# Michael Ryan Zengel

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## Objective

First-year Physics PhD student at MIT, focusing on ultrafast optical spectroscopy and light-driven dynamics in quantum materials. Experienced in THz emission spectroscopy, first-principles theory, and machine learning for materials discovery.

## Education

**Massachusetts Institute of Technology**, *Cambridge, MA*, PhD in Physics — Aug 2025 – Present

- National Science Foundation Graduate Research Fellow
- MIT Dean of Science Fellow

**University of Alabama**, *Tuscaloosa, AL*, BS in Physics and Mathematics — Aug 2021 – May 2025

- Graduated *summa cum laude* | **GPA**: 4.0/4.0
- **Minor**: Randall Research Scholars Program; French

## Research Experience

**Heusler Material Research**, UA Department of Physics – *Tuscaloosa, AL* — May 2022 – May 2025

- Worked with Dr. Adam Hauser to predict the atomic structure and crystalline, magnetic, and conductive properties of 3 element Heusler alloys and check predictions against grown materials.
- Employed Quantum Espresso, a Density Functional Theory Software, on the High-Performance Computing Center to calculate lattice constants, formation energy, density of state around the Fermi energy, and the band structure of alloys.
- Developed training course and instructed new members of lab how to perform DFT calculations.

**University of Michigan CERN REU**, CERN – *Geneva, Switzerland* — June 2024 – Aug 2024

- Participated in the CERN Summer Student Program.
- Worked with the Engagement Group of the Strategy and Executive Governance Division of the IT department (IT-GOV-ENG) and developed a Jupyter Lab Extension for Zenodo, a dataset sharing software, of which I will be an ongoing contributor.
- Attended a lecture series by leading CERN scientists discussing particle physics and accelerator design.

**Ancient Plants and People Lab**, UA Department of Anthropology – *Tuscaloosa, AL* — March 2023 – May 2024

- Developed Python framework to dynamically organize and refine survey data concerning students' perceived food security on the University of Alabama's campus.
- Developed project which uses machine learning and convolutional neural networks to dynamically identify seed species based on shape with respect to morphometrics.

**DAAD RISE Summer Research**, Justus Liebig University – *Gießen, Germany* — May 2023 – Aug 2023

- Designed and constructed an optical setup which generates terahertz frequency via photocurrent injection in semiconductors using a two-color excitation scheme.
- Analyzed the mobility and conductivity of Metal–organic chemical vapor deposition grown monolayers using THz time-domain spectroscopy.

**Compact Muon Solenoid Research**, UA Department of Physics – *Tuscaloosa, AL* — Sept 2021 – July 2022

- Worked with Dr. Sergei Gleyzer to determine the efficacy of convolutional neural networks in classifying raw jet data from the Compact Muon Solenoid at the Large Hadron Collider at CERN.
- Generated and improved upon several convolutional neural networks.
- Researched the application of data augmentation techniques on the convergence of classification.

**DFT Machine Learning Summer Research**, Tulane University Physics Department — June 2019 – Aug 2021

*– New Orleans, LA*

- Worked with Dr. Jianwei Sun to research the applications of machine learning in Density Functional Theory.
- Produced several 2D and convolutional neural networks to predict certain values with the SCAN method of calculation.
- Developed a script that exploited point group symmetry to automate the generation of unique grids around molecules to reduce redundancy within input files.

## Publications

**The 4-2 rule: The (Proposed) Answer to Heusler Alloys, Stability, and (Ordering) Everything** Jul 2026

Ridwan Nahar, Riley Nold, Naomi Derkson, Ka Ming Law, Babajide Akintunde, ***Michael Zengel***, Thomas Roden, Justin Lewis, Harshil Avlani, Sujan Budhathoki, Patrick LeClair, Adam Hauser

10.1016/j.jallcom.2026.189485, *Journal of Alloys and Compounds*

**Coherent Control of Photocurrents in Germanium for Gapless and Broadband Terahertz Emission** Aug 2025

Daniel Anders, ***Michael R. Zengel***, Rodrigo Sandoval Rodriguez, Kalle Bräumer, Sangam Chatterjee, Markus Stein

10.1007/s10762-025-01078-0, *Journal of Infrared, Millimeter, and Terahertz Waves*

**Bilinear and Biquadratic Interlayer Exchange Coupling in Asymmetric $Co_{65}Fe_{35}$/Ru/$Co_{65}Fe_{35}$ Heterostructures** Jul 2025

Upama Karki, Bhuwan Nepal, Naomi Derksen, Anupama Karki, Riley Nold, ***Michael Zengel***, Adam J. Hauser, Gary J Mankey, Tim Mewes, Jamileh Beik Mohammadi

10.1016/j.jmmm.2025.173315, *Journal of Magnetism and Magnetic Materials*

**Atomic Ordering and Electronic Structure of $A_2YSn$ Heusler Alloys: A First-Principles Study** Apr 2025

***Michael R. Zengel***, Riley Nold, Thomas Roden, Ka Ming Law, Ridwan Nahar, Justin Lewis, Adam J. Hauser

10.1016/j.jallcom.2025.179270, *Journal of Alloys and Compounds*

**Phase and d-d hybridization control via electron count for material property control in the $X_2FeAl$ material class** Mar 2024

Ka Ming Law, Ridwan Nahar, Riley Nold, ***Michael Zengel***, Justin Lewis, Adam J. Hauser

10.1016/j.jmmm.2024.171932, *Journal of Magnetism and Magnetic Materials*

**Dataset on Density Functional Theory investigation of Ternary Heusler Alloys** Dec 2023

Ridwan Nahar, Ka Ming Law, Thomas Roden, ***Michael Zengel***, Justin Lewis, Sujan Budhathoki, Riley Nold, Harshil Avlani, Babajide Akintunde, Naomi Derksen, Adam J. Hauser

10.1016/j.dib.2023.109971, *Data in Brief*

## Presentations and Posters

**Connecting Zenodo and Analysis Facilities: a JupyterLab Extension Middleware** Nov 2024

Astronomical Data Analysis Software and Systems, University of Malta, Malta

(Virtual Poster Presentation)

**Atomic Ordering and Electronic Structure of X2YSn Heusler Alloys: A First-Principles Study** Mar 2024

University of Alabama's Undergraduate Research and Creative Activity Conference, Tuscaloosa, AL, United States

(Poster Presentation)

**Atomic Ordering and Electronic Structure of X2YSn Heusler Alloys: A First-Principles Study** Mar 2024

APS March Meeting 2024, Minneapolis, MN, United States.

(Oral Presentation)

**Ab-Initio Investigation of Novel $X_2YSn$ Heusler Compounds** Dec 2023

RRS Live, Tuscaloosa, AL., United States

(Oral Presentation)

**Creating Currents from Light: Terahertz Emission from Novel Materials** Jul 2023

DAAD RISE Heidelberg Meeting 2023, Heidelberg, Baden-Württemburg, Germany

(Oral Presentation)

**First Principles Investigation of Atomic Ordering in Novel Heuslers** Apr 2023

University of Alabama's Undergraduate Research and Creative Activity Conference, Tuscaloosa, AL, United States

(Poster Presentation)

**First Principles Investigation of Atomic Ordering in Novel Heuslers** Mar 2023

Joint Mississippi State University, University of Mississippi, and University of Alabama Physics Graduate Student Association Symposium, Starkville, MS, United States

(Poster Presentation)

**Atomically Ordered Complex Materials vie Control of Entropic Mixing** Dec 2022

RRS Live, Tuscaloosa, AL, United States

(Oral Presentation)

**The Variance of the Angle of Incidence in the Double Slit Experiment** Mar 2020

Greater New Orleans Science and Engineering Fair & Louisiana Science and Engineering Fair, New Orleans, LA, United States

(Poster Presentation)

**Using Machine Learning to De-orbitalize Correlation Model Selection in the SCAN Functional** Aug 2019

Tulane University PEP Summer Colloquium, New Orleans, LA, United States

(Oral Presentation)

## Employment History

**Crew Member**, Dat Dog – New Orleans, LA May 2025 – Aug 2025

- Worked as line cook, with experience grilling, frying, and dressing orders
- Experience with standard restaurant operating procedure

**Head Computer Lab Manager**, Randall Research Scholars – Tuscaloosa, AL Jan 2022 – May 2025

- Performed routine maintenance and software checks of Randall Research computer lab and general honors computer lab
- Maintained on 3 active websites and multiple servers
- Managed Windows operations such as Active Directory, Hyper-V virtual machines, Imaging, et cetera
- Supervised and mentored a team of 8 of other undergraduate students

## Skills

**Experimental Techniques:** XRR/XRD scanning, LASER maintenance, Ultrafast Spectroscopy including THz-TDS and THz emission spectroscopy, Sputter methods in material growth

**Languages:** English, French (Fluent), German (Working Proficiency)

**Programming Languages:** Python, Fortran95, Java, Javascript, HTML, CSS, MATLAB, C#

**Operating Systems and Tools:** Bash, jQuery, Tensorflow, Keras API, Machine Learning, Web Design and Management, Node.js, Next.js, Webserver Management, React.js Framework

**Technology Management:** Active Directory, MECM (SCCM), Hyper-V Manager

**Software:** Quantum Espresso, OriginLab, LABVIEW

## Awards and Certifications

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|---|---|
| National Science Foundation Graduate Research Fellow | Fall 2025 |
| Dean of Science Fellow (MIT) | Fall 2025 |
| Fulbright Research Award (Declined) | Spring 2025 |
| Catherine J. Randall Student Excellence Award | Spring 2025 |
| Fulbright U.S. Student Program Semifinalist | Fall 2024 |
| UA Churchill Scholarship Nominee | Fall 2024 |
| UA Marshall Scholarship Nominee | Fall 2024 |
| UA Rhodes Scholarship Nominee | Fall 2024 |
| Henry Copeland Scholarship | Spring 2024 |
| Randall Outstanding Undergraduate Research Award | Spring 2024 |
| Barry M. Goldwater Scholarship Recipient | Spring 2024 |
| Invited as Young Scientist to Lindau Nobel Laureate Meeting | Spring 2024 |
| University of Alabama Goldwater Scholarship Nominee | Fall 2023 |
| DAAD RISE Scholarship Recipient for Summer Research | Summer 2023 |
| First Place in Physical Sciences at UA's URCA Conference | Spring 2023 |
| Health Track Winner in the University of Alabama BIG IDEAs Competition | Spring 2023 |
| Outstanding Research Presentation in RRS | Spring 2023 |
| Best Poster at the MSU-UM-UA PGSA Physics Symposium | Spring 2023 |
| University of Alabama Goldwater Scholarship Nominee | Fall 2022 |
| Outstanding First-Year Physics Student | Spring 2022 |
| Outstanding Freshman in the Randall Research Scholars Program | Spring 2022 |
| UA President's List | Fall 2021 - May 2025 |
| National Merit Scholar | Spring 2021 |
| University of Rochester Xerox Book Award | Spring 2021 |
| Industry Based Certificate in Javascript Functional Programming and Web Design Level 1 and 2 | Fall 2018 |
| Diplôme d'Etudes en Langue Française (DELF) A2 | Spring 2015 |

## Activities

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|---|---|
| The Crimson White (Contributing Writer) | Fall 2024 - Spring 2025 |
| Phi Beta Kappa | Spring 2024 - Spring 2025 |
| Pi Mu Epsilon | Spring 2024 - Spring 2025 |
| Society of Physics Students (President) | Fall 2021 - Spring 2025 |
| Journal of Science and Health at UA (Editor, Delegate to NUCSJ) | Fall 2021 - Spring 2025 |
| Sigma Pi Sigma | Spring 2023 - Spring 2025 |
| RRS Freshman Mentor | Fall 2023 - Spring 2025 |

RRS Selection Committee Member — Fall 2022 - Spring 2025

RRS Finalist Weekend Volunteer — Spring 2023, 2024