Biosciences

Quinn Abfalterer, Mining Omics Data to find Homologs of Viral Tail Fiber Genes 2
Lauryn Anaya and Nicole Aldaz, RETRO Rx 3
Peter Chen, Mixotrophic Algae Cultivation: Economics and Life-cycle Sustainability 4
Elisa Cirigliano, The Role of ACE2 in SARS-CoV-2 Pathologies 5
Samantha Courtney, Beacons and Biosensors: An Approach to Influenza Diagnostics 6
Jazmyn Gutierrez, Differences in Gut Microbiome Diversity between Sister Species of Pupfish 7
Beauty Kolade, Validating Toxin Structures using Cheminformatics and Quantum Chemistry 8
Shepard Moore, Sabotaging Iron Metabolism: How We Can Use Siderophores as Radiotherapeutics 9
Sara Pacheco, Chlorella Salinity Tolerance Test 10

Chemistry

Amelia Kirkland, Utilizing Beehive Materials as an Environmental Uranium Monitor 12
Sarah Chong, Gamma Spectroscopy Library Update 13
Derek Kober, Assessing Chromophores in Common Foods using UV-Vis Spectroscopy 14
Amanda Trevino and Jacob Piper, LIBS Process Monitoring of Composition of Glass-Forming Compounds 15

Computing

Ben Burnett and Andres Quan, Containerizing Darwin 17
Zachary DeStefano, Distributed and Verifiable Machine Learning using Zero-Knowledge Proofs Maksim 18
Eren, Anomalous Event Detection using Non-Negative Poisson Tensor Factorization 19
Brett Layman, Generating Job Profiles and Expectations for HPC Workloads 21
Oisin O’Connell, Introduction to Physics Modeling in Geant4 22
Thaddeus White, A Modern User Interface for the LANL Neutron Pulse Simulator (NPS) 23

Earth and Space Sciences
Alyre Blazon-Brown, Distance Effects in the Quantitative Predictions of ChemCam Measurements 25
Jade Comellas and Ari Essunfeld, Geologic Patterns of Elevated Manganese Deposits on Curiosity Rover's Traverse 26
Ryan Herring, Automated Identification of Arctic River Ice via Sentinel-1 SAR 27
Emma Lathrop, Variability in Soil Porewater Geochemistry in a Degrading Permafrost Landscape 28
Matthew Nellessen, Boron Adsorption in Clay Minerals: Borate Speciation Modeling 29
Joseph Sarrao, Characterizing Instrument Response for SuperCam 30

Engineering
Stanley Afonta, Jacob Torrez, Tannis Breure, Brian Roman, and Amabilis Baca, 2020 Smart Labs Project 32
Matthew Balcer, Multidual Sensitivity Method in Ray-Tracing Transport Simulations 33
Serena Birnbaum, Simple Transport Models for the Temperature-Dependent Linear Magnetoresistance 34
Zachary Brounstein, Developing Filament Feedstock of Polymer Composites for Additive Manufacturing 35
Bridget Daughton, Varying Nitrogen Sources to Reduce Algae Production Costs 36
Megan Hickman Fulp, Utilizing Temporal Similarities for Improved Data Reduction 37
Xeph Ivankovich, UV Mutagenesis and Screening of Green Microalga Picochlorum soloecismus 38
Kilkee Flynn, Hannah Van Gerpen, Austin Selley, Justin Kim, and Theo Dardia, ALDCP Construction Technology Project 39
Paul Lathrop, Chance Constrained Rapidly Exploring Random Trees CC-RRT 40
Grace Long, Parameters Affecting Coincident Neutron Rates Detected from Spent Nuclear Fuel 41
Elizabeth Martinez, Characterizing AM Lattice Structures Using FEA Modeling 42
Andrew Montalbano, Replicating Fiber-Reinforced 3D-Printed Composites in FEA 43
Michael Narum and Florian McLelland, Designer Earthquakes 44
Thomas Roberts, Dynamic Effect of Life-Cycle Model-Form Uncertainty in Hyperelastic Foam Systems

Robert Schloen, Vision Guided Automation and Assistance

Joshua Tempelman, Sensor Fusion for Keyhole Pore Identification in Additive Manufacturing

Michael Teti, Synthesizing Neutron Pulse Trains

Kezia Tripp, Riding the Bus: Modifying and Configuring Space-Based Electronics

Matthew Vigil, Development of Electrochemical Methods for in situ Diagnostics of Fluids

Jianchao Zhao, Silicate Sequestration for Water Treatment

Materials Sciences

Jessica LaLonde, Applications of Machine Learning to Degradation Prediction of PHAs

Lauren Naatz, Optocouplers: Their Polymer Components, Current Applications, and My LANL Project

Natasha Story, Experimental Optimization to Determine Heat Capacity of SX358 by MDSC

Camille Wong, Method Development: LC-MS/MS of eutectic bis(2,2-dinitropropyl) acetal/formal

Mathematics

Grant Hutchings, Bayesian Model Calibration using Physics-Informed Machine Learning

Samuel Myren, In situ Inference for Exascale Computing

Other

Gabriela Baca, Non-lab Contingent Workers

Thomas Chadwick, Who Invented the Christy Gadget?

Physics

Charles Coleman, Investigating the Degradation of PHA Biopolymers and their Derivatives

Abigail Louise Ferris, CT Analysis of Double Shell Targets

Keng Lin, Study Neutrinos using MiniBooNE Detector
<table>
<thead>
<tr>
<th>Title</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bricker Ostler, Developing a Longitudinal Charge Density Diagnostic for Electron Bunches</td>
<td>67</td>
</tr>
<tr>
<td>Liam Pocher, Implications of Numerical Operator Mutation on Differential Forms</td>
<td>68</td>
</tr>
<tr>
<td>Chandler Smith, Quantitative Analysis of U and Pu using Decay Energy Spectroscopy</td>
<td>69</td>
</tr>
</tbody>
</table>
BIOSCIENCES
Mining Omics Data to find Homologs of Viral Tail Fiber Genes

With the rapid rise of antibiotic resistance, many bacterial infections that have historically been treated with antibiotics now have strains that cannot be treated with traditional antibiotics. This poses a major challenge to public health. Antibiotic resistant infections are set to be a leading cause of death in the near future as traditional antibiotics become increasingly obsolete. Moreover, the discovery and development of antibiotics is a slow process and cannot effectively keep up with emerging antibiotic resistant pathogens. Bacteria, however, have a natural enemy called bacteriophages or viruses that infect and kill bacteria. Using bacteriophages to control bacterial infections in a clinical setting is called phage therapy. Although the technology has not well been adopted for phage therapy, there has been some notable successes and potential to be a viable solution to control infection from antibiotic resistance pathogens. However, there are challenges, specifically because bacteriophages are highly specific and can usually only infect one bacterial host species. The specificity is due to tail fiber proteins of bacteriophages that attach to their bacterial target as a first step of infection, just as a key is specific to a lock. One of the first steps towards using bacteriophages to combat antibiotic resistant bacteria is cataloguing this very specific relationship. Here, in this project we use bioinformatic techniques to find homologs of bacterial tail fiber genes in publicly available genomes and metagenomes. Specifically, we acquired all tail fiber genes that were found in viral RefSeq (a curated genomic database), and used them as queries against all bacterial genomes from GenBank and few interesting metagenomes from Sequence Read Archive database. Upon finding the homologs, we reconstructed their phylogenetic history to better understand their diversity and evolution.

Watch presentation: https://www.youtube.com/watch?v=XgUiW1jV1Ow
Lauryn Anaya

Program: Undergraduate
School: University of New Mexico
Group: B-10
Mentor: Nileena Velappan

Nicole Aldaz

Program: Undergraduate
School: New Mexico State University
Group: B-10
Mentor: Nileena Velappan

RETRO Rx

RETRO Rx is a web-based, epidemiological tool that combines the complementary tools AIDO and RED-Alert. Our work this summer concentrated on broadening/enhancing these epidemiological analytics to include dengue, measles and COVID-19 outbreaks.

Watch presentation: https://www.youtube.com/watch?v=o1Kmmwt_Gtg
Mixotrophic algae cultivation: Economics and life-cycle sustainability

The LEAF project at LANL studies mixotrophic algae for biofuels and co-products. An engineering model was developed to quantify possible sustainability improvements. Results set up the direction for the project’s near- and distant-future.

Watch presentation: https://www.youtube.com/watch?v=mL9XClQjx-I
Elisa Cirigliano

Program: Undergraduate  
School: University of British Columbia  
Group: B-10  
Mentor: Sofiya Micheva-Viteva  
Category: Biological Science  
Type: Individual  
LA-UR-20-25485

The role of ACE2 in SARS-CoV-2 pathologies

We are studying the effects of SARS-CoV-2 viral binding on human lung cells. We hope to discover a mechanism behind severe COVID-19 symptoms and identify a non-virus specific therapy that can work against SARS-CoV-2.

Watch presentation: https://www.youtube.com/watch?v=JsRtQpztYLI
Samantha Courtney

Program: Post Bachelors  
School: University of Tampa  
Group: C-PCS  
Mentor: Jessica Kubicek-Sutherland  
Category: Biological Science 
Type: Individual  
LA-UR-20-25710

Beacons and Biosensors: An Approach to Influenza Diagnostics

Our influenza diagnostic approach consists of designing the "Fast Evaluation of Emerging Risks" algorithm for molecular beacons, characterizing the thermodynamics of the beacons, and applying the beacons to a waveguide-based optical biosensor.

Watch presentation: https://www.youtube.com/watch?v=PS0cwEqPsR4&t=12s
Differences in Gut Microbiome Diversity Between Sister Species of Pupfish

We amplified the 16S rRNA bacterial gene from fecal samples of three Cyprinodon fish species from the Bahamas. Our results show bacterial diversity is preserved in the wild compared to the lab, while some bacteria are retained or lost.

Watch presentation: https://youtu.be/P3GRfK1BaPk
Validating Toxin Structures using Cheminformatics and Quantum Chemistry

This project is focused on developing a computational pipeline for identifying toxins by generating conformers for validation with experimental results. This pipeline involves the use of RDKit and psi4 software and is being tested on Digitoxin.

Watch presentation: https://vimeo.com/444510270
**Shepard Moore**

**Program:** Post Masters  
**School:** University of New Mexico  
**Group:** C-PCS  
**Mentor:** Laura Lilley  
**Category:** Biological Science  
**Type:** Individual  
**LA-UR-20-25765**

---

**Sabotaging Iron Metabolism: How we can use siderophores as radiotherapeutics**

Using siderophores as radiotherapeutics against emerging pathogenic threats.

Chlorella Salinity Tolerance Test

Plant-based biofuels are superior to fossil fuels in many ways, including being renewal and carbon neutral. Algae as a source of biofuels has all of the benefits of plant-based biofuels without the disadvantage of competition for resources such as arable land and fresh water because it can be grown in locations where other organisms cannot habituate. Salt water as a media for algal growth is a promising avenue of research because the large majority of the Earth’s water contains varying degrees of salinity. Our research aims to determine which algal strains can grow well in a variety of salinity concentrations while also accomplishing our goals of improved biomass production and increased carbon storage molecules. In our study, we examined four different strains of the algae genus *Chlorella*; *C. sorokiniana* 1228, *C. sorokiniana* LANL, *C. desiccata* 2437, and *C. desicatta* 2526. Both of the *C. desiccata* strains, in addition to *C. sorokiniana* LANL, have proven to grow at all salinity concentrations studied, from 17.5 ppt to 52.5 ppt. Further growth and analysis will determine the strain productivity and whether these strains will be able to meet our goals of increased biomass accumulation and increased carbon storage accumulation.

Watch presentation: [https://youtu.be/9U5uyy6UMNA](https://youtu.be/9U5uyy6UMNA)
CHEMISTRY
Utilizing Beehive Materials as an Environmental Uranium Monitor

Honey bees products are commonly used monitors for environmental contamination. We believe beehives collect uranium and its isotopic ratio to a measurable extent. We analyzed two hive materials and found that the $^{235}\text{U}/^{238}\text{U}$ ratio was depleted in both.

Watch presentation: https://youtu.be/BmHP_322rXs
Gamma Spectroscopy Library Update

The Nuclear and Radiochemistry Countroom facility employs many HPGe detectors in order to identify and quantify radioactive isotopes for multiple missions and customers. An automated system gathers and analyzes and archives the data.

Watch presentation: https://www.youtube.com/watch?v=W4Vq_ZBLikE&feature=youtu.be&hd=1
Assessing Chromophores in Common Foods using UV-Vis Spectroscopy

Chromophores are commonly utilized in food products to create vibrant colors that attract customers. In this project, I used common spectrophotometry techniques to determine the dye components and concentrations in popular candies with bright colors.

Watch presentation: https://youtu.be/LgGISzfovJo
LIBS Process Monitoring of Composition of Glass Forming Compounds

This project used LIBS to develop an industrial process monitoring technique for the Hanford DFLAW VIT Plant. Experimental and simulated LIBS spectra were analyzed together with Raman spectroscopy with the intent of data fusion of Raman and LIBS.

Watch presentation: https://youtu.be/zUwqg4p9tKM
COMPUTING
Containerizing Darwin

Darwin is a heterogeneous cluster and with it comes the challenge of maintaining software both for administrative tasks and for users doing their research across multiple architectures. Containers have the potential to assist with both of these.

Watch presentation: https://youtu.be/cnvrI0hHLPk
Distributed and Verifiable Machine Learning using Zero-Knowledge Proofs

We construct efficient PCD zk-SNARKs for verifiable AI/ML training and execution using recursive zero-knowledge proof composition. Applications of this research include nuclear treaty verification, data integrity, and supply chain security.

Watch presentation: https://youtu.be/4Lh_R3d-PTA
Anomalous Event Detection using Non-Negative Poisson Tensor Factorization

An integrated multidimensional anomaly scoring method based on tensors and Poisson recommender systems is proposed. We build a higher-order model that can detect the accounts compromised by red-team.

Watch presentation: https://youtu.be/_z7yCd4vqrc


Analysis and Numerical Verification of a Slice of a Geologic Framework Model

Verification and analysis of meshes used as precursors for the analysis of a full-scale model of the Mimbres basin in Southwest New Mexico. The eventual goal of the project is to verify suitability of the location for spent-fuel long-term storage.

Watch presentation: https://youtu.be/jp8OJ1EM2Hc
Generating Job Profiles and Expectations for HPC Workloads

We developed an application for dynamically generating HPC job profiles and workload expectations from time series data. It establishes a basis for live job monitoring and enables various methods for detecting aberrant job performance.

Watch presentation: https://www.youtube.com/watch?v=Kie58_vpsZU
Oisin O’Connell

Program: Undergraduate  
School: New Mexico Tech  
Group: ISR-1  
Mentor: Mark Galassi  
Category: Computing  
Type: Individual  
LA-UR-20-25374

Introduction to Physics Modeling in Geant4

Geant4 is a particle physics simulator useful for modeling nuclear particles. This project demonstrates a Geant4 application and introduces students to using Geant4 with code examples and explanations.

Watch presentation: https://www.youtube.com/watch?v=8Md-YKKQeoY
Thaddeus White

**Program:** Undergraduate  
**School:** University of Denver  
**Group:** ISR-3  
**Mentor:** Keith Morgan  
**Category:** Computing  
**Type:** Individual  
**LA-UR-20-25446**

### A Modern User Interface for the LANL Neutron Pulse Simulator (NPS)

Designing a modern web interface, using ReactJS and GO, for the LANL-developed Neutron Pulse Simulator (NPS).

Watch presentation: [https://vimeo.com/442760182](https://vimeo.com/442760182)
EARTH & SPACE SCIENCES
Distance Effects in the Quantitative Predictions of ChemCam Measurements

ChemCam’s elemental abundance calibration shows spurious trends that correlate with the distance to the target. Results from the Murray formation in Gale crater on Mars were investigated to empirically correct for these effects.

Watch presentation: https://youtu.be/vdtJ5Jv7jHo
Geologic Patterns of Elevated Manganese Deposits on Curiosity Rover's Traverse

The Curiosity Rover’s ChemCam instrument has identified elevated Manganese deposits in rock targets along its traverse on Mars. We present geologic patterns among these high-Mn targets thus classifying them to lay the foundation for interpretation.

Watch presentation: https://youtu.be/ZGK5ngd7S_8
Automated Identification of Arctic River Ice via Sentinel-1 SAR

Through the development of a moving window Otsu image segmentation method, a process was formulated by which to automatically classify ice cover in the Kolyma Delta via the employment of vertically polarised Sentinel-1 Interferometric Wide SAR data.

Watch presentation: https://drive.google.com/drive/folders/166utt8yyZShCPhDNDVY4DD5xxiPGdBh?usp=sharing
Variability in soil porewater geochemistry in a degrading permafrost landscape

We analyzed soil porewater from two permafrost watersheds in the Seward Peninsula of Alaska to determine the dominant environmental factors controlling hydrogeochemistry.

Watch presentation: https://vimeo.com/445038164
Boron Adsorption In Clay Minerals: Borate speciation modeling

Speciation modeling of boron in aqueous solutions to understand processes for adsorption of boron onto Mars analog clays.

Watch presentation: https://www.youtube.com/watch?v=LSp0VkJCoXKg&feature=youtu.be
Joseph Sarrao

**Program:** Undergraduate  
**School:** University of California, Berkeley  
**Group:** ISR-2  
**Mentor:** Roger Wiens  
**Category:** Earth and Space Sciences  
**Type:** Individual  
**LA-UR-20-25600**

---

**Characterizing Instrument Response for SuperCam**

SuperCam is a spectral instrument on the Perseverance rover. However, as an optical instrument, the data it collects is subject to vignetting. By characterizing Supercam’s response, we can correct for this vignetting and ensure our data is accurate.

Watch presentation: [https://youtu.be/s1tuAdPQAAo](https://youtu.be/s1tuAdPQAAo)
ENGINEERING
2020 Smart Labs Project

The 2020 Smart Labs project at Los Alamos National Laboratory aims to incorporate seven key principles of Smart Lab designs and incorporate them into different buildings at Los Alamos National Laboratory in the form of four major project areas.

Watch presentation: https://www.youtube.com/watch?v=lzE7sThFNf4&feature=youtu.be
Matthew Balcer

Program: Graduate  
School: The University of Texas at San Antonio  
Group: XCP-7  
Mentor: Jeffrey Favorite  
Category: Engineering  
Type: Individual  
LA-UR-20-26017

---

**Multidual Sensitivity Method in Ray-Tracing Transport Simulations**

The multidual differentiation method has been implemented in a ray-tracing transport code called SENSPG to calculate arbitrary-order uncollided particle leakage sensitivities.

Watch presentation: https://youtu.be/9q9uTE936ec
Simple transport models for the temperature-dependent linear magnetoresistance

Models of magnetoresistance that deal with inhomogeneities are used to determine if linear magnetoresistance in "strange metals" is caused by disorder or more exotic physics. Variations in disorder and magnetoresistance curve shapes are studied.

Watch presentation: https://youtu.be/c5Ym0vzNwyY
Developing filament feedstock of polymer composites for additive manufacturing

Common 3D-printing polymers, acrylonitrile butadiene styrene and polylactic acid, were combined with metal, polymer, and ceramic fillers via a solvent treatment to fabricate multifunctional composite materials for advanced manufacturing.

Watch presentation: https://youtu.be/FJOFsPw1v_k
Varying Nitrogen Sources to Reduce Algae Production Costs

The purpose of this experiment is to compare algal growth in media when using either nitrate or ammonium as the nitrogen source. Transitioning to ammonium as the primary nitrogen source would reduce overall production costs for algal biofuels.

Watch presentation: https://youtu.be/ldG1CpxsEOk
Utilizing Temporal Similarities for Improved Data Reduction

This research investigates of the combination of spatial and temporal sampling to reduce data size such that a higher reconstruction quality is reached without increasing the storage needed, compared to original techniques.

Watch presentation: [https://www.youtube.com/watch?v=rUF1NGpNwQw&feature=youtu.be](https://www.youtube.com/watch?v=rUF1NGpNwQw&feature=youtu.be)
**Xeph Ivankovich**

**Program:** Post Bachelors  
**School:** University of Colorado at Boulder  
**Group:** B-11  
**Mentor:** Claire Sanders  
**Category:** Engineering  
**Type:** Individual  
**LA-UR-20-25585**

---

**UV Mutagenesis and Screening of Green Microalga Picochlorum soloecismus**

UV mutagenesis, Fluorescence-Activated Cell Sorting (FACS), and screening of green microalgae Picochlorum soloecismus clones to increase lipid accumulation for biofuel applications.

Watch presentation: [https://youtu.be/wJ1c9-2f5zQ](https://youtu.be/wJ1c9-2f5zQ)
Kilkee Flynn

Program: Undergraduate
School: New Mexico Institute of Mining and Technology
Group: ALDCP-IA
Mentor: Steven Renfro

Justin Kim

Program: Undergraduate
School: Texas A&M University
Group: ALDCP-IA
Mentor: Steven Renfro

Hannah Van Gerpen

Program: Undergraduate
School: Arizona State University
Group: ALDCP-IA
Mentor: Steven Renfro

Theo Dardia

Program: Undergraduate
School: Carnegie Mellon University
Group: ALDCP-IA
Mentor: Steven Renfro

Austin Selley

Program: Undergraduate
School: North Carolina State University
Group: ALDCP-IA
Mentor: Steven Renfro

**ALDCP Construction Technology Project**

This project aims to improve the visualizations and accuracy of penetration operations by integrating augmented reality platforms and subsurface scanning devices with the ultimate goal being to increase the workers safety and productivity.

Watch presentation: [https://youtu.be/sDzB-p2umSA](https://youtu.be/sDzB-p2umSA)
Paul Lathrop

**Program:** Graduate  
**School:** University of California San Diego  
**Group:** E-3  
**Mentor:** Beth Boardman  
**Category:** Engineering  
**Type:** Individual  
**LA-UR-20-25405**

---

**Chance Constrained Rapidly Exploring Random Trees CC-RRT**

Chance Constrained Rapidly Exploring Random Trees* (CC-RRT*) is a random sampling path planner that ensures probabilistic feasibility of a path through an obstacle environment by using Gaussian state and noise modeling.

Watch presentation: [https://youtu.be/7CHUsnnwKTw](https://youtu.be/7CHUsnnwKTw)
Parameters Affecting Coincident Neutron Rates Detected from Spent Nuclear Fuel

Comparisons between fuel assembly models were used to examine how variations in control rod insertion, depletion percentage, and cooling time produced different coincident neutron detection rates in assemblies with similar total fissile mass content.

Watch presentation: https://youtu.be/R3GcFecl-Kg
Elizabeth Martinez

**Program:** Post Bachelors  
**School:** The University of Texas at El Paso  
**Group:** E-1  
**Mentor:** Howard Rathbun  
**Category:** Engineering  
**Type:** Individual  
**LA-UR-20-25336**

---

**Characterizing AM Lattice Structures Using FEA Modeling**

Lattice structures were modeled such that their continuum model was constructed by isolating a single lattice unit cell within quasi-static conditions using Abaqus CAE. Trends from the extracted elastic moduli were then plotted on the Ashby chart.

Watch presentation: [https://www.youtube.com/watch?v=XNPPboJE4Ts](https://www.youtube.com/watch?v=XNPPboJE4Ts)
Replicating Fiber Reinforced 3D Printed Composites in FEA

Additively manufactured carbon fiber reinforced polymer structures possess increased strength and design versatility at the cost of modeling accuracy. Over this summer an FEA model was developed and validated that accurately predicts their behavior.

Watch presentation: https://www.youtube.com/watch?v=6lHoBksZysM&feature=youtu.be
The goal was to create a program that could generate a random signal in the time domain with an equivalent frequency-domain response spectra that matches a PF-4 In-Structure Response Spectra. This procedure supports equipment seismic qualification.

Watch presentation: https://www.youtube.com/watch?v=bX02GhP6zcE&feature=youtu.be
Dynamic Effect of Life-Cycle Model-Form Uncertainty in Hyperelastic Foam Systems

Engineering analysts have a need to understand the effects of model-form uncertainty on the dynamic response of suspended-mass and closed-cell foam systems. Here, we discuss the effects of uncertainties in the system's entire engineering life-cycle.

Watch presentation: https://youtu.be/hhLTBSKqX0s
Vision Guided Automation and Assistance

The safety and efficiency of robotic automation and assistance can be improved using robot vision. The vision pipeline I am developing processes point clouds to extract the location of objects and classifies the objects using a deep neural network.

Watch presentation: https://youtu.be/tT4Y2cLHPyU
Sensor Fusion for Keyhole Pore Identification in Additive Manufacturing

We devise a method to detect and localize keyhole pores in laser powder bed fusion by jointly analyzing thermal and acoustic signals.

Watch presentation: https://www.youtube.com/watch?v=mQP5pC20qzM
Synthesizing Neutron Pulse Trains

Due to the cost and availability of tools and material, there is a need for realistic simulation data to train nuclear facility inspectors. Here, for the first time, we observe the ability of data-driven deep learning models at simulating PSMC data.

Watch presentation: https://www.youtube.com/watch?v=hmlj1VhQY_c
Riding the Bus: Modifying and Configuring Space-Based Electronics

I2C is an intra-board communication bus that is used in many day-to-day devices including cellphones. We in ISR are using the bus for communicating to ROMs and sensors on a board to assist in start-up and state of health review on space satellites.

Watch presentation: https://youtu.be/W9yyMhNDJn8
Matthew Vigil

**Program:** Undergraduate  
**School:** University of New Mexico  
**Group:** MPA-11  
**Mentor:** Alp Findikoglu  
**Category:** Engineering  
**Type:** Individual  
**LA-UR-20-25403**

---

**Development of Electrochemical Methods for In Situ Diagnostics of Fluids**

We are developing electrochemical methods used for characterizing a fluid during a process in terms of conductivity and permittivity while also being able to distinguish electrolytes from one another non-destructively.

Watch presentation: [https://www.youtube.com/watch?v=4gE8iOejQkA](https://www.youtube.com/watch?v=4gE8iOejQkA)
Silicate Sequestration for Water Treatment

This work investigates the use of four different molecular weights of PEG and determines the optimal concentration for each in deionized and tap water which provides a foundation for increasing the number of allowable cycles used in cooling systems.

Watch presentation: https://youtu.be/KKkKpb5duBE
MATERIALS SCIENCES
Applications of Machine Learning to Degradation Prediction of PHAs

This project involves the construction of a machine learning algorithm in Python to assist with the design of poly(hydroxyalkanoate) biopolymers by generating a database and random forest model for prediction environmental degradation.

Watch presentation: https://vimeo.com/444570413
Optocouplers: Their Polymer Components, Current Applications and My LANL Project

My project at LANL includes conducting thermal and mechanical tests on three different cure profiles of epoxy to collect data about shrinkage, coefficient of thermal expansion, and degree of cure for a group wanting to produce their own optocoupler.

Watch presentation: https://www.youtube.com/watch?v=n8m6OpBLqsw
Experimental Optimization to Determine Heat Capacity of SX358 by MDSC

The parameters of a quasi-isothermal MDSC experiment were optimized, focusing on calibration and the appropriate selection of modulation period. 90 seconds was identified as an ideal modulation period for measuring the heat capacity of SX358 at 0°C.

Watch presentation: https://youtu.be/70h6C65T3jw
Camille Wong

**Program:** Graduate  
**School:** University of Oregon  
**Group:** MST-7  
**Mentor:** Alexander Edgar, Dali Yang  
**Category:** Materials Science  
**Type:** Individual  
**LA-UR-20-25731**

---

**Method development: LC-MS/MS of eutectic bis(2,2-dinitropropyl) acetal/formal**

This presentation reviews LC-MS/MS instrumentation and discusses the methodology development for the characterization of a mixture of bis (2, 2-dinitropropyl) acetal/formal nitroplasticizer.

Watch presentation: [https://youtu.be/Y8v_r1TCQTg](https://youtu.be/Y8v_r1TCQTg)
MATHEMATICS
Bayesian Model Calibration using Physics-Informed Machine Learning

We illustrate Sepia, an open-source python code for physics-informed machine learning. A simple physics example is presented to illustrate parameter calibration and prediction capabilities. Additionally, we validate Sepia against recent literature.

Watch presentation: https://www.youtube.com/watch?v=VeuLIC8_hSY&feature=youtu.be
Samuel Myren

Program: Post Bachelors  
School: Virginia Tech  
Group: CCS-6  
Mentor: Earl Lawrence  
Category: Mathematics  
Type: Individual  
LA-UR-20-25683  

In-situ Inference for Exascale Computing

High performance computing simulations create more data than can be stored. We are developing statistical tools to analyze the data while the simulation runs. This project seeks to determine the needed statistical complexity before analysis begins.

Watch presentation: https://youtu.be/MreSy8n-WvE
OTHER (NON-TECHNICAL)
Gabriela Baca

Program: Undergraduate  
School: University of New Mexico  
Group: HR-FCS  
Mentor: Sandra Morello  
Category: Other (Non-Technical)  
Type: Individual  
LA-UR-20-25916

Non-lab Contingent Workers

Gabriela Baca is an intern at LANL this summer and she helps approve functions within the field and Central Services group in the human resources division for non-contingent workers as well as other tasks.

Watch presentation: https://youtu.be/weV7BaGWMCs
**Who Invented the Christy Gadget?**

This project outlines and resolves the ongoing dispute over who deserves credit for the invention of the Christy Gadget, drawing upon unique evidence from the National Security Research Center.

Watch presentation: [https://youtu.be/w3jj9P2rjjk](https://youtu.be/w3jj9P2rjjk)
PHYSICS
Charles Coleman

Program: Undergraduate  
School: Morehouse College  
Group: C-CDE  
Mentor: Joseph Dumont  
Category: Physics  
Type: Individual  
LA-UR-20-25407

Investigating the degradation of PHA biopolymers and their derivatives

Polyhydroxyalkanoates (PHA) are a family of polyesters that can be produced by microorganisms such as cyanobacteria. In this work, we investigated the accelerated thermal degradation at 90°C of two commercially available PHA-based bioplastics.

Watch presentation: https://youtu.be/q2V4vC4GPH8
CT Analysis of Double Shell Targets

Double shell experiments are being performed to measure symmetry of Al outer shells. We have been using MATLAB routines to analyze target CT data to determine the initial asymmetry in the capsule.

Watch presentation: https://vimeo.com/444266648
Keng Lin

Program: Post Bachelors
School: Columbia University
Group: P-25
Mentor: William Louis, Richard Van De Water
Category: Physics
Type: Individual
LA-UR-20-26082

Study Neutrinos using MiniBooNE Detector

We study the most current MiniBooNE data set of 18.75 POT and have gained more understanding of the observed electron neutrino-like excess. The radial spectrum disfavors the interpretation that the excess is purely neutral pions or dirt background.

Watch presentation: http://youtu.be/uNV7w-aG0WA?hd=1
Developing a longitudinal charge density diagnostic for electron bunches

We present the development of a novel diagnostic that uses coherent off-axis undulator radiation to measure the longitudinal charge density of a highly relativistic electron bunch nondestructively with femtosecond resolution in a single shot.

Watch presentation: https://youtu.be/g5SbJaonC7g
Implications of Numerical Operator Mutation on Differential Forms

The entropy producing effects of viscosity and heat conduction are physical dissipative mechanisms that are not always calculated. It is shown that these effects can lead to locally negative contributions to global entropy in fluid flow.

Watch presentation: https://youtu.be/dpMcKmkop-8
Chandler Smith

Program: Post Bachelors  
School: Occidental College  
Group: NEN-1  
Mentor: Katrina Koehler  
Category: Physics  
Type: Individual  
LA-UR-20-25769  

Quantitative Analysis of U and Pu using Decay Energy Spectroscopy

Decay energy spectroscopy is a novel radiometric measurement technology under development for its potential to increase analysis sensitivity and throughput in safeguards laboratories. Isotope ratios were determined to within $1.6\sigma$ of certified values.

Watch presentation: https://youtu.be/mIHI27_PFrw