Dr. Huan Zhao
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Huan Zhao

Center for Nanophase Materials Sciences
Oak Ridge National Laboratory

RESEARCH AREAS

Nanoelectronics, Nanophotonics, Condensed Matter Physics, Quantum Optics, Optical Imaging

EDUCATION & PROFESSIONAL EXPERIENCE

12/04/2023 ~ Eugene P. Wigner Distinguished Staff Fellow, Oak Ridge National Laboratory

01/03/2023 ~ 12/03/2023 Postdoc, Caltech Optical Imaging Laboratory, Department of Medical Engineering, Caltech. Mentor: Prof. Lihong Wang

09/09/2019 ~ 01/02/2023 Director's Postdoctoral Fellow, Center for Integrated Nanotechnologies, Los Alamos National Laboratory. Mentor: Dr. Han Htoon

08/05/2014 ~ 12/18/2019 PhD, Department of Electrical Engineering, University of Southern California. Mentor: Prof. Han Wang

09/01/2010 ~ 06/30/2014 Bachelor's degree in physics (with honors), Nanjing University.

AWARDS AND HONORS

07/2023 Eugene P. Wigner Distinguished Staff Fellowship (~0-2 awardees worldwide per year)

05/2019 Director's Postdoctoral Fellowship, Los Alamos National Laboratory (<5%)

01/2019 Chinese Government Award for Outstanding Self-Financed Students Abroad (< 1%)

07/2017 *Nano Research* Top Paper Award (~10 awardees worldwide per year)

02/2014 Four-Year Viterbi Dean's Doctoral Fellowship, USC (< 5%)

PROFESSIONAL SKILLS

Cleanroom Nanofabrication: EBL, photolithography, RIE, metal deposition, ALD, wire-bonding, etc.

Optical Spectroscopy. Raman, PL, FTIR, magneto-optics, single-photon measurements, etc.

Optical Imaging: Compressed Ultrafast Photography

Material Characterizations: SEM, AFM, I-V measurement, etc.

Computing and Programming: Artificial Neural Network, MATLAB, etc.

PROFESSIONAL ACTIVITIES

Served as a reviewer >35 times for journals such as: *Science Advances, Nano Letters, Nano Energy; Scientific Reports; Advanced Optical Materials; Nanophotonics; IEEE Optical and Quantum Electronics; IEEE Transactions on Nanotechnology, IEEE International Conference on Nanotechnology*, *etc.*

Mentoring and Outreach Experience

As Prof. Han Wang's first PhD student, Huan directly mentored four PhD students (Xiaodong Yan, Haimeng Zhang, Jiajun Xu, and Hefei Liu) and numerous M.S./undergraduate students during 2014-2019.

Served as a mentor of "USC Summer high school intensive in next-generation engineering (SHINE) program", 2015.

Served as the president of Los Alamos Chinese Students and Scholars Association (2020-2022). Huan's leading effort to help the local community amid the COVID-19 pandemic was recognized by *New Mexico Magazine* as "New Mexico Magazine True Heroes"

Past Grants and Approved Proposals

LANL LDRD #20190648PRD3. Title: The Optoelectronic Device Applications of 2D Interlayer Moiré Excitons. P.I.: Huan Zhao. 09/09/2019-09/08/2022; Additional Funding: $30K.

LANL LDRD #20190648PRD3. Title: The Optoelectronic Device Applications of 2D Interlayer Moiré Excitons. P.I.: Huan Zhao. 09/09/2019-09/08/2022; $285K.

SELECTED PUBLICATIONS

(†: Huan as co-1st author)

External collaborators include late Prof. Ahmed H Zewail from Caltech, Prof. Fengnian Xia from Yale, Prof. Jing Kong from MIT, and several senior scientists from National Labs (SNL, BNL, ORNL, etc) and industries (IBM TJ Watson, Northrop Grumman).

Publications can be accessed here: *https://scholar.google.com/citations?user=6JGFmsYAAAAJ&hl=en*

Total citations > 3000.

- **Postdoc projects: Creating telecom quantum light sources with layered materials.**
  1. Li, Xiangzhi, Andrew C. Jones, Junho Choi, **Huan Zhao**, Vigneshwaran Chandrasekaran, Michael T. Pettes, Andrei Piryatinski et al. "Proximity-induced chiral quantum light generation in strain-engineered WSe2/NiPS3 heterostructures." *Nature Materials* (2023): 1-6.
  2. **Huan Zhao**, Zhu, L., Li, X., Chandrasekaran, V., Baldwin, J. K., Pettes, M. T., ... & Htoon, H., Manipulating Interlayer Excitons for Ultra-pure Near-infrared Quantum Light Generation. *Nano Lett.* 2023, 23, 23, 11006–11012
  3. **Zhao, Huan**, Pettes, M.T., Zheng, Y. and Htoon, H., 2021. "Site-controlled telecom-wavelength single-photon emitters in atomically-thin MoTe2." *Nature Communications* 12.1 (2021): 1-7.
- **PhD projects: Atomically thin memory devices and their applications in neuromorphic computing.**

1. Tong Wu†, **Huan Zhao**†, Fanxin Liu, Jing Guo, Han Wang, Tunable Stochastic Memristive Device for Simulated Annealing in Boltzmann Machine Designed by a Machine Learning Method. arXiv:1905.04431
2. **Zhao, H.**; Dong, Z.; Tian, H.; DiMarzio, D.; Han, M. G.; Zhang, L.; Yan, X.; Liu, F.; Shen, L.; Han, S. J.; Cronin, S.; Wu, W.; Tice, J.; Guo, J.; Wang, H., Atomically Thin Femtojoule Memristive Device. *Advanced Materials* 2017, 29 (47).
3. **Huan Zhao**, Beibei Wang, Fanxin Liu, Xiaodong Yan, Haozhe Wang, Wei Sun Leong, Mark J Stevens, Priya Vashishta, Aiichiro Nakano, Jing Kong, Rajiv Kalia, Han Wang, Fluidic Flow Assisted Deterministic Folding of Van der Waals Materials.

   Advanced Functional Materials 2020, 1908691
4. Sanchez , I.; **Zhao, H.**; Wang, H., Efficient learning and crossbar operations with atomically-thin 2-D material compound synapses. *Journal of Applied Physics* 2018, 124 (15), 152133.
5. Dong, Z.; **Zhao, H.**; DiMarzio, D.; Han, M.-G.; Zhang, L.; Tice, J.; Wang, H.; Guo, J., Atomically Thin **CBRAM** Enabled by 2-D Materials: Scaling Behaviors and Performance Limits.

   IEEE Transactions on Electron Devices 2018, (99), 1-7.
6. Tian, H., Guo, Q., Xie, Y., **Zhao, H**., Li, C., Cha, J.J., Xia, F. and Wang, H. (2016), Anisotropic Black Phosphorus Synaptic Device for Neuromorphic Applications. Adv. Mater., 28: 4991-4997.

- **PhD projects: Light-matter interactions and birefringent materials.**

1. Niu, S. †; **Zhao, H. †**; Zhou, Y.; Huyan, H.; Zhao, B.; Wu, J.; Cronin, S. B.; Wang, H.; Ravichandran, J., Mid-wave and Long-Wave Infrared Linear Dichroism in a Hexagonal Perovskite Chalcogenide. *Chemistry of Materials* 2018, 30 (15), 4897-4901.
2. Niu, S. †; Joe, G. †; **Zhao, H. †**; Zhou, Y.; Orvis, T.; Huyan, H.; Salman, J.; Mahalingam, K.; Urwin, B.; Wu, J.; Liu, Y.; Tiwald, T. E.; Cronin, S. B.; Howe, B. M.; Mecklenburg, M.; Haiges, R.; Singh, D. J.; Wang, H.; Kats, M. A.; Ravichandran, J., Giant optical anisotropy in a quasi-one-dimensional crystal.

   Nature Photonics 2018, 1.
3. Liao, B. †; **Zhao, H. †**; Najafi, E.; Yan, X.; Tian, H.; Tice, J.; Minnich, A. J.; Wang, H.; Zewail, A. H., Spatial-temporal imaging of anisotropic photocarrier dynamics in black phosphorus.

   Nano Letters 2017, 17 (6), 3675-3680.
4. Wu, J. B. †; **Zhao, H. †**; Li, Y. †; Ohlberg, D.; Shi, W.; Wu, W.; Wang, H.; Tan, P. H., Monolayer molybdenum disulfide nanoribbons with high optical anisotropy.

   Advanced Optical Materials 2016, 4 (5), 756-762.
5. **Zhao, H.**; Wu, J.; Zhong, H.; Guo, Q.; Wang, X.; Xia, F.; Yang, L.; Tan, P.; Wang, H., Interlayer interactions in anisotropic atomically thin rhenium diselenide.

   Nano Research 2015, 8 (11), 3651-3661.
6. **Zhao, H.**; Guo, Q.; Xia, F.; Wang, H., Two-dimensional materials for nanophotonics application. *Nanophotonics* 2015, 4 (1), 128-142.
7. Jia, Y.; **Zhao, H.**; Guo, Q.; Wang, X.; Wang, H.; Xia, F., Tunable plasmon–phonon polaritons in layered graphene–hexagonal boron nitride heterostructures.

ACS Photonics 2015, 2 (7), 907-912.

- **Conference presentations**

Huan has presented in multiple conferences including the APS March Meeting (2015, 2018, 2020, 2022), MRS Spring Meeting (2019, 2022), MRS Fall Meeting (2021), etc. Huan was a session chair in 2022 APS March Meeting.