

SPS Zone 6 Conference Report Florida Institute of Technology

February 17, 2007

By: Christine Gabrielse, President, Florida Tech chapter

Website: <http://activities.fit.edu/SPS/zone6/zone6.html>

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On Saturday, February 17, the Society of Physics Chapter at Florida Institute of Technology hosted a Zone 6 meeting with 56 students and 7 faculty members from seven universities registered. Universities represented were University of Central Florida, University of Florida, Gainesville, University of West Florida, Stetson University, University of Puerto Rico, Mayaguez, University of Alabama, Huntsville, and Florida Institute of Technology. The main purpose for hosting the meeting was for students to meet, present their research to each other, and gain valuable experience. After two oral presentations were dropped, there were a total of 14 presentations in both the oral and poster sessions. Aside from the research presentations, there was a zone meeting between chapters, a guest speaker, and a BBQ mixer at the beach.

On Friday night, members of the Florida Tech SPS chapter met with the students from UPRM at Jason's Deli to become acquainted and to give the visiting students a taste of the area. The group tried watching the THEMIS rocket launch, but it was postponed to the following evening.

Saturday morning began with registration at 8:15 when participants were given nametags, a schedule, and other SPS paraphernalia supplied by SPS National. Juice, water, donuts, bagels, and fruit etc. were provided and were also available during the breaks. Next was the first oral presentation session in the Olin Engineering building right next door. Christine Gabrielse, president of the Florida Tech chapter, led the meeting and guided the transitions between sessions. There were seven judges consisting of faculty members/SPS advisors of the attending universities. While the judges were "simply" commissioned with the task of determining the best presenter in both sections—oral and poster—they were given a "score sheet" for guidance.

After the intriguing 12 minute talks, Stan Starr of the Applied Physics Lab at Kennedy Space Center gave a demonstration of the labs' inventions that have assisted NASA, such as a method to suck water out of shuttle tiles, a device that aids in making long-distance measurements, and lamps that prevent ice from forming in dangerous locations on the shuttle. Some of the inventions are now used commercially. For example, a sensor was built that translates inaudible sound waves to wavelengths recognizable by the human ear. This sensor is used to locate gas leaks.

Following his educational talk, the group gathered for a photograph and to pick up sub sandwich lunch bags provided by Florida Tech. Everyone then made their way back to the presentation room to finish eating and have the zone meeting. Don Burnette started out the meeting with some announcements regarding SPS national and the importance of national membership. There was then some discussion on what chapters were doing that seemed effective, and advice for areas that were lacking. Some chapters had difficulty recruiting undergraduates, while others had a hard time getting graduate students to participate. Emails were swapped and it was suggested that each zone 6 chapter link the other chapters' websites to its own to help keep each other connected.

After the zone meeting, everyone transitioned to the Olin Physical Sciences building for the hour long poster session. The posters were set up in two adjoining rooms for judging and presented another opportunity for students to mingle and learn about each others' research. Afterwards was the second oral presentation session, followed by the presentation of awards. The judges emphasized the difficulty in picking one "best" presentation from each, and actually requested to award two for the poster session: one to

a graduate student and one to an undergraduate. Sergio Tafur of UCF was awarded the best poster as a graduate student for Error! Not a valid bookmark self-reference., and Josh Olitzky of UWF was awarded the best poster as an undergraduate student for *Development of Coherent anti-Stokes Raman Spectroscopy*. Brandon Marsell of Stetson University was awarded the best oral presentation for *The Effects of Magnetic Fields on 90° Scattered Polarization at Sodium D1 and D2 Wavelengths*. Each winner was presented with an R.S. Jin Award certificate (in honor of Florida Tech's previous SPS advisor) as well as a \$50 gift card for Barnes and Noble. (Since we had not purchased three gift cards before the event, we purchased one afterward and mailed it to Sergio Tafur. This is why one of our Barnes and Noble receipts is dated for after the conference.) Florida Tech advisor Dr. Marcus Hohlmann also recognized Florida Tech and UCF for achieving Outstanding Chapter of the Year awards for 2005-2006.

After closing, some students were given a tour of the physics building by Dr. Terry Oswalt, Florida Tech's Physics and Space Sciences department head. Other students headed out to the beach to watch the launch of THEMIS and enjoy hamburgers, hotdogs, dessert, and fellowship. This was a great chance for the different chapters to socialize in a comfortable setting, playing soccer and chowing down on the Florida Tech supplied BBQ.

Schedule of Events

Time	Event
8:15	Arrival and sign-up. Poster set-up time. Put PowerPoint presentations onto computer system. (Please bring your PowerPoint on a thumb drive or CD. We will try to have available the ability to use your own laptop, but this is not definite.)
8:45-8:50	Introduction
8:50-9:45	Oral Presentations (4)
9:45-9:55	Break
9:55-10:45	Oral Presentations (4)
10:45-11:00	Break
11:00-12:00	Speaker: Stan Starr of the Applied Physics Lab at Kennedy Space Center
12:00-12:15	Break. Lunch: Sub sandwiches, chips, cookie, and drink by Florida Tech catering service
12:15-12:45	Chapter meeting during lunch: Update how chapters are doing, what is working for them, what doesn't, any help they need, etc.
1:00-2:00	Poster presentation session and judging
2:00-2:10	Break
2:10-3:05	Oral Presentations (4)
3:05-3:15	Break
3:15-4:10	Oral Presentations (4)
4:10-4:20	Break
4:20	Presentation of awards and closing
4:30	Take down followed by Mixer at Melbourne Beach: Hamburgers and hotdogs served around 5:00, weather permitting. Provided by Florida Tech. (Directions to beach from Florida Tech are at the bottom of the Maps/Directions page. Click HERE for Google Map.)

Zone 6 Meeting at Florida Institute of Technology, February 17, 2007

Poster Abstracts

Detection of arsenic implanted into silicon at very low doses

Abhijeet Ardey and Gabriel Braunstein
Department of Physics, University of Central Florida

We have explored the use of heavy ion backscattering spectrometry (HIBS) to detect arsenic dopants implanted into silicon at very low doses. Arsenic ions have been implanted into silicon substrates at energy of 100 keV, using doses of 10^{12} , 10^{13} and 10^{15} atoms/cm². Conventional Rutherford backscattering spectrometry (RBS) can detect the arsenic only for the highest dose of 10^{15} atoms/cm². However, using HIBS, we are able to detect even the lowest dose of 10^{12} atoms/cm². A computer program, developed to model the experimental results, permits to extract the arsenic concentration as a function of depth. The potential of this technique to monitor low dose, low energy implantations, is discussed.

RXTE Observations of Microquasars GRO J1655+105 and GRS 1915+105

Gul Esra Bulbul
University of Huntsville, Alabama

RXTE timing analysis of Galactic Microquasars GRO J1655-40 is presented. I have investigated quasi periodic oscillations (QPOs) in the black hole binary GRO J1655-40 observed in 99 observations made by the Proportional Counter Array (PCA) on board Rossi X-Ray Timing Explorer (RXTE) in both low energy band (2-12 keV) and high energy band (13-27 keV), respectively. Four different X-ray states are seen in the combined characteristics of power spectra, light curves extracted by using All Sky Monitor (ASM) and spectra during 1996 and 2005. Timing analysis of RXTE observations of both of two black hole binary GRO J1655-40 displays twin high frequency quasi periodic oscillations (QPOs) which are sometimes simultaneous in high energy band. I briefly discussed our results and the models on black hole spin and mass.

Infrared Spectroscopic Characterization of Field Brown Dwarf Candidates from a Deep Survey

R. Deshpande, E.L.Martin, R. Tata, R. Wainscoat, M.M.Montgomery
SPS, Department of Physics, University of Central Florida

We present preliminary results of low-resolution near-infrared spectrum obtained with NIRSPEC on the Keck II telescope for a brown dwarf candidate that was previously identified in the IFA Subaru/Suprimecam deep survey. The photometric identification was made on the basis of extremely red optical colors. The NIRSPEC spectrum allow us to derive the spectral classification of IFA 0230 to be a T2 dwarf. We find its $M_J = 14.3$ and assuming its $m_J = 18.7$ based on photometry, we find a distance of $\sim 58 \pm 4.2$ pc. Assuming a $T_{\text{eff}} = 1390\text{K}$, $L = 2.88 \times 10^{-5}L_{\odot}$, we find its mass to be $M = 0.083M_{\odot}$ which is $\sim 49 M_{\text{Jupiter}}$

Study of O VI Distribution in the Large Magellanic Cloud

Yese J. Felipe, in collaboration with William P. Blair, Ph.D. & W. Van Dyke Dixon, Ph.D.
University of Puerto Rico at Mayaguez

Star data gathered from FUSE Satellite was used in order to study the content and distribution of O VI of superbubbles and the interstellar medium in the Large Magellanic Cloud. Although the amount of stars that could be used for this study were few, results seem to imply that there lies a higher amount of O VI concentration in superbubbles than in their surrounding interstellar medium.

Study of pairwise interactions from the first principles for simulations of nanotubes/nanocluster systems

Satyender Goel and Artem Masunov
SPS at the University of Central Florida

Carbon nanotubes (CNTs) are cylindrical carbon molecules with novel properties that make them potentially useful in a wide variety of applications in nano-electronics. However, engineering of devices may be feasible only if these CNT have specific chirality. Much work remains to be done to control the selectivity of CNT growth process. Atomistic simulations open the venue to optimize environmental conditions and produce CNT of desired chirality. We propose to analyze detailed mechanism, and build kinetic model of catalytic growth by multiscale approach. High theory level can be used for di- and tri-atomic fragments, and generate parameters for bond order force field. In turn, force field simulations will be used to characterize intermediates and transition states, and calculate rate constants. Finally, the rate constants will be used to simulate the growth at realistic time scales.

Potential energy curves for diatomic molecules AB including catalytic transition metals (A,B = Fe, Co, Ni, C, H) were studied with Density Functional Theory. The equilibrium bond lengths and dissociation energies were found in good agreement with published ab initio results. Fermi smearing and quadratic SCF convergence algorithm combined with wavefunction stability analysis was found necessary to obtain correct description. We also present detailed analysis of electronic structure.

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J. Helsby, R.D. Pena, M. Hohlmann
Florida Institute of Technology

Implementation of a grid computing cluster at Florida Tech. J. HELSBY, R.D. PENA, M. HOHLMANN. Dept of Physics and Space Sciences, Florida Institute of Technology, Melbourne, FL 32901. In order to handle the large amounts of data which are expected from the LHC experiments at CERN, the strategy is to build a grid of large computing clusters distributed worldwide. Florida Tech, a member of the CMS experiment at the LHC, will be integrated into this computing network by contributing a small cluster. Implementation, integration, and usage of the Florida Tech computing cluster will be discussed.

A Comparison of Integrated Electric Field with Substorm Activity

J. Kissinger, T. Cullens, A. Moss, R. Bruntz, R.E. Lopez
Florida Institute of Technology

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 $E_y = V_x B_z$, 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.

Current Work on Modifying the Shack Cube Interferometer

Fei Liu, Joseph Geary
SPS, University of Alabama in Huntsville

Shack cube interferometer was first built at the Optical Science Center (OSC) at the University of Arizona, Tucson, in 1974. It was a discovery by mistake at the beginning, however, it has been used for testing many large optical components and systems in the next 20 years. In recent years, the popularity of shack cube interferometer has been going down as oppose to commercial Fizeau-type interferometers due to some of

its inherently-undesired features and difficulty in software integration. This paper proposes some of the initial thoughts on modifying the shack cube interferometer, including light source replacement and mechanical redesign, which will highlight more its own advantages over other interferometers. One test example is given to make the comparison before and after modification.

Quarknet

Joel Melendez and Ben Storch
Florida Institute of Technology

Information on Quarknet and what we as a research group are planning to learn from it.

Determination of the orbit of the secondary asteroid in the binary system 2003YT1

Giselle M. Miranda-Diaz, Mike C. Nolan and Jose M. Rosado
University of Puerto Rico at Mayaguez

I worked the summer of 2004 under advisor Mike Nolan to determine the orbit of the secondary asteroid around the primary of the binary system 2003YT1. After analyzing the images (images from May 1-4), creating various MATLAB programs and working with some equations like the ellipse equations and Kepler's laws, we found, using Newton's laws of motion and Newton's law of universal gravitation, that the orbit is elliptical. We concluded that probably this is a recently formed system with abundant energy (is unstable).

The Clustering Properties of Radio Galaxies in the COSMOS field

Keri Salvador (Florida Tech, NSF REU, AMNH) , Dr. Timothy Paglione (York College, CUNY/AMNH)

We determine the angular clustering of radio sources from the VLA-COSMOS Large Project. Analyzing the clustering of radio galaxies as a function of angular separation will help answer questions in observational cosmology on galaxy formation and evolution, such as how the faint galaxy population is distributed at high redshifts. The radio portion of COSMOS, called the VLA-COSMOS Large Project, observes 3646 radio sources, uses 264 hours to cover the entire $2d^2$ field at 1.4GHz, has a resolution of $1.4'' \times 1.5''$ and contains sensitivity of down to $40 \mu\text{Jy}$. The median flux of the observed radio galaxies at $.09 \text{ mJy}$ indicates a significant amount of low-luminosity star forming galaxies within the survey. The slope and amplitude of the angular clustering is consistent with previous studies and extends to very small separations of $6''$.

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L. Seward (UAH), S. Patel (NASA/MSFC), C. Kouveliotou (NASA/MSFC), M. Finger (USRA), E. Rol (U. of Leicester)

Gamma-ray bursts (GRBs) are short-lived bursts of gamma-ray photons with decaying multi-wavelength energy afterglows. With the unprecedented early observations of GRB X-ray afterglows by the Swift space observatory, many unexpected afterglow characteristics have been revealed, including X-ray flaring. We present here our study of the time variability in the X-ray flux of bright flares in the light curves of a selected GRB sample observed by Swift X-Ray Telescope. We describe the time resolved and total Fourier power density spectra of these flares and discuss our results and how these fit with theoretical models.

Development of Coherent anti-Stokes Raman Spectroscopy

J. D. Olitzky, C. G. Clanton, and L. Ujj

University of West Florida, Department of Physics

We have developed a CARS (Coherent Anti-Stokes Raman Scattering) spectrometer using a Nd:YAG laser and a modified Optical Parametric Oscillator, operating in a broadband mode. Combining these beams in a four wave mixing arrangement produces a non-linear optical process that is the coherent version of Raman Scattering. The interaction previously described between the two input beams causes an excitation of discrete allowed vibrational and rotational levels of the molecule, generating a CARS spectra. The spectra can then be analyzed to identify the structural makeup of the examined molecule. These results will be detailed in our presentation poster. We have developed a polarization sensitive version of CARS, and have been able to record the spectra of simple solvents. The polarization sensitive technique is useful to suppress the non-resonant background, said suppression of the noise will give the spectra a similar spectral line shape to that of Raman Scattering. The results of this polarization sensitive CARS will be presented as well.

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S.Tafur, J.M. Hales, K..D. Belfield, A. Masunov

SPS at the University of Central Florida

We report theoretical studies of five conjugated chromophores experimentally shown to have large TPA cross-section. We used Time Dependent Density Functional Theory (TD-DFT) Methods. A third order response formalism within TD-DFT was applied to calculate frequency-dependent third order polarizability tensors. Thermal broadening was simulated implicitly via an empirical constant. We report these results and compare them to experimental measurements. We also discuss future plans, including the reduction of computational costs by use of semi-empirical Hamiltonians and few-state models, as well as explicit simulations of thermal broadening and solvent effects by implementation of molecular dynamics.

Zone 6 Meeting at Florida Institute of Technology, February 17, 2007

Oral Presentation Abstracts

1. Substorm Energy Deposition and Correlation with Substorm Characteristics

Christine Gabrielse, Ami M. DuBois, Patricia I. Gavin, Ian R. Swanson, Sandra Brogl, Dr. Ramon E. Lopez

Florida Institute of Technology

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.

2. Hurricane Wind Structure: Assymetries and wind maxima

Leira Cuadrado, Eric Uhlhorn

University of Puerto Rico at Mayaguez

We all know that to make any forecast and study any state of the atmosphere its necessary the radar, satellite and remote sensing information. To study hurricanes and its behavior we use satellites, radar data and, the most important, data from the reconnaissance aircrafts that fly into the hurricane getting data from sensors in the plane. The Stepped Frequency Microwave Radiometer (SFMR) it's a passive sensor measure over-ocean wind speed and rain rate in hurricanes and tropical storms. With the SFMR data from 58 flights through 21 storms we were able to make analysis about hurricane wind structure asymmetries and secondary wind peaks.

3. Development of a Geophysical testing and Calibration Site Using the Geonics EM-31

Ricardo Velez

University of Puerto Rico at Mayaguez

As part of a collaborative geophysical study, several instruments were used to establish a national geophysical testing and calibration site at the National Energy Technology Laboratory in Pittsburgh, PA. This secure site consists of: a geologically undisturbed area, an abandoned underground coal mine and active underground experimental mines. The Geonics EM 31, which employs the principals of electromagnetic induction, was the primary resourceful tool used to collect the data in this study. With the acquired baseline data, and making use of an imaging/mapping software, an accurate depiction of conductive areas of the test site will be developed to be used for testing future technologies and for field exercises by the University of Pittsburgh and the West Virginia University. Furthermore, the results will provide useful data for evaluating the extent of underground flooding, or mine pools, for future potential geothermal applications.

4. The Effects of Magnetic Fields on 90° Scattered Polarization at Sodium D1 and D2 Wavelengths

Brandon Marsell, Stetson University, DeLand FL.

Dr. Steven Tomczyk, High Altitude Observatory, Boulder Co.

In solar research, much information about the sun can be gathered from the polarization state of light radiating from it. Isolating the sodium D1 and D2 wavelengths and analyzing their polarization state, one can detect magnetic fields in the lower limb of the sun [1]. Using the four Stokes parameters I,Q,U,V it is possible to fully describe the polarization state of light at the sodium D1 and D2 wavelengths. A laboratory study was conducted to relate Stokes polarization measurements at these wavelengths to magnetic fields.

The experiment consists of a glass cell containing sodium gas embedded in a pair of Helmholtz coils capable of producing around 200 Gauss. The cell is then illuminated with unpolarized light and a polarimeter used to measure the polarization state of the light scattered at 90° since this is the angle of light polarized at the solar limb. The set up allows for measurement of polarization state as a function of magnetic field.

The results of the experiment reaffirmed the theoretical prediction of zero Stokes U and V polarization and an increase in Stokes Q polarization at a 0° increasing magnetic field for the D2 wavelength [1]. [1] Trujillo Bueno et al., Appl. J.L. L53, 566 (2002).

5. Berry-phase blockade in single-molecule magnets

Gabriel Gonzalez and Michael N. Leuenberger

University of Central Florida SPS

We formulate the problem of electron transport through a single-molecule magnet (SMM) in the Coulomb blockade regime taking into account topological interference effects for the tunneling of the large spin of a SMM. The interference originates from spin Berry phases associated with different tunneling paths. We show that in the case of incoherent spin states it is essential to place the SMM between oppositely spin-polarized source and drain leads in order to detect the spin tunneling in the stationary current, which exhibits topological zeros as a function of the transverse magnetic field.

6. Fabrication of nano-gapped single-electron transistors for the study of single-molecule magnets at low temperature

J.J. Henderson, C.M. Ramsey, E. del Barco. UCF Physics Dept.

A. Mishra, G. Christou. UF Chemistry Dept.

We report single-electron transport measurements on a functionalized Mn12 based single-molecule magnet. The self-assembly of these molecules was confirmed by scanning probe microscopy and XPS measurements. Because it is well known that the molecule's environment within the crystal can have a profound influence on the quantum properties of the system, it is important to study the quantum spin dynamics in individual isolated molecules. Single electron transistor devices have been prepared for this purpose using electron beam lithography. The transport properties of a single, isolated Mn12 molecule were measured at low temperature in a 3-D superconducting vector magnet with arbitrary field direction. Magnetic field and temperature dependence as well as theoretical aspects will be discussed.

7. Ferromagnetic Resonance on Ultra-thin Co Films

Dr. Enrique del Barco, Juan Carlos Gonzalez

University of Central Florida

We report on ferromagnetic resonance (FMR) conducted at room temperature with Cobalt thin films between 1 nm and 50 nm thick deposited on silicon wafers, the films were created using UHV metal evaporation. The FMR was conducted using a high frequency coplanar wave-guide with variable frequency

range up to 50GHz, and an Agilent(R) vector network analyzer. The g-factor, Gilbert damping effect, anisotropy and other quantum properties were analyzed.

8. Modified Einstein-Hilbert action in general relativity and the resulting field equations

Pontus Ahlqvist and Costas Efthimiou
University of Central Florida

The field equations of general relativity may be derived by varying the Einstein Hilbert action with respect to small variations in the metric. We discuss a generalized action which has as a special case the Einstein Hilbert action. We continue by varying this new action with respect to the metric to obtain more general field equations that reduce to the equations of general relativity for the case in which the action reduces to the Einstein Hilbert action.

9. First commissioning results of sensors for the Alignment of Muon Endcap Chambers in the CMS experiment at CERN

Samir Guragain, Marcus Hohlmann
Florida Institute of Technology

The positions of muon endcap chambers were monitored precisely in the Compact Muon Solenoid (CMS) experiment at CERN's Large Hadron Collider (LHC) in 2006. During the summer, the detector was closed up and the huge 4 Tesla solenoid magnet of CMS was turned on for the first time ever, successfully. The movement of the chambers for the alignment in R- Φ and Z directions was monitored continuously by a complex system of wire extension and linear motion potentiometers (R sensors, Z sensors and proximity sensors), inclinometers, and optical DCOP sensors based on CCDs during the CMS Magnet Test & Cosmic Challenge Phase I & II. These sensors clearly indicated the flexing of the large absorber disks when the field was turned on and off. The results agree with expectations predicted by a Finite Element Analysis using the ANSYS program and the system monitors the chamber positions with 75-200 μm accuracy in the R Φ plane, $\sim 400 \mu\text{m}$ in the radial direction, and $\sim 1 \text{ mm}$ in the Z direction along the beam axis. We present about the system briefly and first commissioning results of the sensors showing the disk deformations

10. Direction Sensitive Gamma Ray Detector – Compton Camera Project

Ruben Mendez Rodriguez
University of Puerto Rico at Mayaguez

In this project I worked on the development of a prototype for directing sensitive radiation detector using the Compton scattering. The study was conducted at the Physics Department of Purdue University, Indiana. My work included testing photomultiplier tube for later calibration and the construction of the drift chamber.

11. EDEP

Robert Wilkos, Mallory Berry, Jessi Mikkelson, Pat Malvosio, Streven Bukowsky, Ben Pepper, John Ferreira, Steven Garcia Morales
Florida Institute of Technology

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 think the CIS thin films should be free of these natural defects and this will cause the efficiency of the completed solar cell to be increased. This presentation will be an update of the research leading up to the flight in Houston.

12. Inspiration: Mars Student Climate Lander

Simon Porter
University of Alabama, Huntsville

Inspiration is a student-led Mars mission concept study started this summer with the goal designing an ultralight (>25 kg) spacecraft to land on the Martian surface and study climate and surface-atmosphere interactions.

13. Dissociative Recombination of H₃⁺

Nicolas Douquet, Viatcheslav Kokoouline
University of Central Florida

The study of cold gazes represents today a wide and interesting field of physics, since its results can be applied in several different main physics subjects, like for instance, superconductivity or astrophysics. In the following article, we are treating the collision of three identical particles in such gazes, by considering the symmetries of the total wave function of the system. Thus, we use either hyperspherical or Jacobien coordinates, depending on which ones are best suited to describe the different configurations of the system. Precisely, for this purpose, we need to describe the wave function of the system at large distances, in order to understand the states of the particles before and after the collision, but also point out the wave function at short distances during the actual collision process. Then, we will be able to predict the possible recombinations of particles after collision, by using symmetry's considerations. In particular, we will describe the interesting recombination of the system in one free particle and a dimer, naming Efimov state, observed recently in the experience with B.E.C (Bose Einstein Condensation) by the experimental group of R.Grimm in Innsbruck.

14. Calculating three-body resonances using slow-variable discretization and complex absorbing potential

Juan Blandon, Viatcheslav Kokoouline, Francoise Masnou-Seeuws
University of Central Florida

We are developing a method that uses computer modeling to apply the slow variable discretization method of Tolstikhin et al. [1], along with an optical potential and several grid mapping procedures to obtain three-body resonances. These resonances are pre-dissociated three-body bound states, which are relevant to three-body processes, e.g. three-body recombination in ultracold quantum gases. We apply our method to a model three-body system of identical bosons with nucleon mass and compare our results with Ref. [2]. We search for Efimov resonances in a model three-body bosonic system whose pairwise interaction is described by a gaussian function and we compare our results to those of Ref. [3].

[1] O. I. Tolstikhin, S. Watanabe, and M. Matsuzawa, J. Phys. B: At. Mol. Opt. Phys. 29, L389 (1996).

[2] D. V. Fedorov, E. Garrido, and A. S. Jensen, Few Body Sys. 33, 153 (2003).

[3] E. Nielsen, H. Suno, and B. D. Esry, Phys. Rev. A 66, 012705 (2002).

15. Dissociative Recombination of H₃⁺

Samantha Fonseca dos Santos, Viatcheslav Kokoouline
University of Central Florida

The process of dissociative recombination (DR) of the H₃⁺ ion has been studied over the past years and it was found that the coupling of vibrational and electronic degrees of freedom plays a crucial role in the mechanism: when the Jahn-Teller coupling effect was incorporated into the theoretical treatment it yielded DR rates in much better agreement with experiments. The previous work on H₃⁺ was performed using hyperspherical coordinates and Siegert states for the vibrational wave functions. SVD technique employed in this study provides more accurate vibrational energies than the Siegert state approach for it takes into account the non-adiabatic coupling between different adiabatic channels. Another improvement towards theory-experiment agreement was to take into account the conditions and parameters of the experiments performed.

16. Development of Triple Gaseous Detection System for Ionizing Radiation

N. Leioatts, J. Mikkelsen, D. Dickey, S. Rembeczki, M. Hohlmann
Florida Institute of Technology

Gas Electron Multipliers (GEM) were first introduced in 1997 by F. Sali. Since then various institutions have replicated and made alterations to that original device. One of these types is the three layer GEM used to detect various forms of ionizing radiation. Research institutions have vested interests in these devices for assorted applications. Other GEM's in the past were developed and tested but met with limited success. New tests are attempting to surpass the results of previous tests, through the use of different methods of assembly. Proper functionality of this device will detect a single incidence of ionizing radiation through a cascading effect which can be interpreted and analyzed electronically.

The present approach uses SVD vibrational states in the calculation of H₃⁺ DR rates and accounts for experimental conditions. Incorporating averaging procedures that describe better the experimental conditions improves the agreement between theory and experiment. Results for vibrationally-excited initial states of H₃⁺ are also presented in this work.