

Physics and Astronomy

Dominik Schneble



We were pleased to welcome Assistant Professor Dominik Schneble to the Atomic Molecular & Optical group beginning this past winter. He and Elisa arrived with 4-month old Adelia just before the holidays, and luckily found a very nice place to live in Port Jefferson Station. Dominik was born and raised in Germany, and finished his Ph.D. thesis work in 2001 with Tilman Pfau and Jürgen Mlynek at the University of Konstanz on gases confined to two-dimensional spaces by trapping cold atoms near a surface. His arrival here underscores the long and pleasant relationship we have enjoyed with Konstanz.

Dominik's most recent appointment was as a post-doc at MIT working on Bose-Einstein condensates in the laboratory of Wolfgang Ketterle and Dave Pritchard. He has a strong interest in continuing related work here at Stony Brook, and we anticipate the first BEC in the State of New York some time in the not-too-distant future. He is presently building a lab from the ground up in the basement area formerly occupied by Luis Orozco. Once BECs are reliably reproduced, his early explorations will be

with strongly correlated atoms. These may be in one, two, or three-dimensional geometries in the presence of a weak or strong optical lattice. There is a wealth of new phenomena waiting for discovery by graduate students interested in a thesis in this burgeoning area of study.

Adam Durst



The Department is very happy to welcome Adam Durst to the faculty. Adam is a theorist who arrived in January of this year. Adam's interests include high temperature superconductors and other exotic forms of matter. He did PhD studies at MIT with Patrick Lee. His thesis examined the implications of a superconducting gap which has zeros at points on the Fermi surface. He found that a signature of these zeros should appear in thermal conductivity. This prediction has attracted a lot of attention.

Adam then spent two productive years as post-doc at Yale, where he found an interesting explanation for the puzzling properties of a two-dimensional electron gas when it is illuminated by microwave radiation.

At Stony Brook, Adam is hard to miss, since he towers even over Gene Sprouse. He continues his work on superconductivity while planning an expansion of his family. His collaborator on the expansion project is his wife Sarah, a business woman and writer of children's books.

**Bachelor's Degree
Candidates
2004-2005**

December 2004

Zoe Berger
Richard Brown
Mark Cheng
Spiro Kartsonis
Adrienne Moscinski
James Scholtz

May 2005

Iqbal Farhana
Thomas Fiero
Christopher Joseph
Rita Kalra
Jesse Miner
Rustum Nyquist
Sal Pontillo
Aaron Reitz
Brett Rimes
Samantha Roberts
Yihua Rong
Anthony Sacks
Nikita Simonian
Steven Wilson
Yousuke Yagi

August 2005

**Sigma Pi Sigma
Physics National Honor
Society
27th Annual
Induction**

Kyung Soo Choi
Melissa E. Friedman
Eric A. Kuflik
Jonathan H. Langdon
Tak Chu Li
Ka Ho Lo
Steven R. Wilson

Awards and Prizes

FACULTY

Dmitri Averin was elected Fellow of the American Physics Society.

Gerry Brown has received an honorary degree at Ohio State University.

Tom Hemmick has received the 2005 Outstanding Teacher Award.

Janos Kirz won the Arthur H. Compton Award, given by the Advanced Photon Source Users Organization.

Konstantin Likharev received the IEEE Council on Superconductivity Award for Significant and Sustained Contributions to Applied Superconductivity.

Vladimir Litvinenko won the Free Electron Prize for 2004 for 'outstanding contributions for free electron science and technology.'

Sergei Maslov won the Presidential Science and Engineering Award.

Laszlo Mihaly was awarded the Albert Szent-Gyorgy Fellowship by the Hungarian Academy of Sciences.

Peter Paul received the first BSA Distinguished Service Award.

Norbert Pietralla won the DOE Outstanding Junior Investigator award.

Ralf Rapp received an NSF Career Award.

Vasili Semenov was elected Fellow of the Institute of Physics (UK).

Edward Shuryak was the Dirac Lecturer at the University of New South Wales in Australia, and was appointed to the rank of Distinguished Professor by the Chancellor of SUNY. He has also been given the Humboldt Award.

Jack Smith was awarded the President's Award for Research and Scholarly Activities.

George Sterman was appointed to the rank of Distinguished Professor.

Awards and Prizes

STUDENTS

David Cardoza has been awarded the Silsbee Prize for the most outstanding graduate student.

Alia Davis and **Robert Pearson** have been awarded the Edward Lambe Prize for Science and Teaching.

Eduardo Gomez and **Zuxin Ye** have both received the 2005 President's Award to Distinguished Doctoral Students.

Yildirim Mutaf has received the Wilcox Prize for excellence in experimental PhD research.

K. M. Shah Newaz, **Dustin Schones**, and **Jing Wang** are winners of the 2005 Peter B. Kahn Fellowships, given for travel to scientific conferences.

Sasa Ratkovic has been awarded the Dresden Prize for the outstanding theoretical thesis.

Samantha Roberts received the Soroff Prize for outstanding contribution in Physics.

Leonid Shifrin has been awarded the David Fox Prize for the best Teaching Assistant.

Ann Sickles received the Gertrude Goldhaber Award for the best PhD dissertation by a woman graduate student working at Brookhaven National Laboratory.

Senior **Rita Kalra** was named a 2005 Winston Churchill scholar and Rhodes Scholar finalist. She expects to study the biophysics of synaptic integration at Cambridge. She was also named one of 14 Stony Brook seniors to receive the Chancellor's Award for Student Excellence. Rita was the College of Arts & Sciences hooding representative at Commencement.

Jesse Miner received the John S. Toll Prize for the senior who shows the greatest promise in physics and/or astronomy, as well as achievement during his or her undergraduate career .

Jesse Miner and **Rustum Nyquist** have received the Jefferson Award for students who have exhibited traits which suggest that they will be responsible citizens.

Rustum Nyquist received an Undergraduate Achievement Award.

Robyn Odegaard, **Gloria Gil** and **Shengcao Cao** have been awarded the Feingold Prize for outstanding students in introductory Astronomy.

Master's Degrees 2004-2005

December 2004

Sarah Campbell
Jeremy Holt
Florian Langhojer
Jingbin Li
Huijie Miao
Matthew Nguyen
Jonathan Rameau
Anne Sickles
Lai-Wa Siu
Nicholas Stroud
Carlos Trallero
Jie Yu

May 2005

Shivani Ajuja
Ryan DiSilvestro
Simone Giombi
Kenneth Herner
Xiaojing Huang
Sarah Nichols
Riccardo Ricci
Diego Trancanelli
Florin Tudorica

MSI Degrees

Sanjeewa Abeytunge
Tan Ahn
Masaki Tsukuda

Letter from the Chair

*Prof. Paul Grannis**Prof. Peter Koch*

With this newsletter, my term as chair is coming to a close, so it is an occasion to both look forward—and backward.

Going forward we are very pleased that Peter Koch has agreed to become the new chairman of the department. For the past two years, Peter has served with considerable energy as the Associate Dean for Facilities and Budgets. In that role Peter has helped us and the college to improve the efficiency of operation. He has also become a respected figure in the university administration, and this will serve the department well. Peter will take the helm (not a bad metaphor for a former Annapolis midshipman) at the beginning of July.

Looking back, there are many good memories for me. The best among them is the opportunity to learn more about the varied and exceptional research achievements of our students, postdocs and faculty. Without an excuse to learn something about the many new research results, most of us shelter in our own small communities and miss sharing the excitement in other areas of physics and astronomy. Without being chair, I might not have come to know about ways to sculpt molecular reactions with shaped laser pulses, the possibility that deconfined quarks and gluons resemble sticky molasses, or have appreciated the intricacies of turbulent flame propagation in exploding stars. I can't say that I have become much of an expert in these challenging enterprises but it has been fun to learn! It is a reminder for us all that physics and astronomy form an interconnected web, and that we should take the time to broaden our horizons.

As we all know, funding for higher education and for basic research is increasingly threatened. For the past three years, the university has operated under severe budget restrictions and these are likely to continue for at least the next couple of years. Federal research budgets have stagnated in many fields, so that the competition for the grants on which we depend for new programs grows increasingly competitive. Against this backdrop, I am pleased that we have been able to hold our own. The losses of faculty to retirement and resignation have been offset by excellent new additions. Our research funding has continued to rise. There are new initiatives for studying the mysteries of neutrinos, the matter-antimatter asymmetry, developing new computing paradigms, and for probing the earliest epochs of the universe with novel telescopes and accelerators. Doubtless, not all of these will pan out as we hope, but they lay a firm foundation on which the department can build.

Finally, on the eve of my retirement I would say a word of thanks for the fantastic staff who keep this department humming. Seeing at close hand the remarkable dedication of the main office staff and the professionalism of the shops and technical people, gives me a new-found appreciation for how lucky the department is to have such a stable, collegial and effective staff. Without them, we would not have the strength we presently enjoy.

Paul Grannis

Congratulations

Chen Ning Yang and Weng Fan (Fanfan) were married in January, 2005. Prof. Yang writes:

Fanfan is 28 and was born in ChaoZhou in Guangdong Province. ChihLi and I had first met her when we went, in the summer of 1995, to an international physicists' conference at the Univ. of Shantou. There were 4 participants who were Nobel medalists. So the Univ. recruited students to serve as guides, and Fanfan, then a freshman, was selected to be the Yangs' guide. It was an arrangement which could only have been made by God. ChiLi and I instantly liked Fanfa. She was pretty, active, considerate and guileless. She spoke excellent English, being a major in the English Dept. After we left Shantou, we maintained infrequent contacts with her. As providence would have it, she dropped us a note last Feb after not having been in contact with us for several years.



The letter was mailed to Stony Brook and was forwarded to me while I was in Hong Kong. Thus began our getting reacquainted during the past months.

I found Fanfan, now a mature woman, retaining the ingenuousness that ChihLi and I had liked in her 9 years ago. Youthfulness is not so much about age, but about spirits. Fanfan is mature but youthful. I am sure each of you will like her when you meet her.



Yiing-Rei Chen (Ph.D. 2003) and Chi-Lun Lee (Ph.D. 2003) were married at New York City Hall on March 11, 2005.

Phil Allen writes:

Yiing-Rei Chen came to Stony Brook from Taiwan in 1998. She did a thesis with me, finishing in Fall 2003, and moved to Columbia as a post-doc in their Nanoscience Center. She was awarded the Gertrude Goldhaber award for her research work on competing lattice and magnetic polarization effects on dilute electronic carriers in insulators. Chi-Lun Lee also came to Stony Brook from Taiwan. He was mentored by Barry McCoy who arranged for him to do a theses with George Stell in Chemistry. His theses was about the statistical mechanics of polymers and protein folding. After finishing, he took a post-doctoral position with the Polymer Physics Institute of the University of Massachusetts in Amherst.

Both Yiing-Rei and Chi-Lun are talented musicians. Yiing-Rei has studied piano at the Curtis School of Music in Philadelphia and the Manhattan School of Music. She has performed at the Staller Center as accompaniest to many music student recitals. Chi-Lun plays violin.

Our warmest wishes for many happy years together



Research Notes

We like to sample some of the excitement of the research accomplishments in the Department. Alas, in this space we cannot do justice to all the activities.

Below, Hal Metcalf gives an overview of recent experiments using exquisitely controlled laser light to manipulate atoms singly and in correlated patterns.

On the next pages, Gerry Brown and Boris Gelman outline our understanding of the remarkable new results emerging from the Brookhaven Lab Relativistic Heavy Ion Collider experiments (see the Spring 2004 Newsletter), where the highly touted "quark gluon plasma" has turned out to resemble sticky molasses more than a gaseous plasma. Their article is a first for the Newsletter, being a full-fledged scientific article. We look forward to citations for The Physics & Astronomy Newsletter in the scholarly journals!

Paul Grannis

Optical Manipulation of Ultra-Cold Atomic Vapors

Hal Metcalf

When atoms are illuminated by light tuned to the resonant frequency between two of their levels, the resulting coupling between the two states is represented by an off-diagonal element in the Hamiltonian matrix. The interaction causes both transitions and energy shifts, and although the optical parameters can be manipulated so that one or the other effect dominates, neither effect of the light ever vanishes. The effects of the light can be used to manipulate atoms and control their motion, but in very different ways.

In the case where excitation is followed by spontaneous emission, the irreversibility of the process can be exploited to cool an atomic cloud with astounding effectiveness. MicroKelvin temperatures are routinely achieved, and hundreds of nanoKelvins are not unusual. Atomic velocities of a few mm/s are slower than mosquitoes, and deBroglie wavelengths can be comparable to optical wavelengths.

In the case where excitation is followed by stimulated emission, the concomitant energy shifts produce conservative forces in inhomogeneous optical fields that can be used to confine and manipulate atoms in exquisitely precise ways. Among the most dramatic of these is the optical lattice produced by interfering waves (e.g. standing optical waves) that confine atoms in an array at each node or antinode. When the atomic sample in an optical lattice is not merely cold, but is actually a Bose Einstein Condensate (BEC), new phenomena appear. Even single atoms can be confined and manipulated with a few mW of moderately well-controlled laser beams.

Laser light that is modulated, or contains a mixture of frequencies, generates forces with totally different properties than those from monochromatic light. The forces are very much stronger, very much less dependent on atomic velocities (independent of Doppler shifts), act over much larger distances, and can be reversed with simple phase changes. Experiments with such non-monochromatic light are opening a new area of optical forces on atoms.

Modern electronic and optical technology has given us exacting control of laser light, and we exploit this for similarly exquisite capability in manipulation of single atoms, clouds of atoms, BEC's, and arrays of atoms in optical lattices of one, two, and three dimensions. Single atoms are available on demand for pure quantum mechanical studies, fountains of atoms are available for the most precise, all-optical clocks ever made, arrays of atoms are available for quantum information studies and applications, microKelvin vapors can be converted to microKelvin neutral plasmas, etc. There seems to be no limit to the range of applications of atomic manipulation.

Such experiments in coherent optical control of atomic motion occur in the labs of Profs. Schneble and Metcalf, and the two most recent PhDs are Matt Partlow and Oleg Kritsun. Related experiments on optical manipulation and control of atomic binding in molecules are performed in the lab of Prof. Weinacht. Our experimental AMO group has about a dozen students, one or two postdocs at various times, and our efforts are complemented by frequent visitors and by the theoretical work of Prof. Bergeman and his students.

What hath RHIC wrought? A tale of two glues

G.E. Brown and B.A. Gelman

*Department of Physics and Astronomy
State University of New York, Stony Brook, NY 11794-3800*

(May 5, 2005)

I. INTRODUCTION

Before the Brookhaven Heavy Ion Collider (RHIC) went on the air, CERN claimed that they had found the quark-gluon plasma, in generally accepted parlance a weakly interacting system of essentially free quarks and gluons. However, within a month or two of operation, RHIC found the new matter they formed to be an extremely strongly interacting liquid, nothing like the quark gluon plasma. The key to this new matter is, as we shall explain, in the glue from the gluons exchanged between quarks.

II. TWO TYPES OF GLUE

There are two types of glue, a soft one and hard one (epoxy). The exchange of soft gluons holds hadrons together at temperatures below the phase transition temperature $T_c = 175 \text{ MeV}$. Below this temperature the fact that they are coupled to hadrons produces a soft gluon condensate which is melted as T goes up to T_c . As the soft glue melts the constituent quarks turn into massless current quarks.

The hard glue (epoxy) begins to melt only above T_c . It is the epoxy condensate that produces the length parameter Λ_{QCD} by breaking scale invariance and through what is called "dimensional transmutation." And it is the Coulomb force made up out of epoxy that binds quark and antiquark for $T > T_c$.

The fact that there are two glues was first found in the thesis work at Columbia by Yuefan Deng [1]. He found in lattice gauge simulations (LGS) that about half of the total glue, the soft glue, was melted as T reached T_c .

III. BROWN/RHO SCALING

In 1991 [2] Brown and Rho predicted that as the soft glue melted with increasing temperature (or increasing density) hadron masses would decrease essentially proportional to the decrease in the soft gluon condensate, going to zero at T_c . Their initial scaling suggested in [2] was $\frac{m^*}{m} \sim (\frac{\langle \bar{q}q \rangle^*}{\langle \bar{q}q \rangle})^{1/3}$ but Koch and Brown [3] found from lattice results that $\frac{m^*}{m} \sim \frac{\langle \bar{q}q \rangle^*}{\langle \bar{q}q \rangle}$, so called Nambu scaling. Shuryak and Brown [4] showed that the results of the STAR detector at RHIC demonstrated that the ρ meson mass was somewhat decreased at low density at RHIC and a paper [5] soon to be published in Physics Review Letters shows that the mass of the ω meson while inside a tin nucleus is somewhat less than in free space. Both

decreases follow the quantitative estimates of Brown and Rho, corresponding to an $\sim 20\%$ drop in mass by nuclear matter density.

IV. MESON MASSES ARE ZERO AT T_c

Brown, Jackson, Bethe and Pizzochero [6] introduced mesons with masses that decreased with temperature going to zero at T_c . They described in this way the large entropy increase found in lattice gauge calculations as $T \rightarrow T_c$. In other words, the phase transition was described as mesons going massless; technically, one of chirally restored mesons since the phase transition is one of chiral restoration. The chiral symmetry is restored at T_c .

V. THERMAL MASSES

But quarks and antiquarks have very large thermal masses m_q just above T_c . (They are really energies, 4th components of four vectors, not scalar masses.)

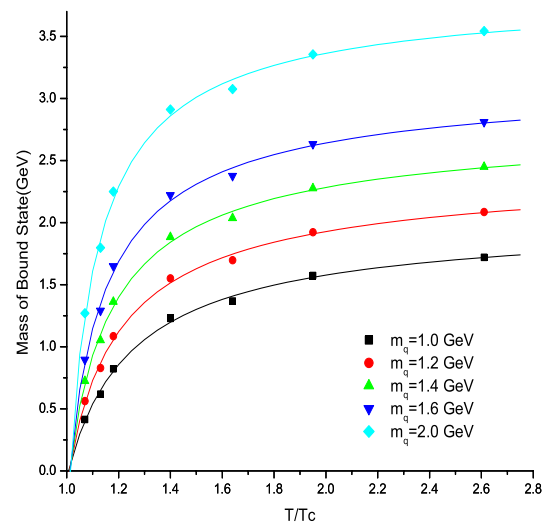


FIG. 1. The mass of bound states. The fitting curves show that the mass of bound states approaches zero as T goes to T_c .

* Massless mesons have an entropy of $4k_B^{-1}$ per particle, nearly double that of massive ones.

One of the surprises of the Bielefeld lattice gauge calculations was that they found the quarks to have masses of $m_q \sim 1 \text{ GeV}$ at $T = 1.5 T_c$ and similarly large masses at nearby temperatures. Now $T_c = 175 \text{ MeV}$ so that the Boltzmann factor[†] for the quark $e^{-m_q/T}$ is tiny. Similar results were found for gluons. Thus, there are not enough quarks and gluons present to produce the pressure, etc. found in RHIC experiments. But if the mesons π, σ, ρ, a_1 go massless at T_c , they can furnish the pressure. But they can only go massless if the binding of $\sim 1 \text{ GeV}$ quarks and antiquarks is $\sim 2 \text{ GeV}$, so the bound states have to be incredibly small, $\sim \hbar/2 \text{ GeV}$ in radius, much smaller than the typical \hbar/mc of the usual mesons, where m is their mass[‡]. The interaction must bring $2m_q \sim 2 \text{ GeV}$ to zero, and therefore is very strong.

In Fig. 1 [7] we show the mass of the bound states above T_c , calculated with input of the lattice results for the Coulomb potential [8,9] with magnetic effects added. Since, the (thermal) quark masses m_q have not been calculated at T_c (only at $1.5T_c$ and $3T_c$) we have plotted the curves for various assumptions within the range $1 - 2 \text{ GeV}$. The meson masses go to zero at T_c regardless of this mass.

The heavy quark Coulomb potential calculated in LGS

$$V(r) = -\frac{\alpha_s}{r} \quad (1)$$

is multiplied by $1 - \vec{\alpha}_1 \cdot \vec{\alpha}_2$ to take into account the magnetic interaction. The product of helicities $\vec{\alpha}_1 \cdot \vec{\alpha}_2$ are either 1 or -1 ; in the latter case the interaction is doubled.

The Coulomb potential is hydrogenic in nature, except that $V(r) = 0$ at $r = 0$ because of asymptotic freedom. (It should be shifted to this value by adding a constant.) At large distances we identify $V(r)$ with $2m_q$. In a hydrogenic wave function for $V(r)$, the binding energy is then $-m_q$, the state being shifted down to m_q , the kinetic energy. Then in the case the interaction is doubled by the velocity-velocity interaction, the energy moves down to zero. In this way regardless of m_q , the energy goes to zero as $r \rightarrow 0$.

VI. RESULTS OF LATTICE GAUGE CALCULATIONS

Lattice gauge calculations solve the Yang-Mills equations numerically. For the problem in hand they have to solve for the Helmholtz free energy

$$F = V - TS, \quad (2)$$

and for the entropy S in order to extract the potential V . The strongest potential is the colorless (gauge theory) Coulomb force. Since the lattice calculations are for quarks of infinite mass, corrections for the magnetic interactions have to be made for light particles. This is the factor $(1 - \vec{\alpha}_1 \cdot \vec{\alpha}_2)$

As long as hadrons with masses are present, chiral symmetry is broken and scales are set by the chiral symmetry breaking one $4\pi f_\pi \approx 1 \text{ GeV}$, where $f_\pi \approx 90 \text{ MeV}$ is the pion decay constant. However, once chiral symmetry is restored at T_c , the scale is determined by the π, σ, ρ, a_1 meson masses which are zero at T_c . Since, at least perturbatively, the coupling runs inversely with the logarithm of the scale, it would seem to go to infinity, which of course it can't reach. But it does go far toward the infrared so that the effective Coulomb interaction, evaluated in lattice gauge calculations of the Polyakov loop [8], becomes large. The Coulomb coupling constant[§] $\alpha_s \rightarrow 16/3$ as $T \rightarrow T_c$. Since $\alpha_s = g^2/4\pi$ this means that $g \rightarrow 8$, and $g > 1$ being the strong coupling. This strong coupling is manifested in the interactions for $T \geq T_c$.

The 32 degrees of freedom of the mesons going massless, just matches the entropy increase as $T \rightarrow T_c$ in lattice calculations. The entropy in perturbative calculations was always $\sim 15\%$ too high.

Thus Brown/Rho scaling is well confirmed, as well as Brown *et al.* [6].

The increase in entropy as $T \rightarrow T_c$ can be understood by the mesons going massless.

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 - [2] G.E. Brown and M. Rho, Phys. Rev. Lett. **66** (1991) 2720.
 - [3] V. Koch and G.E. Brown, Nucl. Phys. **A560** (1993) 345.
 - [4] E.V. Shuryak and G.E. Brown, Nucl. Phys. **A717** (2003) 322.
 - [5] D. Trnka *et al.*, nucl-ex/0504010.
 - [6] G.E. Brown, A.P. Jackson, H.A. Bethe and P.M. Piz-zochero, Nucl. Phys. **A560** (1993) 1035.
 - [7] H.J. Park, C.-H. Lee and G.E. Brown, hep-ph/0503016, Nucl. Phys. **A**, submitted
 - [8] O. Kaczmarek, F. Karsch, F. Zantow and P. Petreczky, Phys. Rev. **D70** (2004) 074505.
 - [9] O. Kaczmarek, F. Karsch, P. Petreczky and F. Zantow, Phys. Lett. **B543** (2002) 41.

2004-2005 Ph.D.s

- Sergey Butsyk, *Open charm measurement at RHIC*, (Hemmick)
- Xiangyun Chang, *Studies in laser photo-cathode RF guns*, (Ben-Zvi, BNL)
- Evan Crocker, *Structural changes of a light-activated G protein-coupled receptor determined by solid-state NMR: channeling light energy into the visual pigment rhodopsin*, (s. Smith, Structural Biology)
- Jamil Egdemir, *Nuclear modification factors from heavy flavor decays*, (Averbeck)
- Raymond Flieller, *The crystal collimation system of the Relativistic Heavy Ion Collider*, (Peggs, BNL)
- Bryan Field, *Higgs Phenomenology in the Standard Model and Beyond* (Smith)
- Eduardo Gomez, *Spectroscopy of trapped Francium*, (Orozco)
- Yusuf Kinkhabwala, *Quasi-continuous charge transfer in electron hopping*, (Likharev)
- Eftychios Matathias, *Identified particle production in p+p and d-Au collisions at RHIC*, (Hemmick)
- Yildirim Mutaf, *Measurement of the ratio of inclusive cross sections $\sigma(pp\bar{b}-Z + b\text{-jet})/\sigma(pp\bar{b}-Z + \text{jet})$ at $\sqrt{s}=1.96\text{TeV}$* , (Grannis)
- Dmitry Ostrovsky, *Topologically nontrivial events in high-energy collisions*, (Shuryak)
- Matthew Partlow, *Bichromatic collimation to make an intense Helium beam*, (Metcalf)
- Sergey Pflyuk, *Development of next generation superconductor RSFQ devices*, (Semenov)
- Anuj Purwar, *Study of initial and final state effects in ultrarelativistic heavy ion collisions using Hadronic probes*, (Hemmick)
- Kristian Rabenstein, *Decoherence and measurement in solid state qubits* (Averin)
- Sasa Ratkovic, *Topics in neutrino and gravitational astrophysics*, (Prakash)
- Daniel Robles Llana, *Studies in non-anticommutative gauge theories, geometric dualities, and twistor strings* (Rocek)
- Gail Schaefer, *Dynamical masses of pre-main sequence stars*, (Simon)
- David Shapiro, *Biological imaging by soft X-ray diffraction microscopy*, (Kirz)
- Woon Song, *Shot noise in negative-differential conductance devices*, (Mendez)
- Ozgur Turel, *Devices, circuits and architectures for nanoelectronic implementation of artificial neural networks* (Likharev)
- Constantin Vaman, *Gamma spectroscopy*, (Sprouse)
- Stefano Venturini, *The molecular gas content of ultraluminous infrared galaxies*, (Solomon)
- Zuxin Ye, *Magneto optical imaging of magnetic flux in superconductors*, (Qiang, BNL)
- Daniel Yohannes, *Process development for high speed superconductor microelectronics* (Tolpygo, HYPRES)
- Konstantinos Zoubos, *Holography, Green's functions and conformal invariance*, (Rocek)

Where Are They Now?

Nitant Kenkre, PhD 1971, has been a professor of physics at the University of New Mexico for 20 years, and was named this year's Research Lecturer, the highest honor for research and creative work that the university can bestow on a faculty member.

Bhaskar Balakrishnan, PhD 1972, has been appointed Ambassador Designate of India to Greece.

Umesh Garg, PhD 1978, is a professor of physics at Notre Dame.

Adam Wolf, BS 1978, is a professor of physics at The Cooper Union in NYC.

Li-Hua Yu, PhD 1984, is a Senior Scientist at Brookhaven National Laboratory, and has been named a Fellow of the American Physical Society for his creative contributions to the development of the SASE laser and the HGHG laser.

Mohsen Yeganeh, BS 1986, is working for ExxonMobil and is the new Secretary-Treasurer of the APS Forum of Industrial and Applied Physics.

Uwe Bergmann, PhD 1994, writes that he has been working at the Stanford Synchrotron Radiation Laboratory since March 2003 and loves his job. He often thinks back to his time at Stony Brook. (See page 11)

Drew Shindell, PhD 1995, a climatologist at NASA's Goddard Institute for Space Studies, received the Scientific American Top 50 Scientist Award.

Marc Timme, MA 1998, received a Ph.D. (Dr. rer. Nat.) from the University of Göttingen in 2002 and is now a Staff Scientist at the Max Planck Institute for Fluid Dynamics in Göttingen. His research focuses on the nonlinear dynamics of cooperative phenomena in biological neural networks. He was awarded the Otto Hahn Medal of the Max Planck Society in 2002 and won the 2003 Dissertation Award of the Berliner Ungewitter Foundation. Marc writes: "I would like to thank Robert Shrock and Jac Verbaarschot for their thorough, motivating, and inspiring introduction to advanced statistical physics. This helped me very much in gaining a deeper understanding of cooperative phenomena in general. And thank you all for the valuable time at Stony Brook."

Kumal Das, PhD 2001, has accepted a tenure track position at Fordham University in the Bronx.

Yaroslav Kulik, PhD 2001, is a financial analyst with the Royal Bank of Canada in New York.

Bogdan Kulik, PhD 2002, is a financial analyst with Wachovia Bank in New York

Scott Bogner, PhD 2002, is a research associate in the Dept. of Physics & Astronomy at Ohio State University in Columbus.

Jaan Mannik, PhD 2003, has accepted a postdoc position at UC Irvine.

Uwe Bergmann, PhD 1994, of the Stanford Synchrotron Radiation Laboratory, is using a particle accelerator to reveal the long-lost writings of the Greek mathematician Archimedes, work hidden for centuries after a Christian monk wrote over it in the Middle Ages. Highly focused X-rays cause iron in the hidden ink to glow.

Bergmann normally uses the accelerator to study the structure of water, and how water is split to create oxygen during photosynthesis. While reading an article on the palimpsest (a twice-used parchment book) Bergmann realized he could use a particle accelerator to detect small amounts of iron in the ink.

Scholars believe the treatise was copied by a scribe in the 10th century from Archimedes' original Greek scrolls written in the third century B.C., and then erased about 200 years later by a monk who reused the parchment for a prayer book when parchment was rare and costly but Archimedes' works were in less demand.

Thank you!

At time of writing, the Departmental annual campaign has netted over \$25,000 in support of activities of the Department ranging from fellowships and prizes to funds for new faculty housing loans. More major gifts are still being discussed. We are extremely grateful to all who joined in giving to our Department; our programs are much enhanced as a result.

It's not too late to join in supporting the Department!
Send us your donation with the form below, or visit
<http://www.physics.sunysb.edu/Physics/donate.shtml>

✂ detach here

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