple types of topological fermions in PdBiSe** *PHYSICAL REVIEW B*
  Lv, B. Q., Feng, Z., Zhao, J., Yuan, N. F. Q., Zong, A., Luo, K. E., Yu, R., Huang, Y., Strocov, V. N., Chikina, A., Soluyanov, A. A., Gedik, N., Shi, et al
  2019; 99 (24)

- **Evidence for topological defects in a photoinduced phase transition** *NATURE PHYSICS*
  Zong, A., Kogar, A., Bie, Y., Rohwer, T., Lee, C., Baldini, E., Ergecen, E., Yilmaz, M. B., Freelon, B., Sie, E. J., Zhou, H., Straquadine, J., Walmsley, et al
  2019; 15 (1): 27-+

- **Combining time-resolved optical (TOS), electronic (trARPES) and structural (UED) probes on the class of rare earth tritellurides RTe3**
  Rohwero, T., Zong, A., Kogar, A., Bie, Y., Lee, C., Baldini, E., Ergecen, E., Yilmaz, M. B., Freelon, B., Sie, E. J., Zhou, H., Straquadine, J., Walmsley, et al
  edited by Cerullo, G., Ogilvie, J., Kartner, F., Khalil, M., Li, R.
  E D P SCIENCES.2019

- **Ultrafast manipulation of mirror domain walls in a charge density wave** *SCIENCE ADVANCES*
  Zong, A., Shen, X., Kogar, A., Ye, L., Marks, C., Chowdhury, D., Rohwer, T., Freelon, B., Weathersby, S., Li, R., Yang, J., Checkelsky, J., Wang, et al
  2018; 4 (10): eaau5501