



**CALIFORNIA STATE SCIENCE FAIR
2011 PROJECT SUMMARY**

Name(s) Nathaniel R. Armstrong	Project Number J0901
Project Title Magnetic Linear Accelerator	
Objectives/Goals There are two goals to this experiment. The first is to find out if the starting energy of a projectile shooting through a rail gun affects the speed/distance. The second is to find if the increase in speed between each magnet is linear or nonlinear and why.	
Abstract The methods in this experiment was having four magnets held in place three inches apart on a piece of wood with a trough cut in it. Then attach a ramp to the end of the piece of wood. Mark a point with a marker on the top of the ramp, a half-inch from the magnet closest to the ramp, and one between each magnet. To test the linear increase test going through only one magnet, two, three, and four. Then compare the increase between no magnets and one magnet, one and two... Also find the difference between from the top of the ramp and before the first magnet. I used ten square gold-plated half inch neodymium-iron-boron magnets.	
Methods/Materials The results were that it was a non-linear increase. The increase of energy diminishes with each successive magnet. I believe this is because the magnet increases the energy based on the time the magnet has to accelerate the projectile. The first magnet will have longer than the second, which will have longer than the third and so on. The starting kinetic energy does not matter as to the final distance of the projectile is the same due to the same principle that made it be a nonlinear increase.	
Results In conclusion my experiment proved an interesting and surprising property of magnets and inelastic collisions. My original assumption was that each magnet would increase the distance linearly because the magnets were the same and that the higher the starting energy the farther the distance the projectile would go.	
Conclusions/Discussion I built a magnetic linear accelerator and tested properties of magnetism and inelastic collisions.	
Summary Statement Dad helped build project; Teacher helped review papers	
Help Received	



**CALIFORNIA STATE SCIENCE FAIR
2011 PROJECT SUMMARY**

Name(s) Thomas M. Arrizza	Project Number J0902
Project Title High Voltage Discharges: Investigating Effects of Wire Structures	
Abstract Objectives/Goals About a year ago, I became fascinated with the idea of a Tesla coil. In September I built a Tesla coil. I observed that the sparks farther away from the Tesla coil seemed to be longer. I decided to research and find out why. I believed the differences might be caused by the electric field surrounding the Tesla coil. If this was so, the spark lengths would change length based upon the distance the discharge point was to the Tesla coil. I made this my hypothesis. Methods/Materials To test my hypothesis, I constructed structures from copper tubing. I performed approximately 60 tests and recorded and measured a total of 20 samples. For these experiments, I tested the shorter wire heights against the longer wire heights in configurations I constructed to compare the sparks emitted. I named my first wire structure the #Daisy Flower#. The second structure I made I called the #Ladder#. The third structure I tested was a wire with adjustable heights. I placed each of the configurations on the toroid of the Tesla coil and took several photographs of each result. I then measured the length of the sparks indirectly by measuring the lengths on the photographs I took. Results I found that my first two configurations, when tested, seemed to support my hypothesis, the sparks emitted were ten times longer at the farthest wires (at the greatest vertical heights). The separate wire heights experiment did not show the same result. I was puzzled by this, so I researched to find answers. Conclusions/Discussion I found that the sparks travel as far away from the Tesla coil as they need to complete a circuit with ground. Even though my hypothesis was not supported, my findings may be helpful in research regarding harvesting directed lightning for power.	
Summary Statement This project studies the effect of copper wire shapes that I made on high voltage, low current electrical discharges from a Tesla Coil	
Help Received Father supervised project; Teacher helped guide project in correct direction	



**CALIFORNIA STATE SCIENCE FAIR
2011 PROJECT SUMMARY**

Name(s) William H. Baldwin	Project Number J0903
Project Title The Superconducting MagLev Train	
Abstract Objectives/Goals To build a working model of a small scale superconducting magLev train that provides sufficient data to calculate whether or not building a full scale superconducting MagLev train is possible, and if so what would the specifications be. Methods/Materials Experimental procedure: 1. Build the train. 2. Lay the magnets on the track in a three magnet thick oval where the outer rows of magnets are inversely polarized to the middle row of magnets. 3. Build the mechanical motor and size it correctly on the track in order to propel the train when levitating. 4. Choose which height you would like the train to be cooled at (2mm-14mm) place train on shim and cool...wait.....and we have lift off! 5. Measure heights, weights, speeds, and times. 6. Calculations Materials - A 35#65#16mm High Grade, Melt Textured Yttrium Barium Copper Oxide Bulk Superconductor. -400 .5#.5#.125" N42 Grade Neodymium Magnets.(Magnetized through Thickness) -A .25" thick cold-rolled Steel sheet. -Liquid Nitrogen. -Polystyrene Plastic sheeting. Results The levitation height was able to be varied from 2mm-14mm due to the enhanced flux pinning effects of the superconductor. However, the levitation gets much weaker the higher the levitation. The average speed through the acceleration-gates was 3.38k/h. While the average speed through the speed-gates was 4.81Km/h. Conclusions/Discussion Over all, the experiment did turn out how I had anticipated. The Small scale superconducting maglev train did provide accurate data, and I actually determined that running full scale superconducting trains would not be a feasible replacement for traditional trains due to the extreme build up of cost and weight.	
Summary Statement To build a completely functional small scale Superconducting MagLev Train and use its performance aspects to determine whether or not full scale Superconducting Trains would be a feasible replacement for traditional locomotives.	
Help Received My parents helped me purchase the necessary materials, along with supervising me with the liquid nitrogen.	



**CALIFORNIA STATE SCIENCE FAIR
2011 PROJECT SUMMARY**

Name(s) Alexander C. Barrett	Project Number J0904
Project Title How Does the Number of Magnets on a Gauss Rifle Affect the Distance Flown by Its Projectiles?	
Abstract Objectives/Goals My objective was to discover if the number of magnets on a Gauss Rifle affected how far its launched projectile traveled. My Hypothesis was that the more magnets connected to each other along the barrel the farther the marble would fly. Methods/Materials I assembled a miniature version of a Gauss Rifle that had two neodymium super magnets. Then I lined up three meter sticks and put the Gauss rifle exactly 2 centimeters off the ground. From there I fired five iron balls and recorded where they landed along the meter sticks. I then added two more magnets at a time to the mechanism and repeated the process. Finally, after ten magnets had been successfully tested, I determined whether the number of magnets on a Gauss Mechanism affects how far it shoots. Results My data that I have collected and graphed shows that the average distances the marbles traveled for each set of magnets were 10.68cm for two magnets, 12.06cm for four magnets, 15.89cm for six magnets, 17.66cm for eight magnets, and 22.06cm for ten magnets. From my experiment I have concluded that the more magnets you have on a Gauss rifle the farther the projectile will travel, so my hypothesis about this particular experiment was correct. Conclusions/Discussion My experiment shows that the more magnetic force you have pulling on an object, the harder it will hit the magnet when attracted, thus producing a stronger output of kinetic energy on the opposing side of the magnet. This is why I believe I got the results I got. My experiment is important as it shows how this generally classified #Sci-Fi# weapon can be used effectively in the real world. My experiment in particular could be beneficial to the military, especially in the role of a sniping weapon. The U.S. armed forces have many advanced reconnaissance sniper teams around the world that could gain the advantage from this idea. Most snipers have to compensate for wind resistance, bullet drop, and the coriolis effect (the earths rotation against the bullets flight path); but with my design they theoretically shoot five-times farther with significantly less bullet drop, no wind resistance, and an almost non-existent Coriolis effect.	
Summary Statement My project was about proving the Gauss Rifle theory	
Help Received My father helped me research my experiment background.	



**CALIFORNIA STATE SCIENCE FAIR
2011 PROJECT SUMMARY**

Name(s) Tim S. Brown	Project Number J0905
Project Title Frames of Silence	
Abstract Objectives/Goals This project was designed to test if you can measure how far away something is by using sound and light. The idea is that if a light and sound were emitted from the exact same place at the exact same time, the light would be seen before the sound is heard. A video camera and a computer can be used to detect the exact moment the light is detected and the exact moment the sound is detected. Methods/Materials To test this, I made a short clip where the computer would flash white exactly (the same 30th of a second) when a loud sound occurred. While playing the video, I set up the camera different distances from the screen. When the footage was downloaded onto the computer, you could easily see the difference between the flash of light and the sound. Results The tests showed that as the distances increase, so does the gap between the flash and the sound. The distance was divided by the average amount of seconds to get the meters per second sound would have traveled to get each result. The closer the number was to the speed of sound (340 meters per second, the more accurate the video camera is as a distance measurement device. The closer the measurements were taken from, the more inaccurate the results were. For example, from 10 meters, the data resulted in 1800 meters per second, far from the actual speed of sound. Conclusions/Discussion The numbers at greater distances, the numbers got closer to the speed of sound, showing that it was more accurate at greater distances.	
Summary Statement Using a video camera, measured how far away something that made a sound and a light at the same time was.	
Help Received Dad helped with testing the project, and Mr. Yogi gave advice.	



**CALIFORNIA STATE SCIENCE FAIR
2011 PROJECT SUMMARY**

Name(s) Tim Castiglione; Michael White	Project Number J0906
Project Title Water with a Zap!	
Objectives/Goals Purpose Our project was to determine if the output voltage of our homemade hydro-electric generator will change linearly, exponentially or not at all when you increase the household water pressure. Hypothesis We believe the output voltage will increase linearly if the turbine and the generator are synchronized and spinning together.	
Abstract Methods/Materials We built a homemade turbine and coupler with a 50 Pack & 25 Pack CD cases. Each case had CDs spaced with 8 neodymium magnets. We built a homemade generator using a small cardboard box with a nail through the center of box and attached four ceramic magnets on the nail. We wrapped thirty gauge coated wire around the box 300 times to create our coil. Procedure We used the following steps to complete our project; 1.Hot glued the magnetic coupler to the turbine 2.Placed the sharp end of the nail from the generator into the shaft of the coupler using a carburetor vacuum plug. 3.Placed the completed hydro-electric generator in the plywood stand to keep secure while testing. 4.Turbine was connected to our water supply using an outdoor water valve and 3 foot hose. 5.Connected the volt meter using alligator clips to the two ends of coated wire on the generator 6.Performed five 30 second test at 10 different pressure set points. Each pressure set point was in increments of 5 PSI to a maximum of 50 PSI. The voltage output was measured using a calibrated volt meter for each test and recorded.	
Results After averaging all the test data and plotting on our graph, we found that the output voltage increased exponentially as the water pressure increased.	
Conclusions/Discussion Our test results proved that our hypothesis was incorrect. We would like to retest this project with a few improvements for next year. If we used unlimited water pressure, larger turbine, and a higher capacity generator would the voltage continue to increase indefinitely?	
Summary Statement Our science project is about using household water pressure and building a homemade hydro-electric generator to test the effects of water pressure to generate voltage.	
Help Received Mr. White used the air dremel tool to bevel the PVC inlet pipe. Mr. Castiglione used the chop saw and scroll saw for the wood stand. Mr. Castiglione completed the on-line application.	



CALIFORNIA STATE SCIENCE FAIR 2011 PROJECT SUMMARY

Name(s) Jagjot S. Dosanjh	Project Number J0907
Project Title Green Your PC: How Much Power Do the Major Parts of a Computer Consume?	
Objectives/Goals The objective of my investigation was to find how much power the major parts and programs of a computer consume and how you can configure your PC so that it conserves power. Abstract Methods/Materials All the needed materials for my experiment are: One (1) P3 International P4400 Kill A Watt Electricity Usage Monitor, One (1) Gateway computer, One (1) power strip, One (1) wall outlet, One (1) stopwatch, One (1) HP Officejet Pro 8500 Wireless Printer, One (1) AT&T 2Wire modem, One (1) video game (Diner Dash), One (1) DVD (Transformers 2), One (1) Microsoft Word 2007 program, and One (1) Notebook. First, plug the computer into the power strip, which is then plugged into the Kill A Watt, and finally plug the Kill A Watt into a wall outlet. Second, measure and record peak power and steady state power in watts for all variables. Finally, measure and record the amount of time taken for sleep, hibernate, and shutdown to recover back to start page. Results The results indicates that the computer and monitor consumes the most amount of peak power and shutdown consumes the least amount of peak power. It also indicates that test page print consumes the most amount of steady state power and shutdown consumes the least amount of steady state power. Finally, it indicates that sleep takes the least amount of time to recover back to start page (6 seconds) and shutdown takes the most amount of time (57 seconds). The average amount of peak power/ steady state power consumed: computer and monitor (178.6) (116.8), computer (81) (81), screen saver (111) (111), brightness (minimum) (108.3) (108.3), brightness (maximum) (111.6) (111.6), disk defragmenter (156.4) (117.5), Word 2007 (162.2) (117.4), video game (Diner Dash) (174.2) (123.2), DVD (Transformers 2) (175.8) (132.4), printer (169.2) (131.5), test page print (170.6) (142.2), modem (145.2) (121.8), internet (169.4) (124.1), sleep (3.2) (3.2), hibernate (3.17) (3.17), shut down (2) (2). Conclusions/Discussion The different programs and parts do take up different amounts of power. People should shut down computers when they are not using them and put them in hibernate if they are going to use them later in the day. You can also change the brightness on your computer and use the screen saver. By doing these things and using certain parts and programs of the computer less you can lower your energy bill and help conserve power.	
Summary Statement I am investigating how much power various parts and programs of a computer consume.	
Help Received Mother provided transportation to needed destinations, putting board together, and buying necessary materials, Father helped type the report and take pictures.	



**CALIFORNIA STATE SCIENCE FAIR
2011 PROJECT SUMMARY**

Name(s) Lelah M. Ericson	Project Number J0908
Project Title The Human Battery: Reducing the Human Body's Resistance to the Flow of Current	
<p style="text-align: center;">Abstract</p> <p>Objectives/Goals With the development of cell phones and other small devices that we carry with us has come the problem of keeping their batteries charged. It would be wonderful if people could use energy produced by their body as a back-up power source for their electronic devices. A "human battery" works by using the human body to complete a circuit so that electricity flows. The resistance of the human body to the flow of electricity controls the strength of the current. How can the human battery be enhanced to produce a stronger electrical current? My question is "Which liquid (water or vinegar) minimizes the human body's resistance to the flow of current?" My research showed that acid is used in batteries to provide the electron transfer necessary to generate electricity. My hypothesis is that water will reduce the human body's resistance to the flow of current but since vinegar is acidic it will furthest reduce the human body's resistance.</p> <p>Methods/Materials To build the human battery I connected wires to copper and aluminum plates and to the terminals of a micro-amp (ua) meter. I measured the electrical current produced by 48 different people using each of three treatments (no liquid, water, vinegar.) Each person placed their hands on the two metal plates and I recorded the current produced. Then I sprayed water on the person's hands, placed their hands on the plates and measured the current produced. I dried their hands, sprayed vinegar on them, placed them on the plates and again measured the current produced.</p> <p>Results The average current produced by dry hands was 25.64 ua. For hands wet with water it was 58.65 ua. For hands wet with vinegar it was 82.29 ua. The results show that the strongest current is produced when hands are wet with vinegar.</p> <p>Conclusions/Discussion My hypothesis was correct. Both vinegar and water appear to be reducing the human body's resistance to the flow of current. The use of vinegar produces the strongest current. It is possible that the vinegar is acting like an electrolyte solution in a cell battery and creating a higher electron transfer rate. During my experiment I encountered several problems. The first time I did this experiment, using a micro-amp meter with a range of 0 to 50 ua, the data in many cases topped out at 50 ua. I redid my experiment using a ua meter with a range of 0 to 500 ua. This allowed me to see what the highest readings actually were.</p>	
Summary Statement This project is about an electrical circuit that is completed by the human body and testing whether water or vinegar will minimize the resistance of the human body to the flow of current.	
Help Received My grandfather helped me to build the human battery. My mom and the students in her classes helped me by allowing me to conduct my experiment using them as subjects.	



**CALIFORNIA STATE SCIENCE FAIR
2011 PROJECT SUMMARY**

Name(s) Julie A. Fukunaga	Project Number J0909
Project Title Weedfinder: An Eco-Friendly Herbicide Sprayer	
Abstract Objectives/Goals Design and build a device using simple electronic components and a microcontroller to detect weeds in vineyards. This eco-friendly system will lower farmers' operating costs and reduce the volume of herbicide and water used by up to 50%. Weedfinder can be produced at a low cost for widespread use. Methods/Materials I designed and implemented electronic components with a microcontroller and computer programming. Weedfinder is equipped with sensors capable of identifying the plants' light reflectance because chlorophyll pigments reflect infrared light. It is then attached to a weed sprayer system that releases herbicide on weeds instead of covering the bare ground. Results The volume of herbicide and water saved, when using Weedfinder, is 25% with a #2 sprayer nozzle and 45.47% with a #3 sprayer nozzle. Conclusions/Discussion The initial hypothesis that farmers can reduce the amount of herbicide and water used by up to 50% is verified. Weedfinder can be improved in many ways to benefit farmers (water, herbicide, time and gas savings), the environment (less chemicals in groundwater, residue in fruits and vegetables, toxic effects on animals and microorganisms), and farm workers' health. The prototype is inexpensive to produce and can be distributed for widespread use.	
Summary Statement My project is about building an eco-friendly device that identifies and sprays weeds selectively to help farmers save on the herbicide, gas and water they use.	
Help Received My father helped spray chemicals, solder the electric components, and taught me about the basics of computer programming. My mother helped me arrange the board layout. I would like to thank Mrs. Anderson and Mr. Oliver for their support and guidance during this project.	



CALIFORNIA STATE SCIENCE FAIR 2011 PROJECT SUMMARY

Name(s) Brenden J. Geary	Project Number J0910
Project Title H.E.A.R. Ham Radio Emergency Aerial Repeater	
Abstract Objectives/Goals My objective is to build a communications device that is inexpensive, reliable and easy to deploy during a natural disaster or terrorist attack. This device should also be able survey the area and it should also be flexible enough to add additional equipment if needed. H.E.A.R. (Ham radio Emergency Aerial Repeater) is device I plan to build. Methods/Materials Using my past experience with electronics I was able to design a simple and lightweight Ham Radio repeater. One of my electronic mentors, Allen Lord, was able to build this repeater for me. To get the repeater into the air I used two 1,000 gram helium filled weather balloons. On board two separate payloads contained the following: 300mw cross band repeater, two APRS trackers, Spot satellite tracker, weather station, video camera, hard drive to record video, still digital camera, parachute, DTMF decoder, siren, cutoff circuit and relay board. Results I launched the repeater from Alta Loma, CA, it reached a maximum altitude of around 80,000 feet. I recovered it three and a half hours later in Thousand Palms, CA. Due to both my primary and secondary trackers failing I was not able to get an exact altitude. During the flight my still camera took pictures every 5 seconds, just as I programmed it with the CHDK firmware hack. I started making contacts through my repeater almost as soon as it took off. The early contacts were local, however the contacts progressively pushed out further as the balloon increased in altitude. The furthest contact I made was in Goodyear, Arizona over 320 nautical miles from the launch site. Conclusions/Discussion HEAR is a successful communications device. It could be deployed during a natural disaster or terrorist attack, however I believe that a longer flight is necessary. To make HEAR a longer term solution you would need to have a team releasing another HEAR every two to three hours. Then another team recovering each HEAR as it landed. HEAR would work well to cover a military operation that would be over in less then three hours. I was able to prove that HEAR is a viable solution as a communication device at altitude. In future experiments I plan to test HEAR in an unmanned solar powered drone; which I believe could increase the flight time to days not hours.	
Summary Statement Providing a temporary method of communication using a weather balloon and Ham radio repeater at high altitudes, for use during a natural disaster or terrorist attack.	
Help Received Allen Lord built the repeater, my dad drove the chase truck and my grandpa donated the helium.	



**CALIFORNIA STATE SCIENCE FAIR
2011 PROJECT SUMMARY**

Name(s) Jeremy A. Horwich	Project Number J0911
Project Title The Chain Gang	
Abstract Objectives/Goals My science fair experiment investigated tabletop linear accelerators. The experiment tested chain reactions using the forces of magnetic and kinetic energy. The question is is it possible to cause a significant chain reaction by using the forces of magnetism and kinetic energy? Methods/Materials # Double-Sided Foam Tape # 9 Steel Balls (marbles) # 4 Neodymium magnets # 1 Rulers # Recycling Bin Results The first time I launched the marble it took 2.4 seconds to hit the recycling bin. The second time I launched the marble it took 4.0 seconds to hit the recycling bin. The third time I launched the marble it took 2.2 seconds to hit the recycling bin. The fourth time I launched the marble it took 3.7 seconds to hit the recycling. Conclusions/Discussion A linear accelerator is a system that uses energy to create motion in particles. A linear accelerator demonstrates kinetic energy. Linear accelerators are used to study subatomic particles. Understanding how particles interact is an important way to further our knowledge of physics. Next time I do my experiment, I would test if it would go faster if you enlarged the setup of the accelerator. The marble in the accelerator was holding potential energy until it was launched, and at that point it was turned into kinetic energy.	
Summary Statement My project uses	
Help Received Teacher helped film project	



**CALIFORNIA STATE SCIENCE FAIR
2011 PROJECT SUMMARY**

Name(s) Paul H. Lego	Project Number J0912
Project Title How Do Computers Remember?	
Objectives/Goals I wanted to learn how computer memory works, and to build basic computer memory myself. Specifically, I wanted to find a way to make the binary logic to remember a single digit number. I had previously learned that basic computer memory is made up of binary logic called Flip-Flops, so I decided to try to use Flip-Flops to build my basic memory.	
Abstract	
Methods/Materials <ol style="list-style-type: none">1. I researched the binary logic for computer memory and flip flops.2. I chose a D Flip-Flop as the logic design for my experiment.3. I rewired my BCD to 7-segment display project from last year to make it more simple.4. I tested the display and noted that as soon as I changed the input switches, the output LED changed without any delay.5. I added logic for 4 D flip-flops and a clock between the input switches and the inputs of the BCD to 7-segment decoder.6. I added a push button switch to trigger the clock.7. I tested the logic again and finalized the logic diagrams and schematics.	
Results With the D Flip-Flop logic between the input switches and the inputs of the BCD to 7-segment decoder, I observed that, even if I changed the switches, the LED display "remembered" the last number input until I pressed the clock switch to clock the flip-flops.	
Conclusions/Discussion I found that D Flip-Flop logic could be used to make a single bit of basic computer memory and that using four of these Flip-Flops and my BCD to 7-segment decoder and display, my project could "remember" a number until I pressed the clock button.	
Summary Statement My project investigated how computers use binary logic called flip-flops to "remember".	
Help Received My mother helped me with suggestions for how to lay out my display board.	



**CALIFORNIA STATE SCIENCE FAIR
2011 PROJECT SUMMARY**

Name(s) Jonah F. Li-Paz	Project Number J0913
Project Title Power Shower: Home Hydropower	
Objectives/Goals The purpose of this experiment was to discover whether I could produce electricity utilizing the flow of water coming in or draining out of household fixtures. The information gained from this experiment could help others produce electricity that could go to the electrical grid and could be made available to all consumers or could be stored for home use.	
Abstract Methods/Materials I built a hydropower unit (after several failed attempts) and ran two basic experiments. 1) I used the showerhead to turn the turbine, at about 240 RPM. In doing this I gained 0.02 volts measured on my voltmeter. 2) Then I placed my hydro-generator under the increased pressure of my garden hose. The RPM was about 350. The voltmeter read about 0.03 V. Materials Used: Styrofoam Cylinder; Plastic Spoons (x8); Dowel; Glue Gun; Template; Marking Pen; Plastic Container; Thread Rod; 5 Hex Nuts; Glue Gun; Multi meter; Paper Fasteners/ Paper Clips (x4); Copper Wire Coil (x4); Foam Core; Plastic Coil Protector; Template; Sand Paper; Needle Nose Pliers; Scissors; Glue stick; CD/Double faced tape; Magnets (x4); Tolerance Card; X Marking Pen; Garden Hose; Pressure meter; Shower head/Pipe.	
Results I was able to produce electricity! In the end I found that my hypothesis was right and that the higher pressure (PSI) of the garden hose would be more effective in making power than the faucet.	
Conclusions/Discussion Even though I have finished this project, I would still like to pursue it in the future. I would love to build a full size generator and actually install it in my home so I could use the power for actual jobs and different applications. I would love to use the high pressure of the water coming into my house to produce a large amount of power. I would also like to learn how this power could be stored.	
Summary Statement Utilize household water to create household electricity	
Help Received Grandfather guided me to correctly build generator; Clyde Carpenter provided materials and improved design for generator	



**CALIFORNIA STATE SCIENCE FAIR
2011 PROJECT SUMMARY**

Name(s) Taran F. Lynn	Project Number J0914
Project Title Magnetic Strength vs. Voltage	
Abstract Objectives/Goals My objective is to determine the relationship between magnetic strength and voltage. Methods/Materials My materials included: 10 equal-sized magnets, a voltmeter, insulated copper wire with clip ends, and a plastic tube attached to a gallon water container. I set my experiment so that the plastic tube was wrapped with the copper wire which was connected to the voltmeter. I dropped the magnets through the tube and noted the voltage indicated. I put different numbers of magnets together to change the magnetic strength. Results As the number of magnets increased the voltage increased. Conclusions/Discussion As you increase the magnetic strength the voltage increases.	
Summary Statement This project proves the direct relationship between magnetic strength and voltage induced.	
Help Received Dad helped type, brother got magnets, and science teachers gave advice.	



**CALIFORNIA STATE SCIENCE FAIR
2011 PROJECT SUMMARY**

Name(s) Alastair C. Macmillan	Project Number J0915
Project Title The Gauss Cradle: An Experiment on the Application of Magnetic Potential Energy	
Abstract Objectives/Goals The Gauss Cradle uses the concepts demonstrated in both Newton's Cradle and Gauss Rifle to isolate the magnetic potential energy and measure the maximum amount of energy that could be transferred. For my experiment I wanted to see which combination of magnets and ball bearings transferred the greatest amount of energy. I expected four magnets to produce the best result. Methods/Materials I constructed a cradle, which allowed me to test different combinations of neodymium ball magnets and ball bearings. Velocity and maximum height achieved were measured using a backdrop grid and high-speed camera, recording 60 frames per sec. All experiments were conducted during December 2010 and January 2011. Results The results of the experiment were unexpected. When all four magnets were used, the magnetic force holding the end ball on was greater than the force imparted by the shock wave. The end ball did not leave the group. The best combination was two magnets and two ball bearings. Conclusions/Discussion The conclusion of the experiment was that two magnets and two ball bearings produced the greatest height and velocity, therefore energy. This is because the two magnets give the greatest magnetic potential energy, which can be transferred via the shock wave to the end ball bearing. The ball bearing on the end was held with the least magnetic force and therefore had the most efficient transfer of energy.	
Summary Statement The project examines the conversion of magnetic potential energy to kinetic and gravitational potential energy using a Newton's Cradle.	
Help Received Mom helped with the board layout and Dad helped with the power tools when building the cradle.	



**CALIFORNIA STATE SCIENCE FAIR
2011 PROJECT SUMMARY**

Name(s) Madison E. Mathews	Project Number J0916
Project Title Wind Powered Generators	
Objectives/Goals My objective is to see if more copper windings equals more miliamps. I think that the generator with more copper windings will produce more miliamps.	
Abstract	
Methods/Materials I built two generators with diffenecenes in copper windings on the outside. One generator had 500 copper windings, the other has 195 copper windings. Each generator was 36 inches away from the wind source. I tested each generator three times for 30 seconds.	
Results I found that the generator with 500 windings produced 250 miliamps. The other generator produced and average of 116.6. So the generator with 500 windings produced more miliamps.	
Conclusions/Discussion The number of copper winding makes a difference in the number of miliamps that the generator produces. This is because the electromagnetic feild has more volume of copper wire to transmit the electical current through.	
Summary Statement My project is to prove that the more copper windings there are on a generator will produce more miliamps.	
Help Received Father	



CALIFORNIA STATE SCIENCE FAIR 2011 PROJECT SUMMARY

Name(s) Erik Z.S. Meike	Project Number J0917
Project Title Inductors and Pulse Width Modulation in Boost Converters	
<p style="text-align: center;">Abstract</p> <p>Objectives/Goals The purpose of this project was to determine whether a Maximum Power Point Tracking (MPPT) solar battery charger should match the Pulse Width Modulation (PWM) frequency to the resonant frequency of the inductor in order to increase the overall efficiency.</p> <p>Methods/Materials I designed and built an MPPT boost converter so that I could measure the efficiency with different frequencies of PWM. The circuit included an Arduino which I programmed to find the Maximum Power Point (MPP). The Arduino was coordinated with a Parallax Propeller microcontroller that I programmed to generate controlled frequencies of pulses. Experiments were performed sweeping the pulse width frequency from 1 kHz to 250 kHz in 1 kHz steps. Additional experiments were performed in select 1 kHz ranges with 1 Hz steps under both controlled laboratory lighting and natural outdoor sun conditions. Inductors were tested with inductances ranging from 35 μH to 350 μH.</p> <p>Results Based on the measurements taken by my circuit, I was able to calculate the amperage and power into and out of the boost converter. The ratio of the power output to the power input of the boost converter is the efficiency. By correlating the efficiency and the PWM frequency, I can identify resonant frequencies and harmonics. These would appear as spikes in efficiency at certain frequencies. Efficiencies ranging from 0 to over 90% were observed, however no spikes correlating to pulse frequencies were visible. Further analysis showed that there was a strong positive correlation between the input power and efficiency.</p> <p>Conclusions/Discussion Surprisingly, it does not seem that there would be an advantage to continuously tune the PWM frequency to the inductor's resonant frequency, since there appears to be no efficiency gains at any harmonic frequencies. The discovery of a strong positive correlation between the input power and efficiency indicates that the conversion process is very inefficient at low power inputs. This can be caused by low light conditions suggesting that there is more room for improvement in these situations.</p>	
Summary Statement A maximum power point tracking solar panel battery charger does not appear to be made more efficient by tuning its pulse width modulation frequency to the inductor's resonant frequency.	
Help Received Mother helped glue poster. Dad helped keep me on schedule, and reviewed my Parallax Propeller PWM code.	



**CALIFORNIA STATE SCIENCE FAIR
2011 PROJECT SUMMARY**

Name(s) David Meyer	Project Number J0918
Project Title What Is the Most Efficient Way to Wirelessly Transmit Electricity?	
Abstract Objectives/Goals With the advent of portable consumer electronics, the world is now filled with millions of mobile battery powered devices. It would be very desirable to charge such devices wirelessly, thus allowing these mobile devices to be truly mobile. In this science fair project I will test and find the most efficient way to wirelessly transmit electricity using three methods. Methods/Materials Three methods were used: Inductive Coupling Method, Laser Method, and the Sound Method. The first method uses an inductive coupling transmitter and receiver to transmit the electricity as radio waves. The second method uses a laser and solar cell to transmit the electricity as photons (light). The third method uses a speaker and microphone to transmit the electricity as a pressure wave (sound). Results For the inductive coupling method, the efficiency was low overall and near zero for any distance beyond direct contact. For the laser method, the efficiency was quite high even at reasonable distances. For the sound method, the best results were achieved with the lowest frequency at the closest distance. Conclusions/Discussion The laser method was the most efficient way to wirelessly transmit electricity. Each method analyzed has its own advantages and disadvantages. The laser method worked very well over long distances and provided good efficiency; but requires line of sight and precise targeting of the laser. Also, it is unclear what effect lighting and atmospheric conditions would have on this method. The inductive coupling method did not require precise alignment; but worked poorly, if at all, over longer distances. Finally the sound method also did not require precise alignment and was viable at some distance; but the noise generated was extremely distracting and would not be tolerable on a day-to-day basis. The laser method seemed very promising and would be worth investigating further. Follow-up research should be done on the effect of lighting and atmospheric conditions (visibility, temperature, humidity, etc.).	
Summary Statement This project explores three alternatives for the wireless transmission of electricity.	
Help Received Borrowed lab equipment from Santa Catalina School and help was received from the high school physics teacher.	



**CALIFORNIA STATE SCIENCE FAIR
2011 PROJECT SUMMARY**

Name(s) Lam L. Nguyen	Project Number J0919
Project Title Down to the Wire: A Study of How Various Types of Wire Affect the Alternating Current Produced in a Generator	
<p style="text-align: center;">Abstract</p> <p>Objectives/Goals My goal was to find which type of wire would work best in an alternating current generator.</p> <p>Methods/Materials I used 3 different types of wire at 3 different lengths with 5 trials each. The generator was run and the voltage generated was measured with a multimeter.</p> <p>Results The Litz wire yielded the best average voltages, but was almost the same as the twisted multi-stranded wire at 10 feet of wire (low coil numbers). Single stranded had similar data to the twisted multi-stranded wire at higher lengths (high coil numbers) but was worse at lower lengths (coil numbers). &#8195;</p> <p>Conclusions/Discussion The results of my data were, for the most part, supportive of my hypothesis. The data collected proved my predictions correct. With the Litz wire, the generated voltage was clearly higher. I conclude that litz wire is proficient at dealing with the skin and proximity effects mentioned in my research and outshone the other two wires. The multi-stranded wire scored the second highest voltage for low length (low coil numbers). The single stranded wire was equivalent to the multi-stranded wire for higher length (larger coil numbers). The difference with the lower coiling for the multi-stranded wire and the single stranded wire was negligible. I believe that because the wires# only differences were the number of strands and the strands were neither insulated from each other nor twisted, they effectively acted as a single strand of wire, thereby removing any possible negative or positive effects of using multiple strands of wire except for ease of manufacturing. Despite the two similar wires, the goal of the experiment was achieved, and that was to find which wire produced the best voltages in an alternating current generator at various feet of coiled wire. If I were to expand upon this experiment, I would increase the types of wire, perhaps by gauge, increase the numbers of coiling in order to get a better comparison for different wires at different feet of coiling, and simply do more tests. Different types of wire may provide a substitute for Litz wire or even be better for AC power generation. Different gauges may change ohms and thereby increase or decrease voltage.</p>	
Summary Statement My project was a study of how various types of wire used in an alternating current generator affect the alternating current produced.	
Help Received Family gave support; teacher gave ideas.	



**CALIFORNIA STATE SCIENCE FAIR
2011 PROJECT SUMMARY**

Name(s) Brandon Phan	Project Number J0920
Project Title Magnetic Levitation	
Objectives/Goals My project was on magnets and whether a hot magnet, cold magnet, or room temperature magnet would be stronger. My hypothesis was that a hot magnet would be stronger than a cold magnet.	
Abstract Methods/Materials I had to test the magnets so i build a train and track made of magnets, like a mini model of a Mag Lev train. I went through attempts and fails to make my platform on the track. In the end i used a piece of metal that allowed the platform to go up and down in order for me to test it. I used a .5, 1, 1.5, 2, and 2.5kg and recorded how many centimeters the platform and got my results. Then i heated it with a gel pack to 62c and tested the same way. Lastly I put the whole model in the freezer and got it to 2c and then tested it.	
Results Sometimes the hot magnets were stronger than the cold magnets but over by a huge difference the cold magnets were stronger than the hot magnets and room temperature magnets. The room temperature was the weakest overall.	
Conclusions/Discussion My conclusion is that cold magnets are stronger than hot and cold magnets.	
Summary Statement My project was to see which was stronger; a hot magnet, a cold magnet or a room temperature magnet.	
Help Received none	



CALIFORNIA STATE SCIENCE FAIR 2011 PROJECT SUMMARY

Name(s) Todd G. Porter	Project Number J0921
Project Title Self-Optimizing Solar Tracking System	
<p style="text-align: center;">Abstract</p> <p>Objectives/Goals For my experiment, I asked myself this question: Can a self-optimizing solar tracking system produce more energy output over a fixed period of time than a stationary solar panel system? I predicted that if a self-optimizing solar tracking system efficiently tracks the movement of the sun, it will produce greater energy output than a stationary panel over a fixed period of time.</p> <p>Methods/Materials To test my hypothesis, I created a self-optimizing solar tracking system that automatically tracked the sun. Key to the development of this system was the creation of a microprocessor driven algorithm that was designed to command multiple servo motors and a light sensor. To conduct my experiment, I measured the power output (watts) of the Self-Optimizing Solar Tracking System that I created, and compared that to the output of a stationary panel over the course of a day, and then plotted these results for analysis.</p> <p>Results From analysis of my experimental results, my hypothesis proved to be correct. After several months of development(design, programming, tuning) of the self-optimizing solar tracking system, I was able to demonstrate that a solar panel that autonomously tracks the sun produces greater power output over the course of a day than a stationary solar panel. Power measurements for multiple stationary panel starting light angles were analyzed to simulate the sun's movement over the course of a year. Experimental results indicated that both the tracking and stationary solar panels produced similar power output until the solar angle became too large and the stationary panel power output dropped dramatically. Unexpectedly, the experimental outcome demonstrated that the stationary solar panel performed remarkably well over a wide range of solar light angles.</p> <p>Conclusions/Discussion As result of my experiment, I was able to confirm my hypothesis that if a self-optimizing solar tracking system efficiently tracks the movement of the sun, it will produce greater energy output than a stationary panel over a fixed period of time. Although the experimental conclusions seem obvious, the difficulty in development of the self-optimized solar tracking system and the countless days spent tuning the test environment and taking power performance measurements, proved to be challenging</p>	
Summary Statement My science project verifies that a Self-Optimizing Solar Tracking System will produce greater power output over fixed period of time than a stationary panel.	
Help Received Over the course of my experiment I received assistance from my father, my mother, and my science teacher. My Father helped me with difficulties that I had in the C++ code, my mother helped me layout my board, and my science teacher provided insight throughout the entire project.	



**CALIFORNIA STATE SCIENCE FAIR
2011 PROJECT SUMMARY**

Name(s) Abigail D.S. Shulman	Project Number J0922
Project Title The Journey of Sound	
<p style="text-align: center;">Abstract</p> <p>Objectives/Goals The project was test how different liquids change sound energy into electrical energy. It was thought that the liquid with the highest acidity levels would produce the highest volumes in the speaker attached to the circuit, and that milk would produce no sound.</p> <p>Methods/Materials Five liquids (vinegar, water, lemon juice, cola, and water) were poured into a metal bowl attached to a circuit. A speaker was also attached to the circuit. A vibrating tuning fork was lowered parallel into the liquid, so that it barely touched the surface. One of the prongs of the tuning fork vibrated in and out of the liquid, disrupting the current. Due to this fluctuating current, the sound exiting the speaker was the exact hum of the tuning fork. The sound that exited the speaker was amplified, and then measured through a sound meter. The tuning fork was lowered into each liquid ten times for each trial. The volume of each hum was averaged.</p> <p>Results Results: The hypothesis was refuted. In order from highest to lowest volume: milk, lemon juice, vinegar, cola, water. The water did not produce any sound audible to the human ear.</p> <p>Conclusions/Discussion The conclusion is that electrical conductance depends on the number of ions in the liquid, not whether the liquid is acidic or basic. The strength of the acid is a major part in determining how electrically conductive it is. The milk (which was souring slightly) produced the loudest tone in the speaker because it had the most ions to carry the electrons that made up the current.</p>	
Summary Statement The purpose of the experiment was to test how different liquids contributed to transferring sound energy into electrical energy through a circuit.	
Help Received My uncle set up a microphone and amplifier to enable me to measure the very low decibel level. My grandparents helped explain things to me and buy materials.	



**CALIFORNIA STATE SCIENCE FAIR
2011 PROJECT SUMMARY**

Name(s) Mark J. Slezak	Project Number J0923
Project Title A Bright Idea: Solar Cell Power Using CFL and Incandescent Light Bulbs	
Objectives/Goals The problem I am trying to solve is what light bulb can produce the most electricity in a solar cell. The two light bulbs that I have tested are the CFL (Compact Fluorescent light) bulb, or the Incandescent light bulb. I am hoping that I will see that the CFL bulb produces the most amount of power in the solar cell due to the amount of light it illuminates, compared to the dimmer yellow light that the Incandescent produces.	
Abstract The CFL bulb appeared to produce less power than the Incandescent, it only produced about 1/3 of the power that the Incandescent produced.	
Methods/Materials I will: 1) Install incandescent bulb into lamp attached to box. 2) Measure resistance that the resistor will output to get a clear reading. 3) Place solar cell 2 feet away from light bulb, n a closed box. 4) hook up volt meter to solar cell to measure the volts. 5) Turn on incandescent bulb and leave it on for one minute. 6) Measure how many volts the solar cell produces. 7) Calculate how many amps the solar cell creates by dividing the volts over the resistance to get our current. 8) calculate how much power the solar cell creates by multiplying the current times the volts. We measure power in watts. 9) Repeat the experiment using the CFL bulb. 10) Compare how much power each light bulb produces.	
Results The CFL bulb appeared to produce less power than the Incandescent, it only produced about 1/3 of the power that the Incandescent produced.	
Conclusions/Discussion I believe that the reason as to why the CFL only produced about a 1/3 of the amount of power that the incandescent is as follows. The random wave lengths of light that the Incandescent produces, s in fact, "true light". True light is something such as the sun, which heats up so much that is produces light. The CFL bulb has more of a chemical background and produces a steady stream of light. That is my Conclusion.	
Summary Statement To see whether a CFL light bulb or a Incandescent light bulb can produce the most power i a solar cell.	
Help Received My Father helped me sodar two solar cells together to creat one solar cell.	



**CALIFORNIA STATE SCIENCE FAIR
2011 PROJECT SUMMARY**

Name(s) Jordan Smith; Max Wrigley	Project Number J0924
Project Title Exploring Micro-Size Hydro-Electric Generators	
<p style="text-align: center;">Abstract</p> <p>Objectives/Goals Our objective was to explore micro-size, hydro-electric reaction turbines by experimenting with turbine sizes, materials, baffles, and blade-shapes to discover which combination would most efficiently generate energy in a controlled water trough - simulating a low-flow, perennial creek.</p> <p>Methods/Materials A plywood water trough was made and fitted with a used, spa pump to circulate water through plastic pipes in a closed system. We obtained a submersible generator/rotor assembly for mounting the turbine blades. Four experimental trials were run with the different blade characteristics and adjustments to the angles (pitch) of the blades. By measuring voltage, using an electrical multi-meter, we determined the speed of the turbine rotor and the efficiency of each blade design.</p> <p>Results For generating voltage, water velocity rate was more important than the rate of water flow. When we understood the difference between the two rates, we then constructed turbine blades and baffles to best utilize the constant flow rate. Together the blades and baffles constricted the flow rate and added pressure behind the turbine blades. The pressure deformed the plastic blades, so we replaced them with wood blades which did not deform. By using the best blade design, we plotted the test results of turbine blade pitch versus voltage to obtain the greatest, rotational velocity (60 degrees offset) from the water flow.</p> <p>Conclusions/Discussion Visually, we noticed the water level rising behind our turbine baffle. We concluded the baffle, turbine blade assembly, and high degree of pitch combined to restrict the water flow enough to increase back pressure on the turbine assembly. The back pressure increased the height of the water behind the turbine. There were 2 watts of available power for every inch of height change in our experiment. With just 10 feet of water height difference and two times the water flow rate, 480 watts would become available for a water turbine. Thus, small reaction turbines in creeks with modest flow rates and height change would generate sufficient hydro-power for an average, single house.</p>	
Summary Statement This project explores micro-size, hydro-electric, reaction turbines to come up with the most efficient design parameters.	
Help Received Partner's father provided supervision with woodshop equipment and helped generate graphs through Excel. Partner's mother helped type procedures.	



**CALIFORNIA STATE SCIENCE FAIR
2011 PROJECT SUMMARY**

Name(s) Jonathan H. Sussman	Project Number J0925
Project Title Can You Hear Me Now? Terrain Blockage of FM Radio Wave Propagation	
Abstract Objectives/Goals My objective is to test my hypothesis that FM radio waves are blocked by terrain along the line of sight. Methods/Materials Materials: Car Maps Computer Google Earth Java Programming Language Data about terrain Procedure: I drove around the city and recorded the sound quality of two FM radio stations on a scale of 1-5 at 50 places. Then I wrote a program with the java programming language that calculates terrain blockage along the line of sight. In the program, the parameters were adjusted to match the data as best as possible. Then 6 more points were chosen from a new data collection and tested. Lastly I printed maps with colored pushpins on Google Earth with the data and compared it to the predicted data. Results Fifty points were tested for two radio stations. When I created the program to see if the points were blocked, for both radio stations, 87/100 points were correct after increasing the antenna height to 1.1 times its original length and taking away the variable of the Earth radius by making it infinite. If the antenna height is unchanged, the total error is 14/100. If the radius of the Earth variable is put in, then the total error is 63/100. If it increased by 4/3 like one source said, then the total error is 49/100. The second set of data tested after the program was written had a total error of 5/12. Conclusions/Discussion Terrain blockage did in fact cause the loss of signal. The program predicted which points were blocked and the data showed that those points were blocked, thus the hypothesis is true.	
Summary Statement My project tests why FM radio waves are blocked in specific locations.	
Help Received Mother helped lay out the board; Dad drove me to collect data points.	



CALIFORNIA STATE SCIENCE FAIR 2011 PROJECT SUMMARY

Name(s) Maya Varma	Project Number J0926
Project Title Brake Time: A Smart Traffic Alert and Control System for Manually-Driven and Autonomous Vehicles	
<p style="text-align: center;">Abstract</p> <p>Objectives/Goals Driver distraction is a major cause of traffic crashes in the United States. According to National Highway Traffic Safety Administration (NHTSA) statistics, distracted driving was the cause of 5,474 deaths and 1,517,000 injury crashes in 2009. The increased use of devices such as smart phones for texting and talking is the likely culprit.</p> <p>This project aims to improve safety at intersections controlled by traffic lights by alerting drivers approaching the intersection about an impending change in the state of the signal from green to red, allowing them to plan ahead and stop the vehicle safely. The same system can be used when the vehicle is driven by a robot, to slow down and stop the vehicle safely. It can also be used as an intelligent stop sign; as a virtual hazard warning system; or as an aid for visually impaired drivers.</p> <p>Methods/Materials I have designed and built a prototype of the system, consisting of a transmitter module mounted on a traffic signal, and a receiver module attached to a Pololu 3pi robot. The system uses Xbee wireless modules for communication between the transmitter and receiver. When the traffic light is green, the transmitter periodically transmits the time remaining for the signal to change its state. The receiver uses this data to estimate when the robot would arrive at the intersection at its current speed, and issues an alert if it has determined that the signal would change before the robot can safely cross the intersection.</p> <p>Results I have successfully demonstrated the system and performed measurements of its effectiveness at various speeds of the robot vehicle and for various durations of the green signal. The results show that the system can accurately warn drivers when there is a real risk of running a red light, without causing false alarms. I have also experimented with multiple transmitters, designed to simulate multiple intersections in the proximity of the vehicle, and the robot vehicle was able to discern the right signal based on its position, orientation, and direction of travel.</p> <p>I have filed a U.S. Patent application on the project (No. 61450668, 3/9/11).</p> <p>Conclusions/Discussion The results from my tests show that the traffic alert/control system can be built at a low cost. The system uses only a small amount of power, allowing it to be used at intersections in rural areas. The system will save numerous lives that could be lost to distracted driving.</p>	
Summary Statement My project is a system to warn the distracted driver of a vehicle approaching a traffic intersection or other hazard, of an impending change in the state of the signal from green to red.	
Help Received Mr. Doug Ryder prepared the U.S. Patent application for me.	