Fengcheng Wu

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Employment

- Professor, Wuhan University, December 2020-Present

- Postdoctoral Associate, University of Maryland, August 2018-September 2020
  Advisor: Sankar Das Sarma

- Postdoctoral Associate, Argonne National Laboratory, August 2016- August 2018
  Advisor: Ivar Martin

Education

- Ph.D. in Physics, The University of Texas at Austin, 2011-2016
  Advisor: Allan H. MacDonald

- B. S. in Physics, University of Science and Technology of China, 2007-2011

Research Field

Condensed Matter Theory, 2D Materials, Quantum Phases of Matter,
Topological Phases, Superconductivity, Light-Matter Coupling

Research Highlight

With my collaborators, I made a number of theoretical proposals that have recently been experimentally realized/observed.

• **Proposal of using semiconductor moiré bilayers as quantum simulators** (PRL)

see Nature, Nature, and Nature for experimental realizations.

• **Prediction of topological phases in semiconductor moiré bilayers** (PRL)

see Nature for observation of quantum anomalous Hall effects in MoTe2/WSe2.

• **Prediction of signatures of moiré excitons in optical spectrum** (PRL, PRB)

see Nature, Nature, Nature, Nature, and Nature for observation of moiré excitons and polaritons.

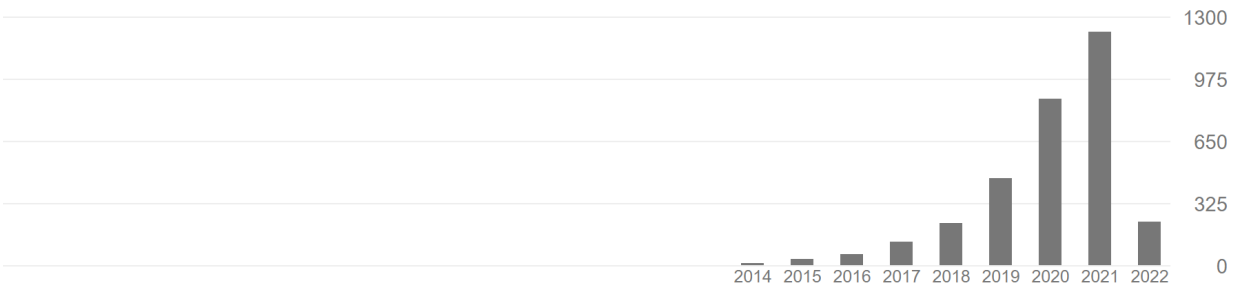
• **Prediction of phonon-induced giant T-linear resistivity in graphene moiré systems** (PRB)

see Nature Physics and PRL for observation of T-linear resistivity in graphene moiré systems.

Publications and Preprints (arXiv, Google Scholar**)**

(20) Physical Review B	WOS	(9) Physical Review Letters	WOS
(4) Physical Review Research	WOS	(2) Nature	WOS
(2) Nature Communications	WOS	(2) Nature Physics	WOS
(1) 2D Materials	WOS	(1) Annals of Physics	WOS
(1) Science	WOS	(1) The Journal of Chemical Physics	WOS

	All	Since 2017
Citations	3257	3139
h-index	24	24
i10-index	36	35



1. Y.-Z. Chou†, **F. Wu**†, J. D. Sau, S. Das Sarma, "Acoustic-phonon-mediated superconductivity in rhombohedral trilayer graphene", Phys. Rev. Lett. **127**, 187001 (2021). [Editors' Suggestion] († corresponding authors)

2. Y.-Z. Chou, **F. Wu**, J. D. Sau, S. Das Sarma, "Correlation-Induced Triplet Pairing Superconductivity in Graphene-Based Moiré Systems", Phys. Rev. Lett. **127**, 217001 (2021).

3. L. Zhang, **F. Wu**, S. Hou, Z. Zhang, Y.-H. Chou, K. Watanabe, T. Taniguchi, S. R. Forrest and H. Deng, "Van der Waals heterostructure polaritons with moiré-induced nonlinearity", Nature **591**, 61 (2021).

4. Y.-Z. Chou, **F. Wu**, J. D. Sau, "Charge density wave and finite-temperature transport in minimally twisted bilayer graphene", Phys. Rev. B **104**, 045146 (2021).

5. Y.-T. Hsu, **F. Wu**, S. Das Sarma, "Spin-valley locked instabilities in moiré transition metal dichalcogenides with conventional and higher-order Van Hove singularities", Phys. Rev. B **104**, 195134 (2021).

6. **F. Wu** and S. Das Sarma, "Collective Excitations of Quantum Anomalous Hall Ferromagnets in Twisted Bilayer Graphene", Phys. Rev. Lett. **124**, 046403 (2020).

7. R.-X. Zhang[†], **F. Wu**[†], and S. Das Sarma, "Möbius Insulator and Higher-Order Topology in $MnBi_{2n}Te_{3n+1}$", Phys. Rev. Lett. **124**, 136407 (2020). ([†] corresponding authors)

8. L. Zhang, Z. Zhang, **F. Wu**[†], D. Wang, R. Gogna, S. Hou, K. Watanabe, T. Taniguchi, K. Kulkarni, T. Kuo, S. Forrest, and H. Deng[†], "Twist-angle dependence of moiré excitons in $WS_2/MoSe_2$ heterobilayers", Nat. Commun. **11**, 5888 (2020). ([†] corresponding authors)

9. **F. Wu**[†], S. Das Sarma, "Quantum geometry and stability of moiré flatband ferromagnetism", Phys. Rev. B **102**, 165118 (2020). ([†] corresponding authors)

10. Y.-T. Hsu, **F. Wu**, S. Das Sarma, "Topological superconductivity, ferromagnetism, and valley-polarized phases in moiré systems: Renormalization group analysis for twisted double bilayer graphene", Phys. Rev. B **102**, 085103 (2020). [Editors' Suggestion]

11. H. Pan, **F. Wu**[†], S. Das Sarma, "Band topology, Hubbard model, Heisenberg model, and Dzyaloshinskii-Moriya interaction in twisted bilayer WSe_2", Phys. Rev. Research **2**, 033087 (2020). ([†] corresponding authors)

12. H. Pan, **F. Wu**, S. Das Sarma, "Quantum phase diagram of a moiré-Hubbard model", Phys. Rev. B **102**, 201104 (2020).

13. F. Xue, **F. Wu**, A. H. MacDonald, "Higgs modes in two-dimensional spatially-indirect exciton condensates", Phys. Rev. B **102**, 075136 (2020).

14. Y. Z. Chou, **F. Wu**, S. Das Sarma, "Hofstadter butterfly and Floquet topological insulators in minimally twisted bilayer graphene", Phys. Rev. Research **2**, 033271 (2020).

15. **F. Wu**, R.-X. Zhang, and S. Das Sarma, "Three-dimensional topological twistronics", Phys. Rev. Research **2**, 022010(R) (2020).

16. G. Tenasini, E. Martino, N. Ubrig, N. J. Ghimire, H. Berger, O. Zaharko, **F. Wu**, J. F. Mitchell, I.

Martin, L. Forró, and A. F. Morpurgo, "Giant anomalous Hall effect in quasi-two-dimensional layered antiferromagnet $Co_{1/3}NbS_2$", Phys. Rev. Research **2**, 023051 (2020).

17. **F. Wu** and S. Das Sarma, "Ferromagnetism and superconductivity in twisted double bilayer graphene", Phys. Rev. B **101**, 155149 (2020). [Editors' Suggestion].

18. S. Das Sarma and **F. Wu**, "Electron-phonon and electron-electron interaction effects in twisted bilayer graphene", Annals of Physics 417, 168193 (2020).

19. X. Li, **F. Wu** and A. H. MacDonald, "Electronic structure of single-twist trilayer graphene", arXiv:1907.12338.

20. X. Li, **F. Wu** and S. Das Sarma, "Phonon scattering induced carrier resistivity in twisted double bilayer graphene", Phys. Rev. B **101**, 245436 (2020).

21. J. Xu, **F. Wu**, J.-K. Bao, F. Han, Z.-L. Xiao, I. Martin, Y.-Y. Lyu, Y.-L. Wang, D. Y. Chung, M. Li, W. Zhang, J. E Pearson, J. S Jiang, M. G Kanatzidis, W.-K. Kwok, "Orbital-flop Induced Magnetoresistance Anisotropy in Rare Earth Monopnictide CeSb", Nat. Commun. **10**, 2875 (2019).

22. **F. Wu** and S. Das Sarma, "Identification of superconducting pairing symmetry in twisted bilayer graphene using in-plane magnetic field and strain", Phys. Rev. B **99**, 220507(R) (2019).

23. **F. Wu**, "Topological chiral superconductivity with spontaneous vortices and supercurrent in twisted bilayer graphene", Phys. Rev. B **99**, 195114 (2019).

24. **F. Wu**, E. Hwang, and S. Das Sarma, "Phonon-induced giant linear-in-*T* resistivity in magic angle twisted bilayer graphene: Ordinary strangeness and exotic superconductivity", Phys. Rev. B **99**, 165112 (2019).

25. **F. Wu**, T. Lovorn, E. Tutuc, I. Martin, and A. H. MacDonald, "Topological insulators in twisted transition metal dichalcogenide homobilayers", Phys. Rev. Lett. **122**, 086402 (2019).

26. K. Tran, G. Moody, **F. Wu**[†], X. Lu, J. Choi, K. Kim, A. Rai, D. A. Sanchez, J. Quan, A. Singh, J. Embley, A. Zepeda, M. Campbell, T. Autry, T. Taniguchi, K. Watanabe, N. Lu, S. K. Banerjee, K. L. Silverman, S. Kim, E. Tutuc, L. Yang, A. H. MacDonald, and X. Li[†], "Evidence for moiré excitons in van der Waals heterostructures", Nature **567**, 71 (2019). ([†] corresponding authors)

27. **F. Wu**, A. H. MacDonald, and I. Martin, "Theory of phonon-mediated superconductivity in twisted bilayer graphene", Phys. Rev. Lett. **121**, 257001 (2018).

28. **F. Wu**, T. Lovorn, E. Tutuc, and A. H. MacDonald, "Hubbard model physics in transition metal

dichalcogenide moiré bands", Phys. Rev. Lett. **121**, 026402 (2018).

29. M. T. Randeria*, B. E. Feldman*, **F. Wu***, H. Ding, A. Gyenis, H. Ji, R. J. Cava, A. H. MacDonald, and A. Yazdani, "Ferroelectric quantum Hall phase revealed by visualizing Landau level wave function interference", Nat. Phys. **14**, 796 (2018). (* equal contribution)

30. **F. Wu**, T. Lovorn, and A. H. MacDonald, "Theory of optical absorption by interlayer excitons in transition metal dichalcogenide heterobilayers", Phys. Rev. B **97**, 035306 (2018).

31. **F. Wu** and I. Martin, "Nematic and chiral superconductivity induced by odd-parity fluctuations", Phys. Rev. B **96**, 144504 (2017).

32. **F. Wu** and I. Martin, "Majorana Kramers pair in a nematic vortex", Phys. Rev. B **95**, 224503 (2017).

33. K. Hao, L. Xu, **F. Wu**, P. Nagler, K. Tran, X. Ma, C. Schüller, T. Korn, A. H. MacDonald, G. Moody, and X. Li, "Trion valley coherence in monolayer semiconductors", 2D Materials **4**, 025105 (2017).

34. **F. Wu**, T. Lovorn, and A. H. MacDonald, "Topological exciton bands in moiré heterojunctions", Phys. Rev. Lett. **118**, 147401 (2017).

35. **F. Wu** and A. H. MacDonald, "Moiré assisted fractional quantum Hall state spectroscopy", Phys. Rev. B **94**, 241108(R) (2016).

36. F. Xue, **F. Wu**, M. Xie, J.-J. Su, and A. H. MacDonald, "Microscopic theory of equilibrium polariton condensates", Phys. Rev. B **94**, 235302 (2016).

37. B. E. Feldman, M. T. Randeria, A. Gyenis, **F. Wu**, H. Ji, R. Cava, A. H. MacDonald, and A. Yazdani, "Observation of a nematic quantum Hall liquid on the surface of bismuth", Science **354**, 316 (2016).

38. K. Hao, G. Moody, **F. Wu**, C. K. Dass, L. Xu, C.-H. Chen, M.-Y. Li, L.-J. Li, A. H. MacDonald, and X. Li, "Direct measurement of exciton valley coherence in monolayer WSe_2", Nature Physics **12**, 677 (2016).

39. **F. Wu**, I. Sodemann, A. H. MacDonald, and Th. Jolicoeur, "SU (3) and SU (4) singlet quantum Hall states at $\nu=2/3$", Phys. Rev. Lett. **115**, 166805 (2015).

40. **F. Wu***, F. Xue*, and A. H. MacDonald, "Theory of two-dimensional spatially indirect equilibrium exciton condensates", Phys. Rev. B **92**, 165121 (2015). (* equal contribution)

41. **F. Wu**, F. Qu, and A. H. MacDonald, "Exciton band structure of monolayer MoS_2", Phys. Rev. B **91**, 075310 (2015).

42. **F. Wu**, I. Sodemann, Y. Araki, A. H. MacDonald, and Th. Jolicoeur, "SO(5) symmetry in the quantum Hall effect in graphene", Phys. Rev. B **90**, 235432 (2014).

43. **F. Wu**, H. Lan, Z. Zhang, and P. Cui, "Quantum efficiency of intermediate-band solar cells based on non-compensated n-p codoped TiO_2", J. Chem. Phys. **137**, 104702 (2012).

44. **F. Wu**, Y. Deng, and N. Prokof'ev, "Phase diagram of the toric code model in a parallel magnetic field", Phys. Rev. B **85**, 195104 (2012).

Awards

1. QuantEmX Scientist Exchange Award, 2018, Institute for Complex Adaptive Materials.
2. Chateaubriand Fellowship, 2015, Embassy of France in the United States.
3. Excellent Undergraduate Thesis Award, 2011, USTC, China.
4. National Encouragement Scholarship, 2008, 2009 and 2010, USTC, China.

Invited Talks

1. *Prediction and realization of topological phases in semiconductor moiré superlattices,* Huazhong University of Science and Technology, December 2021.
2. *Prediction and realization of topological phases in semiconductor moiré superlattices,* University of Science and Technology of China, November 2021.
3. *Prediction and realization of topological phases in semiconductor moiré superlattices,* City University of Hong Kong, November 2021.
4. *Quantum Simulation in Moiré Bilayers,* Xiamen University, June 2021.
5. *Quantum Simulation in Moiré Bilayers,* University of Chinese Academy of Sciences, May 2021.
6. *Quantum Simulation in Moiré Bilayers,* Fudan University, May 2021.
7. *Quantum Simulation using Moiré Bilayers,* ICAM-China 2021 Spring Workshop: Novel Correlated Electronic Matters, Tsung-Dao Lee Institute, Shanghai Jiao Tong University, April 2021.
8. *Quantum Simulation in Moiré Bilayers,* Wuhan University, April 2021.
9. *Pedagogical talk on phonons in twisted bilayer graphene,* Aspen Summer Program "Moiré Materials: Strong Correlations in Synthetic Superlattices", June 2019.
10. *Quantum Simulation and Many-Body Physics in Moiré Bilayers,* Emory University, May 2019.
11. ***Quantum Simulation and Many-Body Physics in Moiré Bilayers*, APS March Meeting, March 2019.**
12. *Unconventional Superconductivity in Twisted Bilayer Graphene from a Phonon Mechanism*, KITP Rapid Response Workshop: Correlations in Moire Flat Bands, January 2019.
13. *Theory of phonon-mediated superconductivity in twisted bilayer graphene,* University of Michigan, August 2018.
14. *Theory on nematic odd-parity superconductivity*, University of Chicago, January 2018.

15. *Topological Excitons in Moiré Heterobilayer*, EP2DS-22/MSS-18, August 2017.
16. *Topological Excitons in Moiré Heterobilayer*, PQE conference, January 2017.

Contributed Talks

1. *Twisted bilayer WSe2 (II): Quantum phase diagram of a Moiré-Hubbard model*, APS March meeting, 2021.
2. *Topological Chiral Superconductor with Spontaneous Vortices and Supercurrent in Twisted Bilayer Graphene*, APS March meeting, 2019.
3. *Theory of Optical Absorption by Interlayer Excitons in Transition Metal Dichalcogenide Heterobilayers*, APS March meeting, 2018.
4. *Topological Excitons in Moiré Heterojunctions*, APS March meeting, 2017.
5. *SU(3) and SU(4) singlet quantum Hall states at v=2/3*, APS March meeting, 2016.
6. *Exciton band structure of monolayer MoS_2*, APS March meeting, 2015.
7. *Broken SU(4) symmetry in quantum hall states in graphene: an exact diagonalization study*, APS March meeting, 2014.

Professional Services

Referee for journals: *Physical Review Letters*, *Physical Review X*, *Physical Review B*, *Nature*, *Nature Physics*, *Nature Communications*, *Science Advances*, and *2D Materials*.