Undergraduate Research Experience
2017 Faculty and Projects

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Biology (NSM)

1. Dr. Bill Hoese — Biology (NSM)

Faculty research interests: Work in my lab focuses on the urban ecology of western bluebirds. Western bluebirds nest in cavities in open areas across Orange County and may be positively or negatively impacted by several factors, including trash and noise pollution.

Available project:
We have an ongoing study of how noise pollution impacts the reproductive success in western bluebirds. RAISE students will contribute to the overall project goals by monitoring territory size, provisioning rates, vigilance, or food availability, across a noisy to quiet gradient.

Desired preparation for this lab: Students must be interested in spending extended periods of time working outdoors and should be prepared for hot, dry conditions.

2. Dr. Misty Paig-Tran — Biology (NSM)

Faculty research interests: functional anatomy, biomechanics, and biomaterials

Available project:
The project would involve 3D printing bio-inspired manta ray filters and using a flow tank to look at the filter mechanics, filtration efficiency of those filters. This involves some model building, working with a flow tank and video equipment, and data analysis via Image J and MATLAB software.

Desired preparation for this lab: interests in marine biology or engineering that would like to get a very hands on approach working with a new bio-inspired water filter

3. Dr. Nilay Patel — Biology (NSM)

Faculty research interests: Drug discovery and identification of mechanism by which niclosamide blocks cell proliferation

Available project:
Our objective for summer 2017 is to determine how niclosamide, an FDA-approved drug, blocks cell proliferation in human cancer cell lines. We use various cell and molecular biology techniques to determine organelle functioning and signal transduction pathway activities after niclosamide treatment.

Desired preparation for this lab: At least one course on cell or molecular biology.

4. Dr. Parvin Shahrestani — **Biology (NSM)**

Faculty research interests: Evolutionary genomics, population genetics, experimental evolution, aging, immunity, Drosophila melanogaster.

Available projects:
Project 1: The fungal pathogen Beauveria bassiana can be used in the biological control of mosquito vectors of malaria and dengue virus. But how exactly does this fungus infect insects? And how do insect hosts fight off the fungal infection? The URE student will complete a series of experiments to answer these questions.

Project 2: As people get older they become more susceptible to infections. The same is also true in other organisms, including insects. But why does aging result in increased susceptibility to infection? And are there ways to mediate this increase susceptibility? The URE student will complete a series to experiments to better understand the relationship between aging and immune defense (what we call immunosenescence).

Project 3. In large populations, some individuals are more susceptible to disease than others. What environmental and genetic factors are responsible for this variation? What genes are involved in resistance or tolerance of infection? The URE student will complete a series of molecular genetic and population genetic experiments to help address these questions.

5. Dr. Danielle Zacherl — **Biology (NSM)**

Faculty research interests: Marine Ecology, Marine Population Connectivity, Restoration Ecology, Marine Invertebrates

Available project:
Examine population dynamics of native oysters in San Diego Bay

Chemistry & Biochemistry (NSM)

6. Dr. Peter de Lijser — **Chemistry & Biochemistry (NSM)**

Faculty research interests: Physical organic chemistry - mechanistic and kinetic studies of reactions involving radical and radical ion intermediates. Drug discovery - rational drug design and synthesis; structure/reactivity studies of drug candidates

Available projects:
Project 1: In this project students prepare different oxime and oxime ether derivatives that contain built-in nucleophiles (alkenes, alkynes, aromatics) and study their reactivity by means of photochemical reactions and NMR spectroscopy.

Project 2: Students design and prepare drug libraries consisting of 16-20 different compounds per library. The drugs are subjected to biochemical and biological assays to determine their efficacy as anti-cancer drugs.

Desired preparation for this lab: Students must have passed organic chemistry I and II (with lab) prior to summer 2017.

7. Dr. Amanda Evans — **Chemistry & Biochemistry (NSM)**

Faculty research interests: Asymmetric chemistry: synthetic flow technology for biomaterial applications. Development of new reaction methodologies for synthesizing and using organocatalytic polymers in flow chemistry contexts. Development of asymmetric flow photochemistry.

Available projects:
Project 1: Enz-Flow (Continuous Bioprocessing). The union of two enabling and increasingly environmentally-friendly technologies, continuous processing and continuous bioprocessing ("Enz-Flow"), is here applied towards novel abbreviated and more sustainable syntheses of three active pharmaceutical ingredients (APIs). Chirally-pure formulations of all three of these APIs have been demonstrated to possess higher activity than the racemic mixtures of these compounds. Continuous processing facilitates abbreviated and telescoped syntheses of these molecules, and continuous bioprocessing affords highly selective stereochemical control. This work will demonstrate the utility of applying continuous processing and continuous bioprocessing strategies for shortening and improving sustainability of API synthesis.

Project 2: Crystallization and Microfluidics in Microgravity. This project will investigate how mass and thermal transport in the crystallization of active pharmaceutical ingredients (APIs) are affected under diffusion-only controlled conditions (microgravity). The experiments proposed will explore two different systems: impurity rejection effects will be studied using paracetamol as a model and polymorphism control will be studied using 5-methyl-2-[(2-nitrophenyl)amino]-3-thiophenecarbonitrile as a model. It is anticipated that the mass and thermal transport supporting crystal formation for these experiments will operate purely under diffusion control and not under solute convection control (which predominates on earth) – and that both impurity rejection and polymorph formation will be optimized in microgravity environments. These experiments will be remotely controlled and visually assessed by cameras on station (limiting required astronaut time), and post-mission sample return will enable quantitative assessment of experimental results of crystal formation.

Desired preparation for this lab: Taken at least general chem and ideally organic chem (but we have successfully worked w previous students who had not taken organic chem yet).

8. Dr. Ally Fry-Petit — **Chemistry & Biochemistry (NSM)**

Faculty research interests: Research interests are in solid state inorganic chemistry, focused on the rational design of new materials through the use of data mining, synthesis, structural characterization and optical and vibrational probes.

Available project:
Students will be researching solid materials that are used in computer memory devices and sonar technologies. Their project will include synthesizing brand new compounds and analyzing their atomic crystal structure via x-ray powder diffraction, UV-vis spectroscopy, and infrared spectroscopy.

9. Dr. Michael Groves — Chemistry & Biochemistry (NSM)

Faculty research interests: Development of machine learning algorithims in order to theoretically determine the structure of chemically relevant nanoparticles and surfaces; computationally determine the chemical reactivity of surfaces in applications ranging from energy generation and storage to pharmaceutical synthesis in collaboration with experimentalists.

Available project:
Higher density fuels intended for the use in fuel cells are critical in moving that technology towards commercialization. This project will be to computationally examine how one newly identified fuel interacts with a Nickel surface so that we can characterize improvements to its efficiency using this catalyst.

10. Dr. John Haan — Chemistry & Biochemistry (NSM)

Faculty research interests: Research interests are in the area of electrochemistry to address alternative energy options, particularly those related to fuel cell technology; development of new catalysts and fuels; probing the chemistry of fuel cell

Available projects:
Project 1: Development of electrochemical sensors for detection of lead in water.

Project 2: Screening of catalysts for the reduction of carbon dioxide into usable fuels.

Desired preparation for this lab: Completion of general chemistry lab (2 semesters) would make student(s) most successful.

11. Dr. Zhuangjie Li — Chemistry & Biochemistry (NSM)

Faculty research interests: Detection and quantification of organic contaminants in water, Kinetic and dynamic study of atmospheric chemistry of volatile organic compounds using fast flow, mass spectrometry, FTIR-ATR spectroscopy and ab initio molecular orbital theory.

Available project:
Detection and quantification of organic contaminants in water, Kinetic study of reaction of volatile organic compounds with atmospheric oxidants

12. Dr. Maria Linder — Chemistry & Biochemistry (NSM)

Faculty research interests: Mammalian copper and iron metabolism, focusing on the structure, function and regulation of proteins associated with these elements. Current emphasis is on copper transport within the blood plasma (particularly a new small copper carrier we have discovered), mechanism of uptake by cells, and excretion of copper via the bile and urine, in conditions of copper overload (which naturally occurs in dogs) as well as in pregnancy and with estrogen intake/exposure. With iron we are studying the mechanism by which iron stored in a large protein, ferritin, is made available to cells and organs when needed. Studies use a broad variety of approaches from cell culture models, mutated mice and rats and tracer radioisotopes, to isolation, sequencing and characterization of proteins, as well as manipulation of mRNA/protein expression.

Available project:
Determining the identity and structure of small copper carriers in the blood plasma of humans and animals

Desired preparation for this lab: interest in biochemistry and/or chemistry

13. Dr. Andrew Petit — Chemistry & Biochemistry (NSM)

Faculty research interests: chemistry or physics; Research interests are broadly focused on using theoretical chemistry and computers to answer fundamental questions about what happens after molecules absorb light and become excited.

Available project:
Modeling the Properties of Kynurenine: Our Eye's Built-In Solar Shield. The kynurenine molecule is found in the lens of our eye and very rapidly and efficiently transforms ultraviolet light, which could damage our eye, into harmless heat. The student will learn how to use computers to work towards discovering how this molecule does its job.

Desired preparation for this lab: This project will be a good fit for students who are planning to major in chemistry, biochemistry, or physics. It would be good if the student has completed either general chemistry or introductory physics. While the project will not directly make use of calculus, calculus experience is preferred. Experience or interest in computer coding/scripting is definitely not required but would be a plus.

14. Dr. Beena Ajmera — Civil & Environmental Engineering (ECS)

Faculty research interests: Geotechnical Engineering

Available projects:
Project 1: GIS-Based Landslide Hazard Mapping for Pre- and Post-Earthquake Rainfall in Nepal. Billions of dollars are lost throughout the word due to landslides alone. Rainfall and earthquakes are two among the major triggering factors of landslides. If these two triggering factors affect the slopes together, the number of landslides that can occur significantly amplifies. Two among the recent major earthquakes – 2011 Japan Earthquake and the 2015 Nepal Earthquake – occurred in dry seasons. The entire world was worried about potential large scale landslides during post-earthquake rainfall. In this project, students will prepare database of landslides before the earthquake event, right after the earthquake, and right after the post-earthquake rainy season to evaluate if the post- earthquake rainfall triggered any landslides.

Project 2: Use of Recycled Materials in Civil Engineering Infrastructures. Recycling of waste materials in construction applications is currently gaining lots of attention due to an increase in the amount of industrial waste causing a heavy disposal cost and the resulting negative effects on the environment. One source of waste materials is scrap tires. It is estimated that, in the United States, a person scraps 1.1 tires a year, leading to an average of over 300 million scrap tires a year. These scrap tires occupy landfill space as they are non-biodegradable, contaminating the environment as they are considered as toxic waste, and pose a significant hazard. In this project, students will examine how the soil type as well as the quantity and size of shredded rubber tires influences the properties of soil-rubber tire mixtures. The research will focus on evaluating the possibility of using scrap tires into civil engineering applications including backfill of retaining walls, pavement for sidewalks and walkways, and embankment as well as ground improvement to increase the load bearing capacity of weak foundation soils.

15. Dr. Hakob Avetisyan — Civil & Environmental Engineering (ECS)

Faculty research interests: Construction Engineering and Management, Energy Efficiency, Water Supply System Management, Sustainability

Available projects:
Project 1: Home Energy Efficient Appliance Calculator Development. During the project duration students will learn on how to develop calculators to aid in efficient appliance energy consumption and comparison.

Project 2: Drinking and Irrigation Water Supply Network Management. Water system in Southern California is aging and many instances of damages occur recently and is expected to happen more and more. During the project duration the system strategic planing and operation will be analyzed for drinking and irrigation water supply.

Project 3. Construction Equipment Sustainable selection for construction projects. Construction equipment are highly emitting pieces of machines and therefor for any construction project those should be selected carefully to save the environment and reduce the cost of construction. During the project different methods for selection would be analyzed.

Project 4. Resource Management for Profit Maximization. In the world all resources are limited and should be utilized with care. This applies also to everyday life situations. During the project students will learn on how to efficiently allocate existing resources to successfully complete task defined for business projects with the aim of profit maximization.

Project 5. Solar Energy Optimal Harvesting Research and Map Development. Given the limited energy availability on earth mankind decided to harvest energy from alternate sources. Solar is one of the options and during the project students will learn about solar mapping and its development for more efficient solar energy harvesting.

Desired preparation for this lab: Some technical and business attitude would be helpful.

16. Dr. Pratanu Ghosh — Civil & Environmental Engineering (ECS)

Faculty research interests: sustainability and durability of concrete structures using advanced experimental and numerical technologies

Available projects:
Project 1: Investigate the beneficial effect of Zeolite based high performance concrete (HPC) mixtures for future implementation in reinforced concrete bridges and pavements. Enjoy hands-on experience in laboratory environment.

Project 2: Service life modeling of bridges and paveemnts using experimental research data.

17. Dr. Sudarshan Kurwadkar — Civil & Environmental Engineering (ECS)

Faculty research interests: The fate of emerging contaminants particularly pharmaceuticals and personal care products, endocrine disrupting compounds, hormones and neonicotinoid insecticides. My research work involves use of High Performance Liquid Chromatography and wet chemistry.

Available projects:
Project 1: Persistence of sulfonamide antimicrobials in engineered wastewater treatment system. In this project student will study the stability of selected sulfonamide antimicrobials in different stages of wastewater treatment system. Engineered wastewater treatment systems have become a sink for emerging micro-pollutants and their occurrence in environment could perturb ecology. This is a critical area of research that has tremendous human health and ecological consequences.

Project 2: Evaluation of photostability of antimicrobial in surface water under simulated radiation source. This exploratory research is a proof of concept to see alternate disinfectants could not only kill the pathogen but also remove low levels of pharmaceuticals and other bio-active compounds. Wastewater with low levels of micro-pollutants will be exposed to UV radiation source to investigate their photostability.

Project 3. Field scale mapping of neonicotinoid insecticides in intensive agriculture operations. This project involves sampling and detection of neonicotinoid insecticides at field scale. This research project involves

collecting soil and water samples from actual application sites of neonicotinoid insecticides, areas proximal to the application sites and areas downstream from the application. Based on the occurrence studies we will be able to demonstrate how far the neonicotinoids move in the post-application scenario.

Desired preparation for this lab: Students should have basic knowledge of organic chemistry, willingness to work in the laboratory, good laboratory health and safety skills (We will provide health and safety training prior to working in the lab).

18. Dr. Phoolendra Mishra — **Civil & Environmental Engineering (ECS)**

Faculty research interests: Understanding how water moves in natural and engineered systems

Available projects:
Project 1: Groundwater Tank Experiment. Understanding Groundwater system is filled surprises. Using our uniquely designed groundwater tank, we will investigate results of different type of groundwater tests such as pumping tests and slug test. We will analyze experimental data using computer methods.

Project 2: Channel flow Experiment. Natural river streams are complex and dynamic systems. Experimental tests and measurements will conducted in CSUF's 50 ft long laboratory channel setup. Computer methods will be used to further analyze the collected data.

Project 3. Hydrologic analysis of water systems. Using available data from agencies such as NOAA, we will develop conceptual understanding of how water moves in various regions of California. We will use computer models to perform hydrologic scenario analysis to better understand the water resources management issues.

19. Dr. Garrett Struckhoff — **Civil & Environmental Engineering (ECS)**

Faculty research interests: My current research interests are bioremediation of contaminated soil and groundwater, biofuels, and greenroofs.

Available projects:
Project 1: We are investigating ways to turn brewery waste into biofuel using algae.

Project 2: Using a combination of green roofs and solar panels to increase solar efficiency while also decreasing thermal load in a building. The green roof also has impacts on water quality and quantity during rain events.

Desired preparation for this lab: Chemistry or biology knowledge will be helpful.

20. Dr. Binod Tiwari — Civil & Environmental Engineering (ECS)

Faculty research interests: geotechnical engineering, earthquake engineering, landslide hazard mitigation, applied GIS, embankments and dams, natural hazard reduction, ground improvement and use of recycled materials in geotechnical application

Available projects:
Project 1: Use of Recycled Materials in Civil Engineering Projects. Recycling of waste materials in construction application is currently getting lots of attention due to an increase in the amount of industrial waste causing a heavy disposal cost and a negative effect in the environmental. One source of such waste materials is scrap tires. The project will mainly focus on evaluating the possibility of using scrap tires and construction waste into civil engineering applications including backfill of retaining walls, pavement for sidewalks and walkways, and embankment, as well as ground improvement to increase the load bearing capacity of weak foundation soils.

Project 2: Reducing the Impact of Earthquake Ground Shaking on Infrastructure. The shaking intensity of ground surface magnifies by 4 to 5 times when a seismic wave travels through soft clayey soil. This requires a heavy construction cost for a building that is planned to be constructed on that type of soil. In this research, a reliable soil modification technique will be investigated to reduce seismic ground vibration.

Project 3: Investigating the Catastrophic Ground Failure during Earthquake. The M9 Tohoku earthquake killed more than 20,000 people in Japan. One of the typical but surprising patterns of ground failures during earthquake was the long travel distance, some of which were longer than 1500 ft. We believe that the earthquake shaking reduced the shear strength of soil tremendously by destroying the suction in the soil or other reasons, which caused a significant reduction in the stability of slopes. In this study, one of those landslides will be modeled in the Shake Table and shaken with M9 Tohoku earthquake intensity, recorded at that landslide site. The travel distance of the landslide mass at that earthquake shaking will be verified in the shake table model. Using available computer simulation software, the deformation pattern of the slope will be evaluated and compared with the results obtained from ground shaking experiment.

Computer Engineering (ECS)

21. Dr. John Faller — Computer Engineering (ECS)

Faculty research interests: Digital Signal Processing (DSP), embedded systems

Available projects:
Project 1: Development of an assistive device that allows people with hearing loss to experience music through touch.

Project 2: Development of a portable real-time noise monitoring prototype to monitor noise pollution levels.

Desired preparation for this lab: Preferably, a computer programming class and a physics class.

22. Dr. Yun Tian

Computer Science (ECS)

Faculty research interests: cloud computing, cloud security, big data, distributed computing, parallel and high performance computing, and computer science education

Available projects:
Project 1: Cloud Computing Storage Security. The rise of huge datasets, dubbed "Big Data", have pushed the need for introducing innovative ways to provide large-scale data processing using cloud and distributed computing systems. Two popular frameworks exist today: Apache Hadoop, which uses the MapReduce paradigm, and Apache Spark, which uses the Resilient Distributed Datasets for in-memory processing. This project focuses on proposing some solutions to store data securely and at the same time process data fast by using these two frameworks.

Project 2: Location-based services. The increase in location-based services (LBS) in recent years has raised the prominence of spatial keyword (SK) queries. As the majority of current modes of transportation require travel along roads, the use of network distances in SK queries is potentially more desirable than Euclidean distances. This project aims to propose a novel indexing method, in a distributed framework, to simultaneously return query results of all relevant points-of-interest.

Project 3. Text Mining. Most of the data we have today is text based and difficult to analyze because of its structure and size. Text mining help many organizations to obtain valuable information from large text based content that can provide intelligent decision making. We will study and propose a solution on text mining application to calculate the aspect rating of hotel reviews using Map Reduce.

Project 4. Cloud Computing Network Security. Software-Defined Networking introduces centralized control logic, and separated data plane from control plane which makes it easy for network engineers to monitor traffic and diagnose threats, insert and change security policies. Customized integration will become easy. However, it also creates security challenges which didn't exist before. In this project, we will analyze the effect of denial-of-service (DOS) attack on controller plane and propose a solution to mitigate DOS attack on SDN controller.

23. Dr. Abhishek Verma

Computer Science (ECS)

Faculty research interests: Machine learning, computer vision, bigdata, deep learning, artificial neural networks, biometrics, data mining, data science, artificial intelligence.

Available projects:
Project 1: Sentiment analysis - It is the process of computationally identifying and categorizing opinions expressed in a piece of text in order to determine the writer's attitude towards a particular topic.

Project 2: Machine learning in images for recognition of scenes, objects, etc.

Project 3. Video analysis using machine learning for recognition of objects.

Desired preparation for this lab: Some amount of programming background although optional but will be useful.

Geological Sciences (NSM)

24. Dr. Natalie Bursztyn — Geological Sciences (NSM)

Faculty research interests: Geoscience education – development of innovative teaching tools in geoscience education.

Available projects:
Most likely a project relating to teaching the rock cycle. Potentially a project relating to modeling sink holes or modeling the Coriolis effect – depending on lab resources.

Desired preparation for this lab (optional): Geology 101

25. Dr. Joe Carlin — Geological Sciences (NSM)

Faculty research interests: coastal and shallow marine geology to investigate how these environments evolve under natural conditions and due to human activities

Available projects:
Project 1: This project will analyze sediment cores collected from offshore Monterey Bay California to investigate how the supply of sediment form the land to the ocean has changed throughout time. The project offers the opportunity to assess environmental changes on land in the ocean over a variety of time scales including the rect past (last ~ 150 years) and recent geologic past (~ 3,000 years).

Project 2: This project will determine how an urban estuary (Upper Newport Bay, CA) has evolved over the past 100 years under the influence of humans, and how future climate change, in particular sea level rise, may impact the bay.

Project 3. This project will analyze a sediment core from a small southern California estuary (Los Penasquitos Lagoon, CA) to reconstruct the environmental changes in the lagoon over the past ~2,500 years.

Desired preparation for this lab: A geology/earth science/ or environmental science course would be beneficial - but not a requirement. Interest in environmental science (of any kind) is a plus, plans to pursue a science degree is a plus, willingness and ability to conduct a little bit of work in the field is also a plus.

26. Dr. Adam Woods — Geological Sciences (NSM)

Faculty research interests: Mass extinctions and paleoenvironments.

Available projects:
Examine the geochemistry of sedimentary rocks deposited during and after the Permian-Triassic mass extinction. Or, analyze sedimentary rocks and fossils across a mass extinction event.

Mathematics (NSM)

27. Dr. Anael Verdugo — Mathematics (NSM)

Faculty research interests: nonlinear dynamics and differential equations, particularly in their applications to biological problems

Available projects:
Project 1: Mathematics and Evolution. Understanding and simulating the mathematical equations that govern evolution.

Project 2: Mathematics and Disease Transmission. Building a mathematical model of the virus transmission.

Mechanical Engineering (ECS)

28. Dr. Chean Chin Ngo — Mechanical Engineering (ECS)

Faculty research interests: transport phenomena in porous media, heat and mass transfer enhancement using electric field and multimedia technology in engineering education & K-12 STEM education

Available projects:
Project 1: Experimental Study of Thermal Energy Storage: This study will investigate the effectiveness of a thermal energy storage using porous media readily available and commonly found in nature such as sand, soil, pebble rocks and gravel. This study will consider a simple and inexpensive thermal storage system which could be constructed easily and examines what could be done to maximize the thermal storage performance. The application of the present study could be more useful for rural areas in developing countries where resources are limited and scarce.

Project 2: The electrohydrodynamics (EHD) technique has been actively applied to heat and mass transport processes in various industries including energy, food, aerospace and defense industries. This study is related to the use of electric field in the design of an EHD pump and/or the use of electric field in propulsion.
Desired preparation for this lab: It's helpful if the applicants have hands-on experience in the machine shop and comfortable working with basic tools.

Physics (NSM)

29. Dr. Wylie Ahmed — Physics (NSM)

Faculty research interests: Biophysics and living material systems

Available projects:
Project 1: "Low-cost microfluidics for biophysics and soft matter". This project includes designing and fabricating microfluidic devices that are capable of manipulating the motion of fluids, particles, and biological molecules at the microscopic scale. It involves hands-on activities with simple microfabrication, microscopy, and digital image analysis.

Project 2: "Force measurement in active matter systems". This project includes the synthesis of microscopic (Janus) particles that are self-propelled by a light-activated chemical reaction, which are then used to study

the physics of active matter. It involves hands-on activities with microscopy, laser tweezers, simple chemistry, and computational simulations.

Desired preparation for this lab: It would be advantageous if students have taken calculus and calculus based physics (mechanics). Students seeking to major in physics, chemistry, biology, or engineering will find this research most appealing.

30. Dr. Leigh Hargreaves **Physics (NSM)**

Faculty research interests: I make measurements of the physical properties of atoms and molecules (their "size" and "shape"), properties that determine their chemical properties and reactivity. My particular focus is currently on molecules relevant to biology and biomass treatment.

Available projects:
Students will fabricate and install a new gas sample handling mechanism to upgrade an apparatus for studying gas targets proposed for the treatment of biomass in the generation of ethanol based fuel sources. If the project proceeds well, students will then take preliminary measurements with the upgraded equipment on levulinic acid.

Desired preparation for this lab: The project requires no speciality knowledge beyond a normal 12 month curriculum in either physics, chemistry or biology.

31. Dr. Geoffrey Lovelace **Physics (NSM)**

Faculty research interests: Gravitational physics, numerical relativity, simulations of merging compact objects.

Available projects:
The student will use supercomputers to model colliding black holes and the gravitational waves they emit. Along the way, the student will learn how to interpret and visualize their results using graphs and 3D animations, and they will learn UNIX and some basics of numerical methods.

Desired preparation for this lab: It would be helpful if incoming students have completed introductory physics, mechanics (e.g., the equivalent of our PHYS 211 or PHYS 225).

32. Dr. Jocelyn Read **Physics (NSM)**

Faculty research interests: Gravitational-wave astrophysics

Available projects:
Project 1: We have simulated data for the gravitational waves emitted by merging neutron stars that tells us how they move as they crash together. From the existing data, we will project how well future observatories would be able to discriminate between different types of stars.

Project 2: Students at CSUF have modeled waveforms from merging neutron stars, but one of the ingredients to our model makes some assumptions about how neutron stars orbit. We'd like to check how well this assumption holes by comparing the computer model we use with to some proposed alternatives.

Project 3. Years ago, I made a fitting formula for how the extremely dense matter at the core of a neutron star behaves. So far it's been very useful for other physicists and astronomers in exploring how matter affects astrophysical observations, but it has some weaknesses. If I modify the fitting formula to address those, can we refit data to confirm that the formula still works?

Desired preparation for this lab: Some experience with computer code would be useful, but not necessary.

33. Dr. Josh Smith — **Physics (NSM)**

Faculty research interests: GWPAC / direct detection of gravitational waves using laser interferometry. Projects include data analysis and experimental modern optics (in particular, light scattering and interferometry)

Available projects:
Project 1: Laboratory measurements of light scattering from high-quality optics. We will investigate how much light is scattered from sample optics for LIGO and future detectors. This will involve the use of lasers, LabView automation, and hands-on experimentation.

Project 2: Monitoring the Advanced LIGO Noise Budget. Advanced LIGO's ability to measure the collisions of black holes is limited by noise sources in the detectors. The relative strength of all of the different noise sources are measured in something called a "noise budget." In this project the student will learn Python programming and run the LIGO noise budget each day to determine how the noise budget evolves during time and contribute to helping determine which noise sources should be worked on at the Livingston, LA and Hanford, WA sites (this project may include a short trip to one of the sites).

Desired preparation for this lab: I would prefer to work with students who are interested in a career in physics, astrophysics, or astronomy. The selfish reason is that if we are a good match I will try to recruit them to join my research group in the future!