Jacob Matthew Molina

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EDUCATION

University of Nevada, Reno

Bachelor of Science in Physics — May 2018 – Present

- Minor: Mathematics
- Expected Graduation: May 2022
- Cumulative GPA: 3.985 / 4.00

RESEARCH EXPERIENCE

Electron-Ion Equillibration in Warm Dense Gold

Advisor: Dr. Thomas White — Sep 2018 – May 2020

The relaxation rate of the electronic and ionic subsystems has proven to be the crux of understanding non-equilibrium states of matter, as well as resolving long-standing disagreements in the literature of warm dense matter research. Several models for this equilibration rate have been proposed in attempts to make sense of the recalcitrant literary conclusions - namely a equilibration rate that is constant, electron temperature dependent, or electron-ion temperature dependent. The determination of a sole correct method is not at all trivial, as different methods appear to be in line with specific physical benchmarks. We have perform large-scale simulations, making use of a highly optimized embedded-atom method interatomic potential, that determined the efficacy of a singular theoretical paradigm of the electron-ion equilibration rate by bench marking to all experimental results.[1]

Diffraction Enhanced Imaging with Low-Energy High-Repetition Rate Lasers [2]

Advisor: Dr. Thomas White — May 2020 – Jun 2020

One of two experiments to be performed at the Extreme Light Laboratory at the University of Nebraska as a result of awarded laser use by the Department of Energy. This experiment aims to demonstrate that diffraction enhanced imaging can be performed on high-repetition low-energy lasers by resolving a diffraction pattern over several laser shots - instead of through the high photon statistics provided by single-shot high-energy lasers.

Experimental Measurement of Mutual Diffusivity in Warm Dense Matter [2]

Advisor: Dr. Thomas White — Aug 2020 – Aug 2020

The second of two experiments to be performed at the Extreme Light Laboratory at the University of Nebraska. The process of the mutual diffusion of warm dense matter is of principle importance when it comes to the understanding of planetary interiors. However, there currently only exists theoretical models predicting the nature of this process. In this project, we aim to make the first experimental measurement of the coefficient of mutual diffusivity between two warm dense matter samples (Silicon Dioxide and Water)

Atomistic Simulations of Phase Boundary Shifts in Ion Damaged Gold

Advisor: Dr. Thomas White — Sep 2020 – Dec 2020

The strength of materials under intense loading is currently of principal importance to the performance of systems in extreme environments such as nuclear reactors. Over time many structural reactor components with integral engineering and technological roles become damaged by high energy ions. This alters important material properties and poses grave safety risks. This project aims to model the effects of this ion damage on single crystalline gold via classical Molecular Dynamics (MD) simulations. This research has been granted funding through the Nevada Undergraduate Research Award, and is still on track to begin in September.

[1] Publication of this work is currently underway
[2] Postponed to later data due to COVID-19

PRESENTATIONS

Summer Research Symposium, University of Nevada, Reno *(Upcoming)* — Aug 2020
Oral Presentation: "Electron-Ion Equillibration in Warm Dense Gold"

National McNair Scholar Conference, University of California, Los Angeles *(Upcoming)* — Aug 2020
Oral Presentation: "Electron-Ion Equillibration in Warm Dense Gold"

American Physical Society Far West Section Conference, Stanford, California — Nov 2019
Poster Presentation: "Atomistic simulation of the ultrafast melting of gold: Benchmarking to experiments"

HONORS & SCHOLARSHIPS

NSF EPSCoR UROP Scholarship — Jul 2020
Daugherty-Westfall Undergraduate Researcher — Jul 2020
Nevada Undergraduate Research Award — Jun 2020
Ronald E. McNair Scholar — Nov 2019
Millennium Scholarship — Jun 2018

RELEVANT COURSE WORK

Physics:
Mathematical Physics (A), Classical Mechanics (A), Quantum Mechanics (A)

Mathematics:
Partial Differential Equations (A), Probability Theory (A)

COMPUTATIONAL SKILLS

Programming Languages:
Daily Use: Matlab, Python *Competency:* Fortran, Mathematica

Molecular Dynamics:
Daily Use: LAMMPS

PROFESSIONAL AFFILIATIONS

UNR Society of Physics Students
Role: President — May 2020

American Physical Society
Role: Undergraduate Member — Jun 2018

OUTREACH

UNR Physics Department Inclusion, Diversity, and Equity Initiative — Jun 2020
University of Nevada, Reno

Together with four faculty members, one graduate student, and one other undergraduate student, I have helped set into motion an initiative that aims to increase the number of faculty and students within our physics department who represent some form of underrepresented minority. More specifically, I am spearheading the entire undergraduate portion of the initiative.

First Generation Student Center - Tutor of Mathematics and Physics — Feb 2020 – Present
University of Nevada, Reno

Whitaker Park Clean Up — Feb 2020
Reno, NV

Physics Demonstrations for Middle School Students Through NevadaTeach — Jun 2019
University of Nevada, Reno