THE PULSE

For the Personnel of the Laboratory for Nuclear Science

Volume 5 Number 5 ******************************** June 1997

http://mitlns.mit.edu/~elsye/pulse.html

Good News

Bruce Bailey has moved to Concord, Mass. Bruce says that he plays a lot of tennis. Bruce and his wife Mary have also set up a literacy and ESL program, and are tutoring at the local prisons.

George Sechen completed a course in fly fishing in Manchester, Vermont.

Mary Hogan just returned from a trip to San Francisco and Yosemite National Park.

Tell us what you're doing. We'd love to hear from our retirees.

Joe Burger, Ken Hocter and **Glen Dale Ross** were inducted into the Quarter Century Club in March 1997.

Cheryl Murphy Cagnina turned 50 on May 9 and as of May 18, 31 of those years has been with the Laboratory.

Gerald Fiumara and **Pamela Bonbanza** were married on February 16, 1997.

Sheila Dodson received a BA degree from Merrimack College, North Andover on May 18, 1997. Sheila graduated summa cum laude. Way to go Sheila!!!

Eric Alan Baker was born on January 11, 1997 to **Mark Baker** and **Brenda Lugo**. He was 7 pounds 1 oz and is now 15 pounds, has lots of blonde hair and is sleeping well through the night.

Helena Johanna van Nieuwenhuizen was born on December 21, 1996 in Tiel, The Netherlands. At birth she weighed 8.7 pounds and now weighs 17 pounds and is 27 inches long. Jolien (a combination of her first names) is the daughter of **Gerrit van Nieuwenhuizen.**

Andrea Heider, daughter of **Dick Heider**, spent her spring break in Wichita, Kansas doing volunteer work for Habitat for Humanity. Andrea is a junior at the University of New Hampshire.

Barbara Corbisier has been accepted to the Ph.D. program in psychology at the University of Massachusetts - Amherst.

Do you have some Good News? Please share it with us!

Alan H. Guth's new book, **The Inflationary Universe: The Quest for a New Theory of Cosmic Origins** is available at the Coop. The book is published by Helix Books/Addison-Wesley, Longman, Reading, Mass. ($25)

How are you doing on your New Year's Resolutions? Here are some we received back in January. Let's hear how you are doing.

1. Lose weight
2. Graduate
3. Learn to drive
4. Exercise regularly
5. Work harder
6. Work less
7. Win megabucks

In this Issue

From my Desk --- Don't Give up your Day Job

I was an extra in the movie "Good Will Hunting." You may be familiar with this movie because some of it was shot at MIT and a story about it appeared in the *TechTalk.* The story is about Will, a janitor at MIT, who is a math prodigy and how a math professor and a psychologist (played by Robin Williams) help this young man to recognize his talents. The role of the math professor was originally written to be the role of a physicist, however, the story line was changed when the writers decided that physics was too difficult.

Chris Moore, a producer from Miramax Films, came to MIT during the winter to have the writers and actors meet some physicists. I set up some meetings for them. I thought after they shot the reunion scene at MIT that I didn't have a chance to be an extra. When I received a call from a casting agency asking if I would like to be an extra I was delighted. The pay would be $60 for up to 13 hours, at non-union wages , and I was to dress in earth tones, bring another outfit with me in case my clothes were not acceptable, and call at 10 P.M. the night before to find out whether my casting call would be 12:30 PM at Au Bon Pain or 7:30 PM in Harvard Square. It turned out that I was scheduled for 7:30 PM. When I arrived, the 12:30 crew was just getting ready to have dinner. We were asked to sit in a holding area and while we were waiting a wardrobe woman came around to each of us to be sure that we were dressed appropriately. We were told that if we weren't, we would get a tap on the shoulder. No one tapped me --- I passed.

Soon we were escorted to the intersection of Brattle and JFK where the bright lights were set up and the camera crew was ready to go! A young man in a Red Sox baseball cap started choosing those of us who would be part of the scene. You, You, You, You stand over there. I was standing beside Prof. Dan Kleitman from Math and soon we and several others were a part a scene in which we had to watch a juggler. We stood and watched that juggler over and over again, until at last someone determined that the scene was right! We were there until around midnight when we were asked to return to the extras' holding area. The same young man with the Red Sox baseball cap asked my friend, Maureen, Dan Kleitman, and me to stay with fifteen other extras for the next shoot. Our next job would be to walk back and forth in front of the Tasty Restaurant. And so we did, back and forth, back and forth, until 2:30 AM when it was a "wrap in Boston."

What struck me most about the experience was how serious the actors were from the Screen Actors Guild. For them it wasn't just a new experience, it was a job. As far as I could tell there were only three of us who were not members of the Screen Actors Guild. I imagined that many of these actors were hoping for a line or just for a chance to be seen.

Bleary-eyed and with aching feet, I said to my friend Maureen, I'm not ready to give up my day job.

-- Jean Flanagan

Do you have something you'd like to share with us? Be our guest editor. Send editorials to 26-537 or email flanagan@mitlns.mit.edu

Computer Tip

Are you away from LNS and you have computer access at your new place? Did you get a brand new PC running Linux, connected to the MIT network and you do not need the VAX Cluster anymore? Do you prefer a Unix system for all your computer work?

To re-route your electronic mail received at the VAX server MITLNS follow the procedure below:

Login to your VAX Cluster account.

$

Type:

$ **mail** **<Return>**

MAIL> **show forward** **<Return>**

(The response would be:*"You have not set a forwarding address." or i.e.: "Your mail is being forwarded to smtp%"johndoe@marie.mit.edu".)*

Type:

MAIL>**set forward smtp%"""your-name@new.loctn.and.net"""**

<Return>

(The three (3) quotation marks are mandatory for the forwarding to take effect.)

MAIL> **show forward** **<Return>**

(You'll get this message:

Your mail is being forwarded to SMTP%"yourname@new.loctn.and.net".

If the message appears with single quotation marks, it is correct.)

Type:

MAIL> **exit** **<Return>**

You may continue with other work or logout from the VAX Cluster.

-- Ed Alvarez

LNS Update

LABORATORY FOR NUCLEAR SCIENCE

No. 9 June 1997

The ATLAS LHC Research Program

• **What is the origin of mass ?**

• **Are there elementary particles which are the 'supersymmetric' mirror images of the known ensemble of spin 1 and spin 1/2 particles ?**

These questions are two of many in elementary particle physics which have remained unanswered by direct experimentation for many decades even though all incisive experimental tests seem to agree with the Standard Model predictions. In order to extend our understanding we must explore new territory. In fact, from a historical prospective, the discovery of new phenomena in elementary particle physics frequently occurs when a new accelerator with higher luminosity and energy is used.

Five universities in the Boston area [Boston University, Brandeis, Harvard, MIT and Tufts] have teamed up to work at the Large Hadron Collider (LHC), presently under construction at CERN in Geneva, Switzerland. The LHC will provide proton-proton collisions at 14 TeV (14 x 10^{12} electron volts) center-of-mass energy and will be the highest energy machine in the world when it is commissioned in 2005. With such high energy, the LHC will present a splendid opportunity to search for new phenomena within the next decade.

The 'Higgs mechanism' has been proposed to generate particle masses, which in its most basic form, predicts the existence of a spin 0 particle that interacts with the spin 1 gauge bosons [photon, gluon, $W^{\pm}$ and Z^0] and spin 1/2 leptons and quarks. The Higgs particle has not yet been detected. Much theoretical work has been done on the idea of supersymmetry. Like the Higgs particle, there is no direct experimental evidence for this new symmetry. However, there are hints.

One of the recent successes of the Standard Model is the prediction of the mass of the top quark and its recent experimental discovery at FNAL. The same chain of reasoning can be carried out by further examination of precision tests of electroweak theory at SLAC, CERN and FNAL to set limits on the mass and production cross section of the Higgs particle. The present limit determined by precision electroweak tests places the mass of the Higgs at a central value of 130 GeV (130 x 10^9 electron volts) and an upper limit (95% CL) of 465 GeV. By direct search, we know the Higgs must be heavier than about 66 GeV. Further, theory tells us that if the Higgs is to be an "elementary particle" it must be lighter than about 1 TeV - otherwise new "physics" must be operative. These experimental - theoretical limits, just beyond the present reach, make the experimental quest for the Higgs ever more tantalizing.

The Higgs particle, as well as other exotic particles, have significant decay modes into muons (heavy electrons). Muons are particularly useful and "interesting" because their experimental signature involves the detection of a penetrating charged particle and can be observed behind massive shielding far from the non penetrating and "unin teresting" debris of the p-p collisions. Our Boston group has therefore decided to concentrate on muons and calls itself the Boston Muon Consortium . We have joined the muon subsystem of the ATLAS (A Toroidal LHC ApparatuS) collaboration, one of the two general-purpose detectors under design and construction at the LHC. By focusing common interests and pooling resources in one LHC experiment a critical mass can be reached in the Boston area which will enable the BMC to assume a large responsibility in the design and construction of the ATLAS muon system. The near term focus of our group will be to become one of the two ATLAS endcap muon chamber fabrication sites and ultimately become a physics analysis site.

How are masses generated ? Is the universe "supersymmetric" ? Maybe we will know in 10 years.

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LNS Publications

Center for Theoretical Physics

"The Unreasonable Effectiveness of Quantum Field Theory," R. Jackiw, CTP #2500, LNS-97-238.

"Screening in High-T QCD," R. Jackiw, CTP #2513, LNS-97-239.

"Cobe-DMR-Normalized Open CDM Cosmogonies," Bharat Ratra, et al, CTP #2548, LNS-97-240.

"Vacuum Instability in Low-Energy Supersymmetry Breaking Models," Lisa Randall, et al, CTP #2555, LNS-97-241.

"Dilatations Revisited," HoSeong La, CTP #2557, LNS-97-242.

"Green's Function Approach to Infrared Factorization and Finite Eikonal Corrections," C.N. Ktorides, CTP #2558, LNS-97-243.

"Universality of the Operator Product Expansions of SCFT," D.Z. Freedman, CTP #2560, LNS-97-244.

"Elimination of the Vacuum Instability for Finite Nuclei in the Relativistic s-w Model," CTP #2563, LNS-97-245.

"Deeply-Virtual Compton Scattering," Xiangdong Ji, CTP #2568, LNS-97-246.

"Constraints on Beta Functions from Duality," Peter E. Haagensen, CTP #2569, LNS-97-247.

"Magnetic Monopole Loop for the Yang-Mills Instanton," CTP #2570, LNS-97-248.

"Quark States Near a Threshold," R. L. Jaffe, CTP #2572, LNS-97-249.

"In Defense of the 'Tunneling' Wave Function of the Universe," Jaume Garriga, LNS-97-250.

"Quantum Link Models: A Discrete Approach to Gauge Theories," S. Chandrasekharan and U. Wiese, CTP #2573, LNS-97-251.

"Non-minimal Couplings in Two-Dimensional Gravity: a Quantum Investigation," L. Griguolo and D. Seminara, CTP #2578, LNS-97-252.

"Entropy of Localized States and Black Hole Evaporation," Ken Olum, CTP #2580, LNS-97-253.

"Theta Vacua and Boundary Conditions of the Schwinger-Dyson Equations," Zachary Guralnik, et al, CTP #2582, LNS-97-254.

"Perfect Lattice Actions for Staggered Fermions," W. Bietenholz, et al, CTP #2584, LNS-97-255.

"Quantum Effects on Winding Configurations in SU(2)-Higgs Theory," Arthur Lue, CTP #2585, LNS-97-256.

"A Nonrelativistic Chiral Soliton in One Dimension," R. Jackiw, CTP #2587, LNS-97-257.

"Conformal Symmetry and the Chiral Anomaly," Daniel Z. Freedman, CTP #2588, LNS-97-258.

"Kosterlitz-Thouless Phase Transitions on Discretized Random Surfaces," Andrei Matytsin, CTP #2589, LNS-97-259.

"Semi-Analytical Approaches to Local Electroweak Baryogenesis," Arthur Lue, et al, CTP #2590, LNS-97-260.

"New Mechanisms of Gauge-Mediated Supersymmetry Breaking," Lisa Randall, CTP #2591, LNS-97-261.

"An Analog Analogue of a Digital Quantum Computation," Edward Farhi, CTP #2593, LNS-97-262.

"Weak Hyperon Production in ep Scattering," Xuemin Jin and R. L . Jaffe, CTP #2594, LNS-97-263.

"Molecular and Exotic Dibaryons and Other Hadrons," E. L. Lomon, CTP #2595, LNS-97-264.

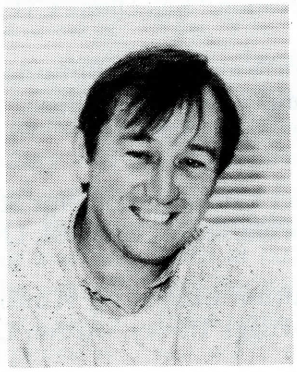
"Confinement in N = 1 SUSY Gauge Theories and Model Building Tools," Csaba Csaki, M. Schmaltz and Witold Skiba, CTP #2597, LNS-97-265.

"Solutions to a Quantal Gravity-Matter Field Theory on a Line," Roman Jackiw, CTP #2598, LNS-97-266.

"On the Coulomb and Higher-Order Sum Rules in the Relativistic Fermi Gas," T.W. Donnelly, et al, CTP #2576, LNS-97-268.

ASK A PHYSICIST

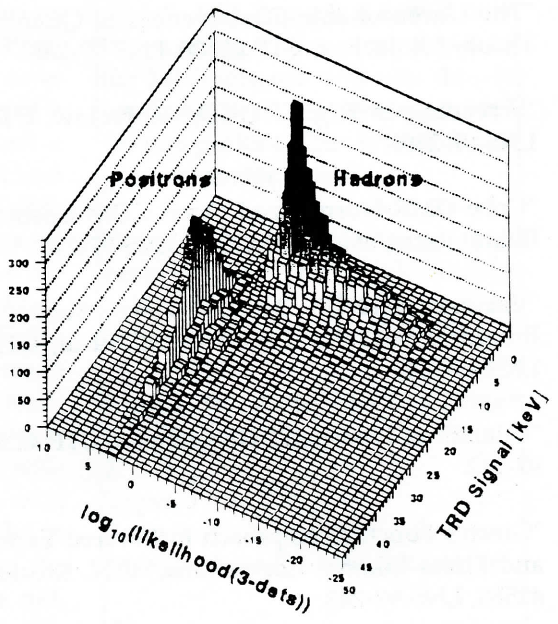
Prof. Richard Milner



Recently the HERMES experiment has received a lot of press. What is the significance of the results of the spin structure of the neutron?

Most of the observable matter around us consists of protons and neutrons. These form the nuclei of atoms. In the most fundamental theory, the protons and neutrons consist of quarks and gluons. It is of great importance to understand the properties of the protons and neutrons in terms of these fundamental constituents. A basic property of protons and neutrons, indeed of all elementary particles, is spin. This is similar to mass and charge but spin is a completely quantum mechanical concept. The spin of a proton (or neutron) is one half. This means that if I perform an experiment which can probe the spin of the proton (or neutron) I can only measure either + 1/2 or -1/2. The question then arises of how the fundamental constituents (the spin 1/2 quarks and the spin 1 gluons) combine to form the spin 1/2 proton and neutron. This is the basic goal of HERMES. Experiments at CERN and SLAC have shown that the fraction of the proton spin carried by the quarks is about 25%. HERMES uses a completely new technique to measure spin dependent deep inelastic scattering. Further, it detects the coincident hadrons made by the scattered lepton in deep inelastic scattering. This should allow the ability to unravel the contributions to the proton spin.

Do you have a question you'd like to ask a physicist? Send it to us!



A Particle identification plot from the HERMES experiment showing the clean separation of positrons and hadrons, as recently shown in the April issue of Science Magazine.

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