

# Curriculum Vitae

## Alex Frañó

### Education

**2014:** Technical University of Berlin/Max Planck Institute (Berlin, Germany): Ph.D. in Physics (*summa cum laude*)

**2010:** University of Stuttgart (Stuttgart, Germany): M.Sc. in Physics (*summa cum laude*)

**2005:** National University of Honduras (Tegucigalpa, Honduras): B.S. in Physics

### Work Experience

**July 2023 – Present: Associate Professor.** University of California (UC) San Diego; La Jolla, CA.

**July 2017 – June 2023: Assistant Professor.** UC San Diego; La Jolla, CA.

**July 2017 – September 2017: Visiting Professor.** UC Berkeley; Berkeley, CA.

**July 2016 – June 2017: UC Presidential Postdoctoral Fellow.** UC Berkeley; Berkeley, CA

**July 2014 – June 2016: Postdoctoral Researcher.** Materials Science Division/Advanced Light Source (ALS), Lawrence Berkeley National Lab; Berkeley, CA.

**February 2014 – June 2014: Postdoctoral Researcher.** Max Planck Institute for Solid State Research (MPISSR); Stuttgart, Germany.

**October 2010 – January 2014: Graduate Researcher.** MPISSR / Helmholtz Center Berlin; Berlin, Germany.

### Synergistic Activities

**August 2018 – present:** Assistant Director of the “[Quantum Materials for Energy Efficient Neuromorphic Computing](#)” DOE Energy Frontiers Research Center, UC San Diego.

**2019:** Chair of the American Physical Society—Far West Section Executive Committee.

**2020:** Chair of the [User Executive Committee](#) of the Advanced Light Source (ALS), Lawrence Berkeley National Lab (LBNL).

**2020:** Member of the Scientific Advisory Committee (SAC) of the ALS, LBNL.

### Awards/Fellowships

**2023:** Fellow of Scialog: Molecular Basis of Cognition (MBC)

**2022:** CIFAR Global Azrieli [Scholar](#)

**2022:** NSF CAREER Award

**2022:** American Physical Society’s Forum for Early Career Scientists (FECS) “Diversity & Inclusion Award”

**2022:** UCSD Division of Physical Science “Equity, Diversity, and Inclusion Excellence Award”

**2021:** Cottrell Scholar [Award](#)

**2020:** [Sloan Research](#) Fellow

**2016:** University of California Presidential Postdoctoral Fellow (Berkeley, CA)

**2014:** Ernst-Eckhard-Koch Prize (Helmholtz Center Berlin; Berlin, Germany)

**2014:** Outstanding PhD Research Prize (Springer Publishing House; Germany)

## Publications

- 1) Ivan A. Zaluzhnyy, Uday Goteti, Boyan K. Stoychev, Rourav Basak, Erik S. Lamb, Elliot Kisiel, Tao Zhou, Zhonghou Cai, Martin V. Holt, Jeffrey W. Beeman, Ethan Y. Cho, Shane Cybart, Oleg G. Shpyrko, Robert Dynes, and Alex Frano. [Structural Changes in  \$\text{YBa}\_2\text{Cu}\_3\text{O}\_7\$  Thin Films Modified with  \$\text{He}^+\$ -Focused Ion Beam for High-Temperature Superconductive Nanoelectronics](#). ACS Appl. Nano Mater.. 7, 15943 (2024).
- 2) Elliot Kisiel, Ishwor Poudyal, Peter Kenesei, Mark Engbretson, Arndt Last, Rourav Basak, Ivan Zaluzhnyy, Uday Goteti, Robert Dynes, Antonino Miceli, Alex Frano, and Zahir Islam. [Direct detection system for full-field nanoscale X-ray diffraction-contrast imaging](#). Optics Express 32, 27682-27689 (2024).
- 3) Yufei Wang, Yilong Zhou, Quanpeng Yang, Rourav Basak, Yu Xie, Dong Le, Alexander D. Fuqua, Wade Shipley, Zachary Yam, Alex Frano, Gaurav Arya, and Andrea R. Tao, [Self-Assembly of Nanocrystal Checkerboards via Non-Specific Interactions](#), Nature Communications 15, 3913 (2024).
- 4) K. Scott, E. Kisiel, F. Yakhou, S. Agrestini, M. Garcia-Fernandez, K. Kummer, J. Choi, R. D. Zhong, J. A. Schneeloch, G. D. Gu, Ke-Jin Zhou, N. B. Brookes, A. F. Kemper, M. Minola, F. Boschini, A. Frano, A. Gozar, and E. H. da Silva Neto, [Detection of a two-phonon mode in a cuprate superconductor via polarimetric resonant inelastic x-ray scattering](#), Phys. Rev. B 109, 125126 (2024).
- 5) Henry Navarro, Sarmistha Das, Felipe Torres, Rourav Basak, Erbin Qiu, Nicolas M. Vargas, Pavel N. Lapa, Ivan K. Schuller, and Alex Frano, [Disentangling transport mechanisms in a correlated oxide by photoinduced charge injection](#), Phys. Rev. Materials 7, L123201 (2023).
- 6) Shan Wu, Rourav Basak, Wenxin Li, Jong-Woo Kim, Philip J. Ryan, Donghui Lu, Makoto Hashimoto, Christie Nelson, Raul Acevedo-Esteves, Shannon C. Haley, James G. Analytis, Yu He, Alex Frano, and Robert J. Birgeneau, [Discovery of Charge Order in the Transition Metal Dichalcogenide  \$\text{Fe}\_x\text{NbS}\_2\$](#) , Phys. Rev. Lett. 131, 186701 (2023).
- 7) Ravindra Singh Bisht, Jaeseoung Park, Haoming Yu, Chen Wu, Nikhil Tilak, Sylvie Rangan, Tae J. Park, Yifan Yuan, Sarmistha Das, Uday Goteti, Hee Taek Yi, Hussein Hijazi, Abdullah Al-Mahboob, Jerzy T. Sadowski, Hua Zhou, Seongshik Oh, Eva Y. Andrei, Monica T. Allen, Duygu Kuzum, Alex Frano, Robert C. Dynes, and Shriram Ramanathan, [Spatial Interactions in Hydrogenated Perovskite Nickelate Synaptic Networks](#), Nano Letters (2023).
- 8) Biswajit Sahoo, Alex Frano, Eric Fullerton, [Efficient charge to spin conversion in iridium oxide thin films](#), Applied Physics Letters 123, 032404 (2023).
- 9) Kirsty Scott, Elliot Kisiel, Timothy J. Boyle, Rourav Basak, Gaëtan Jargot, Sarmistha Das, Stefano Agrestini, Mirian Garcia-Fernandez, Jaewon Choi, Jonathan Pellicciari, Jiemin Li, Yi-De Chuang, Ruidan Zhong, John A. Schneeloch, Genda Gu, François Légaré, Alexander F. Kemper, Ke-Jin Zhou, Valentina Bisogni, Santiago Blanco-Canosa, Alex Frano, Fabio Boschini, Eduardo H. da Silva Neto, [Low-energy quasi-circular electron correlations with charge order wavelength in  \$\text{Bi}\_2\text{Sr}\_2\text{CaCu}\_2\text{O}\_{8+\delta}\$](#) , Science Advances, 9, eadg371 (2023).
- 10) Veronika Sunko, Y. Sun, M. Vranas, C. C. Homes, C. Lee, E. Donoway, Z.-C. Wang, S. Balguri, M. B. Mahendru, A. Ruiz, B. Gunn, R. Basak, S. Blanco-Canosa, E. Schierle, E. Weschke, F. Tafti, **A. Frano**, and J. Orenstein, [Spin-carrier coupling induced ferromagnetism and giant resistivity peak in  \$\text{EuCd}\_2\text{P}\_2\$](#) , Phys. Rev. B 107, 144404 (2023).
- 11) A. Ruiz, B. Gunn, Y. Lu, K. Sasmal, C. M. Moir, R. Basak, H. H., J.-S. Lee, F. Rodolakis, T. J. Boyle, M. Walker, Y. He, S. Blanco-Canosa, E. H. da Silva Neto, M.

- Brian Maple, **A. Frano**, [\*Stabilization of three-dimensional charge order through interplanar orbital hybridization in  \$Pr\_xY\_{1-x}Ba\_2Cu\_3O\_{6+\delta}\$\*](#) , Nature Communications 13, 6197 (2022).
- 12) X. Chen, E. Schierle, Y. He, M. Vranas, J. W. Freeland, J. L. McChesney, R. Ramesh, R. J. Birgeneau, and **A. Frano**, [\*Antiferromagnetic order in Co-doped  \$Fe\_5GeTe\_2\$  probed by resonant magnetic x-ray scattering\*](#), Phys. Rev. Materials 6, 094404 (2022).
  - 13) M. Bluschke, R. Basak, A. Barbour, A. N Warner, K. Fürsich, S. Wilkins, S. Roy, J. Lee, G. Christiani, G. Logvenov, M. Minola, B. Keimer, C. Mazzoli, E. Benckiser, Alex Frano, [\*Imaging mesoscopic antiferromagnetic spin textures in the dilute limit from single-geometry resonant coherent x-ray diffraction\*](#), Science Advances, 8, eabn6882 (2022).
  - 14) I. K. Schuller, A. Frano, R.C. Dynes, A. Hoffmann, B. Noheda, C. Schuman, A. Sebastian, J. Shen, [\*Neuromorphic computing: Challenges from quantum materials to emergent connectivity\*](#), Applied Physics Letters 120, 140401 (2022).
  - 15) A. Hoffmann, S. Ramanathan, J. Grollier, A. D. Kent, M. J. Rozenberg, I. K. Schuller, O. G. Shpyrko, R. C. Dynes, Y. Fainman, A. Frano, E. E Fullerton, G. Galli, V. Lomakin, S. P. Ong, A. K. Petford-Long, J. A. Schuller, M. D Stiles, Y. Takamura, Y. Zhu, [\*Quantum materials for energy-efficient neuromorphic computing: Opportunities and challenges\*](#), APL Materials 10, 070904 (2022).
  - 16) S. Zhang, I-T. Chiu, M.-H. Lee, B. Gunn, M. Feng, T. J. Park, P. Shafer, A. T. N'Diaye, F. Rodolakis, S. Ramanathan, A. Frañó, I. K. Schuller, Y. Takamura, and G. Galli, [\*Determining the Oxygen Stoichiometry of Cobaltite Thin Films\*](#), Chemistry of Materials 34, 2076-2084 (2022).
  - 17) M. Vagadia, S. Sardar, T. Tank, S. Das, B. Gunn, P. Pandey, R. Hübner, F. Rodolakis, G. Fabbris, Y. Choi, D. Haskel, A. Frano, and D. S. Rana, [\*Extraordinary anisotropic magnetoresistance in  \$CaMnO\_3/CaIrO\_3\$  heterostructures\*](#), Phys. Rev. B 105, L020402 (2022).
  - 18) I. A. Zaluzhnyy, P. O. Sprau, R. Tran, Q. Wang, H.-T. Zhang, Z. Zhang, T. J. Park, N. Hua, B. Stoychev, M. J. Cherukara, M. V. Holt, E. Nazaretski, X. Huang, H. Yan, A. Pattammattel, Y. S. Chu, S. P. Ong, S. Ramanathan, O. G. Shpyrko, A. Frano, [\*Proton distribution visualization in perovskite nickelate devices utilizing nanofocused x rays\*](#), Phys. Rev. Materials 5, 095003 (2021).
  - 19) U. S. Goteti, I. A. Zaluzhnyy, S. Ramanathan, R. C. Dynes, and A. Frano, [\*Low-temperature emergent neuromorphic networks with correlated oxide devices\*](#), Proceedings of the National Academy of Sciences 118, e2103934118 (2021).
  - 20) X. Chen, Y. He, S. Wu, Y. Song, D. Yuan, E. Bourret-Courchesne, J. P. C. Ruff, Z. Islam, A. Frano, and R. J. Birgeneau, [\*Structural and magnetic transitions in the planar antiferromagnet  \$Ba\_4Ir\_3O\_{10}\$\*](#) , Phys. Rev. B 103, 224420 (2021).
  - 21) A. Ruiz, N. P. Breznay, M. Li, I. Rousochatzakis, A. Allen, I. Zinda, V. Nagarajan, G. Lopez, Z. Islam, M. H. Upton, J. Kim, A. H. Said, X.-R. Huang, T. Gog, D. Casa, R. J. Birgeneau, J. D. Koralek, J. G. Analytis, N. B. Perkins, and A. Frano, [\*Magnon-spinon dichotomy in the Kitaev hyperhoneycomb  \$\beta\$ - \$Li\_2IrO\_3\$\*](#) , Phys. Rev. B 103, 184404 (2021)
  - 22) T. J. Boyle, M. Walker, A. Ruiz, E. Schierle, Z. Zhao, F. Boschini, R. Sutarto, T. D. Boyko, W. Moore, N. Tamura, F. He, E. Weschke, A. Gozar, W. Peng, A. C. Komarek, A. Damascelli, C. Schüßler-Langeheine, A. Frano, E. H. da Silva Neto, and S. Blanco-Canosa, [\*Large response of charge stripes to uniaxial stress in  \$La\_{1.475}Nd\_{0.4}Sr\_{0.125}CuO\_4\$\*](#) , Phys. Rev. Research 3, L022004 (2021).
  - 23) H. Navarro, J. del Valle, Y. Kalcheim, N. M. Vargas, C. Adda, M.-H. Lee, P. Lapa, A. Rivera-Calzada, I. A. Zaluzhnyy, E. Qiu, O. Shpyrko, M. Rozenberg, A. Frano, and Ivan

- K. Schuller, [A hybrid optoelectronic Mott insulator](#), Appl. Phys. Lett. 118, 141901 (2021).
- 24) S. Wu, Y. Song, Y. He, A. Frano, M. Yi, X. Chen, H. Uchiyama, A. Alatas, A. H. Said, L. Wang, T. Wolf, C. Meingast, and R. J. Birgeneau, [Short-Range Nematic Fluctuations in  \$Sr\_{1-x}Na\_xFe\_2As\_2\$  Superconductors](#), Phys. Rev. Lett. 126, 107001 (2021).
- 25) F. Boschini, M. Minola, R. Sutarto, E. Schierle, M. Bluschke, S. Das, Y. Yang, M. Michiardi, Y. C. Shao, X. Feng, S. Ono, R. D. Zhong, J. A. Schneeloch, G. D. Gu, E. Weschke, F. He, Y. D. Chuang, B. Keimer, A. Damascelli, A. Frano, and E. H. da Silva Neto, [Dynamic electron correlations with charge order wavelength along all directions in the copper oxide plane](#), Nature Communications 12, 597 (2021).
- 26) H.-T. Zhang, T. J. Park, I. A. Zaluzhnyy, Q. Wang, S. Nagnath Wadekar, S. Manna, R. Andrawis, P. O. Sprau, Y. Sun, Z. Zhang, C. Huang, H. Zhou, Z. Zhang, B. Narayanan, G. Srinivasan, N. Hua, E. Nazaretski, X. Huang, H. Yan, M. Ge, Y. S. Chu, M. J. Cherukara, M. V. Holt, M. Krishnamurthy, O. Shpyrko, S.K.R.S. Sankaranarayanan, A. Frano, K. Roy, S. Ramanathan, [Perovskite Neural Trees](#), Nature Communications 11, 2245 (2020).
- 27) A. Frano, S. Blanco-Canosa, B. Keimer, and R. J. Birgeneau, [Charge ordering in superconducting copper oxides](#), J. Phys.: Condens. Matter 32, 374005 (2020).
- 28) Y.-D. Chuang, X. Feng, A. Cruz, K. Hanzel, A. Brown, A. Spucches, A. Frano, W.-S. Lee, J. Kim, Y.-J. Chen, B. Smith, J. S. Pepper, Y.-C. Shao, S.-W. Huang, L. A. Wray, E. Gullikson, Z.-X. Shen, T. P. Devereaux, A. Tremisn, W. Yang, J. Guo, R. Duarte, and Z. Hussain, [Momentum-resolved resonant inelastic soft X-ray scattering \(qRIXS\) endstation at the ALS](#), Journal of Electron Spectroscopy and Related Phenomena (2020).
- 29) A. Ruiz, V. Nagarajan, M. Vranas, G. Lopez, G. T. McCandless, I. Kimchi, J. Y. Chan, N. P. Breznay, A. Frano, B. A. Frandsen, and J. G. Analytis, [High-temperature magnetic anomaly in the Kitaev hyperhoneycomb compound  \$\beta\$ - \$Li\_2IrO\_3\$](#) , Phys. Rev. B 101, 075112 (2020).
- 30) N. P. Breznay, I. M. Hayes, N. L. Nair, T. Helm, J. G. Analytis, R. D. McDonald, Z. Zhu, Y. Krockenberger, H. Irie, H. Yamamoto, K. A. Modic, A. Frano, P. Shafer, and E. Arenholz, [Interplay of structure and charge order revealed by quantum oscillations in thin films of  \$Pr\_2CuO\_{4\pm\delta}\$](#) , Phys. Rev. B 100, 235111 (2019).
- 31) A. Frano, M. Bluschke, Z. Xu, B. Frandsen, Y. Lu, M. Yi, R. Marks, A. Mehta, V. Borzenets, D. Meyers, F. Baiutti, G. Kim, G. Christiani, G. Logvenov, E. Benckiser, B. Keimer, and R. J. Birgeneau, [Control of dopant crystallinity in electrochemically treated cuprate thin films](#), Phys. Rev. Materials 3, 063803 (2019).
- 32) M. Kang, J. Pellicciari, A. Frano, N. Breznay, E. Schierle, E. Weschke, R. Sutarto, F. He, P. Shafer, E. Arenholz, M. Chen, K. Zhang, A. Ruiz, Z. Hao, S. Lewin, J. Analytis, Y. Krockenberger, H. Yamamoto, T. Das, and R. Comin, [Evolution of charge order topology across a magnetic phase transition in cuprate superconductors](#), Nature Physics 15, 721 (2019).
- 33) M. Yi, A. Frano, D. H. Lu, Y. He, Meng Wang, B. A. Frandsen, A. F. Kemper, R. Yu, Q. Si, L. Wang, M. He, F. Hardy, P. Schweiss, P. Adelman, T. Wolf, M. Hashimoto, S.-K. Mo, Z. Hussain, M. Le Tacon, A. E. Böhmer, D.-H. Lee, Z.-X. Shen, C. Meingast, and R. J. Birgeneau, [Spectral Evidence for Emergent Order in  \$Ba\_{1-x}Na\_xFe\_2As\_2\$](#) , Phys. Rev. Lett. 121, 127001 (2018).
- 34) M. Bluschke, A. Frano, E. Schierle, D. Putzky, F. Ghorbani, R. Ortiz, H. Suzuki, G. Christiani, G. Logvenov, E. Weschke, R. J. Birgeneau, E. H. da Silva Neto, M. Minola, S. Blanco-Canosa, and B. Keimer, [Stabilization of three-dimensional charge](#)

- [order in  \$YBa\_2Cu\_3O\_{6+x}\$  via epitaxial growth](#), Nature Communications 9, 2978 (2018).
- 35) M. Hepting, R. J. Green, Z. Zhong, M. Bluschke, Y. E. Suyolcu, S. Macke, A. Frano, S. Catalano, M. Gibert, R. Sutarto, F. He, G. Cristiani, G. Logvenov, Y. Wang, P. A. van Aken, P. Hansmann, M. Le Tacon, J.-M. Triscone, G. A. Sawatzky, B. Keimer and E. Benckiser. [Complex magnetic order in nickelate slabs](#), Nature Physics online <https://doi.org/10.1038/s41567-018-0218-5> (2018).
- 36) Y. He, S. Wu, Y. Song, W.-S. Lee, A. H. Said, A. Alatas, A. Bosak, A. Girard, S. M. Souliou, A. Ruiz, M. Hepting, M. Bluschke, E. Schierle, E. Weschke, J.-S. Lee, H. Jang, H. Huang, M. Hashimoto, D.-H. Lu, D. Song, Y. Yoshida, H. Eisaki, Z.-X. Shen, R. J. Birgeneau, M. Yi, and A. Frano, [Persistent low-energy phonon broadening near the charge order q-vector in bilayer cuprate  \$Bi\_2Sr\_2CaCu\_2O\_{8+y}\$](#) , Phys. Rev. B 98, 035102 (2018).
- 37) A. Ruiz, A. Frano, N. Breznay, I. Kimchi, T. Helm, I. Oswald, J. Chan, R. J. Birgeneau, Z. Islam, and James G. Analytis, [Field-induced intertwined orders in 3D Mott-Kitaev honeycomb  \$\beta\$ - \$Li\_2IrO\_3\$](#) , Nature Communications 8, 961 (2017).
- 38) B. A. Frandsen, K. M. Taddei, M. Yi, A. Frano, Z. Guguchia, R. Yu, Q. Si, D. E. Bugaris, R. Stadel, R. Osborn, S. Rosenkranz, O. Chmaissem, and R. J. Birgeneau, [Local Orthorhombicity in the Magnetic C4 Phase of the Hole-Doped Iron-Arsenide Superconductor  \$Sr\_{1-x}Na\_xFe\_2As\_2\$](#) , Phys. Rev. Lett. 119, 187001 (2017).
- 39) N. P. Breznay, A. Ruiz, A. Frano, W. Bi, R.J. Birgeneau, D. Haskel, and J. G. Analytis. [Resonant x-ray scattering reveals possible disappearance of magnetic order under hydrostatic pressure in the Kitaev candidate  \$\gamma\$ - \$Li\_2IrO\_3\$](#) , Phys. Rev. B Rapid Communications 96, 020402(R) (2017).
- 40) M. Bluschke, A. Frano, E. Schierle, M. Hepting, G. Christiani, G. Logvenov, E. Weschke, E. Benckiser, and B. Keimer, [Transfer of Magnetic Order and Anisotropy through Epitaxial Integration of 3d and 4f Spin Systems](#), Phys. Rev. Lett. 118, 207203 (2017).
- 41) M. Foerst, K.R. Beyerlein, R. Mankowsky, W. Hu, G. Mattoni, S. Catalano, M. Gibert, O. Yefanov, J.N. Clark, A. Frano, J.M. Glowonia, M. Chollet, H. Lemke, B. Moser, S.P. Collins, S.S. Dhesi, A.D. Caviglia, J.-M. Triscone, and A. Cavalleri, [Multiple supersonic phase fronts launched at a complex-oxide hetero-interface](#). Phys. Rev. Lett. 118, 027401 (2017).
- 42) Y.-D. Chuang, Y.C. Shao, A. Cruz, K. Hanzel, A. Brown, A. Frano, R. Qiao, B. Smith, E. Domning, S.-W. Huang, L. Wray, W.-S. Lee, Z.-X. Shen, T. Devereaux, J.-W. Chiou, W.-F. Pong, V. Yashchuk, E. Gullikson, R. Reininger, W. Yang, J. Guo, R. Duarte, and Z. Hussain, [Modular soft X-ray spectrometer for applications in energy sciences and quantum materials](#), Rev. Sci. Instrum. 88, 013110 (2017)
- 43) A. Frano, S. Blanco-Canosa, E. Schierle, M. Minola, M. Bluschke, Y. Lu, M. Wu, G. Cristiani, H. U. Habermeier, E. Benckiser, E. Weschke, M. Le Tacon, and B. Keimer, [Stabilizing Charge Density Wave Order in Cuprate-Manganite Superlattices](#). Nature Materials 15, 831 (2016).
- 44) Y. Lu, A. Frano, M. Bluschke, M. Hepting, S. Macke, J. Stempffer, P. Wochner, G. Cristiani, G. Logvenov, H.-U. Habermeier, M. W. Haverkort, B. Keimer, and E. Benckiser, [Quantitative determination of bond order and lattice distortions in nickel oxide heterostructures by resonant x-ray scattering](#). Phys. Rev. B 93, 165121 (2016).
- 45) R. Comin, R. Sutarto, F. He, E.H. da Silva Neto, L. Chauviere, A. Frano, R. Liang, W.N. Hardy, D.A. Bonn, Y. Yoshida, H. Eisaki, A.J. Achkar, D.G. Hawthorn, B. Keimer, G.A. Sawatzky, A. Damascelli. [Symmetry of charge order in cuprates](#). Nature Materials 14,

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- 46) M. Foerst, A. Frano, S. Kaiser, R. Mankowsky, C. R. Hunt, J. J. Turner, G. L. Dakovski, M. P. Minitti, J. Robinson, T. Loew, M. Le Tacon, B. Keimer, J. P. Hill, A. Cavalleri, and S. S. Dhesi, [\*Femtosecond x rays link melting of charge-density wave correlations and light-enhanced coherent transport in  \$YBa\_2Cu\_3O\_{6.6}\$\*](#) . Phys. Rev. B 90, 184514 (2014).
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- 49) S. Blanco-Canosa, A. Frano, E. Schierle, J. Porras, T. Loew, M. Minola, M. Bluschke, E. Weschke, B. Keimer, and M. Le Tacon. [\*Resonant x-ray scattering study of charge-density wave correlations in  \$YBa\_2Cu\_3O\_{6+x}\$\*](#) . Phys. Rev. B 90, 054513 (2014).
- 50) R. Comin, A. Frano, M. Yee, Y. Yoshida, H. Eisaki, E. Schierle, E. Weschke, R. Sutarto, F. He, A. Soumyanarayanan, Y. He, M. Le Tacon, I.S. Elfimov, J. Hoffman, G.A. Sawatzky, B. Keimer, and A. Damascelli. [\*Charge Order Driven by Fermi-Arc Instability in Underdoped Cuprates\*](#). Science 343, 390 (2014).
- 51) E. da Silva Neto, P. Aynajian, A. Frano, R. Comin, E. Schierle, E. Weschke, A. Gyenis, J. Wen, J. Schneeloch, Z. Xu, S. Ono, G. Gu, M. Le Tacon, and A. Yazdani. [\*Ubiquitous Interplay between Charge Ordering and High-Temperature Superconductivity in Cuprates\*](#). Science 343, 393 (2014).
- 52) A. Frano, E. Benckiser, M. Wu, Y. Lu, M. Castro-Colin, A. V. Boris, E. Detemple, W. Sigle, P. van Aken, G. Cristiani, G. Logvenov, H.U. Habermeier, P. Wochner, B. Keimer, and V. Hinkov. [\*Layer Selective Control of the Lattice Structure in Oxide Superlattices\*](#). Adv. Mater. DOI:10.1002/adma.201303483 (2013).
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