"Astronomy"

Spring Meeting of the Illinois Section of the AAPT

April 3-4, 2009

Illinois Wesleyan University, Bloomington, Illinois

Friday, April 3, 2009

9:30 - 5:00 **Registration. Atrium of the Center of Natural Science (CNS), Beecher Street.**
Please make out checks to "ISAAPT".

Please Recycle. When you leave the meeting to return home, please place your plastic name tag holder in the box which will be provided. It will be used at the next meeting. Thanks.

10:00 - 12:00 **Workshop W1. "The Illinois Articulation Initiative for Physics Majors and iTransfer"**, Panel Discussion. Moderated by George Bart, Truman College and Michael Fortner, Northern Illinois University. Center for Natural Science (CNS) - WS005.

12:00 - 1:00 **Lunch** - on your own. See the list of restaurants on the Web site.

Here is a list of those who are doing contributed presentations.
Note that Presentations A1-A5 and D1-D6 are part of the *Student Research Symposium*.

Friday 1:00 - 2:45		Friday 4:00 - 5:35		Saturday 8:25 - 9:30		Saturday 10:30 - 12:00	
1:00	A1. Kevin Wabick	4:00	B1. Noella D'Cruz	8:25	C1. Amit Joshi	10:30	D1. Michael Chastain
1:15	A2. Jacob Weidner	4:15	B2. James Conwell	8:40	C2. Kishor Kapale	10:45	D2. Brad Sliz
1:30	A3. Alison Smith	4:30	B3. Tom Carter	8:55	C3. Deborah Lojkutz and Ann Brandon	11:00	D3. Mark Kasperczyk
1:45	A4. Leah Goldberg	4:45	B4. James van Howe			11:15	D4. Emily Gospodarczyk
2:00	A5. Joshua Harden	5:00	B5. Narendra Jaggi	9:10	C4. Carl Wenning	11:30	D5. David Wischhusen
2:15	A6. Dave Sykes	5:15	Take Fives	9:25	Take Five	11:45	D6. Isaac Goodin
2:30	A7. Andrew Morrison						

1:00 - 2:45 Session A - CNS C101 - Chair: *Noella D'Cruz*

1:00 - 1:15 - A1 - Student Research Symposium

Clustering of Epistatically Related Genes. *Kevin Wabick, Jacob Weidner, B. K. Clark*, Illinois State University, Normal, IL 61761. Each living organism has its own unique combination of genes, a few of which contain new modifications that arise through mutations. The organization of genes within DNA is slowly reorganized from generation to generation via the processes of crossover and inversion. We constructed a computer model that had a target fitness, which acted as our environment, 400 strands of DNA, and 50 genes per strand. Our goal is to explore Pepper's claim that epistatically linked genes tend to move closer to each other in a strand of DNA than non-epistatically linked genes. We carry out simulations similar to Pepper's in an attempt to further examine this claim. [1] Pepper, J. W., "The evolution of evolvability in genetic linkage patterns," BioSystems 69, 115-126, 2003.

1:15 - 1:30 - A2 - Student Research Symposium

DNA and Population Fitness in a Changing Environment. *Jacob Weidner, Kevin Wabick, B. K. Clark*, Illinois State University, Normal, IL 61761. Each living organism has its own unique combination of genes, a few of which contain new modifications that arise through mutations in addition to organizational changes through crossover and inversion. The changes that these processes enact on the DNA of an organism can either benefit or hinder that organism's ability to survive in its environment, in other words these processes affect the fitness of an organism for its environment. In this computational simulation, the environment is represented as a target fitness that we can vary at a controlled frequency or rate. In a real ecosystem in which the target fitness of the environment changes, survivability of a population depends on its ability to track the target fitness. We investigate the roles of mutation, crossover, and inversion in a population's capacity to track varying target fitness.

1:30 - 1:45 - A3 - Student Research Symposium

Observation of a Resonance State in 25F. *Alison R. Smith, Mark S. Kasperczyk, Nathan H. Frank, MoNA Collaboration*, Illinois Wesleyan University, Bloomington, IL 61701. Resonances are fundamental phenomena in physics. In a nucleus, which consists of protons and neutrons, resonances or states occur at specific energies that provide information on the underlying structure of the nucleus in question. The energies of these states in nuclei that are far from stability are currently of great interest. A state resulting in the emission of a neutron from 25F was observed for the first time. The 25F isotopes were produced by one-proton removal from a high energy beam of 26Ne on a 9Be target at the nuclear physics facility of the National Superconducting Cyclotron Laboratory at Michigan State University. The subsequent decay of the 25F isotopes resulted in 24F and neutrons which were detected in coincidence. The properties of the charged particles and neutrons were used to reconstruct a decay energy spectrum for 25F which was compared to simulations. Results will be presented.

1:45 - 2:00 - A4 - Student Research Symposium

RPC Modifications for the PHENIX Collaboration Muon-Trigger Upgrade. *Leah Goldberg*, Illinois Wesleyan University, Bloomington, IL 61701. The PHENIX experiment at the Relativistic Heavy Ion Collider at Brookhaven National Laboratory intends to study proton spin structure through the detection of high pT muons produced from W-Boson decay. Such measurements will require an upgrade of the first level muon trigger using Resistive Plate Chambers (RPCs). RPCs are gas detectors in which high voltage is applied across two resistive electrodes spaced 2 mm apart. The resistivity of the electrodes and possible coatings on the surface of the electrodes determine the rate capability of RPCs. We tested the performance of a double gap RPC in avalanche mode under gamma radiation from an Fe55 source. In this presentation we present the rate capability of a Bakelite RPC with a coating of linseed oil applied to the Bakelite electrode surfaces.

2:00 - 2:15 - A5 - Student Research Symposium

Modeling Optical Phenomena using Harmonic Oscillators. *Joshua Harden and Amitabh Joshi*, EIU, Charleston, IL 61920. An atomic medium can absorb light at two different frequencies at the same time. Under certain conditions of atomic level configurations, the atomic medium becomes transparent to the first frequency of light when a second light passes through the medium. This implies that light is controlling the light and giving rise to the phenomenon of electromagnetically induced transparency (EIT), which is observed in vapors of three or more atomic levels when laser lights pass through such an atomic medium. We simulate EIT phenomenon of three-level atoms using simple harmonic oscillators. The model can be described as two coupled harmonic oscillators subject to a harmonic driving force, which can be solved analytically and numerically. This EIT can be experimentally verified simply by using resistance-inductance-capacitance (RLC) circuits.

2:15 - 2:30 - A6 - Research

The Art of Estimation - Some Results. *Dave Sykes*, Lincoln Land Community College, Springfield, IL 62794-9256. At the Fall, 2008 meeting of the ISAAPT a survey was given to approximately 30 science teachers to determine their skill level at making estimations. In this presentation the results of said survey will be reported as well as the results of a similar survey given to 40 Physical Science students at Lincoln Land Community College.

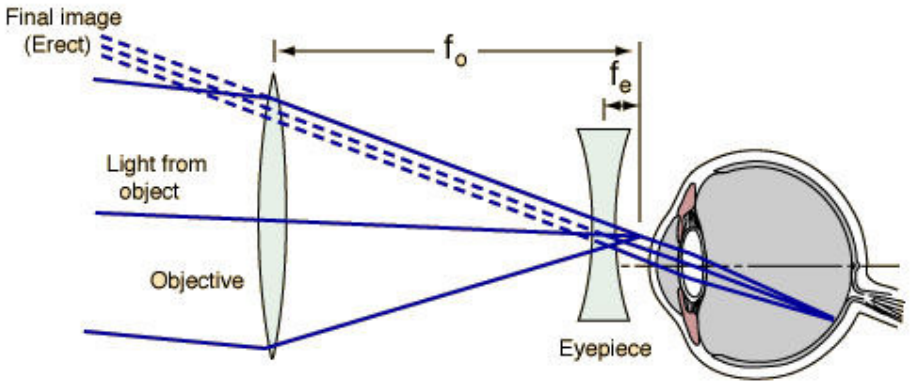
2:30 - 2:45 - A7 - Demonstrations

Extended uses and Applications of the "Mysterious Glowing Ball". *Andrew Morrison*, Northwestern University, Evanston, IL 60208. The "Mysterious Glowing Ball" is a relatively new and increasingly popular demonstration item for use in teaching the concepts of color mixing. Several other demonstrations can be performed by photographing the ball using a camera with an adjustable shutter speed. Also presented will be ideas for in-class or laboratory activities for color, kinematics, simple harmonic motion and other concepts from introductory physics.

2:00 - 3:00 Workshop W2. "Hands On Astronomy" *Lew Detweiler*, Illinois Wesleyan University
Mark Evans Observatory

2:45 - 3:00 Break

Galilean Telescope



3:00 - 3:45 ***"Measuring Ancient Light"***

Dr. Thushara Perera
Department of Physics, Illinois Wesleyan University
CNS C101

Why are millimeter wavelengths ideal for exploring the early universe? How have we, and how will we overcome the technical difficulties related to the fact that our surroundings, like the atmosphere or the ground, make up the majority of emission? The talk will address these questions and provide examples where millimeter wavelengths are helping understand the physics of the early universe.

3:45 - 4:00 Break

4:00 - 5:35 Session B - CNS C101 - Chair: *Linda French*

4:00 - 4:15 - B1- Teaching Methods

Group Projects and Group Tests in ASTR 101. *Noella D'Cruz*, Joliet Junior College, Joliet, IL 60431. In Spring 08, my introductory astronomy students did two group projects related to telescopes to commemorate the 400th anniversary of the invention of the telescope. The first project was to recommend a telescope for purchase from a set of three models. The second project was to recommend a location in the solar system for a ground-based telescope (excluding Earth). Student feedback on these projects was positive, and students felt more confident doing the second project because of their experiences with the first. I will report on the details of the projects and student feedback. My spring 08 and Fall 08 students also participated in group tests, and I will talk about students' reactions to group tests as well.

4:15 - 4:30 - B2 - Other

EIU Observatory: Effects in the Physics Department after Four Years. *James Conwell*, Eastern Illinois University, Charleston, IL 61920. The effects of the campus observatory at Eastern Illinois University are summarized after four years of operation. Among the effects that were noticed, are enrollment of physics majors, research with other observatories, and community outreach.

4:30 - 4:45 - B3 - Research

Initial Results from Using a Low Cost Introductory Physics Text at a Community College. *Tom Carter*, College of DuPage, Glen Ellyn, IL 60137. I will compare indicators of student knowledge and performance from class using the low-cost black and white textbook by Wolfson to classes using the PER based text by Knight and the more standard text by Halliday, Resnik and Walker. Indicators of student performance will include average normalized gain on the FCI, performance on a locally produced standardized exam and fraction of students successfully retained in the class. I would like to pose the question as to the best way to use a textbook.

4:45 - 5:00 - B4 - Teaching Methods

Synthesis of Peer Instruction and Just-in-Time-Teaching for Introductory Acoustics: Examples and Assesment of Learning Gain. *James van Howe*, Augustana College, Rock Island, IL 61201. I will demonstrate a typical acoustics class I taught at Augustana College where I synthesized known techniques of Peer Instruction and Just-in-Time Teaching. I will show assessment data from this class which shows a normalized learning gain of 67% using an Acoustics Concept Inventory (ACI) I developed.

5:00 - 5:15 - B5 - Teaching Methods

Embedding: An Approach to Integrating Computational Skills in the Curriculum. *Narendra Jaggi*, Illinois Wesleyan University, Bloomington, IL 61701. During its recently completed self-study, the physics department at IWU decided to try to articulate its curriculum as a multi-fold spiral which might guide us as we purposefully revisit, reinforce, and refine various physical concepts, laboratory skills, mathematical methods, and computational skills by embedding them at multiple points in this Spiral Curriculum. So, the key question is: What is it that we wish to revisit, reinforce, and refine in the courses/experiences we offer to our students? In preparation for an upcoming departmental retreat where we will attempt to articulate this Spiral Curriculum, I have collected some early thoughts about the value of this particular approach. I will share some of these thoughts, using computational skills as an example.

5:15 - 5:35 - Take Fives

1. *Zak Knott*, "Join AAPT for Free"
2. *Dave Sykes*,"Survey of Community College Engineering Enrollment "
3. *Gabriel Spalding*, "Announcement of Topical Conference on Advanced Labs"
4. *Taiyo Wilson*, "Promoting Inquiry Using APOD To Solve Gigantic Problems"

5:45 - 6:15 Social time - Turfler Room in the Memorial Center

6:15 - 7:15 Banquet - Turfler Room in the Memorial Center. Presentation of the *Outstanding High School Physics Teacher Award* to Diane Riendeau, Deerfield High School, Deerfield, Illinois.

7:30 - 8:30 ***"Recent Advances in Understanding the Youngest Protostar Systems"***

Dr. Leslie Looney

Department of Astronomy, University of Illinois, Urbana-Champaign

CNS C101

The youngest protostars hold the secrets to the initial conditions of star formation, as well as containing the deeply embedded circumstellar disks, both of which are setting the initial conditions for planet formation. With the increase in sensitivity that the Spitzer (IR space telescope) and CARMA (millimeter array) observatories have provided, we have made great inroads in understanding the earliest structures of star formation. I will present some of the results of these new observations, limitations, and new hope on the horizon.

Later Friday evening

Following Dr. Looney's talk, there will an opportunity to

1. Watch the DVD of Michael Frayn's Tony Award-winning drama "Copenhagen", directed by Howard Davies, starring Stephen Rea, Daniel Craig and Francesca Annis (117 minutes). Intro by *Linda French*, Illinois Wesleyan University. CNS C101
2. Observe in the Quad with telescopes provided by two local amateur astronomers, Lee Green and Dan Miller - weather permitting.

Saturday, April 4, 2009

7:00 - 8:15 ISAAPT Council meeting - Presiding: *Tom Foster*, President. CNS C212

8:00 - 9:00 Registration. Atrium of the Center of Natural Science.
Please make out your checks to "ISAAPT".

8:25 - 9:30 Session C - CNS C101 - Chair: *Andrew Morrision*

8:25 - 8:40 - C1 - Teaching Methods

Effective Teaching of Introductory Physics with some Guidelines of Cognitive Principles. *Amit Joshi*, EIU, Charleston, IL 61920. Class instructions based on unknown assumptions about students can lead to results way different from our expectations. Perhaps the knowledge about functioning of students mind can help us to prepare effective instructional material. Cognitive science guides us to enhance the effectiveness of instructions in terms of basic conceptual developments of topics and their coherent mixing into a well knitted knowledge structure. Hence the goal of teaching instructions for introductory physics students, i.e., learning physics is a growth to build robust functional knowledge may be achieved. Discussion based on teaching certain topics in introductory Physics will be presented.

8:40 - 8:55 - C2 - Research

Measuring Optical Angular Momentum In Astrophysical Context. *Kishor Kapale*, Western Illinois University, Macomb, IL 61455. We theoretically investigate methods to simultaneously measure polarization and orbital angular momentum of light emitted by various astrophysical objects. These methods when applied to the analysis of light coming from space may offer a new window to explore our universe.

8:55 - 9:10 - C3 - Active Learning

Sizes and Distances on the Way to Pluto. *Debby Lojkutz and Ann Brandon*, Joliet West High School, Joliet, IL 60404. Students often have difficulty visualizing the relative size of things in the universe. We will share a few activities that will help your students understand the relative sizes and distances of the solar system, starting with a trip to Pluto.

9:10 - 9:25 - C4 - Active Learning

An Online Student Laboratory Handbook. *Carl Wenning*, Illinois State University, Normal, IL 61790. In many introductory physics labs students seemingly are expected to learn many of the techniques of data management by "osmosis." The presenter will describe an online Student Laboratory Handbook used at Illinois State University that addresses a number of instructional problems by providing practical solutions for physics instructors.

9:25 - 9:30 - Take Five
1. *Don Reid*, "Thinking 'Inside' the Box"

9:30 - 10:15 ***"Astrochemistry and H_3^+"***

Dr. Benjamin McCall
Assistant Professor of Chemistry and Astronomy, Affiliate in Department of Physics
University of Illinois, Urbana-Champaign
CNS C101

Astrochemistry is an emerging area of interdisciplinary research at the intersection between physics, chemistry and astronomy. The central theme of astrochemistry is that fundamental knowledge of the chemical physics of molecular spectra and interactions from experiments and theory can shed light on the physical and chemical conditions in interstellar space. I will present an overview of the field, and give some specific examples from our work with H_3^+, the simplest polyatomic molecule.

10:15 - 10:30 Break

10:30 - 11:30 Workshop W3. "Hands On Astronomy" *Lew Detweiler*, Illinois Wesleyan University
Mark Evans Observatory

10:30 - 12:00 Workshop W4. "StarLab - a Portable Planetarium" Don Reid, Lincolnwood High School
CNS Atrium

10:30 - 12:00 Session D - CNS C101 - Chair: *Deborah Lojkutz*

10:30 - 10:45 - D1 - Student Research Symposium

A Detailed Study of the Kinetic Theory of Real Gases by Computer Simulations. *Michael Chastain and Jie Zou*, Eastern Illinois University, Charleston, IL 61920. We report some of the results of an on-going undergraduate research project that aims at a detailed study of the kinetic theory of real gases by computer simulations. Specifically, we investigate how pressure varies with temperature in a real gas and compare the result with the linear relationship predicted for an ideal gas. In our model, besides collision with the container walls, we also include the intermolecular interactions modeled by the Lennard-Jones potential: the molecules strongly repel each other when they are too close and attract each other when they are at a distance. The proposed computational method for the simulations is molecular dynamics and the simulations are performed in MATLAB. The simulation result of this project will provide a three dimensional animation that could be appropriated by the physics department for conceptual enhancement in classes covering this material.

10:45 - 11:00 - D2 - Student Research Symposium

A Molecular Dynamics Approach to Multi-Body Planetary Motion: A Computer Simulation of Our Solar System. *Brad Sliz and Jie Zou*, Eastern Illinois University, Charleston, IL 61920. In this project, we apply molecular dynamics, a computational approach, to the investigation of multi-body planetary motion in our solar system, in which the Sun, the planets, and their satellites interact through the gravitational forces. The main goal of this research is to perform detailed computer simulations and investigate the influence of the other astronomical objects, such as the planets and satellites, on the orbital motion of a particular planet, such as the Earth. An animation of the solar system is created. The project offers a detailed computational model for studying complex astronomical systems. The computer simulation also helps an observer to better understand the physics of planetary motion both visually and mathematically.

11:00 - 11:15 - D3 - Student Research Symposium

Observation of a Resonance State in 26F. *Mark Kasperczyk, Alison Smith, Nathan Frank, MoNA Collaboration*, Illinois Wesleyan University, Bloomington, IL 61701. Resonances are fundamental phenomena in physics. In a nucleus, which consists of protons and neutrons, resonances or states occur at specific energies that provide information on the underlying structure of the nucleus in question. The energies of these states in nuclei that are far from stability are currently of great interest. A state resulting in the emission of a neutron from 26F was observed for the first time. The 26F isotopes were produced by a proton-neutron exchange reaction from a high energy beam of 26Ne on a 9Be target at the nuclear physics facility of the National

Superconducting Cyclotron Laboratory at Michigan State University. The decay of the 26F isotopes resulted in 25F isotopes and neutrons that were detected in coincidence. A simulation which included a two-body nuclear reaction model, decay energy line-shapes, and detector resolutions and acceptances were used to analyze this state. Results will be presented.

11:15 - 11:30 - D4 - Student Research Symposium

Energy Structure of an Interacting Fermion-Boson System. *Emily Gospodarczyk*, Intense Laser Physics Theory Unit & Physics, Normal, IL 61790-4560. The long-term goal of this project is to use temporal and spatially resolved computer animations to visualize the interaction between two charged particles. As a first step, we approximate this Fermion and Boson particle exchange via an essential state model that involves a finite number of momentum modes for the Fermions and a small number of Bosonic modes with finite occupation numbers. The interaction between the particles will conserve total charge as well as momentum. With these assumptions we will calculate properties such as the energies and eigenstates of the interacting system and discuss how they vary with the coupling strength. We will examine the difference between bare and physical (dressed) particles and show its impact on the occurrence of macroscopic forces.

11:30 - 11:45 - D5 - Student Research Symposium

Computer Simulations of Light Scattering and Absorption in Random Media. *David Wischhusen*, Intense Laser Physics Theory Unit & Physics, Normal, IL 61790-4560. We propose a computer procedure based on Monte-Carlo simulations that allows us to predict the intensity distribution of light that is scattered by a random medium. This medium contains several obstacles at various locations that can absorb the light. At the moment these large-scale simulations are the only theoretical approach to study the light scattering in the presence of absorbers, as there are no analytical solutions available from the Boltzmann theory. The ultimate goal of such a computer simulation is to provide a theoretical guidance for parallel experimental investigations and to examine theoretically several recently proposed image inversion schemes.

11:45 - 12:00 - D6 - Student Research Symposium

Experimental Investigation of the Decomposition Based Imaging Scheme. *Isaac Goodin*, Intense Laser Physics Theory Unit & Physics, Normal, IL 61790-4560. I will describe simple experiments testing ideas of light scattering and absorption in milk-water mixture environments. In order to understand the physics better, I measure the light scattering pattern as a function of scattering concentration using a sensitive ccd camera Next I determine the absorptive modification of the scattering pattern. These data will serve as guidance to other theoretical tools including the Monte-Carlo based computer simulation and simple theoretical approximations such as the down-stream model. I will take measurements of the light pattern associated with obstacles at various locations and study the image inversion schemes such as the decomposition based imaging and study its limitations. We acknowledge the funding from the NSF and the Research Corporation.

12:00 - 1:00 Lunch - *It must be ordered with Registration.* The sandwich choice you made is printed on your name tag. **C101**

Astronomical Telescope