

"All the v's

That's fit to Print"

ΦYAST ΦLYER

The Department of Physics & Astronomy

The University of Oklahoma

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FACULTY RETIREMENTS

The Department will be down three next fall when classes start, only to lose a fourth member after December. George Kalbfleisch, Neal Huffaker, and Bob Petry retired as of this spring, while Tibor Herczeg will do the same following the fall semester. On the evening of Wednesday, May 12, 81 faculty, staff, and their families convened at the University Club to say formal farewells to George, Bob, and Tibor. The event, expertly organized by Kim Milton and Stu Ryan, began with an informal social hour, followed by a dinner. After-dinner events included a brief career review of each retiree by the team of Helmut Fishbeck and Ron Kantowski plus short speeches from Bob and George. Tibor gave a sensitive and humorous retrospective of the changes the Department's character has undergone since his acceptance of an invitation from ``Dr. Kan Towsky" in 1970 to visit the OU campus. Professors Emeriti in attendance were Steve and Mary Whitmore, Bob St. John, and Helmut Fishbeck, along with Fran Fowler, wife of Dick Fowler, late Professor of Physics. Individual articles on George, Tibor, and Neal appear below. The winter newsletter included an article about Bob. We wish all four the best in the future and thank them for the valuable contributions they have made to the Department over the years.



Tibor Herczeg will retire at the start of the new millennium. He came to the Physics Department as its first astronomer in 1970 from Hamburg Observatory after having escaped from Budapest in 1965. In part due to his love of astronomy and his dedication to teaching, we are now the Department of Physics and Astronomy. We could have remained a one-astronomer department as do most Physics departments; however, after three short years, Tibor convinced us all that astronomers were valuable colleagues that carry their own weight and more. He plans to continue his research and resolve the mass differences between radio and x-ray pulsars that happen to occur in binaries. He obviously will remain our binary star expert for some time to come. He plans to travel to NYC and abroad even more often as soon as he is free of teaching.

Neal Huffaker

Originally thinking he might major in advertising, Neal took a course in physical science as an undergraduate at the University of Chicago and found from reading Galileo and Newton that physicists seemed to think the way his mind worked. Thus began a change in direction which resulted in an MS in Physics from Emory University and a PhD in Physics from Duke University. As a theorist, Neal's principal interest early-on was nuclear physics. He became an assistant professor at the University of Alabama in 1963 and remained there until 1967 when he moved to OU as an associate professor, lured here by then-chair Dick Fowler. Keith Carroll, Bob Petry, and Dick Day were hired in the same year. Neal's research interests soon turned to molecular physics, a field he had worked in for his masters research and which occupied him during two sabbaticals, one in Kobe, Japan in 1975-1976 and the other at Dartmouth in 1986-1987. Neal is also an accomplished musician, playing trumpet and French horn. He is a founding member of a big-band jazz group in Norman with which he regularly performs.

George Kalbfleisch

After a 38 yr. career Professor George R. Kalbfleisch is retiring. George earned his PhD in '61 from Berkeley and worked at several national labs (Lawrence Berkeley, Brookhaven, and Fermilab) before coming to OU in 1979. He established and obtained continuous funding through the Department of Energy for the OU High Energy Physics group (OU-HEP), which currently consists of 6 faculty members. George also established a sister group in 1990 at Langston University consisting of 2 additional HEP physicists. The group works on experiments at the Cornell electron-positron accelerator, Fermilab's Tevatron Collider and the Large Hadron Collider at CERN. George is only retiring from teaching; he will continue his search for magnetic monopoles in his Nielsen Hall lab. He will also continue some genealogical family tree work, maybe get back to stamp collecting, try out his rusty trumpet, and continue trips with his wife Ruth Ann to visit children and grandchildren.

ALUMNI NEWS

If you have not added your current status and e-mail address to our alumni database, we encourage any former faculty, students or staff to visit our alumni web page at: <http://www.nhn.ou.edu/alumni/> and choose the link to our information form. We can't update or add the information without your input, so please give us a hand!

CHUN LIN SYMPOSIUM

The symposium to honor former OU professor Chun Lin has now been moved to fall, 2000, to accommodate more guests. The person in charge, Deborah Watson, is currently waiting to find out about football schedules before proceeding with further planning. Pressing questions about the symposium can be addressed to her at watson@nhn.ou.edu.

NEW DOCS

Eric Smith finished his Ph.D. work on a search for charged Higgs at Fermilab, and was "fortunate to be able to decline a post-doc position at Florida State University in favor of a position at OU." He will work on PRL and PRD drafts of the Higgs analysis, as well as upgrades to the hardware and software used in Dr. Kalbfleisch's and Wei Luo's magnetic monopole search.

KUDOS TO GRETTIE!

Grettie Bondy, one of our three fine secretaries in the Department, received the George Lynn Cross Superior Performance Award this spring. This is the second time in the past four years that Grettie has won an award for her secretarial performance. There are many of us in the Department who interface primarily with Grettie and get a chance to witness the qualities that make her such a fine secretary. To name a few: she is always cheerful and positive in her interactions and approaches to problems, for which she also displays considerable fine common sense; she is pro-active in her attitude in that she often resolves problems before they even come to anyone's attention; she'll drop whatever she's currently working on and attend to your present problem. In addition to all this, she is very active in the OU community at large, being past president and current secretary of the Hourly Employee's Council, HEC representative on the Staff Senate, a member of the Staff Week Committee, Staff Senate Communications Committee, Campus Disciplinary Board, Staff Senate Grievance Committee, and Selection Committee for the Regent's Award For Superior Staff. In the wider community, Grettie is a member in the Order of Eastern Star, Help Oklahomans Go Back To Work, Oklahoma Cleft Palate Association, OU Alumni Association of Cleveland County,.....etc. I think the picture is clear!

So, Grettie, congratulations for your energy and accomplishments  we are fortunate to have you with us!

Jack Cohn



STUDENT AWARDS

The annual April departmental awardsfest was held on April 29, and again gave us the chance to recognize numerous students for their fine academic achievements. Those receiving honors (and the name of the award) are: Sabrini Zoe Siloti and Sylwester Jan Ratowt (Homer L. Dodge Award for Outstanding Scholarship in Physics & Astronomy), Eric Andrew Wolf (Duane E. Roller Award for Outstanding Scholarship in Physics & Astronomy), Myra Louise Blaylock (J. Clarence Karcher Award for Outstanding Scholarship in Physics & Astronomy), Grant Walter Biedermann (Homer L. Dodge Award for Outstanding Scholarship in Engineering Physics and Karcher Scholarship), Lance Edward Oelke and Wade Louis Wolf (Duane E. Roller Award for Outstanding Scholarship in Engineering Physics), Ryan Louis Ciolli (J. Clarence Karcher Award for Outstanding Scholarship in Engineering Physics), Abby Elizabeth Deans (Fowler Prize for the Outstanding Senior in the Department), Wade Louis Wolf (Webb Scholarship), Ben Dribus, John Ehrhart, Anne Margaret Gehant, James A. Hilty, James L. Sanders IV, Noah Paul Schmitz, John Thomas Farrar, Sylwester Jan Ratowt, Mark Eric Trosper Jr. (Karcher Scholarship), Joseph William Milton (Roy B. Adams Scholarship), and Lance Edward Oelke (Keys Scholarship). Recognition for achievement was also given to Michael Allen Ball, Paul H. Barsic, Daniel Alan Brue, Karen Benson Bottoms, Matt D. Cagle, Ryan Louis Ciolli, Trevor Dion Decker, Kevin L. Hobbs, Derrick Scott Kiker, Adam C. Martin, Randayl Wayne Biggs, Myra Louise Blaylock, Hans D. Bruno, Darrin A. Casebeer, Ugurcem I. Cene, Kara C. Chiodo, Solon A. Clinton, Abby Elizabeth Deans, Timothy J. Frye, Jeffrey H. Harwell, Christopher Alan Henry, Brent W. Hobbs, Lise Aline Johnson, Geoffrey Mark Lovelace, Christopher Patrick McRaven, Eric William Morton, Ty E. Nance, Anthony Paul O'Dell, Sean Michael Pullen, Matthew J. Szabo, Sabrina Zoe Siloti, David E. Smith, Justin R. Thiessen, Robert Pendleton Taylor III, Eric Andrew Wolf, Todd R. Wuest, and Richard Yoesting. Congratulations to all of these students for their work over the years.

FACULTY AWARDS

Again this year our faculty carried off some prestigious honors for their research and teaching accomplishments. Congratulations go to Mike Morrison for becoming the Department's newest Presidential Professor (that's four professorships in four years for us!). Mike Strauss was recognized by the OU Student Association as the Outstanding Faculty Member in the College of Arts and Sciences. And Eric Abraham received a Junior Faculty Research Program summer fellowship.

BRETT MCKINNEY, OUTSTANDING RA

The OU Graduate Student Senate recognized graduate student Brett McKinney as the Outstanding Graduate Research Assistant and Outstanding Graduate Assistant. No doubt Brett's ability to organize intra-departmental sporting events cinched the case.

SUMMER REU PROGRAM



The Department's Summer Research Experience for Undergraduates Program is sponsoring 18 undergraduate students, half of whom are from outside of OU. These students (home institutions; sponsoring OU faculty member) are: Nate Bastian (U. Wis. Mad.; Baron), Jeremy Bowles (SEOSU, Mullen), Wade Bullington (U. Cen. Ark. Conway; Kalbfleisch), Angela Osterman (Ga. Tech; Baron), Merlyn Pulikkathara (Prairie View AM; Furneaux), Erica Snow (Grove City College, PA; Baron), Mitch Soderberg (Truman St. U, Kirksville; Johnson), Josh VerHage (N. Park U. Chicago; Abraham), Josh Zirbel (U. Mo. Rolla; Keil); plus the following OU students: Mike Ball (Johnson), Paul Barsic (Santos), Trevor Decker (Gutierrez), Lance Oelke (Shafer-Ray), Sylwester Ratowt (Romanishin), Jay Sanders (Santos), Zoe Siloti (Romanishin), Matt Szabo (Abraham), and Wade Wolf (Gutierrez). We welcome all of these students and hope you have a rewarding experience with us this summer!

LIBRARY NEWS

At the beginning of this academic year, the library's web pages became a functional tool for research which, I'm glad to say, met with great approval. Also, upon request the University Libraries now deliver photocopies of articles directly to professors' offices. This popular service called Sooner Xpress saves busy faculty a significant amount of time. Finally, the University of Oklahoma invested over \$1 million for a new library computer system called Sirsi Unicorn. The system will support acquisition and organization of library information, and it will be a gateway to resources found on campus and around the world. Sirsi Unicorn is currently used at the Oklahoma Baptist University and any additional information about their service can be located on their web page www.sirsi.co.uk/. It will tentatively be operational by August. Along with the new system, old identification numbers on University IDs and books will be replaced with bar codes. Orientation sessions will be ongoing to assist the university community in making the adjustment to our new system.

Jason Dupree, Librarian



RESEARCH NEWS

Papers Published

E. Lentz, D. Branch, and E. Baron, "Monte Carlo Simulation of the Galactic ^{26}Al 1.809 MeV Map", *Astrophys. J.*, 512, 678 (1999)

A. Fisher, D. Branch, K. Hatano, and E. Baron, "On the Spectrum and Nature of the Peculiar Type Ia Supernova 1991T", *Mon. Not. Roy. Astron. Soc.*, 304, 67 (1999)

C.M. Bender (Wash. U.) and K. A. Milton, "Nonunitary version of massless quantum electrodynamics possessing a critical point", *J. Math. Phys.* A 32, L87-L92 (1999).

R.B.C. Henry, K.B. Kwitter (Williams Coll.), & R.J. Dufour (Rice U.), "Morphology and Composition of the Helix Nebula", *Astrophys. J.*, 517, 767 (1999)

Grants Awarded

NSF Division of Materials Research, M.B. Santos, R.E. Doezema and S. Murphy, "Electronic Properties of Strained Narrow-Gap Quantum Wells," \$349,999 for 3 years.

Department of Energy, K. A. Milton PI, "Nonperturbative Quantum Field Theory", \$92,000 for 1 year.

NSF, Dick Henry, with Karen Kwitter (Williams Coll.), "Planetary Nebulae As Communicators Of Stellar And Galactic Evolution", \$241,000 for

3 years.

Meetings

The following talks were presented at the American Physical Society Centennial Meeting in Atlanta GA on March 20-26: Xiao-Ming Fang presented "Interfacial reactions in the GaSb/PbSe material system" by X.M. Fang, Z. Shi, P.J. McCann, S.J. Chung, and M.B. Santos; Ning Dai presented "Determination of the InSb/InAlSb Band Offset Using Parabolic Quantum Wells" by N. Dai, F. Brown, G.A. Khodaparast, R.E. Doezema, S.J. Chung, K.J. Goldammer, and M.B. Santos; Fred Brown presented "Investigation of doped InSb/InAlSb multiple quantum wells by FTIR" by F. Brown, N. Dai, G.A. Khodaparast, R.E. Doezema, S.J. Chung, K.J. Goldammer, and M.B. Santos; Giti Khodaparast presented "Electron cyclotron resonance in InSb/AlInSb quantum wells" by G.A. Khodaparast, S.J. Chung, K.J. Goldammer, M.B. Santos, and R.E. Doezema; Seokjae Chung presented "A Study of Factors Limiting Electron Mobility in InSb Quantum Wells" by S.J. Chung, K.J. Goldammer, S.C. Lindstrom, M.B. Johnson, and M.B. Santos; and Georg Steinbrueck presented "Measurement of the angular distribution of electrons from W Boson decays".

John Cowan attended the March meeting of the American Chemical Society.

Eric Smith gave a presentation on the charged Higgs search at University of Florida last March at the Higgs/Supersymmetry workshop, which was attended by experimentalists from the US and Europe.

David Branch and Eddie Baron attended the STScI Symposium on "Supernovae and Gamma-Ray Bursts - The Largest Explosions Since the Big Bang". Also in attendance were OU PhDs Francesca Boffi (STScI), Peter Nugent (LBL), and Tim Young (Arizona).

Talks

On March 4, Mike Santos presented a seminar entitled "Semiconductor Quantum Wells" to the Society of Physics Students at the University of Tulsa.

In April David Branch spoke to faculty, students, and donors of the Oklahoma High School of Science and Mathematics, and at the annual Physics Banquet of Oklahoma State University, on "Supernovae as Probes of the Universe".

John Cowan spoke on "Nuclear Physics, Stellar Abundances and the Age of the Galaxy," at the American Chemical Society Meeting in Anaheim, CA (March 1999).

"The Search for Magnetic Monopoles" was presented by Kim Milton at Washington University, St. Louis, January 13, 1999. Kim also spoke on "Recent Developments in the Casimir Effect", at OU, February 25, 1999.

Mark Keil gave talks at two universities in Israel. Both talks were titled "Chemical Reaction Dynamics for the F+H₂ Reaction: Initial and Final State Dependence of Angular Distributions", and were presented on Monday, April 26 at Hebrew University, Jerusalem, Israel, and on Wednesday,

April 28 at Bar-Liana University, Raman An, Israel.

Dick Henry gave a talk on "Abundance Profiles In Disk Galaxies From Nebulae", at Cardiff University (Wales), May 5. He also discussed tornadoes in Oklahoma.

David Branch gave an invited talk on "Supernova Spectroscopy" at the STScI Symposium on "Supernovae and Gamma-Ray Bursts - The Largest Explosions Since the Big Bang".

Research Travel

John Cowan (as part of a group from 5 universities) had two nights of observing time on the Keck telescope (Keck I) in Hawaii in April. The team was looking for (and detected) very heavy elements in very old galactic halo stars. This was the first time John was actually present (as opposed to remotely observing) for the observations.

Kim Milton travelled to Washington University, St. Louis, January 10-15 to collaborate with Carl Bender on PT symmetric theories .

Dick Henry spent April 8 to May 8 working with Mike Edmunds at Cardiff University, Wales. They launched a new project intended to discover the cosmic origins of carbon and nitrogen.

Visitors Hosted

Peter Garnavich of Harvard's Center for Astrophysics visited for three days in March to work with the supernova group on supernova spectroscopy and to present a colloquium on "Supernovae and the Fate of the Universe".

Chris Sneden, Univ. of Texas visited John Cowan for several days in February to work on several projects regarding the chemical evolution and age of the Galaxy, as measured by stellar heavy element abundances. John also hosted Friedel Thielemann, Univ. of Basel, who came for a week in March to work on several projects related to the formation of heavy elements in various astrophysical environments. They continue to work on their graduate-level textbook. Finally, Chris Eck, former graduate student of John's, took time from his cushy computer-modelling job at Raytheon Space Systems in Aurora, CO, to fly in for a weekend of work in May. Chris is working on a paper that is an extension of his thesis work and previous paper on the galaxy M83.

Kim Milton hosted Michael Bordag, March 8-15, from University of Leipzig. They worked on the Casimir effect and magnetic charge. In addition, Carl Bender visited Kim April 26-30, from Washington University, and worked on PT symmetric quantum field theories.



HIGH ENERGY FOCUS:

ATLAS EXPERIMENT AT CERN

Recently the OU High Energy Physics group joined the ATLAS experiment which is now under construction at the European particle accelerator laboratory (CERN) located near Geneva, Switzerland. ATLAS is one of two all-purpose experiments which will take data when the next generation proton accelerator (called the Large Hadron Collider or LHC) is built. This is expected to be in the year 2005. The LHC will collide bunches of protons every 25 ns with a center-of-mass energy of 14 TeV, which will make it the highest energy particle accelerator in the world. The OUHEP group is collaborating on design and construction of the innermost layers of the ATLAS detector which we call the pixel detector. This consists of three layers constructed of tiles of silicon wafers, each approximately 6 cm x 2 cm in area. Each wafer has ~46,000 sensitive elements (pixels) which can be used to detect the passage of charged particles. Each pixel is bump-bonded to a charge-sensitive, low noise amplifier which stores the charge and later reads it out if it is above a specified threshold and an event trigger occurs. The amplifiers were designed by members of our collaboration specifically for this detector and are fabricated in sixteen chips for each tile. Altogether, over 2000 tile-amplifier modules make up the entire ATLAS pixel detector.

The OUHEP group has taken on the responsibility to design and procure high-density low- mass interconnection circuits which route signals between the chips on the module. This flexible circuit attaches to the back of each tile and has passive and active components mounted on it. To minimize mass, unusually small feature sizes had to be used so only a few vendors are capable of making it. We have designed a prototype which was fabricated in-house at CERN and has now been successfully tested in our lab and at other institutions. This has led to the decision last February to use this technology on 90% of the pixel modules. The total cost of these flex circuits is expected to be about 1 million dollars. The design work has been done by electrical engineer Rusty Boyd with the help of EE Masters students K. Neriyanuri (now graduated and working for Intel) and S. Krishnama. We have also had the valuable help of OU undergraduate student Chris Henry. Members of our group travel regularly to CERN to attend collaboration meetings and participate in beam tests. We are also belatedly beginning the study of French.

Pat Skubic



MILLER'S BRAINTEASER

The following problem was sent in by Tom Miller, former professor in the Department. You may contact Tom at tmiller@plh.af.mil for the solution. Please show your work.

A rope over the top of a fence has the same length on each side and weighs $\frac{1}{3}$ pound per foot. On one end hangs a monkey holding a banana, and on the other end a weight equal to the weight of the monkey. The banana weighs two ounces per inch. The rope is as long as the age of the monkey, and the weight of the monkey in ounces is as much as the age of the monkey's mother. The combined ages of monkey and mother are 30 years. Half the weight of the monkey, plus the weight of the banana, is $\frac{1}{4}$ as much as the weight of the rope.

The monkey's mother is half as old as the monkey will be when it is 3 times as old as its mother was when she was half as old as the monkey will be when it is as old as its mother will be when she is 4 times as old as the monkey was when it was twice as old as its mother was when she was $\frac{1}{3}$ as old as the monkey was when it was as old as its mother was when she was 3 times as old as the monkey was when it was as old as its mother was when she was 3 times as old as the monkey was when it was $\frac{1}{4}$ as old as it is now.

How long is the banana?

(Jeez, Tom, we don't deserve this, do we?...ed.)

PRE-PRINT RESEARCH

From John Cowan: C. J. Stockdale, J. J. Cowan, M. Rupen, & Y. Chu will be observing SN 1961V in NGC 1058 with the Very Large Baseline Array this summer, in an attempt to clarify the exact nature of this peculiar object, supernova or variable star?

From Kim Milton: "Carl Bender and I have been working on theories which appear not to be Hermitian but nevertheless are well defined because of nontrivial boundary conditions. What is essential for the consistency of the theories is the preservation of the product of parity (P) and time reversal (T) symmetry, PT, not of P and T separately. We believe now that we can apply these ideas to the Higgs sector of the standard model, which in the conventional approach is not well defined because the scalar sector of the theory is trivial (noninteracting). In our approach it is not; instead, the scalar sector appears to be asymptotically free, that is, the coupling becomes weak at high energies, just like in QCD. And the scalar field acquires a vacuum expectation value which may be perturbatively calculable."

“The scientific biography of Julian Schwinger I am writing with Jagdish Mehra is nearing completion; I am finishing the last chapter, and completing my interviews with Schwinger's students and colleagues. We expect to receive a contract from Oxford University Press shortly. Look for it next year in your favorite bookstore!”

From Mark Keil: “We are developing a “molecular window” that transmits molecules but blocks light! Usually windows do the reverse, but we're doing the impossible by diffracting away the long-wavelength light while letting through the (short DeBroglie wavelength) molecules! This will enable us to improve our bolometer detector by a factor of 10x or so, making it capable of detecting 10^{-15} watts. How much is this? It's essentially equivalent to detecting the heat from a flashlight bulb at a distance of about 1000km. So turn off all your lights and then we can make our measurements!”

OUTREACH TEACHING

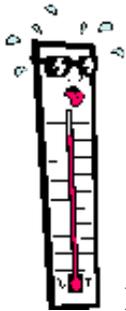
Every year various members of the Department, both faculty and graduate students, are invited to visit a public school or a club and make a presentation appropriate for the audience or age group about a topic of interest in physics and/or astronomy. This exercise turns out to be one of the most important and challenging things we do, in that the opportunity provides us with a forum for exposing the public to our subject and hopefully getting them excited about it. The challenge comes in moving from the misty, esoteric environment of our labs to, say, a fourth grade classroom where we're forced to put things in jargon-free terms and at a level where you don't have to be, well, a rocket scientist to understand. Stu Ryan's work in this regard is, of course, legend and ongoing. Examples of others who have performed this kind of service recently are graduate student Jackie Milingo and Professor John Cowan. Below is a description by each about their experiences.

Milingo At Truman Elementary

“Recently I was invited to give a short talk and slide show to a few of the third graders at Truman Elementary here in Norman. The kids that I talked to had just finished a unit on the Solar System so they were not only full of questions but full of information that I didn't even know! We had a good time looking at all of the slides of planets, moons, fluffy colorful nebulae, galaxies, telescopes, and finally a picture of Beta Pictoris. They were so thrilled to see an actual picture of what could be a system of planets just like ours. A few of them had heard stories on the news about the plethora of extra solar planets that have been found in the past few years and were very excited to see something to associate with that. I think that we're all approached quite often to do public service shows like this, and I often decline or pass it on because I feel that I have too much of my own work to do but when I actually show up with my slide projector and celestial sphere and posters and cheap-o spectroscope ... the look on their faces is just amazing! Regardless of where I've been the students, parents, and teachers are always so very grateful for my time and they're always very enthusiastic to learn and listen and ask questions. If only I could find that kind of spirit in my students here! It never fails that I always leave a school talk feeling a bit renewed and reminded of why I became excited about learning astronomy many years ago.”

Cowan At Southgate-Rippetoe Elementary

``For the second year in a row I was invited to spend a day lecturing to the sixth grade science classes at Southgate-Rippetoe elementary in Moore. (I am worried it is becoming an annual event.) I was originally invited by one of the teachers who I had known socially. I consider it very early recruiting for OU! I offer to talk about other topics, but they seem very focused on black holes (and to a lesser extent extraterrestrial life.) The students at that age are full of questions and curiosity. They begin asking questions the minute I start and continue to do so even as I leave the school grounds. It is a very different experience than in introductory astronomy at OU with older and more sophisticated students. From the sixth graders I get a lot of "I just don't get these black holes" and "what are the chances that we on earth are going to run into a black hole" and a few, "what if the Starship Enterprise fell into a black hole, would it..." By the end of my visit, I am worn out from answering questions. I come away greatly respecting the endurance, patience and abilities of our elementary school teachers."



HISTORY LESSON

Daniel Gabriel Fahrenheit was a Dutch physicist born in Gdansk, Poland, in 1686. Fahrenheit invented the first accurate thermometers and the temperature scale named after him. Originally intending to learn business in Amsterdam, he became interested in scientific instruments. Beginning in 1707 he wandered Europe, gaining knowledge of his trade by meeting scientists and other instrument makers. He then became an instrument maker himself in Amsterdam in 1717, remaining in Holland until his death in 1736. Fahrenheit published his methods of making thermometers in the Phil. Trans. of 1742 and was admitted to the Royal Society the same year. Though Galileo developed the first thermometers, Fahrenheit combined methods of Roemer and Amontons in 1714 to make the first mercury-in-glass thermometers, having found that mercury was more accurate because its rate of expansion, although less than that of alcohol, is more constant, and mercury could be used over a wider temperature range. During the 20th century, Fahrenheit's temperature scale has been gradually supplanted in most countries by the one invented by 19th century physicist U.B. Centigrade, an American expatriate who requested in his will that his scale never be used in his native land.

FROM THE CLASSROOM

Graduate student John Walkup has supplied these comments from his teaching evaluations of his class at East Central University:

``Too much physics, not enough astrology''.

``The instructor was an excellent teacher. The only thing he/she should improve is the material and he/she can't do too much about that." (Could the student not tell a `he' from a `she'? What were you wearing, John?...ed.)

Have a safe and fun 4th of July!!!

