Haining Pan

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# Education

**Ph.D.** University of Maryland, College Park, Physics Aug. 2017 to now

Advisor: Sankar Das Sarma

PhD candidate

**B.Sc.** Nanjing University, Physics Sept. 2013-Jun. 2017

**B.Eng.** Nanjing University, Computer Science Sept. 2013- Jun. 2017

# Research Interest

* Topological quantum computing
* Strongly correlated system
* Topological phases of matter
* Machine learning

# Research Experience

**Majorana zero modes in semiconductor-superconductor nanowires** 2017 to now

* Simulate the transport properties of nanowire in the presence of disorder
* Use the random matrix to simulate zero-bias peaks in class D ensemble

**Twisted bilayer** 2019 to now

* Construct an extended Hubbard model and Heisenberg model in twisted bilayer
* Discover a field-tunable Dzyaloshinskii–Moriya interaction in the system
* Discover rich quantum phase diagrams at various fractional filling factors
* Predict a platform for realizing quantum anomalous Hall effect and spin liquid

# Publications

**Pan, H.,** and Das Sarma, S, “Disorder effects on Majorana zero modes: Kitaev chain versus semiconductor nanowire” arXiv:2012.12904 (2020)

**Pan, H.,** and Das Sarma, S, “Interaction-driven filling-induced metal-insulator transitions in 2D moiré lattices” arXiv:2012.04554 (2020)

**Pan**, **H**., Sau, J.D., and Das Sarma, S., “Three-terminal nonlocal conductance in Majorana nanowires: distinguishing topological and trivial in realistic systems with disorder and inhomogeneous potential” arXiv:2009.11809 (2020)

**Pan, H.,** Wu, F. and Das Sarma, S, “Quantum Phase Diagram of a Moiré-Hubbard model” Phys. Rev. B 102, 201104(R) (2020)

**Pan, H.,** Wu, F. and Das Sarma, S, “Band topology, Hubbard model, Heisenberg model, and Dzyaloshinskii-Moriya interaction in twisted bilayer WSe­2” Physical Review Research 2, 033087 (2020)

**Pan, H.** and Das Sarma, S, “Physical mechanisms for zero-bias conductance peaks in Majorana nanowires” Physical Review Research 2 (1), 013377 (2020)

**Pan, H**., Cole, W.S., Sau, J.D. and Das Sarma, S., “Generic quantized zero-bias conductance peaks in superconductor-semiconductor hybrid structures” Physical Review B 101 (2), 024506. (2020)

**Pan**, **H**., Sau, J.D., Stanescu, T. and Das Sarma, S., “Curvature of gap closing features and the extraction of Majorana nanowire parameters” Physical Review B 99 (5), 054507. (2019)

**Pan**, **H**., Winkler, K., Powlowski, M., et al and Kim, N. Y.., “Two-kind boson mixture honeycomb Hamiltonian of Bloch exciton-polaritons” Physical Review B 99 (4), 045302 (2019)

Sett, A, **Pan**, **H**., Falloon, P.E. and Wang, J.B., “Zero transfer in continuous-time quantum walks” Quantum Information Processing 18 (5), 159. (2019)

Huang, Y, **Pan**, **H**., Liu, CX., Sau, J.D., Stanescu, T. and Das Sarma, S., “Metamorphosis of Andreev bound states into Majorana bound states in pristine nanowires” Physical Review B 99 (5), 054507. (2018)

# Professional Service

**Peer-Reviewed Articles for**:

* Physical Review B
* Physical Review Letter
* Physical Review X

# Computer Skills

**Programming**: MATLAB, Mathematica, Python, C++, Shell Script, Julia, ASM, Pascal

**Platforms & Packages**: Slurm, Linux, PyTorch

# Honors and Fellowship

[**KITP Graduate Fellowship**](https://www.kitp.ucsb.edu/apply/fellowships/graduate-fellowship-program)**, Spring 2021**

**First tier Dean Fellowship by University of Maryland, 2018-2019 &2017-2018**

**China National Scholarship, top 0.1% undergraduate, 2015**

# References

**Dr. Sankar Das Sarma**,

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**Dr. Jay Deep Sau**,

Condensed Matter Theory Center, University of Maryland

Email: jaydsau@umd.edu