

Physics Newsletter

Physics Department
Baylor University

September 2006

Volume 1, Issue 1

Tutorials headline new intro lab content

Dr. Lillian McDermott from the University of Washington visited Baylor in the spring of this year and presented some of her work in physics education. She briefly described the tutorials that were taught at UW and showed how there was a measurable improvement in student understanding of concepts which students often find difficult. Her presentation motivated our department into trying a similar approach.

Part of what Linda Kinslow did this summer was to plan the implementation of using the tutorials in the introductory physics laboratories. To help with the implementation, Linda went to the AAPT summer meeting in Syracuse, New York and attended two training courses taught by Dr. McDermott and Dr. Schaffer the authors of *Tutorials in Introductory Physics*. This semester the plan is to alternate lab handbook experiments and tutorial experiments from the UW tutorials during the regularly scheduled laboratory timeslot for the first and second semester classes of introductory physics.



Inside this issue:

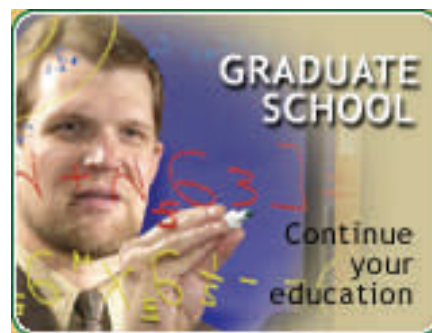
Publications	2
Conferences	2
New Additions	3
Visitors	3
Odds & Ends	3
Current Directions	4-5
Coming Events	6

First Thursdays Retirees' Coffee

The Physics Department faculty has begun a new tradition of having coffee together on the first Thursday of each month in the Department Conference Room, at 10:30 a.m. The coffees began last spring and had a great turn out among the emeritus faculty, including Bob Packard, George Wang, Don Hardcastle and Bill Adams.



First Thursdays,
10:30 a.m.



Professor Gerald Cleaver recently appeared in this ad on the Baylor homepage.

Recent Publications by the Department

- Dr. Park and collaborators at Oak Ridge National Laboratory published an article on interstitial-driven surface reconstruction in Physical Review Letters (June 7, 2006 – Park *et al.*, Phys. Rev. Lett. **96**, 226105 (2006))
- G. Benesh and A. Wang, *Self-Similar Collapse of Perfect Fluid with Plane Symmetry*, Gen. Relativ. Grav. **38**, 345 (2006).
- R.-G. Cai and A. Wang, *Black Hole Formation from Collapsing Dark Matter in the Background of Dark Energy*, Phys. Rev. **D73**, 063005 (2006) .
- F.I. Pereira, R. Chan, and A. Wang, *Gravitational Collapse of a Massless Scalar Field and a Perfect Fluid with Self-Similarity in (2+1) Dimensions*, Inter. J. Mod. Phys. **D15**, 131 (2006).
- Y.-G. Gong and A. Wang, *Observational constraints on the acceleration of the Universe*, Phys. Rev. **D73**, 083506 (2006) .
- Y.-G. Gong, A. Wang, and Y.-Z. Zhang, *Exact scaling solutions and fixed points for general scalar field*, Phys. Lett. **B636**, 286 (2006).
- Y.-G. Gong and A. Wang, *Acceleration from M theory and Fine-tuning*, Class. Quantum Grav. **23**, 3419 (2006) .
- Y.-G. Gong, A. Wang, and Y.-Z. Zhang, *On curvature coupling and quintessence fine-tuning*, Europhys. Lett. **74**, 930 (2006).
- G. W. Baxter and J. S. Olafsen, “The Temperature of a Vibrated Granular Gas” , Granular Matter, DOI: 10.1007/s10035-006-0019-x, Springer-Verlag, August (2006).

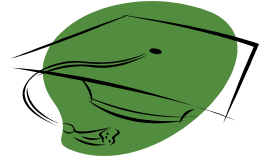
Conferences:

- Dr. Park presented the combined STM and DFT results on TiO₂ surface reconstruction at the 66th Physical Electronics Conference on June 18 -21, 2006. The conference was held at Princeton University, NJ.
- Dr. Benesh attended the Willow Creek Leadership Summit held at Baylor August 10-12.
- Dr. Wang attended the International Conference on Physics Education and Frontier Research, Taipei, China, June 27-30, 2006. Invited talk: *Accelerating Universe in Randall-Sundrum Models of Two 3branes*, String Conference 2006, Satellite Workshop: Gravitation and Cosmology, Shanghai, China, June 12-14, 2006. Invited talk: *Accelerating Universe from M-theory* and the seminar, *Hawking's Information Loss and Resolution*, Physics Department, Zhanjiang Normal University, Zhanjiang, China, July 6, 2006
- Dr. Matthews attended the 11th Workshop on the Physics of Dusty Plasmas in Williamsburg, VA, where she presented a paper titled "Formation of Cosmic Dust Bunnies," which has been submitted for publication in IEEE Transactions on Plasma Science.
- Dr. Yost traveled to CERN, Geneva and presented a talk on new developments in work on a Monte Carlo program for LHC physics at the *LHC* at the *HERA and the LHC* workshop.
- Drs. Ward and Yost both attended the *International School-Workshop on Calculations for Modern and Future Colliders* at the Joint Institute for Nuclear Research in Dubna, Russia. Prof. Ward presented a talk on the resummation of quantum gravity, and Dr. Yost presented a review of precision work on electron-positron scattering.
- Drs. Ward and Yost attended the *XXXIII International Conference on High Energy Physics* in Moscow, where Prof. Ward presented two talks, on resummation in quantum gravity and QCD, and Prof. Yost presented a talk on the numerically-stable calculation of precision electroweak scattering processes.
- Samuel Joseph, a graduate student working with Prof. Ward, attended the XXXIV SLAC Summer Institute, *The Next Frontier: Exploring with the LHC*, and presented a poster on his work on techniques for calculating higher-order Feynman diagrams.

Summer Commencement

Walter Wilcox participated in summer commencement, Aug. 12, as a graduation Marshall as did Kenneth Park. B.F.L. Ward also took part in the graduation ceremonies. This was a somewhat historic occasion as it was the first commencement since Baylor was re-classified as a research university by the Carnegie Foundation. Baylor had the largest number of graduating Ph.D.'s than at any prior commencement (25).

- **Jack Norton**, senior thesis on “GMRES and QDP++.” Defended April 28, 2006. Currently a graduate student at SMU, Dallas.
- **Ryan Rios**, senior thesis on “*Solving the Friedmann Equation Numerically.*” Defended on April 28, 2006. Currently a graduate student in SMU, Dallas.
- **Amy Webber**, senior thesis on “*Black Hole Thermodynamics: an Overview*” Defended on April 28, 2006. Currently a graduate student in Physics Department, Washington University, Seattle.
- **Ben Dundee**, Master’s thesis on “Grand Unified Theories in Higher Dimensions: From the Heterotic String to Randall-Sundrum.” Defended August 7, 2006. Currently a Ph.D. student in string theory at Ohio State University.
- **Dean Darnell**, Ph.D Dissertation on “Strange Quark Contribution to the Nucleon.” Defended August 9, 2006. Currently employed at Apple (Cupertino, CA), in charge of the reliability of iPods.



Visitors

Walter Wilcox’s postdoctoral fellow, **Abdou Abdel-Rehim**, arrived at the beginning of August. His wife and 2 sons arrived just this week. He is originally from Egypt, so is not unfamiliar with the heat situation we have been experiencing in Waco over the summer. He is being supported by the Baylor Postdoctoral Fellowship Program and will be working on evaluating quark disconnected loop contributions to hadronic form factors using lattice QCD techniques. Dean has been a great help in orienting him relative to our computer programs.

Dr. Zhong-Heng Li, from Zhanjiang Normal University, China, has been visiting our Department since January, 2006, and shall stay here until January, 2007. He is sponsored by the Chinese government.

New Additions

Four new faculty members have joined the Baylor Physics Department this fall. Dr. Lorin Matthews was already a member of Baylor’s CASPER program and has been promoted to Assistant Professor. Drs. Jeffrey and Linda Olafsen have come to Baylor from the University of Kansas as Associate Professors. Dr. Yumei Wu joins the department as a part-time lecturer. (Yumei is married to our own Dr. Anzhong Wang.)

Diana and Walter Wilcox welcomed a son, Christopher John Wilcox, who was born on 6/2/06. He weighed 6 lbs. 2 oz. “He is the light of our lives. He continues to grow and learn new things every day. We are so proud of him!” - Proud Papa Walter.

Odds & Ends

- Shortly before arriving at Baylor, three of Linda Olafsen's graduate students at the University of Kansas successfully defended. In May, Todd McAlpine defended his Ph.D., with his dissertation titled “Cavity Length Study of a Resonantly Pumped W-OPIC Semiconductor Laser.” Todd has taken a position as a Visiting Assistant Professor at the College of Wooster in Ohio. Kristina Young defended her Master's thesis, “Resonant Pump Wavelength Variation in an Optical Pumping Injection Cavity Laser,” in mid-July and is now a Ph.D. student in the Department of Physics at the University of Houston. Michael Santilli defended his Ph.D. in late July, and his dissertation is titled, “Cavity length study of an electrically pumped W-Well Laser.” Mike currently is teaching and working on postdoctoral research at the University of Kansas.

- Together with Dr. Qin (Tim) Sheng from Mathematics Department, Dr. Wang was awarded \$21,9000 through the VPR’s FACULTY RESEARCH INVESTMENT PROGRAM.

Current Directions

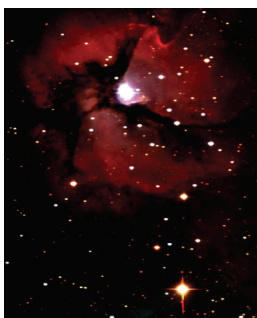
Greg Benesh

For quite some time I have been interested in what core-level shifts at surfaces tell us about charge transfer and bonding. An unexpected result is that adsorbed electropositive atoms, such as cesium, induce smaller surface core-level shifts than electronegative atoms, such as oxygen. Experimental results such as these have led some to conclude that electropositive atoms bond more covalently and less ionically than electronegative atoms. We are currently focusing attention on several surface of rhodium. The Rh(111) surface is particularly interesting since the surface and subsurface shifts are in opposite directions! Obviously, contributions other than from charge transfer play an important role, because no charge transfer is expected between neighboring rhodium atoms. In fact, we believe that the environmental effect (caused by the reduced coordination of surface atoms) is at least as important as charge transfer. There is also a relaxation (final-state) contribution that is caused by the different screening properties of surface and bulk atoms. We are currently calculating all three contributions to the surface and subsurface core-level shifts at the Rh(001), Rh(111), and Rh(110) surfaces. *On a personal note, on May 6th we traveled to Atlanta for our son Daniel's graduation from Georgia Tech. Later in May, Dana and I (and daughter Deborah) made a short trip to England. We spent several days in Cambridge where I was a postdoc, and where we lived during a sabbatical. In June, my son Nathan and I took a week-long canoeing trip to the boundary waters area of Minnesota and Quetico Provincial Park in Canada.*

Kenneth Park

During this summer, two students, Mr. Alex Price (Point Loma Nazarene Univ.) and Ms. Ksenia Terekhova (Univ. Louisville) participated in automating low energy electron diffraction optics and temperature-programmed mass spectroscopy. Also in June a high school student, Ms. Weike Wang (International Academy, MI) experienced first-hand experimental surface physics using computer-controlled low energy electron diffraction optics and learning kinematic scattering theory.

Dwight Russell



Working with Dick Campbell for Mechanical Engineering, and two REU students, Sarah Smith and Hallie Graves, and in collaboration with Don Winget's group in the UT-Austin Astronomy department, we took light curves measurements of white dwarf stars using the Central Texas Astronomical Society (CTAS)'s new Meyer Observatory. The Meyer Observatory's central instrument is a 23" reflector with CCD imaging. The summer long study included a survey of potential variable white dwarf stars. This system is capable of obtaining excellent light curves for object as faint as 16th magnitude. The four target stars, KBS107, KBS08, KBS35 and KBS44 were eliminated as possible pulsating white dwarfs. We also studied a known pulsating white dwarf, G226-29. This particular white

dwarf has a triplet of resonances near 109 seconds. Our data clearly shows a variable light curve with the expected period. We are presently involved in doing the data reduction needed to extract the three distinct resonance frequencies from our data. This was an excellent summer project for the REU students and quite a remarkable collaboration including students, professors, professional and amateur astronomers.

Walter Wilcox

Two summer students, Josh Qualls and Jessica Norcia, were involved in the preparation of computer programs in the QDP++ ("Quark Data Parallel") language. This is part of a project to simulate and measure particle polarizabilities using the methods of Lattice QCD. The computer resources are located at Thomas Jefferson laboratory in Newport News, VA. (The students worked on the local Baylor HPC cluster for their project.)

CASPER

This summer CASPER and the Physics Department hosted our thirteenth NSF Research Experience for Undergraduates (REU) and Research Experience for Teachers (RET) programs. Thirteen students and two teachers participated in the program. The students experienced the trials and tribulations of doing research on a variety of theoretical and experimental projects under the direction of Dr. Truell Hyde, Dr. Lorin Matthews, Dr. Ken Park, Dr. Walter Wilcox, Dr. Dwight Russell, and Mr. Dick Campbell. The high school and middle school teachers worked on research projects in the lab and in developing classroom content with Mrs. Edith Davis, a doctoral student in the School of Education.

Undoubtedly the best parts of the experience were the Wednesday Lunch Bunch Seminars and the Friday Updates, probably because of the free food. At the Wednesday seminars, faculty members presented short talks on various physics topics such as “Why Does the Sun Shine?”, “The Physics of Baseball”, and “Calculation of Orbital Parameters for Space Navigation.” Everyone also engaged in a physics song sing-along, though some only participated with their ears. Each Friday the participants gave updates on their research experience and were given tips on literature searches, writing papers, preparing posters and power points, and applying to graduate school. The students were responsible for bringing the refreshments each week, and this year we were treated to international cuisine in the form of Russian caviar, Czech kolaches, and Italian antipasto.

At the end of the summer, each of the participants prepared a poster, gave a twelve-minute presentation, and wrote a paper detailing their research and results. Most of the students submitted their papers for publication in the *Journal of Young Investigators*, an online journal. Several of the REU students also contributed to papers submitted to *IEEE Transactions on Plasma Science*. The program culminated with a dinner and awards presentation at The Palladium.

CDF (Collider Detector at Fermilab)

Jon Wilson and Will Brian, two Baylor University Scholars with an emphasis in physics, spent the summer months in Batavia, Illinois working on the Collider Detector at Fermilab (CDF) experiment with Dr. Jay Dittmann. “These guys made significant contributions to an important upgrade of our experimental apparatus – the eXtremely Fast Tracker, or XFT” reports Dittmann. Jon wrote an intricate piece of software in Java to test the operation of custom-made electronics modules. Jon’s software will be used extensively over the years to confirm that the system is functioning properly. Will wrote software to analyze the performance of the upgraded system using actual proton-antiproton collision data. Both Jon and Will will continue to do research in experimental high energy physics during the 2006-07 academic year.

Dr. Nils Krumnack, a Postdoctoral Research Associate working with Dr. Dittmann, lives in Chicago, IL and is currently leading the commissioning of the eXtremely Fast Tracker project at Fermilab. Nils is heavily involved in bringing the new system online, and he’s doing a great job coordinating personnel from six different universities: Baylor University, the University of Illinois, The Ohio State University, Purdue University, U.C. Davis, and the University of Pisa. The new tracking system is expected to come into full operation sometime this fall.

This fall we are also pleased to welcome a new graduate student into the experimental high energy physics group at Baylor. Martin Frank is a second-year graduate student who transferred to our group from Duke University over the summer. He joins Samantha Hewamanage, a third-year grad student who has been working in the group for over a year. Upon completing the XFT upgrade this fall, we’re planning to push forward on some new analysis topics involving massive vector bosons and jets.

Rainbow of Opportunities

for physics students to get involved in the Physics Department

Students will be receiving an invitation to our annual **Physics Picnic** which will be **Friday, September 8th, 4:30 pm**. This will give students a chance to meet other physics majors, graduate students, as well as faculty. The food is usually pretty good, too!

The **Society of Physics Students** (SPS) meets about once a month throughout the school year. SPS represents the physics department at several events on campus, volunteers at the Physics Circus, and is in charge of planning our annual Christmas party and Senior Recognition Banquet in the spring. You will be hearing soon from the SPS president, Rachel Harder, about the upcoming meetings.

SPS also sponsors *Doughnut Fridays*. Each Friday from 8:30 to 9:30 am we have coffee, doughnuts, and kolaches in the Physics Conference Room (BSB D.311). All physics majors, graduate students, and faculty are invited for an informal get-together before or after class (depending on your schedule).

Students will have several opportunities to get involved with **physics research** projects as they progress through their classes. We encourage freshmen to learn what areas are available by talking with faculty members and other students. Many members of the faculty work extensively with undergraduates, giving the students experience not only in conducting research, but also in writing papers and presenting at national conferences.

There is also a full schedule of **physics seminars** throughout the school year. These are given by physics students, faculty and guest speakers. The graduate seminar meets Fridays at 3 pm. The first seminar on **Friday, September 1**, will be given by two of our physics majors, Pamela Vo and Matt Benesh in BSB E.125. They will be giving overviews of the research they did this summer. CASPER (Center for Astrophysics, Space Physics, and Engineering Research) seminars are each Friday at 2 pm in BSB E.227. Particle Physics seminars are tentatively scheduled for Wednesdays at 10 am in the Physics Conference Room (D.311.3). Keep watching for updates.

September 2006

Sun	Mon	Tue	Wed	Thu	Fri	Sat
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17	18	19	20	21	22	23
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