VIRTUAL

STEM EXPO

RRCC Student Research Symposium

Poster and Video presentations:

Wednesday, May 6th

Thursday, May 7th

Please visit:

https://www.rrcc.edu/hub/hub-expo

Spring 2020 Program

RED ROCKS COMMUNITY COLLEGE

HONORS PROGRAM
Red Rocks Community College

Thanks to all the students and faculty that participated in the STEM Expo this year!

Faculty Advisors:

Lynne Albert, Biology

Carlos Medina, Physics

Shane Spivey, Physics

Lynnette Hoerner, Physics

Toni Nicholas, History

Barbra Sobhani, Honors and NASA Space Grant

STEM EXPO Organizers: Barbra Sobhani, Danea Fidler, Shane Spivey and Tracy Gray

RRCC STEM EXPO

Spring 2020 Program

Student Research Presentations

1. **An Exploration of the Propulsive Capabilities of Solenoids**
   James Sorteberg, PHY 212 Dr. Shane Spivey

   Solenoids are a type of electromagnet which concentrates the strength of their magnetic field allowing for many practical applications in the real world as seen in things such as MRI machines, loudspeakers, and hard disks. Another such application is seen in machines such as magnetic levitation (MagLev) trains where electromagnets are often used as a means of propulsion for the train. As an academic exercise to further the knowledge and understanding of an electromagnet's propulsive capabilities, an experiment was devised to measure the maximum distance an electromagnet of varying strength could move a load horizontally. The results of the experiment showed that using electromagnets as the main propulsive force behind an object's movement ultimately resulted in very small movements in the object, but could potentially be used in larger projects where a magnetic field is applied continuously to achieve much greater speeds and thus achieve a much greater distance traveled.

2. **Bridge Stress Analysis**
   Andrew Bazel, Kiara Billy, Asher Klassen, Ricardo Quijano, PHY 211 Dr. Shane Spivey

   Bridges are constantly undergoing different types of stress, as a result of force interaction. Physics allows us to comprehend, test, and measure the stresses and strains on the materials of a bridge at specific points. Stress is seen as external forces acting on a rigid body, in this case, this causes angular acceleration around a fixed rotational axis creating torque. With that, we began preliminary research about the given topic which included going through the Knight Physics fourth edition textbook and learning about torque, Newton's 2nd law for rotation, which is represented by the equation, = I. Sigma () representing the sum of all net torque () is the moment of inertia (I) times angular acceleration (). Torque is best thought of as the lever arm on a wrench, the larger the arm, the easier a nut can be rotated. After preliminary testing and research, the final bridge was firmly assembled, and the official testing process began. The testing of the bridge consisted of picking different stress points across the surface of the bridge. After we picked our points, we added weight to those points in order to calculate the specific amount of net torque being produced on one support column, which were intended to reflect that of the threshold of equilibrium. Then, we also changed the position of the legs on the bridge in order to change the weight distribution and general situation on the bridge. With that done, we were able to compare our experimental data with the theoretical calculations that were performed based off of the specifications of our bridge. Our calculation results were conclusive and reflected the experimental extrapolations with little error. Overall, the physics behind our bridge and testing process proved to be very useful in the long run.

3. **Center of Gravity**
   Luis Abeyta,Ethan Ryan,Antony Monroy, PHY 211 Dr. Carlos Medina

The purpose of the following experiment is to find the center of mass in three project scenarios. The first experiment shows a seesaw that becomes balanced in static equilibrium when held at the center of mass. The second experiment shows a net gravitation torque equal to zero with forks and a toothpick balanced at the center of mass. The third experiment shows an in-depth integration for moment of inertia to find the center of mass for a non-uniform object. The above experiments will prove that the center of mass for an object is what allows physicists to evaluate situations from a particle standard.

4. Circuit Analysis of a Frequency Radio

Ryan Jolly, Santana Padilla, Audrey Whitesell, Kadeja Salem, PHY 212 Dr. Shane Spivey

The objective is to do circuit analysis through the design and build of a voltage controlled oscillator frequency modulated radio. Different capacitors and inductors will be used during testing to see if they can still produce a frequency, everything else will remain constant. Theoretical data will be compared to experimental data to conclude if changing capacitors and inductors will produce a frequency.

5. CRISPR/Cas9 Course Development

Ashley Obuch, HNR 289 Barbra Sobhani

The abstract of this project was tackling the concept of what the CRISPR/Cas9 system is and transposing this information to give back to students at Red Rocks Community College for the spring semester of 2021. I used the information gathered to then put back into course development for a course for Lynne Albert, Adam Forland, and Brandon English. To be able to learn molecular biology and to learn how to buy equipment for the laboratory. This project is about my research and what discoveries I have found.

6. Current at a Distance

Phillip Kuceravy, Michael Jennings, Matt Scarborough, Brendan Stewart, PHY 212 Dr. Shane Spivey

Magnetic induction is one of the most critical discoveries in the field of physics during the last two centuries. Without induction, many features of modern-day life would be impossible; from metal detectors, to electric motors, to electrical power generation and transformers. In our experiment, we've analyzed the function of a miniature transformer, which uses a magnetic field to induce a current in a wire at-a-distance. Our experiment was, somewhat understandably, marked by multiple simplifications. While we had originally planned to demonstrate metal detection, this needed to be rolled back to a project containing the core component of the technology: induction. In practice, this technology would use a perturbable magnetic field to indicate the presence of a ferromagnetic, e.g. 'metal', substance in the presence of some inductive coils field. A similar set of technologies may be used to 'step down' voltages in power lines. Due to the importance of these applications, we've attempted to explore both of these applications.

7. Electric Cars and Their Potential Impacts

Brysyn Goodson, Adam Setzer, PHY 111 Lynnette Hoerner

With the recent newfound interest in electric vehicles as a source of alternative transportation our group has decided to provide some insight onto what electric cars are and how they work. Our primary research goal was to understand what an electric car is, how they work, and how they impact the environment differently than gasoline cars. We also wanted to place a significance on the structure, so included with our research we built our own small electric motor as a visual aid. Our primary methods of research were looking at online videos, motor diagrams, and expert explanations of electric motors to gain a full grasp of the technology. This included looking deeply into Tesla car motors, and brush-less electric motors as well. In our research we found out that electric car manufacturers use many different systems to power the car. One such system was

the AC induction motor, which Tesla cars use. We also learned how to make a simple brush-less motor from common materials. Along with this we learned that although electric cars do not produce pollution the same way that a gasoline engine does, they still do produce a fair amount in their production alone. They can also tax the environment in other ways. One such way is rare metal mining, with lithium mining being especially destructive. Overall, though, they do only produce about half as much CO2 as gasoline cars in their lifetimes (due to production). If used with renewable energy sources as power they can truly make an impact on carbon footprint, but that's a big if. Currently in Colorado a majority of our power comes from coal power plants. For electric cars to be truly effective at helping the environment then we must also transition to renewable energy.

8. Electromagnet Analysis

Zak Scott, PHY 212 Dr. Shane Spivey

There is something about magnetism that humanity has found mesmerizing. Everyone has wondered at one point or another how a speaker works or how something is able to levitate via magnets. Humans have been scrambling to understand the force of magnetism since the beginning of the industrial revolution. Since then we have come a long way with the science and math that make electricity and magnetism possible. Now we have the ability to plan and predict the behavior and strength of an electromagnet based on its build characteristics. Electromagnets are used frequently within the engineering field. There are so many potential uses for electromagnets in the real world. A couple of great examples of this would be a magnetic levitating train, a speaker system, or an MRI machine. Our team's project examines two different real world electromagnets. By analyzing each electromagnet, we are able to determine the magnetic force produced. In order to do this, we derived the equation, F=(NI)^2uA/2g^2 to find the force of each electromagnet. Through this process we have learned how to better understand electromagnets as well as calculate the force output of any electromagnet.

9. Geothermal Energy

Alyssa Barnhill, Candyce Seger, Grant Bushman, Blake Langolf PHY 111 Lynnette Hoerner

The energy deep in the earth's core is created by molten rock and is called geothermal energy. This energy can be used by humans to generate power by either power plants, well systems, or heated pumps filled with steam or heated water. Specifically, we are researching geothermal well systems and how they can take the heat in the earth and be used to generate power. Geothermal energy is important because it is energy already present inside the Earth and is renewable. It has very little environmental impact, is clean, safe, and has been proven to be extremely reliable. One of the types of geothermal wells takes the water from deep under the surface of the earth and takes it to whatever facility it is going to. As it rises it loses pressure and so becomes steam. When it reaches the facility the steam spins turbines which are connected to a generator that generates electricity. After the steam passes through the turbines it is then moved to a cooling tower where it is condensed into water and then sent back down into the Earth. For our model, we are using an aerosol can to hold the water, which represents the inside of the Earth. We then heat the water up using tea lights which represents the molten rock heating up the water. And then the steam then comes out of the nozzle, representing it coming to the Earth's surface. After it comes out it spins a propeller (our "turbine") which will be connected to a small motor that will power a small LED light. This can be related to physics in a couple of ways. First, the energy plant needs physics to get the water up to the surface in the first place. You also need physics to estimate the pressures of the Earth and of the steam. One needs physics to understand the conversion of energy from the steam to electrical energy. And finally, you need physics to know heating and cooling techniques for the air and water.

10. Guitar Physics: The Physics of Electric Sound Modification

Wyatt Soeffing, Kenneth Weiman, Jeffrey Pollock, Wrigley Burris PHY 212 Dr. Shane Spivey

Idea: We will explore the physics behind the tone, volume, and sounds effects of playing a guitar through an amplifier. Using our knowledge from the basic class curriculum, we will outline how guitar and amplifier components contribute to a familiar sound that many of us have heard. Background: Sound waves are characterized by their frequency, amplitude, and shape. Volume is positively correlated with sound wave amplitude.This means the greater the amplitude, the higher the volume. Pitch is also positively correlated with frequency. Wave shape is harder to describe, but the sound classification of timbre is based on the wave shape. Timbre is often described as "tone color" and is the difference between an electronic screech such as the dial-up internet tone, and something more appealing like a guitar solo of the same musical scale. Multiple sound waves join together to form complex waves, this is what music and all mixtures of sound end up as. Each instrument and amplifier with effect pedals in a rock band create waves of various complexities, frequencies, and amplitudes. Our goal will be to research various circuit components to change the main parameters from the sound wave made from plucking a string. Analysis After researching amplifier and sound pedal components, we will utilize an audible comparison between an unaffected sound wave through an amplifier and the sound resulting from the pedal effect. Our video presentation will compile our sound results and research data.

11. Homage Gyroscope

Chase Beck PHY 211 Dr. Carlos Medina

12. Impact of Friction on a Rolling Object

Melissa Medialdea, Xiwen (April) Zhang PHY 211 Dr. Shane Spivey

This project was a simple experiment that would demonstrate how, on surfaces that had different friction coefficients, the moment of inertia and acceleration would be changed. Three different surfaces were used on top of a ramp upon which six different items were rolled and timed using five separate trial runs. Each of the six items had a different radius and weight, which created a wide variety of data to analyze. The hypothesis was that the items with a larger radius and weight would have the greatest moment of inertia and therefore the velocity and acceleration would be greater. The results of the experiments demonstrated that the hypothesis was correct.

13. La Trebuchet: First in Fright

Creston Merrill, Jesus Munoz PHY 211 Dr. Carlos Medina

We build a trebuchet capable of slinging a tennis ball, and changed the sling length to determine where our highest yield of energy was found.

14. Measuring gravity with respect to elevation

Giovanni Chavez, Noble Skariah, John Buchholz PHY 211 Dr. Carlos Medina

The experiment detailed within the presentation explores the change of gravity values over elevation. Three elevations were taken into consideration: 1,270 m, 1,671 m and 2,919 m. Each elevation was considered for convenience and the possibility of whether or not it would yield differing values of gravity in order to see clear change. Upon measuring the average time of drop for a mass, along with recording the time for a single oscillation with a pendulum, experimental values of gravity were derived from kinematics equations and analyzed to find an overall decreasing trend inverse to increasing elevation. The experiment was flawed from a very early stage mostly due to the fact that drag was unaccounted for and external exchanges of energy were all assumed to be zero and hence could skew the results. However, upon reviewing the data collected, the values of gravity were nearly identical to that of 9.8 m/s^2 as defined by the National Institute of Standards and Technology. Although values for gravity are sparse and perhaps slightly inconsistent, the overall trend as defined by graph 3 is negative implying that the

overall change for gravity is negative over elevation even though the changes are very slight and produce no physical difference in perception. Overall, the experiment was a success in relation to our initial hypothesis that the change would be negative over increasing elevation.

15. Measuring Voltage, Current, and Magnetic Field in a Circuit with Varying Wire Gauges

Holly Hammons, Garrett Swindle, Anton Vandenberge PHY 212 Dr. Shane Spivey

Colorado has been under a stay at home order due to COVID-19. Due to this order, our group had to develop an experiment at home, with resources we had already, and without physically working together. Our limited resources allowed us to build a simple circuit using a C2 cell battery, a light bulb, and wire. We developed this simple circuit in our project to determine if the voltage, current, or magnetic field changes with respect to different gauge wires. By connecting the multimeter in series with our circuit, we tested current a total of three times for each wire gauge. By connecting the multimeter in parallel with the light bulb, we tested voltage a total of three times for each wire gauge. We were also able to use an app on our smartphones, Physics Toolbox Sweep, to measure the magnetic field close to the battery. We found that, while the voltage through the resistor increased as wire gauge decreased, the current didn't fluctuate dramatically. This must be due to experimental errors because, according to Ohm's law, the current is directly proportional to voltage. The magnetic field was not found to have changed significantly among the different gauge wires. However, without knowing the accuracy of the sensors in our smartphones, we can't discount that reading for error.

16. Medieval Siege Weaponry

Adler Langello, Connor McCorkell, Stephanie Howell PHY 211 Dr. Carlos Medina

Our project was set to analyze the unique firing capabilities of three medieval weapons: the trebuchet, the ballista, and the catapult. Our project began with the study of the Physics behind each individual weapon and their advantages over other various types of medieval weaponry. Our testing process began with the construction of a working model of each weapon. We followed this with our testing experimentation, measuring the x-distance traveled by a projectile of equal mass for each weapon. Our analysis consisted of a comparison between our hypothesis and the results of our data from our testing process. We analyzed sources of error and ultimately concluded in a discussion on the purpose of our project and what we would have liked to have done differently the next time.

17. Mini Generator

Luke Kimsey-Biglen, Jessica McConnell, Mathew McCormick PHY 212 Dr. Shane Spivey

What we are looking to achieve is turning energy from a magnetic field into mechanical energy. We will do such by running current through a wire loop so that the exterior uniform magnetic field will apply forces aligning the loop perpendicular to the field. Momentum continues the rotation until the current is flipped and the forces pull in the opposite direction completing each full turn. From the transfer of energy, we are looking to see the relationship between field strength, voltage and how much mechanical energy will be produced. We are aiming to understand in the system which factor will have more of a role in the transfer of energy.

18. Mini Tesla Coil

Ivan Gonzalez PHY 211 Dr, Shane Spivey

I will be creating a mini test coil and testing to see how many N number of loops and battery affect how much energy it can omit to light different size lightbulbs

19. Nuclear Fusion

Ashley Love, Zoe Johnson PHY 111 Lynnette Hoerner

Nuclear fusion with polarized fuel cells might just be the thing we need to help end climate change. The idea of nuclear fusion has been around for decades. The process which nuclear fusion is based on is colliding deuterium and tritium to create helium, energy and a free neutron. They do this by using magnets as the force in a reactor. Using magnets of opposing charges that can help speed up the reaction and make the atoms collide faster which results in better energy removal. Nuclear fusion is better for the environment than nuclear fission; it does not require an unstable atom. It is also better than nuclear burning and doesn't have the waste, though it does take longer than nuclear burning. A problem with Nuclear fusion is that the reactors take time and money to build, and it is a bit longer than coal and oil. With further research and development, it will be cost effective and extremely better for the environment than what we use for energy today. There are other alternative resources to our climate change problem such as solar power and wind power. They are a great start but do not have the ability to help with our energy problem on a global scale. Nuclear fusion as we have found is a great choice to the main problem and just might be the thing we need to propel us into the future.

20. Optimizing and Predicting Projectile Range

Jacob Gregg, Kristian Jorgensen, Austin Riker, Liza Zhurba PHY 211 Dr. Shane Spivey

The purpose of this project is to determine whether a projectile shot at a 45 degree angular elevation will travel further than equally sized projectiles with different masses shot at different elevations. Our group examined this concept by constructing a spring loaded ball-bearing launcher attached to an angular elevator and base plate. We used two kinematic equations, Hooke's Law as well as the concept of drag to derive theoretical results. Various experimental trials with different variance proved the aforementioned concept. We used ball bearing projectiles of equal volumes yet different masses as well as helical springs of equal lengths with different spring constants in order to give variance to our experimental data. Finally, we determined the efficacy of our predictions by comparing our theoretical findings to our experimental results.

21. Pendulum Art

Eric Hoff, CJ Hawkins, Carolyn Cassidy PHY 211 Dr. Carlos Medina

The purpose of our experiment was to study pendulum motion through the use of pendulum art. This was done using basic supplies from home depot, including but not limited to a funnel, paint, and butcher paper. Using duct tape we sealed off most of the funnel to reduce the amount of paint draining from the funnel. Using the home-made pendulum, we confirm that no matter the mass of the funnel, the period of motion will remain the same, relying only on the radius of the arc created. It was also learned that different types of ropes had an effect on the smoothness of the paint line as well as how quickly the funnel would recover from disturbances.

22. Physics 1 project

Daniel Moreno PHY 211 Dr. Shane Spivey

23. RRCC Campus Floristic Survey

Maeve Wilder HNR 289 Barbra Sobhani

The Red Rocks Community College (RRCC) campus is a small snapshot of the low-elevation habitat along the edge of Rocky Mountains. A large part of it has been relatively undisturbed since the opening of the college in 1969. Approximately 166,000 sq meters of campus were surveyed over the collection period from October of 2019 through April 2020. The purpose was to document present flowering or fruiting plant species and preserve identifiable samples of each.

Collection did not discriminate between natives and non-natives. The collected samples were preserved according to herbarium standards and will be stored in a small collection at RRCC. Commentary on the present species and possibilities for conservation is discussed. The results of the survey could facilitate future documentation and restoration efforts on campus.

24. Solar Oven

Tommy Hosier , Alejandra Luevano Sabag, Azuzara Gonzalez PHY 111 Lynnette Hoerner

The purpose of a solar oven is to transform sunlight into useful heat, which is stored in a thermally insulated interior space so that appropriate temperatures for cooking food can be reached. We were able to prove our hypothesis, almost any food can be cooked over a long period of time but in case of an emergency the oven is functional. To create the oven we used cardboard, aluminum foil, tape, glue and plastic oven bags. We made the cardboard panel and lined the inside with the aluminum foil securing it with glue and tape. We used a plastic oven bag to hold the heat around a cooking pot used to hold and cook the food. An important factor in this experiment is the amount of sunlight, so we decided that the best time to try the functionality of the solar oven should depend on the sun's position. The best time is around 11am and 3pm. We started our experiment with a pan with some water and after two hours we saw bubbles at the bottom of the pan which we concluded that the water was starting to boil. After that we decided to use the same pan to fry an egg, since it was already hot from the water. After 1 hour and 30 minutes we had an over easy egg. After that, we added some marshmallows and pieces of chocolate to see if we could have some S'mores. The last food which we tried was pizza, this example of food was cooked around two hours. Our hypothesis was confirmed. All the food was perfectly cooked, so our solar oven worked very well.

25. Solar Panels

Nicholas Stenerson, Grace, Morgan, and Samo PHY 111 Lynnette Hoerner

For our project of photovoltaic solar panels, we will investigate the problem with air pollution from current energy sources and then explain how photovoltaic solar panels are a way to create energy without contaminating the air. We will investigate how photovoltaic solar panels create energy for a household by understanding the creation of energy from sunlight to DC then to AC energy. Once we have an understanding of photovoltaic solar panels, we then will experiment with the efficiency of photovoltaic solar panels. One aspect of physics that is behind solar panels is figuring out the most efficient angle solar panels need to be in relation to the sun to gather the most energy and the energy drop off rate the steeper the angle is towards the sun. We then can explain what technology is already in place to help with the energy gathering efficiency. If time permits, we can explain what angle solar panels need to be at for each time of the year here in Lakewood, Colorado.

26. SPRING FEVER! (triple pun)

Aaron Powers, Avery Thigpen PHY 211 Dr. Shane Spivey

A spring-powered launcher was constructed to illustrate projectile motion. The objective was to use this device to mathematically solve for the distance travelled by two types of spherical objects by testing various spring constants, compressions, and angles. Using common everyday supplies, the projectile launcher provided accurate angle measurements, initial coordinates, and spring compressions that allowed for the calculation of initial velocity. Projectile motion equations were then used to predict the theoretical distance each object would travel after exiting the launcher from knowing only the initial velocity and the angle the projectile was fired. The theoretical results were then compared to the measured distance the objects traveled. When the actual result was compared with the calculations derived from equations, the two are similar after accounting for experimental error. Due to the predictable nature of projectile motion, known properties of a given system may be utilized to determine additional aspects.

27. Stirling Engine

Colton Klable, Jack Horton PHY 211 Dr. Carlos Medina

A simple demonstration of how the expansion and displacement of air in a closed system can generate power. Our Stirling engine is a basic design consisting of a single cylinder with a volume of 283 cubic centimeters and can be reproduced for as little as $10.

28. Strandbeest Motion

Nicholas Biel, Michelle Rout PHY 211 Dr. Carlos Medina

Investigation of Theo Jansen's strandbeest kinetic sculptures; transformation of wind power to lateral walking motion using wind turbine and gear reduction.

29. String Tension vs Final Potential

Stephanie Siegrist, Andrew Floyd, Sebastian Church PHY 211 Dr. Carlos Medina

Our project was designed to determine if the string tension of a tennis racquet has an effect on the distance a tennis ball travels after a collision.

30. The Effects of External Forces on an Object's Motion

Lee Hill, Godfrey Lozada, Zahryn Martinez PHY 211 Dr. Shane Spivey

The purpose of this lab was to figure out how the effects of drag, gravity, friction, and slope alter an object's movement. We have found that the results were more or less what we expected, with the slimmer, roll-able cars having much higher acceleration that the objects that wide, static cars. We suspect this because despite the small scale, drag played a large roll in the dynamics of these cars. This is significant because it gives a little bit of insight on how certain projects such as cars are created, based on how the engineers want a certain object to act.

31. The Healing Effects of Bovine Colostrum

Conrad Obi HNR 289 Barbra Sobhani

This study will focus on Bovine Colostrum and its effects on humans and wound repair. I wanted to start my paper with the focus of explaining what Bovine colostrum is and what the nutritional value of Bovine colostrum is. Bovine colostrum is milk found in the breast of cows. What makes it so unique from ordinary milk is Bovine colostrum is present after cows give birth. Comparative methods used in this paper were a combination of comparative data between Bovine colostrum in humans in relation to wound repair and no Bovine colostrum in humans in relation to wound repair. The nutritional value of Bovine colostrum from Nivedita and Prajakta article is as follows: Laboratory analysis of bovine samples (per 100 g) showed 15.92% total solids, 2.18 g total fat, 13.74 g solid non fat (SNF), 7.98 g total protein, 84.08% moisture & 0.92 g ash. Fat soluble vitamins & water soluble vitamins such as retinol (0.33 mg), vitamin E (0.29 mg), vitamin D (310.37 mcg), thiamine (0.052 mg), riboflavin (0.384 mg), pyridoxine (0.030 mg), pantothenic acid (0.015 mg) & ascorbic acid (0.016 mg) were estimated in 100 g of bovine colostrum.

32. Tiny Virtual Reality Space Experience (VRSE)

Tiffany Lovett NASA Space Grant, HNR 102, Barbra Sobhani

Capturing 360° and VR footage in space during student missions reduces the barrier to entry for those seeking to explore these technology applications. This project is the continuation of a NASA funded rocket integrated payload project for RockSat-X 2020. By recreating a smaller version of the team’s RockSat-X payload for this HighAltitude Balloon platform we can test the

viability and accessibility of this design and its technology for small affordable student projects, as well as the viability of the RockSat - X 2020 Mission objectives. The payload consists of a mini 360° camera which is extended beyond the payload and captures footage of the flight. The programmable boom arm is fully 3D printed in PLA and controlled by consumer microcontroller and prebuilt sensor components. The footage will be compiled with the RockSat-X 2020 mission footage and previous DemoSat Fall 2019 Mission footage to be incorporated in a VIVE VR experience. Additionally, the video will be utilized by institutions for STEM education outreach and the technology can be used to develop viable industry methods and standards.

33. Transformers

David Biryukov PHY 212 Dr. Shane Spivey

The purpose of this project is to experimentally verify the rules surrounding magnetism. The team will be making transformers with various configurations, calculating the theoretical current and voltage output, and measuring the experimental values to compare. The things we will vary are the material that carries the magnetic field, the input voltage, the input current, and the number of coils on the output of the transformer.

34. Van der Graaf Generator

Brendan Navarro, Grant Rold, Jacob Travers, Grace Waters PHY 212 Dr. Shane Spivey

The project to be presented in its current form is the result of a designed Van de Graff generator that explored the arc length caused by electrostatic potential. The experiment tested how the arc length changed by taking observations of the arc length created between the generator and a grounded discharge rod. The materials that were tested consisted of nylon, cotton, silk, and rubber bands. These bands were used to generate the electrostatic potential. The procedure had each material made into a belt that could be attached to the generator. These belts were then spun by using a drill. At the top of the belts, an exposed wire “rake” would collect the charge and transfer it to an attached metal sphere located at the top of the generator. The arc length produced between the main metal sphere and a discharge rod was recorded. The results displayed were as follows: Nylon produced the greatest arc length, silk came in second with slightly shorter arc lengths, cotton had the smallest arc lengths, and rubber was not able to produce any measurable arc. The project demonstrated findings that were expected based on the triboelectric series. Nylon is the highest of the materials on the triboelectric series. So, it is reasonable to conclude that it was able to give up more electrons and create a higher electrostatic potential than the other materials. These results displayed characteristics of the triboelectric series.

35. VRSE: Virtual Reality Space Experience

Nathan Clapp, Caleb Christenson, Mac Grove, Tiffany Lovett, Sina Liufau, Spencer Madison, Cid Quezada, Marieke Spiegleman, and Shannon Walters-Dorchak NASA Space Grant, Barbra Sobhani and Jennifer Jones

This year’s Community Colleges of Colorado (CCofCO), with the support of the Colorado Space Grant Consortium (COSGC) and NASA, have designed a payload -- VRSE (Virtual Reality Space Experience) -- to record 360° footage of a suborbital flight. VRSE’s payload is outfitted with a boom arm, which is an extendable scissor model. The arm is an integral component for ensuring the success of the project. In order for VRSE’s camera to capture video from the appropriate angle, the arm needs to fully extend about 18 inches from the edge of the rocket’s body. Additionally, the arm needs to be secure and stable for the highest quality video recording possible as well as maintain structural integrity and functionality during ascent and re-entry. The CCofCO team had to be cognizant of several factors. While in space, the payload will be subjected to a number of environmental and launch conditions that could affect the performance of the arm. Factors such as weight, water resistance, extreme and highly variable temperatures,

high forces from impact and acceleration, and ultraviolet radiation, as well as forces from rotation of the rocket, have all been taken into consideration when designing every aspect of the arm. Furthermore, the arm will be powered by a stepper motor acting as a linear actuator allowing us to control the rate at which the arm extends as well as the length. After the acquisition of the video, CCofCO is planning to create a VR experience and use it to help future engineers and scientists “see” what they can do. More than anything CCofCO wants to give people the ability to experience space in a way that wouldn’t be possible unless in very special circumstances. As a team, we want to interest people and show a glimpse of what space is and the infinite possibilities that are still unknown to us waiting to be discovered.

36. Wireless Charging: Electromagnetic Induction

Jon Dimercurio, Cid Quezada, Chris Wilhoite PHY 212 Dr. Shane Spivey

Our goal is to explore and test the concepts learned in PHY 212 and exercise our understanding of the material. Our project focuses on the wireless transfer of energy through an electromagnetic field. We created a wireless charger using two individual circuits, a transmitting and a receiving circuit, placed a distance d apart with solenoids connected at either end. When voltage is passed through the transmitting circuit to the solenoid (or transmitter solenoid), energy from the transmitter solenoid is transferred to the receiving solenoid. This is accomplished by the transmitter solenoid generating a magnetic field that extends to the receiving solenoid, which in turn is converted into a DC current in the receiving circuit; powering the object connected to the receiving circuit, in our case, a lightbulb. This will demonstrate the concepts of wireless electricity, electromagnetic induction, electric current, energy transmission and circuits.