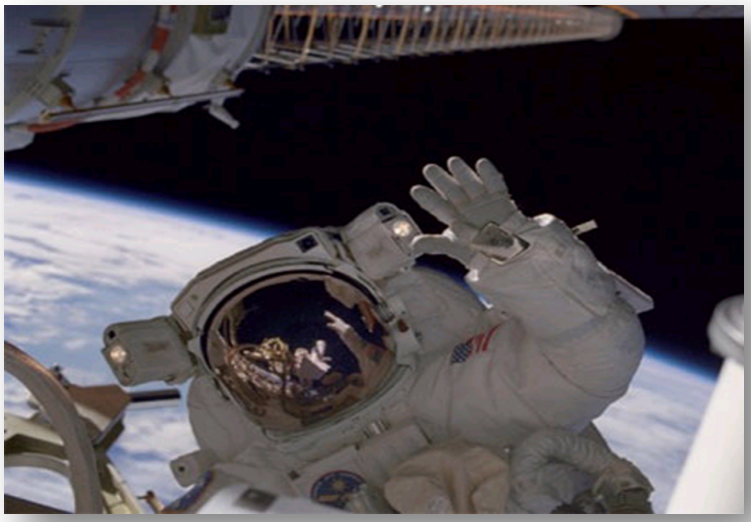
Oregon NASA Space Grant Consortium

2019 SCORE Symposium Proceedings

May 17, 2019

8:45 am - 3:30 pm

LaSells Stewart Center
Ag Science Room
Oregon State University



featuring presentations from
OSGC STEM Community College Opportunity for Research Experience (SCORE) award recipients

2019 SCORE Student Symposium

Hosted by
Oregon NASA Space Grant Consortium (OSGC)
May 17, 2019

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Presentation Schedule

8:45am	**POSTER SET-UP** - Breakfast provided for presenters
9:30am	**OPEN POSTER SESSION**
10:15am	**WELCOME/KEYNOTE ADDRESS** Dr. Jack Higginbotham, Director, Oregon NASA Space Grant Title: *Nuclear Space Power: Past, Present, Future*

TIME	Presenter
11:00am	**Teresa Nguyen** Portland Community College Southeast Campus Title: *Systems Engineering for PSAS: Base 11 Space Challenge*
11:20am	**Hayden Reinhold** Portland Community College Sylvania Campus Title: *Measuring Gravitational Acceleration with Digital Sensors*
11:40am	**Isabella Trifilo-Miley** Southwestern Oregon Community College Title: *Effects of Solar Structure on Solar Flare X-ray Emission*
12:00pm	**Adrian Jimenez** Portland Community College Southeast Campus Title: *Geologic Report on Wind Mountain and a Brief Overview of The Geological History of The Columbia River Gorge*
12:20pm	**LUNCH/NETWORKING/POSTERS** - Food and refreshments provided for presenters
1:20pm	**Emily Gemmill** Portland Community College Sylvania Campus Title: *The Physics of Fluids and Application to Traffic Flow and Patterns: An Applied Literature Review*
1:40pm	**Izikaula Huntley** Portland Community College Southeast Campus Title: *Growing Edible Algae using Vertical Hydroponics and Renewable Energy: Part I*
2:00pm	**Bailee McMahon** Southwestern Oregon Community College Title: *Analysis of Spatial and Temporal Relationships between Hard X-ray and Ultraviolet Emission in Solar Flares Observed with RHESSI and SDO*
2:20pm	**Jacob Brauer** Portland Community College Sylvania Campus Title: *Improve Behr Free-Fall Apparatus*
2:40pm	**Tellina Zavala** Linn-Benton Community College Title: *Zero Gravity Plant Simulation*
3:00pm	**AWARD PRESENTATIONS**
3:30pm	**ADJOURN**

Student Presenters - Abstracts

Jacob Brauer
Portland Community College - Sylvania Campus
Improved Behr Free Fall Apparatus

The Behr free fall apparatus (**1**) is used to test gravity. It has a falling body that is released from an electromagnet at the top of **1**. Between the falling body and the main shaft of **1**, there is disposable material that marks when an arc of electricity goes through it. Upon dropping, a high voltage arc travels through the air from falling body, marking at 60 Hz; relative displacement can be obtained by measuring the distance between these marks. The purpose of this project is to improve the accuracy, safety, and cost of **1**. The existing technology is a problem because it is dangerous to the user from arc contact risk and the exposed live circuits that are needed to make these arcs. Arcing does not occur in a consistent geometry, causing error in the measurement accuracy of **1**. The improved Behr free fall apparatus (**2**) uses infrared triangulation with Vernier equipment to determine the acceleration due to gravity. This is better because no arcs travel through the air and **2** takes reads at 100 Hz. Also, since sparks do not propagate in a vacuum, **2** is better because it makes measuring acceleration in a vacuum possible, which is not possible using **1**. **2** was built to test gravity to the same accuracy as **1**, without the problematic safety hazards and high cost of **1**. **2** is cheaper and safer than **1** and builds the infrastructure to affordably test gravity in a vacuum.

Emily Gemmill
Portland Community College - Sylvania Campus
The Physics of Fluids and Application to Traffic Flow and Patterns: An Applied Literature Review

My research seeks to apply physics and fluid dynamics to car traffic and to develop a model to predict the behavior of two different traffic scenarios. I began with literature reviews on traffic theory and fluid dynamics, as well as research into how those fields are already being merged to develop traffic models. This research was combined to develop mathematical models of traffic as a fluid. I applied this to a scenario of an accident in an intersection to find the time it takes traffic flow to return to normal, the maximum car density, and the distance along the intersecting roads that experienced density increase. I developed a model for roundabouts to see how a roundabout affects traffic density and speed during typical flow and how this compared to intersections in terms of flow, density, and speed. For the intersection, I find that the distance a shockwave travels is dependent on the flow of cars, and takes the same amount of time for flow to return to normal as it takes to clear the original accident. Clearing an accident quickly significantly reduces traffic effects. For normal traffic conditions, I conclude roundabouts have minimal effect on traffic density and speed compared to intersection's interference with those variables, suggesting roundabouts are superior to intersections due to their lack of disruption to traffic flow and density.

Izikaula Huntley
Portland Community College - Southeast Campus
Growing Edible Algae using Vertical Hydroponics and Renewable Energy: Part I

My project focuses on growing food-quality algae in a system using renewable energy and minimal land resources. The growing system, when perfected, could be used in dense urban environments as well as in compact spacecraft. I choose vertical hydroponic gardening because it requires less acreage, less water, and avoids the need for pesticides. As a growing system, vertical hydroponics has not been thoroughly researched.

My system is designed to use efficient and controllable artificial light from LEDs powered by batteries charged with a magnetic motor driven by solar cells to power algae growth; this system is sustainable over time. I choose *Spirulina* as the algae, based on its protein content and the fact it grows in freshwater, its natural environment. The first part of the project was to design and build the apparatus for growing the algae, including a bubbler to input needed levels of oxygen and LEDs to provide light required to create optimum growing conditions. The apparatus is almost functional; when full of liquid, I discovered an unexpected leak through the bottom cap. Once the system is watertight, the next step will be to test its suitability for algae growth.

Adrian Jimenez
Portland Community College - Southeast Campus
Geologic Report on Wind Mountain and a Brief Overview of The Geological History of The Columbia River Gorge

Wind Mountain is a granodioritic intrusion on the Washington side of the Columbia River Gorge. A talus slope exists on its south face that does not fit the geologic data as we understand it. My study consists of fieldwork and research. I collected and analyzed samples from various sites and used publicized research from other geologists. I used this information to create a geologic timeline. Basalt fissures opened near the Oregon-Idaho border 17 ma and have an affect on the placement of the Columbia River. The placement we are concerned with is the modern Columbia channel, formed approximately 2 ma. Wind Mountain and Shellrock Mountain formed prior to the modern Columbia River. Both have talus slopes facing the river; they may have been much closer. Approximately 15 kya, ice dammed the Clark Fork River in Montana, forming the extremely vast Glacial Lake Missoula. When the dam broke the ~100 floods compromised the integrity of Wind Mountain. We know of 40 major earthquakes generated by the Cascadia Subduction Zone in the past 10 ka. The Bonneville Landslide occurred about 600 years ago. Material dammed the Columbia River for several months. The elevation of the lake was about 73.2 m, much lower than the height of the talus slope. The south face talus slope of Wind Mountain was formed post-Missoula Floods. The slope was extremely over steepened by weathering and fractured by the flood's suspended loads. With seasonal frost wedging and CSZ earthquakes, we have the primary drivers of this landslide.

Bailee McMahon
Southwestern Oregon Community College
Analysis of Spatial and Temporal Relationships between Hard X-ray and Ultraviolet Emission in Solar Flares Observed with RHESSI and SDO

The purpose of my research project is to analyze the spatial and temporal relationships between Hard X-ray and Ultraviolet emissions from solar flares. Data from the RHESSI and SDO satellites are used to provide observational constraints for the locations and temporal behavior of the respective wavelengths of emission. The project focused on flares occurring between the years 2012 and 2015 and chosen based on availability and reliability of data from both instruments. Flares considered were M and X class events due to their large size and strength. UV light curves (1600 and 1700 angstrom emission) and X-ray light curves (25-100 keV energies) are compared for temporal correlation. Many features of the time series correlated, although additional UV emission are present. The spatial relations differ as the UV emission is often more extended than the localized X-ray bursts, suggesting a more complex magnetic structure linking the two. The continued study of these relationships with present high-resolution data will continue to constrain possible mechanisms for solar flare energy release.

Teresa Nguyen
Portland Community College - Southeast Campus
Systems Engineering for PSAS: Base 11 Space Challenge

The Portland State Aerospace Society (PSAS) has been an incorporated PSU student group for over 10 years. PSASA wants to develop an accessible project management model to support continued student growth, and needs an effective way to onboard new members. Systems Engineering was introduced by the Base 11 Space Challenge, which provides a conduit for doing research into developing an accessible documentation system that is traceable and easy to use. I created an outline for the organization's technical information, designs, safety, communications, and project management. My research was developed to amplify outreach by using accessible science communication geared towards curious STEM enthusiasts and incoming students from interdisciplinary fields. This process examines how to take an industry organizational system, apply it to a student group, and develop a long term strategy for the structure to be self-sustaining. Moving beyond the design of an accessible documentation system, it is important to integrate this practice into the PSAS ecosystem. I learned implementing a new methodology halfway through the school year conflicts with the momentum PSAS maintains as they continue technological development of amateur rocketry. Going forward, PSAS will continue using Systems Engineering and apply it at the beginning of the school year integrated with their annual project planning curriculum. In conclusion, this research initiated a long term strategy plan not only benefiting students within PSAS, but also our community partners working alongside the organization to better all talents within the aerospace and engineering fields.

Hayden Reinhold
Portland Community College - Sylvania Campus
Measuring Gravitational Acceleration with Digital Sensors

My research project aims to improve methods used to measure acceleration due to gravity. Currently the most widely used machine is the Behr free fall apparatus, which uses an electrical spark generated 60 times a second to mark a metal projectile's vertical position as it falls. I used a system developed by Vernier Software traditionally used for horizontal positional tracking and modified it to accurately track a projectile as it falls. Our main obstacles are ensuring alignment of sensors as the projectile falls and making sure the system is leveled properly to produce the best data. With my final iteration I am able to calculate the value for g with accuracy to 0.3m / s^2 90% of the time and to 0.15m / s^2 60% of the time. My system allowed for 3D printed custom projectiles and I tested two in my experiments. I successfully created a system that can work without sparks, allowing it to be placed in a vacuum. I also attained an accuracy range comparable to the Behr free fall apparatus.

Isabella Trifilo-Miley
Southwestern Oregon Community College
Effects of Solar Structure on Solar Flare X-ray Emission

The purpose of my project is to understand how the Sun's magnetic field affects solar flares. To do this I collected data from RHESSI and HMI for three flares of varying intensity. The flares were selected based on the size of the flare and the quality of X-ray time histories and light curves. With the data I gathered I am able to generate PFSS images depicting a model solar magnetic field based on HMI magnetogram observations. I constructed field images on six-hour intervals for 24 hours before and 24 hours after each flare. Prior to flare, the magnetic field is stretched and contains more energy as shown by open magnetic field lines in my model. Post-flare, most energy has dissipated, resulting in tighter and closed field lines. The closing of the magnetic field is mainly localized to regions around the flare emission, suggesting energy lost from the magnetic field is supplying energy for the solar flare.

Tellina Zavala
Linn-Benton Community College
Zero Gravity Plant Simulation

My project is intended to mimic plant growth in space by simulating the effects of zero gravity. The idea is to create a similar planting experience of that on a space station where plant growth requires artificial light, has limited water, and no gravitational influence. To investigate the effects of zero gravity, I designed and created a structure using CAD software, woodworking tools, and electronic parts controlled by an Arduino. Once the structure was created, the plants were rotated at 1 rpm for a 1-month time period in a horizontal fashion. Afterwards, the roots were compared with a control plant group. This control is under the same light and water conditions but not placed on the rotation shaft. The roots of the control plants grow in a downward fashion, while the rotating plant group has much slower growth results. This seems to be caused by having a planting encasing material too thick for light to penetrate. Another challenge is overheating of the rotation motor when it runs continuously. In order to avoid a fire hazard, the rotation is only implemented with supervision. To collect reliable data, the experiment needs to be done again. The new design would need to allow for a safe, continuous rotation during a 1-month timeframe.