SHUANG (Tim) LIANG

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EDUCATION

Wuhan University (WHU), School of Physics and Technology   **Sep. 2020 - Jun. 2024**

Bachelor of Science, Physics

Huangkun Class. Joint training with Institute of Semiconductors, CAS.

GPA: Overall GPA: 3.77/4.00, 89.55/100; Last two years: 3.95/4.00, 92.98/100

Core courses: *Methods of Mathematical Physics (100), Electrodynamics (93), Circuit Analysis (96), Quantum Mechanics (90), Thermodynamics and Statistical Physics (93), Computational Physics (Python) (96), Solid State Physics (89), Optics (94), C Programming (87)*

Peking University (PKU)   **June 2023 - Jul. 2023**

Summer School Program, *Introduction to Quantum Information Technology (97)*

University of Cambridge   **Sep. 2020 - Oct. 2020**

Interdisciplinary Communication Programme

PUBLICATION

<u>Shuang Liang</u>, Yuze Lu, Haimu Liu, Xiaohe Shang, Rongguang Du, Jiamin Ji, Shunping Zhang*, Saturable Absorption of Few-layer WSe_2 and WS_2 at Exciton Resonance. (To be submitted to *Applied Physics Letters.*)

RESEARCH EXPERIENCE

Undergraduate Thesis Project | Wuhan University, China | Advisor: Prof. Shengjun Yuan   **Nov. 2023 - Present**

Constructing the Tight-binding Model Based on Deep Learning

- Utilized DeePTB framework based on PyTorch to construct and train neural networks for predicting the Hamiltonian of the tight-binding models.
- Prepared datasets containing positions and the band structure of WS_2 and WSe_2 in various thermal status by LAMMPS and VASP.
- Utilizing the trained neural networks for WS_2/WSe_2 heterostructures with defects, predicting the Hamiltonian of these systems with high efficiency and great accuracy.

Independent Research | Wuhan University, China | Advisor: Prof. Shunping Zhang   **Sep. 2022 - Oct. 2023**

Saturable Absorption of Few-layer TMDs at Exciton Resonance

- Constructed a light path for changing the laser power based on a rotating motor embedded with a half wavelength plate and a polarizer and adjusted the power of the laser beam according to the Malus's Law.
- Prepared 2-D TMD samples including WS_2 and WSe_2 by mechanical exfoliation on quartz substrate and performed characterization to confirm the layers structure with AFM and PL measurement.
- Developed a program to control the piezo stage, the rotation of motor, the conversion of the wavelength of the super continuous laser source and the spectrometer simultaneously to optimize the signal to noise ratio with LabVIEW. Conducted repeated power-dependent reflectance contrast measurement.
- Comprehensively investigated the evolution of power density threshold in monolayer, bilayer and trilayer TMDs at the at the wavelength of A exciton resonant areas, systematically reported the evolution of power density threshold with respect to wavelength and layer number, which has potential application for optical switching devices and mode-locked laser.
- Journal paper to be submitted for *Applied Physics Letters* as the first author.

Independent Research | Wuhan University, China | Advisor: Prof. Shunping Zhang   **Jan. 2022 – Sep. 2022**

Probing Reflectance Contrast of Dark Exciton in TMDs With z-Polarized Beam

- Prepared TMD samples including WS_2, $MoSe_2$, MoS_2 and WSe_2 by mechanical exfoliation on quartz substrate, and verified the monolayers by Raman spectroscopy.
- Constructed light path to manipulate the light field distribution with half wave plates and Spatial Light Modulator (SLM), successfully generated Radially Polarized Beams (RPB) in the wavelength range from 500nm to 900nm.
- Utilize LabVIEW to control the super continuous laser source, SLM and the spectrometer in which way simultaneously execute the conversion of wavelength, the modulation of the spatial phase of light and spectral acquisition, to eliminate the influence of low frequency background noise that vibrated over time.

- Observed a weak signal at the wavelength of 629.27 nm in monolayer WS_2, suspected to be the signal of dark exciton.

Independent Research | Wuhan University, China | Advisor: Prof. Shengjun Yuan   **Apr. 2023 - Present**

Simulation of Strain Induced Deformation of Twisted Bilayer Graphene Moiré Superlattice

- Utilized Non-dominated Sorting Genetic Algorithm (NSGA) to match the in-plane strain distribution according to real space Moire superlattice information.

- Developed algorithm with python to introduced strain and twist angle to the twisted bilayer graphene model. Conducted molecular dynamics simulation via LAMMPS to simulate the relaxation of TBG superlattice.

- Developed algorithm to derive strain tensor at specific points in graphene lattice. Simulated the strain-induced polarization based on the evolution of strain tensor along the domain wall according to flexoelectric effect.

- The strain distribution of relaxed Moire superlattice could be predicted automatically by feeding the real Moire superlattice to the algorithm, which is significant for the design and strain analysis of 2-D materials-based microelectronic devices.

Research Assistant | Wuhan University, China | Advisor: Prof. Shengjun Yuan   **Jan. 2023 - Jun. 2023**

Simulation on the Effect of Voltage Bias to hBN-Graphene Structure by Tight-Binding Propagation Method

- Conducted literature investigation on twisted bilayer graphene (TBG), particularly on the strongly correlated effects.

- Programmed with Python to construct model of TBG super lattice samples. Simulated LDOS and band structure of the ABBC stacking regions of TBG with TBPLaS (tight-binding package for large scale simulation) in Python.

- Simulated the effect of various v-bias applied in z-direction and compare the simulation results with experimental data, studied the effect of voltage bias on the electronic band structure of TBG system.

WORK EXPERIENCE

MLE Research Internship | Beijing Rama Alpaca Initial Technology Co., LTD | Supervisor: Dr. Guo Zhang

Motion Controlled Video Generation and Better Pose Estimation for Anime Characters   **Feb. 2024 - Present**

- Developing algorithms for games based on user-generated content. Investigated literature related to the stable diffusion model, ControlNet and OpenPose.

- Programming based on the framework of Stable Diffusion ControlNet and Animate Anyone to realize the generation of video from static images.

- Developing algorithms for pose estimation for illustrated characters with higher performance, with higher accuracy comparing to previous works utilizing transfer learning.

SELECTED PROJECTS

The 7th Hubei College Physics Innovation Experiment Competition | Advisor: Prof. Xiaofeng Wang

Construction and Experiment of Two-dimensional Sound Source Localization Device   **Jan. 2022 - June 2022**

- Realized sound source localization based on the receivers' time differences with microphone audio receiver array.

- Implemented Generalized Cross-Correlation algorithm (GCC - PHAT) in Matlab based on the weighted function in the inverted space to filter out noise to enhance SNR of the signal.

- Second Prize in "The 7th Hubei Provincial Experiment Innovation Design Competition" was awarded to this project.

The 6th Hubei College Physics Innovation Experiment Competition | Advisor: Prof. Weihua Lin

Measurement of Liquid Viscosity Coefficient Based on Mobile Phone   **Jan. 2021 - July 2021**

- Optimized the traditional falling-ball method by relating velocity of the ball in the liquid with the angular velocity of the turntable and used Stokes law and rigid rotation law to measure liquid viscosity coefficient.

- Programmed with OpenCV by Python, and realized the real-time tracking and motion analysis of the ball.

- Developed iOS application with Swift and the angular velocity sensor of iPhone gyroscope was invoked to realize real-time measurement of turntable angular velocity.

- First Prize in "The 6th Hubei Provincial Experiment Innovation Design Competition" and "National Excellence Award in College Physics Experiment Innovation Competition" were awarded to this project.

LEADERSHIP AND ACTIVITIES

Minister | Department of Press and Publicity | Wuhan University   **Jul. 2021 - Jul. 2022**

- Oversee the whole department's Press and Publicity affairs including members' recruitment, budget and final accounts, events' planning, internal and external communication.

- Operated the WeChat publicity platform to inform the faculties and students on academic news and events on the campus.

- Directed videos about campus life in Wuhan University, grasped skills like video editing and camera.

Admission Publicity Ambassador | Undergraduate Admission Office | Wuhan University   **Sep. 2021 - Present**

- Responsible for the publicity of undergraduate admission of Wuhan University in Henan Province.
- Organized yearly admission campaigns in Henan Province in the past few years. Coordinated the operation of new media platforms of the admission office.

SELECTED HONORS & AWARDS

- First Prize in "The 6th Hubei Provincial Experiment Innovation Design Competition"   **Jul.2021**
- Second Prize in "The 7th Hubei Provincial Experiment Innovation Design Competition"   **Jul.2022**
- National Excellence Award in "College Physics Experiment Innovation Competition"   **Oct. 2021**
- Third Prize in "National Mathematics Competition for College Students (Non-Mathematics)"   **Dec. 2020**
- Wuhan University First Class Scholarship (5%, for academic excellence)   **Dec.2021**

SKILLS

Programming: Python, C, Swift, MATLAB, LabVIEW

Framework: PyTorch

Platform: Linux

Software: Stable Diffusion, TBPLaS, DeePTB, VASP, COMSOL, LAMMPS

Development Skills: Machine Learning, Web Development, iOS Application Development, Object Oriented Programming

Experimental Skills: Photoluminescence Spectroscopy, Reflectance Contrast Measurement, Chemical Vapor Deposition, Mechanical Exfoliation, Atomic Force Microscope, Pump/Probe Spectroscopy, Raman Spectroscopy