

# Xiaoxiang Xi

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- EDUCATION**
- University of Florida**, Gainesville, Florida, USA
- Ph.D. in Physics Sep 2009 – Dec 2011
    - Thesis: Conventional and time-resolved spectroscopy of magnetic properties of superconducting thin films
    - Adviser: Prof. David Tanner
  - M.S. in Physics Aug 2007 – Aug 2009
- Nanjing University**, Nanjing, Jiangsu, China
- B.S. in Astronomy Sep 2003 – Jul 2007
- EMPLOYMENT**
- Nanjing University**, Nanjing, Jiangsu, China
- Professor, School of Physics Oct 2016 – Present
- Pennsylvania State University**, State College, Pennsylvania, USA
- Research Associate, Department of Physics Oct 2014 – Jul 2016
    - Advisers: Prof. Kin Fai Mak & Prof. Jie Shan
- Brookhaven National Laboratory**, Upton, New York, USA
- Research Associate, Photon Sciences Directorate Feb 2012 – Sep 2014
    - Adviser: Dr. G. Lawrence Carr

## RESEARCH INTERESTS

In solid-state materials, the interplay of lattice, electronic, and spin degrees of freedom can often lead to novel ground states, intellectually interesting and potentially useful for applications. At reduced dimensions, even more exotic states can be uncovered, thanks to the concerted action of quantum mechanics and stronger Coulomb interaction. In the past two decades, a powerful set of tools have been developed, enabling investigation and control of materials confined in the two- and one-dimensional space.

My group explore the optical and electronic properties of low-dimensional quantum materials, with a focus on collective phenomena related to the multiple degrees of freedom in crystals. Some specific examples include:

- Charge-density waves
- Two-dimensional superconductivity
- Topological materials
- Ferroic materials

## SELECTED PUBLICATIONS

1. G. Liu<sup>†</sup>, T. Qiu<sup>†</sup>, K. He<sup>†</sup>, Y. Liu, D. Lin, Z. Ma, Z. Huang, W. Tang, J. Xu, K. Watanabe, T. Taniguchi, L. Gao, J. Wen, J.-M. Liu, B. Yan\*, and X. Xi\*, “Electrical switching of ferro-rotational order in nanometre-thick 1T-TaS<sub>2</sub> crystals”, *Nature Nanotechnology* **18**, 854–860 (2023)
2. H. F. Yang<sup>†</sup>, K. Y. He<sup>†</sup>, J. Koo<sup>†</sup>, S. W. Shen, S. H. Zhang, G. Liu, Y. Z. Liu, C. Chen, A. J. Liang, K. Huang, M. X. Wang, J. J. Gao, X. Luo, L. X. Yang, J. P. Liu, Y. P. Sun, S. C. Yan, B. H. Yan\*, Y. L. Chen\*, X. Xi\*, and Z. K. Liu\*, “Visualization of chiral electronic structure and anomalous optical response in a material with chiral charge density waves”, *Physical Review Letters* **129**, 156401 (2022)

3. G. Liu, X. Ma, K. He, Q. Li, H. Tan, Y. Liu, J. Xu, W. Tang, K. Watanabe, T. Taniguchi, L. Gao, Y. Dai, H.-H. Wen, B. Yan\*, and X. Xi\*, “Observation of anomalous amplitude modes in the kagome metal CsV<sub>3</sub>Sb<sub>5</sub>”, *Nature Communications* **13**, 3461 (2022)
4. D. Lin, A. Ranjbar, X. Li, X. Huang, Y. Huang, H. Berger, L. Forró, K. Watanabe, T. Taniguchi, R. V. Belosludov, T. D. Kühne, H. Ding\*, M. S. Bahramy\*, and X. Xi\*, “Axial-bonding-driven dimensionality effect on the charge-density wave in NbSe<sub>2</sub>”, *Nano Letters* **22**, 9389–9395 (2022)
5. D. Lin, S. Li, J. Wen, H. Berger, L. Forró, H. Zhou, S. Jia, T. Taniguchi, K. Watanabe, X. Xi\*, and M. S. Bahramy\*, “Patterns and driving forces of dimensionality-dependent charge density waves in 2H-type transition metal dichalcogenides”, *Nature Communications* **11**, 2406 (2020)
6. X. Xi, H. Berger, L. Forró, J. Shan\*, and K. F. Mak\*, “Gate tuning of electronic phase transitions in two-dimensional NbSe<sub>2</sub>”, *Physical Review Letters* **117**, 106801 (2016)
7. X. Xi†, Z. Wang†, W. Zhao, J.-H. Park, K. T. Law, H. Berger, L. Forró, J. Shan\*, and K. F. Mak\*, “Ising pairing in superconducting NbSe<sub>2</sub> atomic layers”, *Nature Physics* **12**, 139–143 (2016)
8. X. Xi, L. Zhao, Z. Wang, H. Berger, L. Forró, J. Shan\*, and K. F. Mak\*, “Strongly enhanced charge-density-wave order in monolayer NbSe<sub>2</sub>”, *Nature Nanotechnology* **10**, 765–769 (2015)
9. X. Xi, X.-G. He, F. Guan, Z. Liu, R. D. Zhong, J. A. Schneeloch, T. S. Liu, G. D. Gu, X. Du, Z. Chen, X. G. Hong, W. Ku, and G. L. Carr, “Bulk signatures of pressure-induced band inversion and topological phase transitions in Pb<sub>1-x</sub>Sn<sub>x</sub>Se”, *Physical Review Letters* **113**, 096401 (2014)
10. X. Xi, C. Ma, Z. Liu, Z. Chen, W. Ku, H. Berger, C. Martin, D. B. Tanner, and G. L. Carr, “Signatures of a pressure-induced topological quantum phase transition in BiTeI”, *Physical Review Letters* **111**, 155701 (2013)
11. X. Xi, J. Hwang, C. Martin, D. B. Tanner, and G. L. Carr, “Far-infrared conductivity measurements of pair breaking in superconducting Nb<sub>0.5</sub>Ti<sub>0.5</sub>N thin films induced by an external magnetic field”, *Physical Review Letters* **105**, 257006 (2010)

†: Equal contributions

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## ALL PUBLICATIONS

### 2024

1. T. Su†, H. Li†, G. Liu†, J. Liang, J. Shao, H. Zhu, K. Li\*, X. Xi\*, and W. Zhao\*, “Electrostatic doping of electron–phonon interaction in 1T'-TaTe<sub>2</sub> with an electric double layer interface”, *The Journal of Physical Chemistry C* **128**, 6412–6418 (2024)
2. Z. Chen†, H. Qiu†, X. Cheng†, J. Cui, Z. Jin, D. Tian, X. Zhang, K. Xu, R. Liu, W. Niu, L. Zhou, T. Qiu, Y. Chen, C. Zhang, X. Xi, F. Song, R. Yu, X. Zhai\*, B. Jin\*, R. Zhang\*, and X. Wang\*, “Defect-induced helicity dependent terahertz emission in Dirac semimetal PtTe<sub>2</sub> thin films”, *Nature Communications* **15**, 2605 (2024)
3. Z. Zhang†, G. Liu†, W. Qi, H. Xie, J. Guo, Y. Du, T. Wang, H. Zhang, F. Zhou, J. Li, Y. Zhang, Y. Yu, F. Fei\*, X. Xi\*, and F. Song\*, “Variation of magnetic properties with current in ferrimagnetic semiconductor Mn<sub>3</sub>Si<sub>2</sub>Te<sub>6</sub>”, *AIP Advances* **14**, 035238 (2024)
4. G. Liu†, Y.-Y. Lv†, Z. Jiang, G.-Z. Liu, X. Zhou, Y. Zhang, J. Zheng, L. Xu, M.-H. Lu, S.-H. Yao\*, Y. Chen, J. Zhou\*, X. Xi\*, and Y.-F. Chen, “Mode-selective anharmonicity induced by lone-pair electrons in layered oxyselenides”, *Phys. Rev. B* **109**, 024302 (2024)

### 2023

5. Z. Fang, Z. Tao, H. Sun, Y.-Y. Lv, Y.-B. Chen, Y. Nie, R. Liu, and X. Xi\*, “Electrical gating of superconducting NbSe<sub>2</sub> using SrTiO<sub>3</sub>-based field-effect transistors”, *Applied Physics Letters* **123**, 132601 (2023)

6. Q. Tian, Z. Wang, W.-M. Zhao, Y.-J. Xu, G. Liu, L. Wang, P. Wang, L.-G. Dou, W. Chen, S. Jin, J. Zong, Q. Meng, F. Yu, C. Wang, X. Xi, F.-S. Li, S.-C. Li, J. Liu, and Y. Zhang\*, “Observation of an abnormally large bandgap in monolayer 1T'-WS<sub>2</sub> grown on SrTiO<sub>3</sub>(001)”, *Applied Physics Letters* **123**, 123104 (2023)
7. Z. Zhou<sup>†</sup>, F. Hou<sup>†</sup>, X. Huang, G. Wang, Z. Fu, W. Liu, G. Yuan, X. Xi, J. Xu\*, J. Lin\*, and L. Gao\*, “Stack growth of wafer-scale van der Waals superconductor heterostructures”, *Nature* **621**, 499–505 (2023)
8. Z. Li<sup>†</sup>, J. Huang<sup>†</sup>, L. Zhou<sup>†</sup>, Z. Xu<sup>†</sup>, F. Qin, P. Chen, X. Sun, G. Liu, C. Sui, C. Qiu, Y. Lu, H. Gou, X. Xi, T. Ideue\*, P. Tang\*, Y. Iwasa, and H. Yuan\*, “An anisotropic van der Waals dielectric for symmetry engineering in functionalized heterointerfaces”, *Nature Communications* **14**, 5568 (2023)
9. J. Xu<sup>†</sup>, W. Liu<sup>†</sup>, W. Tang<sup>†</sup>, G. Liu, Y. Zhu, G. Yuan\*, L. Wang, X. Xi, and L. Gao\*, “Trapping hydrogen molecules between perfect graphene”, *Nano Letters* **23**, 8203–8210 (2023)
10. S. Duan<sup>†</sup>, F. Qin<sup>†</sup>, P. Chen<sup>†</sup>, X. Yang, C. Qiu, J. Huang, G. Liu, Z. Li, X. Bi, F. Meng, X. Xi, J. Yao, T. Ideue\*, B. Lian\*, Y. Iwasa, and H. Yuan\*, “Berry curvature dipole generation and helicity-to-spin conversion at symmetry-mismatched heterointerfaces”, *Nature Nanotechnology* **18**, 867–874 (2023)
11. G. Liu<sup>†</sup>, T. Qiu<sup>†</sup>, K. He<sup>†</sup>, Y. Liu, D. Lin, Z. Ma, Z. Huang, W. Tang, J. Xu, K. Watanabe, T. Taniguchi, L. Gao, J. Wen, J.-M. Liu, B. Yan\*, and X. Xi\*, “Electrical switching of ferro-rotational order in nanometre-thick 1T-TaS<sub>2</sub> crystals”, *Nature Nanotechnology* **18**, 854–860 (2023)
12. X. Ming<sup>†</sup>, Y.-J. Zhang<sup>†</sup>, X. Zhu\*, Q. Li\*, C. He, Y. Liu, T. Huang, G. Liu, B. Zheng, H. Yang, J. Sun, X. Xi, and H.-H. Wen\*, “Absence of near-ambient superconductivity in LuH<sub>2±x</sub>N<sub>y</sub>”, *Nature* **620**, 72–77 (2023)
13. Q. Meng, F. Yu, G. Liu, J. Zong, Q. Tian, K. Wang, X. Qiu, C. Wang, X. Xi, and Y. Zhang\*, “Thickness-dependent evolutions of surface reconstruction and band structures in epitaxial  $\beta$ -In<sub>2</sub>Se<sub>3</sub> thin films”, *Nanomaterials* **13**, 1533 (2023)
14. Y. Zhang, F. Fei\*, R. Liu, T. Zhu, B. Chen, T. Qiu, Z. Zuo, J. Guo, W. Tang, L. Zhou, X. Xi, X. Wu, D. Wu, Z. Zhong\*, F. Song\*, R. Zhang, and X. Wang\*, “Enhanced superconductivity and upper critical field in Ta-doped Weyl semimetal T<sub>d</sub>-MoTe<sub>2</sub>”, *Advanced Materials* **35**, 2207841 (2023)

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15. D. Lin, A. Ranjbar, X. Li, X. Huang, Y. Huang, H. Berger, L. Forró, K. Watanabe, T. Taniguchi, R. V. Belosludov, T. D. Kühne, H. Ding\*, M. S. Bahramy\*, and X. Xi\*, “Axial-bonding-driven dimensionality effect on the charge-density wave in NbSe<sub>2</sub>”, *Nano Letters* **22**, 9389–9395 (2022)
16. H. F. Yang<sup>†</sup>, K. Y. He<sup>†</sup>, J. Koo<sup>†</sup>, S. W. Shen, S. H. Zhang, G. Liu, Y. Z. Liu, C. Chen, A. J. Liang, K. Huang, M. X. Wang, J. J. Gao, X. Luo, L. X. Yang, J. P. Liu, Y. P. Sun, S. C. Yan, B. H. Yan\*, Y. L. Chen\*, X. Xi\*, and Z. K. Liu\*, “Visualization of chiral electronic structure and anomalous optical response in a material with chiral charge density waves”, *Physical Review Letters* **129**, 156401 (2022)
17. K. He, T. Qiu, and X. Xi\*, “Optical study on crystal symmetry of two-dimensional WTe<sub>2</sub>”, *Acta Physica Sinica* **71**, 176301 (2022)
18. G. Liu, X. Ma, K. He, Q. Li, H. Tan, Y. Liu, J. Xu, W. Tang, K. Watanabe, T. Taniguchi, L. Gao, Y. Dai, H.-H. Wen, B. Yan\*, and X. Xi\*, “Observation of anomalous amplitude modes in the kagome metal CsV<sub>3</sub>Sb<sub>5</sub>”, *Nature Communications* **13**, 3461 (2022)

19. R. Zhang, W. Ruan, J. Yu, L. Gao, H. Berger, L. Forró, K. Watanabe, T. Taniguchi, A. Ranjbar, R. V. Belosludov, T. D. Kühne, M. S. Bahramy\*, and X. Xi\*, “Second-harmonic generation in atomically thin 1T-TiSe<sub>2</sub> and its possible origin from charge density wave transitions”, *Physical Review B* **105**, 085409 (2022)
20. L.-D. Chen, L.-H. Shu, G. Liu, P. Nie, Y. Shao, Y.-C. Luo, Y.-Y. Lv, H.-M. Lu, Z.-W. Zhu, X. Xi, J. Zhou, F.-Z. Huang, Z.-X. Cheng, S.-H. Yao\*, Y. B. Chen\*, and Y.-F. Chen, “Magnetic field tuning of magnetic- and structure-phase transition in Mn<sub>2</sub>V<sub>2</sub>O<sub>7</sub> crystals”, *The Journal of Physical Chemistry C* **126**, 5055–5063 (2022)

## 2021

21. X. Xie, D. Lin, L. Zhu, Q. Li, J. Zong, W. Chen, Q. Meng, Q. Tian, S.-C. Li, X. Xi, C. Wang\*, and Y. Zhang\*, “Charge density wave and electron-phonon interaction in epitaxial monolayer NbSe<sub>2</sub> films”, *Chinese Physics Letters* **38**, 107101 (2021)
22. S. Jin, J. Zong, W. Chen, Q. Tian, X. Qiu, G. Liu, H. Zheng, X. Xi, L. Gao, C. Wang\*, and Y. Zhang\*, “Epitaxial growth of uniform single-layer and bilayer graphene with assistance of nitrogen plasma”, *Nanomaterials* **11**, 3217 (2021)
23. Z. Cai, S. Bao, Z.-L. Gu, Y.-P. Gao, Z. Ma, Y. Shangguan, W. Si, Z.-Y. Dong, W. Wang, Y. Wu, D. Lin, J. Wang, K. Ran, S. Li, D. Adroja, X. Xi, S.-L. Yu\*, X. Wu, J.-X. Li\*, and J. Wen\*, “Topological magnon insulator spin excitations in the two-dimensional ferromagnet CrBr<sub>3</sub>”, *Physical Review B* **104**, L020402 (2021)
24. A. Hamill, B. Heischmidt, E. Sohn, D. Shaffer, K.-T. Tsai, X. Zhang, X. Xi, A. Suslov, H. Berger, L. Forró, F. J. Burnell, J. Shan, K. F. Mak, R. M. Fernandes, K. Wang\*, and V. S. Pribiag\*, “Two-fold symmetric superconductivity in few-layer NbSe<sub>2</sub>”, *Nature Physics* **17**, 949–954 (2021)
25. Y.-C. Luo, Y.-Y. Lv, R.-M. Zhang, L. Xu, Z.-A. Zhu, S.-H. Yao\*, J. Zhou, X. Xi, Y. B. Chen\*, and Y.-F. Chen, “Subtle effect of doping on the charge density wave in TaTe<sub>2-δ</sub> (δ = 0.028–0.123) crystals revealed by anisotropic transport measurements and raman spectroscopy”, *Physical Review B* **103**, 064103 (2021)

## 2020

26. W. Chen, M. Hu, J. Zong, X. Xie, Q. Meng, F. Yu, L. Wang, W. Ren, A. Chen, G. Liu, X. Xi, F.-S. Li, J. Sun, J. Liu\*, and Y. Zhang\*, “Epitaxial growth of single-phase 1T'-WSe<sub>2</sub> monolayer with assistance of enhanced interface interaction”, *Advanced Materials* **33**, 2004930 (2020)
27. D. Lin, S. Li, J. Wen, H. Berger, L. Forró, H. Zhou, S. Jia, T. Taniguchi, K. Watanabe, X. Xi\*, and M. S. Bahramy\*, “Patterns and driving forces of dimensionality-dependent charge density waves in 2H-type transition metal dichalcogenides”, *Nature Communications* **11**, 2406 (2020)
28. Y. Zhang, T. Zhu, H. Bu, Z. Cai, C. Xi, B. Chen, B. Wei, D. Lin, H. Xie, M. Naveed, X. Xi, F. Fei\*, H. Zhang\*, and F. Song\*, “Large magnetoresistance in topological insulator candidate TaSe<sub>3</sub>”, *AIP Advances* **10**, 095314 (2020)
29. D. Lin, K. Ran, H. Zheng, J. Xu, L. Gao, J. Wen, S.-L. Yu, J.-X. Li, and X. Xi\*, “Anisotropic scattering continuum induced by crystal symmetry reduction in atomically thin α-RuCl<sub>3</sub>”, *Physical Review B* **101**, 045419 (2020)
30. G. Yuan, D. Lin, Y. Wang, X. Huang, W. Chen, X. Xie, J. Zong, Q.-Q. Yuan, H. Zheng, D. Wang, J. Xu, S.-C. Li, Y. Zhang, J. Sun, X. Xi, and L. Gao\*, “Proton-assisted growth of ultra-flat graphene films”, *Nature* **577**, 204–208 (2020)

## 2017–2019

31. H. Lin, Q. Zhu, D. Shu, D. Lin, J. Xu, X. Huang, W. Shi, X. Xi, J. Wang\*, and L. Gao\*, “Growth of environmentally stable transition metal selenide films”, *Nature Materials* **18**, 602–607 (2019)
32. W. Chen, X. Xie, J. Zong, T. Chen, D. Lin, F. Yu, S. Jin, L. Zhou, J. Zou, J. Sun, X. Xi, and Y. Zhang\*, “Growth and thermo-driven crystalline phase transition of metastable monolayer 1T'-WSe<sub>2</sub> thin film”, *Scientific Reports* **9**, 2685 (2019)
33. X. Xi\*, X. Bo, X. S. Xu, P. P. Kong, Z. Liu, X. G. Hong, C. Q. Jin, G. Cao, X. Wan\*, and G. L. Carr, “Honeycomb lattice Na<sub>2</sub>IrO<sub>3</sub> at high pressures: A robust spin-orbit mott insulator”, *Physical Review B* **98**, 125117 (2018)
34. E. Sohn, X. Xi, W.-Y. He, S. Jiang, Z. Wang, K. Kang, J.-H. Park, H. Berger, L. Forró, K. T. Law, J. Shan\*, and K. F. Mak\*, “An unusual continuous paramagnetic-limited superconducting phase transition in 2D NbSe<sub>2</sub>”, *Nature Materials* **17**, 504–508 (2018)
35. T. Liu\*, C. He, F. Wang, Y. Liu, X. Xi, R. Zhong, and G. Gu\*, “Shockwave-loading-induced enhancement of  $T_C$  in superconducting Bi<sub>2</sub>Sr<sub>2</sub>CaCu<sub>2</sub>O<sub>8+δ</sub>”, *Scientific Reports* **7**, 6710 (2017)

### Before 2017

36. M. Q. Arguilla, J. Katoch, K. Krymowski, N. D. Cultrara, J. Xu, X. Xi, A. Hanks, S. Jiang, R. D. Ross, R. J. Koch, S. Ulstrup, A. Bostwick, C. Jozwiak, D. W. McComb, E. Rotenberg, J. Shan, W. Windl, R. K. Kawakami, and J. E. Goldberger\*, “NaSn<sub>2</sub>As<sub>2</sub>: An exfoliatable layered van der waals Zintl phase”, *ACS Nano* **10**, 9500–9508 (2016)
37. X. Xi, H. Berger, L. Forró, J. Shan\*, and K. F. Mak\*, “Gate tuning of electronic phase transitions in two-dimensional NbSe<sub>2</sub>”, *Physical Review Letters* **117**, 106801 (2016)
38. R. He, J. van Baren, J.-A. Yan, X. Xi, Z. Ye, G. Ye, I. H. Lu, S. M. Leong, and C. H. Lui\*, “Interlayer breathing and shear modes in NbSe<sub>2</sub> atomic layers”, *2D Materials* **3**, 031008 (2016)
39. W. Zhao\*, C.-Z. Chang\*, X. Xi, K. F. Mak, and J. S. Moodera, “Vortex phase transitions in monolayer FeSe film on SrTiO<sub>3</sub>”, *2D Materials* **3**, 024006 (2016)
40. X. Xi<sup>†</sup>, Z. Wang<sup>†</sup>, W. Zhao, J.-H. Park, K. T. Law, H. Berger, L. Forró, J. Shan\*, and K. F. Mak\*, “Ising pairing in superconducting NbSe<sub>2</sub> atomic layers”, *Nature Physics* **12**, 139–143 (2016)
41. X. Xi, L. Zhao, Z. Wang, H. Berger, L. Forró, J. Shan\*, and K. F. Mak\*, “Strongly enhanced charge-density-wave order in monolayer NbSe<sub>2</sub>”, *Nature Nanotechnology* **10**, 765–769 (2015)
42. X. Xi, R. J. Smith, T. N. Stanislavchuk, A. A. Sirenko, S. N. Gilbert, J. J. Tu, and G. L. Carr, “A broadband silicon quarter-wave retarder for far-infrared spectroscopic circular dichroism”, *Infrared Physics & Technology* **67**, 436–440 (2014)
43. Q.-C. Sun, X. Xi, X. Wang, N. Lee, D. Mazumdar, R. J. Smith, G. L. Carr, S.-W. Cheong, and J. L. Musfeldt, “Spectroscopic signatures of domain walls in hexagonal ErMnO<sub>3</sub>”, *Physical Review B* **90**, 121303 (2014)
44. X. Xi, X.-G. He, F. Guan, Z. Liu, R. D. Zhong, J. A. Schneeloch, T. S. Liu, G. D. Gu, X. Du, Z. Chen, X. G. Hong, W. Ku, and G. L. Carr, “Bulk signatures of pressure-induced band inversion and topological phase transitions in Pb<sub>1-x</sub>Sn<sub>x</sub>Se”, *Physical Review Letters* **113**, 096401 (2014)
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46. X. Xi, C. Ma, Z. Liu, Z. Chen, W. Ku, H. Berger, C. Martin, D. B. Tanner, and G. L. Carr, “Signatures of a pressure-induced topological quantum phase transition in BiTeI”, *Physical Review Letters* **111**, 155701 (2013)
47. X. Xi and G. L. Carr, “A THz time-domain susceptibility for superconductors including strong-current effects”, *Superconductor Science and Technology* **26**, 114001 (2013)

48. K. H. Miller, X. S. Xu, H. Berger, V. Craciun, X. Xi, C. Martin, G. L. Carr, and D. B. Tanner, “Infrared phonon modes in multiferroic single-crystal  $\text{FeTe}_2\text{O}_5\text{Br}$ ”, *Physical Review B* **87**, 224108 (2013)
49. X. Xi, Y. M. Dai, C. C. Homes, M. Kidszun, S. Haindl, and G. L. Carr, “Evidence of a full gap in  $\text{LaFeAsO}_{1-x}\text{F}_x$  thin films from infrared spectroscopy”, *Physical Review B* **87**, 180509 (2013)
50. X. Xi, J.-H. Park, D. Graf, G. L. Carr, and D. B. Tanner, “Infrared vortex-state electrodynamics in type-II superconducting thin films”, *Physical Review B* **87**, 184503 (2013)
51. X. Xi, J. Hwang, C. Martin, D. H. Reitze, C. J. Stanton, D. B. Tanner, and G. L. Carr, “Effect of a magnetic field on the quasiparticle recombination in superconductors”, *Physical Review B* **87**, 140502 (2013)
52. X. Xi, J. Hwang, C. Martin, D. B. Tanner, and G. L. Carr, “Far-infrared conductivity measurements of pair breaking in superconducting  $\text{Nb}_{0.5}\text{Ti}_{0.5}\text{N}$  thin films induced by an external magnetic field”, *Physical Review Letters* **105**, 257006 (2010)

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