BIN (JAKIE) LIAN

Undergraduate of Material Physics

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EDUCATION

Bachelor's degree of Material physics

University of Science and Technology of China,(USTC)

2017.08-2021.06 $China \cdot Hefei$

- School of Chemistry and Material Science

UC Berkeley summer session

University of California,Berkeley,(UCB)

2019 Summer $California \cdot Berkeley$

- Quantum mechanics *Physics.137,A*
- Introduction to Analysis *Math.104,A*

Summer Research

Brown University

2020.07-2020.11 $Online$*·(Due to COVID-19)*

- **Instructor**: Prof.Brenda Rubenstein
- Computational Material Area

HONOR & AWARDS

Leica Cup–National Metallographic Skills Competition for College Students

- **First Prize**
- July 2018 –Aug 2018,China,Xi'an

The 15th University Physics Innovation Research Paper Competition(USTC)

- **Grand Prize**
- September 2020 –Dec. 2020,@China,hefei
- Tianjiao Fan,Bin Lian,Hao Wang,Yuliang Chen,The New Fast Light Curing 3D Printing,independently choose and finish project and public an article on ***Physics Experimentation***

China Undergraduate Physics Tournament(USTC)

- **Second Prize**
- Oct 2018 – March 2019,@China,Hefei
- Members:Shengkai Zhu, Bin lian, Qiyuan Wang, Shasha Xu,Zhuang Qian,focusing on topic of The Lopping Pendulum and Flat Self-assembly.

University of Science and Technology of China Excellent Student Scholarship

- **Grade 3**
- First year college ,@China,Hefei
- Second year college ,@China,Hefei

Elite Scholarship of Institute of Chemistry, Chinese Academy of Sciences

- **Elite Scholarship**
- Third year college ,@China,Hefei

Excellent Volunteer of "60th anniversary for celebrating the establish of USTC"

- Third year college ,@China,Hefei

Harris L. Marcus Graduate Fellowship in Materials Science & Engineering

- **Ph.D. Fellowship**
- 2021 @Austin,Texas

TA EXPERIENCE

Quantum Physics(H)

- 2020 Fall Semester,In English,lead 30 students
- Textbook:Modern Quantum Mechanics, J.J.Sakurai & Quantum Chemistry, Levine.

TECHNICAL SKILLS

Programming

Python ●●●●○
C ●●●○○
Wolfram Mathematica ●●●○○
Matlab/Octave ●●●○○
Linux ●●●○○
HTML5,CSS ●●●○○
Shell Script ●●●○○
Jupyter notebook ●●●○○
Julia ●●○○○
MySQL ●●○○○
C++ ●●○○○
JAVASCRIPT ●○○○○

Experiment section:

Chemical experiment skills ●●●●○
Physical experiment skills ●●●●○

SOFTWARE SKILLS

For Computing & simulation:

VASP ●●●●○
Quantum Espresso ●●●●○
Material studio,CASTEP ●●●●○
Multiwfn ●●●○○
Pytorch ●●●○○
Atomic Simulation Environment ●●○○○
Atomic Machine-learning Package ●●○○○
Lammps ●●○○○
Gaussian ●●○○○
NAMD ●●○○○
Comsol Muti-Physics ●●○○○

For Modeling:

VESTA ●●●○○
Rhinoceros,Shaper 3D ●●○○○

Some others:

Origin ●●●○○
Manim ●●●○○

PUBLICATION

- Tian-jiao FAN , Bin LIAN , Hao WANG, Yi-liang CHEN, · · ·etc. Exploration of the method of light curing 3D printing technology,Physics Experimentation,DOI:10.19655/j.cnki. 1005-4642.2020.09.001

RESEARCH INTEREST

Stochastic Electron Structure

- Electron structure determined many behaviors of a material, Using the Ab- initio Method unearth the great characteristic of one material and help us do deeper understanding from a more intrinsic way, supporting experiment results, moreover find the law!

Theoretical Chemistry

- For every step we did in one calculation, there was filled with approximation, From basic Kohn-Sham Equation's $V[n(\vec{r})]_{unknown}$ to wavefunction's Approximation(like Plane-wave approx.), Pseudopotential,etc., I believe when there is an approx. there is an error. So Could we make it better, not via modifying the parameter, but try to improve the basic theory

Micro Material Engineering & Human health

- If we can send a controllable robot into a human's body we will experience great progress in our treatments. Using the micro-scale material we design a new era robot via AC/DC current and magnetic device we control it goes everywhere in the body: deliver the medicine and analysis the component in our body.

ADVANTAGES

- Teamwork
- Fast self-learning
- Open minded

IMPORTANT PROJECTS

[class paper][Freshman seminar]Exploring the development of semiconductor

- TIME:2018.1-2018.5
- We focus on how The Moore's law were established and dysfunction, Our group via exhuming the history of the industry behind the law, every key upgrade of the technology and breakthrough in basic theory bringing such prosperity to Semiconductor, finally we analyze the reason for Moore's law s broken from quantum mechanics and the semiconductor physics reasons.

[Bin Xiang's group] computational Material Science for 2D Materials

- TIME:2019.4-Present
- Focus on doing the calculation of the system $Cr_{1.39}Te_2$'s MAE(magnetic anisotropy energy) to support the experiment result of AMR
- Independently rebuild the environment of our cluster and help our group upgrade the VASP to the least version to gain the ability to do Non-linear calculations.
- using the Vasp5.4.4 calc the MAE
- calc path: Non-SOC Relaxiation –> Non-SOC Static calculation –>SOC Calc—>Add the MAGMA z-axis and changing the SAXIS(quantisation axis for noncollinear spins)direction $\theta \in [0,\pi]$,$\phi \in [0,\pi]$, $E_{MAE} = E_\theta - E_{easy}$

[Class Project][Quantum Physics] Stretching Vibrations Of A XY2 Molecule As A Training Project For "Quantum Physics"

- TIME:2019.10-2019.12
- Programming in both Python edition and Wolfram Mathematica edition
- Calculate the H_2S's Energy considering the Pertubation Theory in Hamiltonian for a Morse oscillator:$H = \frac{p^2}{2\mu} + D_e\left(1 - e^{-\alpha r}\right)^2$
- Visualizing via Jmol, python, data deal with Numpy

[Class Paper][Computational Material Science] Machine Learning (and Deep learning)in Material Science–Achieve and Application

- TIME:2019.10-2020.1
- Focus on the development of the method in material science research, collect and learn some basic idea of ML & DL as the data-driving method applied in Material science

The New Fast Light Curing 3D Printing

- TiME:2019.10-2020.1
- Discuss with my group and rising the idea of 3D printing
- Assemble the experiment instruments and do the test
- Principle: lighting curing depends on the accumulation of the energy of a special wavelength light(depends on the resin) when over the threshold it curing.
- According to the principle, we made the 3D model using a 2D overlap projection. By calculating the Energy accumulation for forming a certain morphology We can determine how deep the color we would use. And using the Rhinoceros to create such 2D animation. printing part directly using a commercial laser projector.

China Undergraduate Physics Tournament

- Time:2018.10-2019.3
- I gathered three schoolmates as a group to investigate two physics phenomena — looping pendulum and self-assembly. For the looping pendulum, we took seven factors that may affect the pendulum's trajectory into consideration. Our group used streamer photography to record the trajectory. After that, we used the Lagrange mechanical method to solve the trajectory in theory and used MATLAB to do the simulation according to the factors we considered. The simulation result entirely agrees with the trajectory in reality
- As for the self-assembly part: By solving the two-dimensional partial differential equation, we gained the possible frequencies to create Chladni Graphics. In the simulation part, we used the COMSOL software to simulate the aluminum plate's amplitude distribution. Then we switched to investigate much general Self-assembly phenomena. We used the vibration plate to provide the driving force and the Lego blocks as the objects. We adopted OpenCV in this process to do image recognition. Using the OpenCV, we can track one stick in the plate and analyze other sticks' behaviors around it. By calculating $G4 =< \cos(4(\theta - \theta_j)) >$, we can quantify the orderliness. After plotting G4 functions, we can easily judge such a system keeping a long-range order but short-range disorder characteristic. We also simulated this process by using the Monte Carlo method. By using the self-design collision judgment algorithm, we got the simulation result, which agrees with reality

[Summer Research]Using the machine learning method accelerate the complex Organic substances behavior on alloy surface

- TIME:ING(2020.7–2020.10)
- Focus on using a machine learning method to accelerate the prediction of the iodine organism's binding energy, which can give a direct view for judging whether the bond would be broken easily, to help illustrate the catalytic condition on the CuPd alloy surface.By using Gaussian descriptor extract the Feature vector—(fingerprint) out from the geometry of every atoms in the slab and using neural network doing regression, we make a function $E = \sum_{i=1}^{N} \hat{E}_i\left(\mathbf{G}_i(\tilde{\mathbf{R}})\right)$ $\mathbf{G}_i(\tilde{\mathbf{R}})$is the No.I Feature vector. For using the Atom-centered scheme the model can be modified by adding more data in it.
  Aiming: using the model trained from a relatively simple organism accelerate much more complex one's calculation