NJAAPT

New Jersey American Association of Physics Teachers

SPRING 2009 SECTION MEETING

March 20-21, 2009
Princeton University

Welcome to the New Jersey AAPT Spring Section Meeting!

The focus of the 2009 section meeting is the application of Physics to other fields of study, including Biology and Medicine.

Special thanks to Geoffrey Gittelfinger and Ed Groth from Princeton University for their help and the use of Princeton facilities. Thanks also to the Executive Board for all of their planning efforts, to Jessie Blair for coordinating the meeting and catering arrangements, and to Nancy Michaelsen for designing the program booklet.

And, of course, we especially thank our guest speakers, who have taken time out of their busy schedules to be here.

We hope that you will find the meeting informative and enjoyable, and we look forward to seeing you at future events.

NJAAPT
EXECUTIVE BOARD

Ray Polomski	President
John Valente	Vice-President
Jessie Blair	Recording Secretary
Dave Bandel	Treasurer
Joseph Spaccavento	AAPT Section Rep.
Jim Kovalcin	Webmaster

Tiberiu Dragoiu
Jim Ferrara
Dave Maiullo
Nancy Michaelsen
Yitzhak Sharon
Rich Urban

SCHEDULE of EVENTS

Friday March 14, 2008
Jadwin Hall

5:00 – 6:00 p.m.	Registration, Hors d'oeuvres
6:00 – 7:15 p.m.	Dinner -- Buffet style in the Joseph Henry Room
7:15 – 8:30 p.m.	Guest Speaker: **Lt. William Pauli** Somerset County Prosecutor's Office *"Physics is Your Passenger"*

SCHEDULE of EVENTS

Saturday March 15, 2008
McDonnell Hall

8:30 – 9:00 a.m.	Registration, Coffee, Tea, Bagels
9:00 – 9:10 a.m.	Welcome: **Ray Polomski** President of NJAAPT
9:10 – 10:20 a.m.	**Bill Bialek** Princeton University *"Physics Problems in Early Embryonic Development."*
10:20 – 10:35 a.m.	Break
10:35 -11:45 a.m.	**Neil Aaronson** Stockton College *" Sound, Hearing, and Music "*
11:45– 12:15 p.m.	**Warren Hein** Executive Officer, AAPT *"Membership in the AAPT and Your Career as a Professional Physics Educator"*

12:15 – 1:30 p.m.	Lunch (included)
1:30 – 2:50 p.m.	**Larry Dougherty,** University of Pennsylvania *"Physics in Research and Clinical Medicine"*
2:50 – 3:00 p.m.	Break
3:00 – 4:00 p.m.	**Borislaw Bilash**, Pascack Valley HS **Dave Maiullo,** Rutgers University *"A Demo a Day –* *A Year of Physics Demonstrations"*

Lt. William H. Pauli – Ret.

Somerset County Prosecutor's Office

" Physics is Your Passenger "

Bill Pauli is a thirty-three year veteran of law enforcement. Mr. Pauli graduated from Valley Forge Military College and attended Fairleigh Dickinson University where he majored in mathematics. He served as a uniformed patrol officer, Traffic Safety Officer, Administrative Officer, a supervisor in Traffic Safety and the Traffic Safety Division Commander. He retired at the rank of Lieutenant in April 2000. He presently serves on the Board of Directors for both the New Jersey Association of Accident Reconstructionists and the New Jersey Prosecutor's Crash Investigator's Association.

Mr. Pauli chose to dedicate his career to traffic safety issues. He served as Legislative Liaison for the New Jersey Police Traffic Officers Association to the NJ State Legislature, as well as on the Governor's task forces specific to traffic safety issues.
Currently with the Somerset County Prosecutor's Office in New Jersey, Mr. Pauli is employed as a Reconstruction Specialist with

the Collision Analysis Reconstruction Team, a Vehicular Homicide Task Force. Mr. Pauli authors and administers several State and Federal grants; works with high school students on underage drinking issues, and lectures to Science and Math classes. Mr. Pauli participates with municipal agencies on bicycle and pedestrian safety programs.

Physics Is Your Passenger

The issue of teen drivers being over-represented in motor vehicle crashes and fatalities has been a concern of mine for many years. Drivers between the ages of 17-25 will never enjoy physical reflexes and optical acuity as keen as they have in this age bracket. Motor vehicle laws and regulations can be learned, behind-the-wheel training is available, yet driving experience must be worked for. Keeping young drivers safe as this experience is developed is one of my professional obsessions.

Physics Is Your Passenger is a program that I have developed to bring awareness of motoring challenges to high school students. Specific to the Physics classes, we discuss the thought that drivers can only place demands upon their cars within the boundaries of what the Laws of Motion will allow. I speak about the concepts of Newton's Laws of Motion, Friction, Work, Kinetic Energy, Force, and Conservation of Linear Momentum and Conservation of Energy. The presentation is graphically supplemented with actual case studies of local crash investigations that I have conducted.

The most positive feedback that I hear from students is that they appreciate seeing how the above concepts are actually utilized. My hope is merely to keep the kids talking about it. If it sticks in their minds, I firmly believe they stand a better chance of being a success rather than a statistic.

NOTES

Bill Bialek, Ph.D.

Princeton University

"Physics Problems In Early Embryonic Development"

William Bialek is the John Archibald Wheeler/Battelle Professor in Physics at Princeton University. Professor Bialek participates in the interdepartmental educational programs in Applied and Computational Mathematics, Biophysics, Neuroscience, and Quantitative and Computational Biology. In addition to his responsibilities at Princeton, he is a Visiting Professor at the Rockefeller University, where he is affiliated with Center for Studies in Physics and Biology.

Dr. Bialek attended the University of California at Berkeley, receiving a PhD degree in Biophysics. After postdoctoral appointments at the Rijksuniversiteit Groningen in the Netherlands and at the Institute for

Theoretical Physics in Santa Barbara, he returned to Berkeley to join the faculty in 1986. He joined the Princeton faculty as Professor of Physics in 2001. Professor Bialek's research interests have ranged over a wide variety of theoretical problems at the interface of physics and biology, from the dynamics of individual biological molecules to learning and cognition. His hope is that these diverse biological phenomena may be understandable through some unifying theoretical principles, in the physics tradition. Dr. Bialek has been involved in helping to establish biophysics as a sub-discipline within physics and in helping biology to absorb the quantitative intellectual tradition of the physical sciences. Currently he is involved in a major educational experiment at Princeton to create a truly integrated and mathematically sophisticated introduction to the natural sciences for first year college students.

"Physics Problems in Early Embryonic Development"

One of the most beautiful phenomena in nature is the emergence of a fully formed, highly structured organism from a single undifferentiated cell, the fertilized egg. Biologists have shown that in many cases the "blueprint" for the body is laid out with surprising speed and is readable as variations in the expression levels of particular genes. As we try to understand how this happens, we face a number of physics problems: How can spatial patterns in the concentration of these molecules scale with the size of the egg, so that organisms of different sizes have similar proportions? What insures that the spatial patterns are reproducible from one embryo to the next? Since the concentrations of all the relevant molecules are small, does the random behavior of individual molecules set a limit to the precision with which patterns can be constructed?

Although the phenomena of life are beautiful, one might worry that these systems are just too complicated and messy to yield to the physicists' desire for explanation in terms of powerful general principles. For the past several years, a small group of us have been struggling with these problems in the context of the fruit fly embryo. To our delight, we have been able to banish much of the messiness, and to reveal some remarkably precise and reproducible phenomena. In particular, the first crucial step in the construction of the blueprint really does involve the detection of concentration differences so small that they are close to the physical limits set by the random arrival of individual molecules at their targets. This problem may be so serious that the whole system for constructing the blueprint has to be tuned to maximize how much signal can be transmitted against the inevitable background of noise, and this idea of optimization is a candidate for a more general principle from which the behavior of such biological systems can be derived.

Neil Aaronson, Ph.D.

Stockton University

" Sound, Hearing, and Music"

Neil L. Aaronson was born and raised in Marlton, NJ. He found his interests of the sciences and of music early on. After graduating from Cherokee High School, he went on to The College of New Jersey, where he earned a B.S. in Physics and did research in the field of Astrophysics. While there, he continued to indulge his penchant for music and became interested in acoustics. He also discovered a love for teaching, likely inherited from his father, a lifelong educator.

After graduating from TCNJ, Neil went on to pursue graduate studies in physics at Michigan State University. There he earned a M.S. in Physics, a second M.S. in Electrical Engineering, and finally a Ph.D. in Physics for his work in the field of Psychoacoustics. His research interests include mechanisms of human sound localization, intonation perception, and the interconnection between

room acoustics and binaural hearing. While at Michigan State University, he founded a choral ensemble especially for graduate students and faculty in physics and engineering, the Grand Canonical Ensemble. Neil earned his Ph.D. in July 2008, and is now an assistant professor of Physics at the Richard Stockton College of New Jersey where he continues to teach and do research.

Abstract

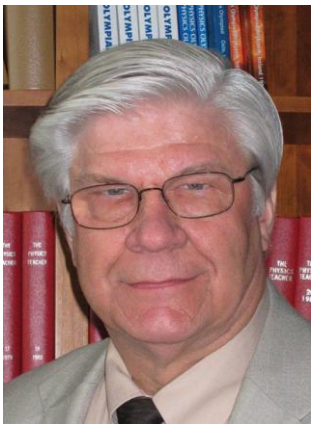
"Sound, Hearing, and Music"

The human auditory system is perhaps the most complex and most sensitive sensory organ in the human body. The process by which mechanical vibrations turn into neural impulses carrying a plethora of information about those vibrations is nothing short of astounding. This presentation will seek to explore the physics of sound, how we perceive it, and how sounds become something more complex – that which we call "music." Several auditory illusions and phenomena will be utilized to emphasize the complex nature of this branch of physics.

Warren Hein

AAPT

"Membership in the American Association of Physics Teachers and Your Career as a Professional Physics Educator"



Dr. Warren W. Hein is Executive Officer at the American Association of Physics Teachers (AAPT).

Hein received his BS degree from the University of Wisconsin-Whitewater in 1966 and his Ph.D. in Nuclear Physics from Iowa State University in 1970. Prior to joining the AAPT as Associate Executive Officer in February 1997, Hein taught physics at Northern State University in Aberdeen, South Dakota, from 1970 to 1979,

and South Dakota State University from 1979 to 1997. He also served as Department Head from 1985 to 1997.

"Membership in the American Association of Physics Teachers and Your Career as a Professional Physics Educator"

Abstract

Membership and active participation in a professional society is an important aspect of what it means to be a professional. For professional physics educators, AAPT offers its members many tangible benefits, serves as an advocate for physics education at all levels, provides resources for the greater physics education community, and provides opportunities for member volunteers to serve the physics education profession. AAPT can have even greater impact if more physics educators would join and become active in the national association as well as their local sections.

Larry Dougherty, Ph.D.

University of Pennsylvania

" Physics Research and Clinical Medicine"

Larry Dougherty has been on the faculty of the Department of Radiology at the Hospital of the University of Pennsylvania since 1997. He did his undergraduate work in physics at Drexel University and Stockton State College (1980) and received his Ph.D. in bioengineering from the University of Pennsylvania in 1996. Larry worked at Temple University Hospital in radiation health physics and as a biophysical engineer where he developed dosimeters for measuring sunburning ultraviolet radiation. He moved to Penn in 1984 where the first clinical MRI scanner was developed. While a graduate student at Penn, he was active in the early development of MRI. During this time he developed innovative cardiovascular imaging methods, some of which are found on commercial MR scanners around the world.

After joining the faculty at Penn in 1997, Dr. Dougherty continued his focus on cardiovascular MR. His Cardiac Imaging Group was also the first to document the value of high-field cardiac imaging.

In his more recent work, he has developed a new approach to imaging cardiac perfusion, which offers clinicians high-resolution images with full heart coverage. In addition to his work in cardiac imaging, Larry has also developed a research program that uses novel approaches to breast imaging. This new technology is currently being tested in hospitals in the United States and Europe.

In addition to Dr Dougherty's research activities, he is a senior member of the Center for Advanced Magnetic Resonance Imaging and Spectroscopy (CAMRIS) at Penn and also teaches physics as an Adjunct Professor at Rowan University.

Physics in Research and Clinical Medicine

From the early use of X-rays to the to the advanced technologies of PET, MRI, molecular imaging and proton therapy, physics has been at the forefront of medical diagnosis and treatment. Sophisticated concepts from physics are used to acquire images of amazing diagnostic quality or allow treatment therapies that are much safer and effective at treating disease then ever before. This talk will review these and other fields, highlighting the role of physics in their development and application. A more detailed look will be taken that shows the variety of physics topics that come into play: mechanics in understanding muscular function; electricity and magnetism in developing imaging probes; quantum mechanics in hyperpolarized MR imaging; optics in MRI pulse sequence design; and nuclear physics in cancer therapy. The drive towards more quantitative understanding of disease will require physicists to continue their research in developing new methods as well as to fuel the transition to clinical application. In addition to the review of physical concepts used in medical applications, the desired skills and required training will be discussed as well as the outlook for salaries and job prospects for those entering the field.

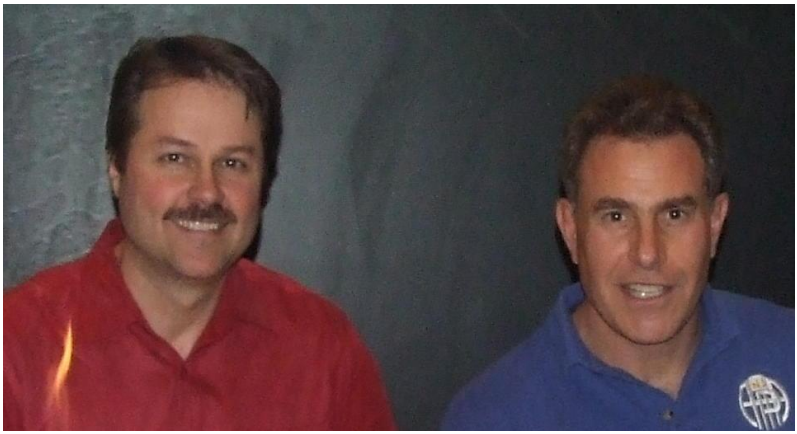
Borislaw Bilash II

Pascack Valley HS

David P. Maiullo

Rutgers University

"A Demo a Day – A Year of Physics Demonstrations"



Borislaw has taught high school physical science, chemistry and physics in New Jersey since 1986. Born and raised in Winnipeg, Manitoba, Canada, Borislaw received his B.Sc. (Physics) from the University of Manitoba and his Ed.M (Science Education) from Rutgers University. Over the years he has taught freshman chemistry at the New Jersey Institute of Technology, and worked with inner-city students in various enrichment programs. He is the lead instructor at the Physics and Chemistry Institutes for High School Teachers at the Liberty Science Center. Borislaw has written four books of the A Demo a Day™ series – demonstration handbooks for teachers of chemistry, biology and physical science. He has coordinated the Demo Dens at the NJ Science Convention

since 1992 and is a regular presenter at state and national conventions often presenting on the topic of demonstrating science and using the constructivist and inquiry methods of teaching science. Borislaw is a Tandy Scholar and has been recognized by numerous organizations including the NJ Science Teacher's Association, NJ Institute of Chemists, the American Chemical Society and USA Today's All USA Teacher Team. Borislaw is a NJ Governor Fellow of Math and Science.

David has been working as a Physics Support Specialist at Rutgers University supervising the Department of Physics and Astronomy lecture demonstration facility since 1986. David has been active in the New Jersey Section of the American Association of Physics Teachers (NJAAPT), coordinating workshops and demonstration shows and serving on the its Executive Board since 1990. David is recognized as a demonstrator extraordinaire and for his work in advancing the craft of physics lecture demonstrations as a member of the Apparatus Committee of the American Association of Physics Teachers (AAPT), and as a leader in the Physics Instructional Resource Association (PIRA). He has served as the chair of the Apparatus Committee and president of PIRA. David is a regular presenter at state and national conventions – teaching teachers how to develop, construct, and present lecture demonstrations for all levels of physics education. David has developed a video series of physics demonstrations for Wiley & Company that is distributed on DVD and accessible through Wiley's online learning. Rutgers University has recognized David's work with the Ernest E. McMahon Award for Public Outreach and the President's Excellence in Service Award. In 2006 David received the Lifetime Service Award from the New Jersey Section of the American Association of Physics Teachers.

A Demo a Day -- A Year of Physics Demonstrations

This recently-published book will be available for purchase through Flinn Scientific (flinnsci.com)

NOTES

NJAAPT

www.njaapt.org

AAPT PHYSICS EDUCATION American Association of Physics Teachers