Bin Lian

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Education

- **University of Science and Technology of China (USTC)** — Hefei, China
  B.S. Material Physics — *Aug 2017 - June 2021*
  Chemistry and Material Science Department
- **The University of Texas at Austin** — Austin, TX
  Ph.D. Student in Texas Material Institute — *Aug 2021 - Present*
  Mechanical Engineering Department, Material Science and Engineering Program

Skills Summary

- **Languages**: Python, C, C++, Matlab, Julia, CUDA, Wolfram, JavaScript, Shell Script, LaTeX, Html, Css
- **Frameworks**: OpenCV, Pytorch, TensorFlow, ASE, Scikit, ROS (Robotic Operating System)
- **DFT & Molecular Dynamics**: VASP, CP2K, Orca, CASTEP, Lammps
- **Finite Element Analysis**: Comsol Multiphysics
- **Nano-scale Material Synthesis and characteristic**: Chemical Nanostructure Synthesis, E-Beam Deposition, Electrochemical Deposition, Metal Assisted Etching, 3D Printing, Raman Spectroscopy

Experience

- **Graduate Research Assistant** — UT Austin
  Full-time — *Aug 2021 - Present*
  - **Nano-structure Synthesis**: Used various approaches for manufacturing nano-structures, such as self-assembly, E-beam deposition, electrochemical deposition, metal-assisted etching, and chemical synthesis.
  - **Modelling and simulation**: Performed modeling and simulations to support experiments, including multi-scale calculations for systems at the atom scale (DFT), molecule scale (MD), and nanoscale and above (FEA).
  - **Micro-scale precise Control**: Applied computer vision and control algorithms to achieve micro-scale robotic control.
- **Teaching Assistant** — UT Austin
  Full-time — *Sep 2021 - Jan 2024*
  - **TA for ME134L (2023 Spring & 2023 Fall)**: Mechanical Engineering lab, supervised two sections with 30 students.
  - **TA for ME316T (2022 Fall)**: Thermodynamics course for Mechanical Engineering, supervised two sections with 50 students.
  - **TA for ME360M (2021 Fall & 2022 Spring)**: Material Science and Engineering lab, supervised two sections with 20 students.
- **Entrepreneur Lead for NSF I-Corps Program** — Austin, Texas
  Part-time — *Mar 2023 - May 2023*
  - **Leader of Team 2954 for Bio-medical Market Investigation**: Organized and conducted interviews with patients and experts in the Bio-medical and Cancer Diagnosis field. Obtained 103 interviews within one and a half months.
- **Undergraduate Research Assistant** — USTC
  Part-time — *April 2019 - Sep 2020*
  Worked in Prof. Bin Xiang Group in the Department of Chemistry and Material Science
  - **Theoretical Calculation for 2D Materials**: Calculated magnetic properties, with a focus on considering Spin Orbital Coupling.
  - **Cluster Manager**: Managed the group's supercomputer consisting of 2 nodes and 256 cores. Updated and maintained the environment and compiled necessary libraries.
- **Teaching Assistant** — USTC
  Part-time — *Sep 2020 - Mar 2021*
  - **TA for Quantum Physics (Honors) (2020 Fall)**: Honors Quantum Physics course with 30+ students.
- **Research Intern** — Brown University
  Part-time — *July 2020 - Sep 2020*
  Worked in Prof. Brenda Rubenstein Group in the Department of Chemistry
  - **Machine Learning-assisted Material Design**: Developed descriptors and used neural networks to accelerate the prediction of complex organic substances' behavior on alloy surfaces.
- **Summer Exchange Student** — UC Berkeley
  Full-time — *Aug 2019 - June 2021*
  - **Courses**: Quantum Mechanics Physics 137A, Introduction to Analysis Math 104.

Projects

- **Investigate and modeling topics: self-assembly and looping pendulum, Undergraduate Physics Tournament**: Experimentally obtained the trajectory of a looping pendulum using streamer photography. Applied the Lagrange strategy to solve the trajectory theoretically and implemented numerical solutions of differential equations using Matlab. The theory aligned perfectly with the experiments. For the self-assembly topic, determined the possible frequencies to create Chladni Graphics by solving a two-dimensional partial differential equation. Utilized OpenCV for image recognition in the experiments. The system exhibited long-range order but short-range disorder characteristics, which was confirmed by simulations based on Comsol. This work won the Second Prize in the tournament (March '19).
- **Magnetic property Calculation for 2D Materials**: Focused on calculating the magnetic anisotropy energy (MAE) of the $Cr_{1.39}Te_2$ system to support the experimental results of AMR (April '19).
- **Stretching vibrations energy states of XY_2-like molecules**: Developed and programmed code to calculate the Morse Oscillation energy states for molecules with XY_2 configuration (October '19).
- **Review thesis: Machine Learning (and Deep Learning) in material science achieve and application**: Summarized the development of big-data-driven methods used in material science research (October '19).
- **The new fast light curing 3D printing**: Developed a system based on the idea of reverse CT scanning and holography to quickly build physical 3D models using a 2D overlapping animation. Calculated the energy accumulation required to form specific morphologies and determined the appropriate intensity to project at each spatial position. Used a commercial laser projector for the printing process. This project won the top prize in The 15th University Physics Innovation Research Paper Competition at USTC (January '20).
- **Using self-designed descriptor and neural networks to accelerate the understanding of complex organic substances' behavior on alloy surfaces**: Utilized a machine learning approach to accelerate the prediction of iodine organism binding energy, aiding in determining bond stability and elucidating catalytic conditions on the CuPd alloy surface. Extracted feature vectors (fingerprints) from atom geometries using Gaussian descriptors and employed a neural network for regression, resulting in the development of a function to streamline the process (November '20).
- **Using Crystal Graph Convolutional Neural Networks to predict the VBMs and CBMs of MOFs (Metal-organic frameworks)**: My Bachlor Thesis, Developed a network architecture based on PyTorch for predicting the valence band maximum (VBM) and conduction band minimum (CBM) of MOFs (June '21).
- **Optoelectric Raman sensor achieve ultrasensitive and voltage-tunable bio-molecule detection**: Fabricated a 3D hierarchical array of silver nanoparticle-coated silicon nanowires by utilizing a uniformly self-assembled PS spheres template. This design is specifically used for voltage-tunable surface-enhanced Raman detection, enabling the achievement of ultrasensitive bio-marker detection.(Close).
- **Understanding the mechanical performance Double Network(DN) hydrogel via molecular dynamic simulation**: (Present)
- **Biommic double helical structure design and optimization via machine learning**: (Present)
- **Helical micro-robotic medical application via electrical tweezer control** : (Present)

Publications

- **Tian-jiao Fan, Bin Lian, Hao Wang, Yu-liang Chen, Exploration of the method of light curing 3D printing technology,Physics Experimentation**: DOI:10.19655/j.cnki.1005-4642.2020.09.001
- **Zexi Liang*, Hyungmok Joh, Bin Lian, and Donglei Emma Fan*, "Light-Stimulated Micromotor Swarms in an Electric Field with Accurate Spatial, Temporal, and Mode Control," Science Advances, 9, eadi993 (2023)**:
- **Jiazheng Bao, Bin Lian, et al, Strong and tough hydrogel enhanced by sequential phase separation and bridging polymer, Under preparation**:
- **Bin Lian,Huaizhi Li, Jianhe Guo, Donglei Emma Fan*, "Optoelectric Raman Nanosensors: Overcoming Intrinsic Limit in Nano-biosensing, 16 July 2024, PREPRINT (Version 1) available at Research Square"**:
- **Bin Lian, Donglei Emma Fan, Rajiform inspired Biommic Micro-swimmer topological design with Machine Learning boosted Structure Optimization to achieve efficient straight locomotion,Under preparation**:

Honors and Awards

- **First Prize**, Leica Cup–National Metallographic Skills Competition for College Students - Aug 2018
- University of Science and Technology of China **Excellent Student Scholarship** Bronze - March 2018
- **Second Prize**, China Undergraduate Physics Tournament - March 2019
- University of Science and Technology of China **Excellent Student Scholarship** Bronze - March 2019
- **Grand Prize**, The 15th University Physics Innovation Research Paper Competition (USTC) - December 2020
- **Elite Scholarship** of Institute of Chemistry, Chinese Academy of Sciences - March 2020
- **University Graduate Continuing Fellowship**, MSE program, UT Austin - Sep 2021 → June 2025

Volunteer Experience

- **Excellent Volunteer of "60th anniversary for celebrating the establishment of USTC"** Hefei, China
  Selected as an excellent volunteer out of thousands of volunteers *Jan 2020 - 2021*