COLLEGE OF SCIENCE
2007 Student Project Showcase
COS–1 to COS–32

BIOLOGICAL SCIENCES

COS – 1

Cloning And Sequencing Of Recombinant DNA Conferring Antibiotic Resistance

Altgent J, Callahan S, Cerrano J, Dyer J, Krell M, Lockhart A, Miller C, Montenegro G, Nakatsuji A, Ouedraogo Y, and T. Rozgaja

Faculty Advisor: Dr. Charles D. Polson

Escherichia coli DH5α cells previously transformed with plasmids pUC19 and pKAN were grown in liquid media and each plasmid was isolated by alkaline lysis. Restriction Endonuclease cleavage was done using BamHI and HindIII, enzymes which have unique sites in each of the plasmids. Ligation reactions were used to join the vector (pUC) and the kanamycin resistance gene (pKAN)producing a recombinant plasmid designated pGE239. Competent E. coli DH5α cells were transformed with the recombinant. Colorimetric (blue/white) and antibiotic resistance screenings were used to identify recombinant containing colonies. The recombinants screen as ampicillin resistant (from pUC), kanamycin resistant (from pKAN), and white due to the kan insertion into the lacZ' locus (in pUC). Recombinants were verified by alkaline mini-lysis and restriction enzyme analysis. Covalently closed circular pGE239 was isolated from cells and purified by CsCl equilibrium density gradient centrifugation. Chain termination sequencing and a BLAST search of genebank identified a corresponding sequence of the kanamycin resistance gene.

COS – 2

Effects Of Habitat Alteration On The Predator-Prey Interaction Between Invasive And Native Poeciliid Fishes

Wagner J.

Faculty Advisor: Dr. Ralph Turingan

This study compared the prey-capture performance of invasive pike killifish in two habitat types (with and without submerged vegetation) using digital high-speed videography. Results revealed that distance to strike, approach velocity, and attack velocity did not differ between fish fed in tanks with and without vegetation, indicating that pike killifish perform equally well in both habitats.

COS – 3

DnaA-ATP-Specific Binding Sites In E. coli oriC Are Required For Correct Timing Of Initiation Of DNA Replication

Rozgaja T and Torgue J

Faculty Advisors: Dr. Julia Grimwade and Dr. Alan Leonard

Initiation of DNA replication is precisely timed during the cell cycle to ensure that daughter cells receive equal genomes. In eukaryotes, archea, and eubacteria, initiation requires that structurally conserved ATP-binding initiator proteins interact with replication origins in a pre-replication complex (pre-RC). In E. coli, initiator DnaA first forms an origin recognition complex (ORC) at high affinity binding sites in the chromosomal origin, oriC. Initiation is triggered by converting ORC to pre-RC when DnaA fills lower affinity sites. Two low affinity sites preferentially bind DnaA-ATP, and single base alterations in both sites eliminate this preference. To examine the role of DnaA-ATP sites in initiation timing, replication of mutated oriC plasmids was examined. Plasmids with oriC lacking discriminatory sites replicated early and more than once in the cell cycle, and had a higher copy number than wild-type origin plasmids. Mutant oriC-pBR322 plasmids exhibited severe incompatibility with wild type chromosomal oriC, resulting in spontaneous replacement of host oriC with mutant oriC. This incompatibility could be reversed by conversion of a non-discriminatory low affinity site into one that preferred DnaA-ATP. These data indicate that binding of DnaA-ATP to low affinity sites plays a role in initiation timing, and there is plasticity in the positioning of discriminatory sites in oriC.

COS – 4

To Match Or Not To Match: Does Substrate Reflectivity Influence The Choice Of Shell Reflectivity By Pagurus Maclaughlinae?

Capobianco C, Seadon V, Wagner J, and B. Switzer

Faculty Advisor(s): Dr. Richard Tankersley

[no abstract available]

COS – 5

Vertical Migration Of Emerita Talpoida In The Intertidal Zone

Ohme M, Geyer P, and J. Medina

Faculty Advisor: Dr. Richard Tankersley

[no abstract available]

COS – 6

A Limnological Assay Of Cell 3 At The Viera Wetlands

Cohen P, Henrickson D, Hillyer R, and R. Purvis

Faculty Advisor: Dr. Mark Bush

[no abstract available]

COS – 7

Decreasing Size Of Reef-Associated Fish In The Bahamas From 1997–1999

Roverelli R, Riggs S, and M. Schrandt

Faculty Advisor: Dr. Mark Bush

Many processes in reef-associated fish are density dependent such as reproduction, growth and mortality (Rose 2001). As the size of fish increases, the abundance decreases. Habitat is also an important factor to understand when studying reef-associated fish. Therefore, it is important to look at both factors together. Coral reefs in the Bahamas have been severely impacted by ENSO events, hurricanes and historical fishing exploitation that have led to a decrease in fish over time. Abundance can increase when size decreases, however, often by a different species due to a shift in habitat. A continual decrease in size can result in a shift to earlier maturation of fish, however a threshold will be reached resulting in a nonviable young and a population that is no longer sustainable.

CHEMISTRY

COS – 8

Synthesis Of CdS Nanoparticles For A Freshman Nanotechnology Laboratory

Thomas Noviello

Faculty Advisor: Dr. Kurt Winkelmann

First-Year students in Florida Tech's Nanoscience and Nanotechnology Laboratory course synthesize CdS nanoparticles within a water-in-oil emulsion. Particle size is typically 5 nm in diameter as determined by UV/vis spectroscopy and the effective mass model. There is a visible difference in color between the nanoparticles (yellow) and bulk CdS material (orange). Students are introduced to band theory of solids, surfactants and quantum confinement during a pre-lab presentation and handouts. The experiment is appropriate for general chemistry students who have knowledge of intermolecular forces and quantum chemistry. This presentation will describe the synthesis procedure and show students' typical results.

COS – 9

The Effect Of Natural Organic Matter (NOM) On Copper Partitioning In An Estuarine System (Indian River Lagoon)

Melissa LeMay

Faculty Advisor: Dr. Mary Sohn

The partitioning of toxic metals in aquatic environments affects the availability of the metals to aquatic organisms. Previous studies have emphasized the influence of NOM on the partitioning of metals in the environment. This study specifically focuses on the effects of variable NOM concentrations, on copper partitioning in an aqueous matrix set to model an estuarine system such as the Indian River Lagoon. Conditional copper partitioning constants will be evaluated at various concentrations of humic and fulvic acids using flameless atomic absorption spectroscopy.

COS – 10

The Effects Of Natural Organic Matter (NOM) And Iron(VI) On The Removal Of Arsenic From Water

Ras K. Gurung,

Faculty Advisors: Dr. Virender Sharma and Dr. Mary Sohn

Several different methods have been investigated for the removal of the toxic and carcinogenic element, arsenic, from natural, waste and drinking water. Previous studies have revealed that As(III) compounds are consistently more toxic than the oxidized form, As(V). This study focuses on the effects of NOM and dissolved sulfur species on the oxidation and coagulative removal of arsenic from water. By simulating groundwater and drinking water conditions, the ability of Iron(VI) to oxidize and remove arsenic from water is being examined with respect to extent of removal and kinetics.

COS – 11

A Two Step Synthesis Of A Fish Pheromone From Cortexolone

Yannick Ouedraogo, Longchuan Huang, and Mariana Plazas-Mayorca,

Faculty Advisors: Drs. Rudolf Wehmschulte, Junda Lin, and Nasri Nesnas

A two step procedure for the construction of a fish pheromone (17alpha-20beta-dihydroxy-4-pregnen-3-one) was developed with an overall 10% yield and 99% enantioselectivity from inexpensive starting material cortexolone. The pheromone is a reproductive hormone that is present in female goldfish and triggers reproductive responses; cortexolone is a common metabolite for hormones. A second procedure, using a newly developed aluminum reducing agent (HAlO), was designed for a three step synthesis of the C-20 epimer of the pheromone in an overall 20% yield. The difference in biological activity of the C-20 epimers is still under study.

COS – 12

Biomimetic Catalysis In The Construction Of Visual Chromophores Using Opsin

Peter Cohen, Rui Guo, Nicole Miller, Siddieg Elsiddieg, and Antoine Zufferey

Faculty Advisor: Dr. Nasri Nesnas

Different animals have different kinds of retinoids. The synthesis of retinoids is usually very complicated and may take several steps. Our research involves the generation of different kinds of retinoids directly in their own mold, which is the opsin protein, in one single step. The goal of this research focuses on the notion that nature has designed the perfect mold to construct important molecules like enzyme substrates. We can learn a lot from nature by using a mold such as opsin in the generation of novel retinoids, a concept not previously explored. We synthesized the 11-cis/trans retinal which is a new retinoid and a pure compound will be obtained and tested in our synthesized-methylated-opsin.. We also dissected cow eyes and isolated the rhodopsin from those eyes. As soon as we get the crude ROS(rod outer segments), we will bleach it to get the opsin and then methylate it. We also interested in bateriorhodopsin, which we are currently culturing for future isolation.

COS – 13

Scanning Tunneling Microscopy of Indolo[2,1-b]quinazolin-6,12-dione (tryptanthrin) On HOPG: Evidence Of Adsorption-Induced Enantioisomerization

J. W. Buhrow,

Faculty Advisors: Dr. M. J. Novak, Dr. J. C. Baum, and Dr. J. A. Olson

Scanning tunneling microscopy was used to observe 2-dimensional liquid crystals of indolo[2,1-b]quinazolin-6,12-dione (tryptanthrin, an anti-malarial agent) at the solution–graphite interface. The liquid crystals were formed via physisorption from a saturated solution in 1-phenyloctane. Sub-molecular resolution was achieved allowing elucidation of the primary electronic features of the molecule. The molecule's appearance is attributed to the molecular HOMO or LUMO, calculated using density functional theory, with contrast attributed to differences between the molecular moieties. The lamellae form rows that alternate in contrast (light/dark), from row to row. The contrast variation between the rows is attributed to adsorption-induced stereoisomerization of the individual molecules, with each row comprised of one enantiomeric configuration. This example is the first-ever observation of physisorption-induced stereoisomerization of individual molecules.

MATHEMATICAL SCIENCES

COS – 14

Chaos Game

Mark Saunders

Faculty Advisor: Dr. Semen Koksal

The chaos game is a process of generating fractals (self similar objects with non-integer dimensions). A random point is chosen; then the system is iterated based on randomly chosen values to determine more points in the image. From this process, which at first glance one might suspect would lead to a random image, a familiar object, such as a Sierpinski carpet or a fractal fern, will emerge. The computer simulation of the chaos game that has been created allows one to experiment with various parameters to create many different types of fractals, including the Sierpinski triangle, Sierpinski carpet, and Sierpinski hexagon. By altering the rules of the chaos game, rotational effects can be added to give each image an extra level of complexity. As with all fractals, visualization is essential in order to appreciate the intricacy of these objects. During showcase activities, theory of chaos game will be presented and computer program will be demonstrated.

COS – 15

Modeling Enzyme Activity In The Fertilized Starfish Eggs

Ioana Policeanu

Faculty Advisor: Dr. Semen Koksal

This research project develops methods to analyze the enzyme MAP kinase in individual starfish oocytes. It is already known that mitogen-activated protein kinase (MAPK) plays an important role in preventing DNA replication and parthenogenesis in maturing oocytes. The phosphorylation-state of the enzyme is known to change during starfish oocyte maturation and again at fertilization, when the oocyte becomes dephosphorylated. After eggs are fertilized, inactivation of MAPK occurs, allowing development to proceed. Without fertilization, highly synchronous apoptosis of starfish eggs starts 10 hours after germinal vesicle breakdown, which can vary according to season and individual animals. To understand how MAPK kinase is regulated during these transitions, we do quantitative measurements to calculate how the single oocytes differ from the assayed oocyte populations as a batch. The single cell system will allow examination of the variability of individual oocyte response to different stimuli (hormones, etc). This is something that has not been done previously due to technological restrictions. My contribution in this project is to gather data in the form of protein electrophoresis gels and western blotting with an antibody specific for the phosphorylated form of MAP kinase and to develop a method for the quantitative analysis of any observed changes. Using Mathematica, we model the different ways in which individual oocyte responses vary during the regulation of MAPK.

SCIENCE & MATHEMATICS EDUCATION

COS – 16

The Role Of Metacognition And Peer Pressure In Group Study

Heather Novak

Faculty Advisor: Ms. Debra Blenis

The purpose of this study was to gain insight into the metacognition of ninth grade honors biology students (N = 90) and the dynamics of peer pressure within study groups. In addition, students increase their awareness of their learning processes while participating in activities that emulate true scientific practices and discourse. The design of this study was conceived and carried out as a normal classroom activity prior to being identified as a potential research learning opportunity for the student teacher. Utilizing a traditional classroom setting, students were assessed using a multiple choice, modified true/false, and short answer examination. Students received their initial exam grades; however, they were not permitted to review the corrected examination. In addition, they were unaware of a second assessment study using the same exam. Three days later, students were placed into random groups of three to four to retake the examination. Students discussed each question within their group, but the answers they submitted on their individual exam did not have to be by group consensus. Subsequently, students evaluated the effects of individual versus group discussion on their performance when both exams were returned together. Class discussion and survey results were used to obtain data on students' awareness of their learning processes and how the role of peer pressure affected the second exam score. These results were shared with the students in the classroom setting to heighten their awareness of factors that influence their decision making.

PHYSICS & SPACE SCIENCES

COS – 17

Improved Time-of-Flight Mass Spectrometer (TOFMS) For Space Applications

Diego Alvaro Concha and Andrew Chrest

Faculty Advisors: Drs. Joseph R. Dwyer, Hamid K. Rassoul, and Lee Caraway

The study of energetic particles in space is important for understanding the complex interactions between particle sources, such as the Sun, and the planetary atmospheres and magnetic fields which lie in their trajectories. Solar events, such as coronal mass ejections, solar flares, and the solar wind, are of particular interest due to their direct impacts on the geospace environment. The detection and analysis of the ejected particles has led to a better understanding of solar events, the mechanisms behind them, and methods for protecting space and ground based systems against their adverse effects. These reasons alone drive the development of better solar particle detection techniques and instrumentation. In the last decade a new type of instrument called a time-of-flight mass spectrometer (TOFMS) has been successful at measuring the energy spectra in wider energy ranges, anisotropies, time-intensity profiles and composition of solar particle populations. Despite their improvements over older technologies, these instruments still possess weaknesses, such as low mass resolution, detector saturation, low-energy inefficiency, and other instabilities. For the past few years our research group has been working to tackle these problems and improving existing TOFMS. Our improved TOFMS utilizes a compact design complimented by specially designed, selected, and tested electronics including solid state detectors (SSDs), used for measuring incident particle kinetic energies, and microchannel plates (MCPs), which in an array yield the velocity of the solar particles. The detailed analysis of our improvements over old TOFMSs and the subsequent results will be discussed fully in this presentation.

COS – 18

Substorm Energy Deposition And Correlation With Substorm Characteristics

Christine Gabrielse, Ami DuBois, Patricia Gavin, Ian Swanson and Sandra Brogl

Faculty Advisor: Dr. Ramon Lopez

The total energy deposition of various substorms was determined from Polar UVI Substorm Movies, provided by NASA and APL, using the Lyman-Birge Hopfield-Long (LBHL) filter which mapped the total energy flux over latitudes above 60 degrees North. Because the movies run in two dimensions, it was necessary to form a model to project an image's total area of energy deposition from lying on a circle to lying on a sphere. Several relationships were then ascertained. There is a direct relationship between an onset's peak auroral electrojet (AE) index and the total energy deposition at that point in time. It was discovered, however, that this relationship does not continue throughout a substorm's lifetime. It is therefore inappropriate to state that a substorm's total energy deposition is directly related to its AE index at any point in time. There is also a relationship, though less notable, between the total energy deposition at the onset peak and the latitude at which the substorm began. These latitudes do not vary by much, though, and are generally between 65 and 70 degrees North.

COS – 19

Field-Aligned Currents In The Polar Cap During Saturation Of Polar Cap Potential

Jason Seiler, Kelly Hallman, Salvador Hernandez, and Jorge Landivar

Faculty advisor: Dr. Ramon E. Lopez

We are using Interplanetary Magnetic Field (IMF) data to investigate the correlation exists between the magnitude of the Y component of the solar wind electric field and the latitude of the Earth's polar cap boundary. The location of that boundary is an indicator of how much magnetic flux is connected to the IMF. It is well known that there is a correlation between the polar cap boundary and the solar wind Ey for moderate values of Ey. We are investigating if that correlation disappears during very large Ey, that is to say, we are investigating if the polar cap flux saturates for a given value of Ey.

COS – 20

Field Line Currents In The Polar Cap

Kelly Hallman, Jason Seiler, Salvador Hernandez, and Jorge Landivar

Faculty Advisor: Dr. Ramon E. Lopez

Using satellite data, we have been searching for evidence of field aligned current (FAC) flow on open magnetic field lines -- geomagnetic field lines that are connected to the solar wind. We collected and analyzed magnetometer data from the DMSP-F13 satellite, a near circular, sun synchronous, polar orbit spacecraft that flies at low altitudes around 850 km. The magnetometer data allowed us to identify the location and dynamic of the FAC flows. We also identify the upper atmospheric polar cap boundaries from precipitating particle data. Our data is consistent with findings of several cases of current flow on open field lines during the time periods when the solar wind electric field is large. We will present these observations and discuss the implications of these obseravtions.

COS – 21

A Comparison Of Integrated Electric Field With Substorm Activity

Jennifer Kissinger, Tamara Cullens, Alicia Moss, and Robert Bruntz,

Faculty Advisor: Dr. Ramon E. Lopez

When the interplanetary magnetic field (IMF) in the solar wind suddenly turns northward after pointing southward for ~1-2 hours, a substorm is usually triggered. A study was undertaken to compare strength and duration of substorms to electric field input into the Earth's magnetosphere. Periods for which the IMF pointed southward for 1-2 hours and then rapidly turned northward (i.e., when the Bz component of the solar wind is negative and turns positive) were found using the ACE satellite data available through CDAWeb. Using Ey = V x Bz, the electric field data was integrated to determine an estimate of the solar wind input during these periods. The integrated electric field will be compared directly to substorm data to check for correlations between solar wind input and magnetospheric output.

COS – 22

Investigation Of Eclipsing Binary Alpha Coronae Borealis

Rachel Allen

Faculty Advisor: REU faculty and Dr. Joe Dwyer

Alpha Coronae Borealis is a 17.36 days eclipsing binary star composed of a type A0V main sequence star and type G5V main sequence dwarf. The system is young at 314 million years old and has not moved much off the zero age main sequence (ZAMS). Theoretically, through light curves, x-ray curves and time curves, multiply aspects of the binary system can be calculated, so the data can support theory of planetary or proto planetary system. Unfortunately at this time, the data analysis is inconclusive. While the x-ray observations and data are more recent, majority of the raw data was taken from Gerald E. Kron and Katherine C. Gordon (1953). Extensive data analysis was later performed by Jocelyn Tomkin and Daniel M. Popper (1986) using Kron's and Gordon's data. I will present these findings and discuss their implications for discovery of young planetary systems.

COS – 23

Imaging JSC-1a Lunar Regolith Simulant On Various Surfaces Using An Atomic Force Microscope

Ami M. DuBois and Jessica Tramaglini

Faculty Advisor: Dr. James Mantovani, KSC/FIT

An atomic force microscope (AFM) is a scanning-probe device that moves a small sharp tip across a sample, such as lunar dust, or any sort of microstructure, to record the contours of the surface. JSC-1a substance is the lunar regolith simulant that we have used to conduct our experiments. The substance, is usually extracted from a volcanic ash layer, closely matches the chemical composition, mineralogy, particle size distribution, and engineering properties of lunar mare soil. Solar panel screens are being developed with electrodes to pass a current across them for removal of electrostatic dust on the lunar surface. We are imaging different clean surfaces, such as solar panel screens, and comparing those contours to images of the same surfaces containing lunar dust. We used the AFM to image lunar dust on different surfaces and compare those to images of the clean surfaces, in an attempt to find a way of distinguishing lunar particles from bumps and scratches on the surface. We also came up with a unique way to distribute the dust uniformly on our surfaces. This is based on how well the dust is attracted to the different surfaces, and then find problematic areas on the boards where large amounts of dust collect, such as at the edge of electrode. We then send a current though the electrodes to see how efficient the process is in removing dust from surfaces. I will present the idea behind this new technique and our preliminary results of our investigation.

COS – 24

Latitude Of Poleward Expansion Versus Auroral Electrojet Maximum Of Isolated Substorms

Ami M. DuBois, Christine Gabrielse, Patricia Gavin, Ian Swanson, Sandra Brogl

Faculty Advisor: Dr. Ramon Lopez

A substorm is a short magnetospheric disturbance lasting only a few hours. We are using the UVI substorm movies provided by the POLAR satellite to find if there is a correlation between the intensity of a substorm and how far north auroras move from the initial magnetic latitude onset. We downloaded the auroral electrojet (AE) data for each movie that was an isolated substorm and which occurred at anytime other than between 1400 UT and 1900 UT. For the Polar movie that corresponds to the substorm we identified the latitudes at which the onset of the aurora and the maximum northern point of the aurora occur. The onset is the point at which the aurora begins to intensify or expand to greater latitudes. Since the aurora expands southward as well as northward, we also measure maximum southern point of the aurora. From here, we compare the latitude of the maximum northern point the aurora reached, the difference in latitude between the onset of the aurora and the northern most point, the latitude of the onset of the aurora, and the difference in latitude between the northern most and southern most points of the aurora all to the peak strength of the substorm and plot the results. From the preliminary results, we found there was a correlation between the latitude of onset and other quantities. We will discuss the implications of this result for energy storage and the size of substorms.

COS – 25

Classification Of Bright BATSE Gamma-Ray Bursts Using Spectral Evolution Of Average Energy Per Photon

Andy Herron

Faculty Advisor: Dr. G.J. Fishman (NASA/MSFC) and Dr. Joseph Dwyer

This research attempts a new classification scheme for bright gamma-ray bursts emitted at cosmological distances using 325 bright gamma-ray bursts (GRBs) observed by the Burst and Transient Source Experiment aboard the Compton Gamma Ray Observatory starting in April 1991 and ending in June 2000. The classification scheme examines the average energy per photon over the time evolution of these GRBs and groups them into either abrupt or delayed events. Both categories are divided into 5 subgroups. This subjective classification scheme holds great promise, especially once it can be explained qualitatively and converted into a more objective system.

COS – 26

Creation And Analysis Of Algol's (β Perseus) Light Curve

Katelyn Hazelwood

Faculty Advisors: Dr. Joseph R. Dwyer and Mr. Kyle Johnson

The purpose of this research is to provide a process of observing eclipsing binary systems and creating a light curve with the collected data. These observations were preformed with the naked eye by comparison to other known magnitude stars. After the apparent magnitudes and times were obtained, a light curve for Algol was created and analyzed. With this light curve, orbital parameters were calculated strictly from these observations. Also included in this project is a thorough background on the properties of eclipsing binary star systems. Algol is an excellent candidate for this task because it has a short orbital period, allowing for many eclipses to be observed over a shorter period of time, and therefore more data to work with.

COS – 27

Comparing Single- And Multiple-Onset Isolated Substorms

Patricia Gavin, Ami DuBois, Christine Gabrielse, Ian Swanson, and Sandra Brogl

Faculty advisor: Dr. Ramon Lopez

Using Auroral Electrojet (AE) data, we have identified 218 isolated substorms whose initial onset was over North America (between 0300UT and 0800UT). We constructed a data table that contained each substorms' onset time, strength in AE, duration, and whether or not the substorm was a multiple-onset or a single-onset substorm. We have examined the statistics of these events, in particular comparing single-onset and multiple-onset substorms. Preliminary results indicate that the distributions of strengths as determined by AE of both single- and multiple-onset substorms are very similar. Further investigations will determine if there are relationships between a substorm's maximum strength and duration, and what factors, such as the strength of the first onset in a multiple-onset substorm, affect those characteristics.

COS – 28

Characteristics Of Untriggered Substorms

Ian Swanson, Ami M. DuBois, Christine Gabrielse, Patricia Gavin, and Sandra Brogl

Faculty advisor: Dr. Ramon Lopez

It is generally believed that most substorms have some kind of trigger such as a northward turn in the interplanetary magnetic field (IMF). We have identified over 200 isolated substorms in the North American sector from 1998-2002 based on the auroral electrojet index (AE). From this set of events, we have identified several that do not seem to have a solar wind trigger. In this presentation, we will discuss the characteristics of these events and contrast them to several events that seem to have a trigger.

COS – 29

Dst And The Ring Current In Geomagnetic Storms: A Correlation Study

Nathalia Alzate, William D. Cramer, Ami M. DuBois

Faculty Advisor: Dr. Niescja E. Turner

Geomagnetic storms produce magnetic disturbances by way of current systems in the magnetosphere—a region in which Earth's magnetic field is dominant. The system we are interested in is called the ring current. It is composed primarily of ions and situated between 2-8 Earth radii above the equator. In order to study the strength of the ring current, measurements are taken on ground magnetometers that measure the perturbation of Earth's magnetic field at the equator. Recent work has also used direct particle measurements to calculate the energy of the ring current for comparison to the ground magnetometer-derived Disturbance Storm Time (Dst) index. Turner et al. [2001] found a contribution of about half the Dst index is due to energy of the ring current particles. We are expanding on these studies by analyzing the contribution to Dst index during different phases of storms using data taken by ground magnetometers as well as POLAR satellite data for in situ measurements to compare to the ring current energy. In the comparison of both sets of data, we determine how much of the measured Dst is due to the ring current. We separate each storm into main phase and recovery phase and determine the coupling coefficient between Dst and ring current for each phase. We then show how much the ring current contributes to the Dst during each phase.

COS – 30

Electrochemical Deposition Experiment – A University-Wide Student Research Project

Robert Wilkos (Team Leader), Mallory Berry, Stephen Bukowsky, John Ferreira, Stephen Garcia, Pat Malvoso, Jessi Mikkelson, and Ben Pepper

Faculty Advisor(s): Dr. Joel Olson and Dr. Hamid Rassoul

The Electrochemical Deposition Experiment (EDEP) team is flying an experiment on NASA's C-9 to determine the effects of gravity on the deposition of thin films in solar cells and any correlation to efficiency that stems from this. Thin film solar cells have a theoretical efficiency for converting light to energy of about 72%. In use, though, solar cells have not reached over 20% efficiency. One known reason for the drop in efficiency is misplaced atoms in the structure, formed during deposition, and other such native defects. These structural errors change the semiconductor efficiency, since the defects reduce the carrier density. We will use the microgravity environment aboard the C-9 to investigate the effects a reduced gravity environment on the deposition of copper indium Diselenide (CIS) polycrystalline thin films. CIS thin films are already one of the best materials used in solar cells. After being deposited under reduced gravity we believe the CIS thin films should be free of these natural defects and this will cause the efficiency of the completed solar cell to be increase. This presentation will be an update of the pre-flight research leading up to the flight mission in Huston.

COS – 31

Asymmetric Ring Currents During The Recovery Phase Of Magnetic Storms

Jessica Edwards and Ismael Diaz

Faculty Advisor: Dr. Ramon Lopez

In this study we are comparing magnetic storms in which there is a fast shut off of energy from the solar wind versus storms in which the solar wind energy is slowly shut off. We are testing the hypothesis by O'Brien et al (2002) that slow shut off storms have asymmetric ring currents during the recovery phase, whereas fast shut off storms will have symmetric ring currents during the recovery phase. If there is a symmetric ring current then there will be a symmetric disturbance and the Dst as measured from mid-latitude stations should be similar in all features including the recovery phase. If there is an asymmetric ring current then the Dst profiles will look different and there will be delays in the recovery phases of those stations that see the ring current. We detrended the raw data from mid-latitude stations, calculated the disturbance at each station and looked for local time asymmetry in these disturbances. Our preliminary results agree with the hypothesis set forth by O'Brien et al (2002) and we do see an asymmetry in the recovery phase of slow shut off storms.

COS – 32

Artificial Ozone Layer

David Toro

Faculty Adviser: QEP Faculty

Continual degradation of the ozone layer has caused concern among the scientific community. This paper states the consequences of ozone layer depletion and it summarizes possible solutions to this growing problem. The paper cites the possibility of creating an artificial ozone layer in the stratosphere by using powerful intersecting microwaves beams (A.V Gurevich, et al).