

RESEARCH ASSOCIATESHIP PROGRAMS
NEWSLETTER

Winter 2008-2009

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NATIONAL RESEARCH COUNCIL
OF THE NATIONAL ACADEMIES

**NOAA AOML
Hurricane Research**

The Hurricane Research Division (HRD) is part of the Atlantic Oceanographic and Meteorological Laboratory (AOML) which is part of the National Oceanic and Atmospheric Administration. They are engaged in advancing the basic physical understanding and improving the forecasts of hurricanes and tropical meteorological systems. A key aspect of HRD's activity is its annual field program of flights aboard NOAA's research aircraft (two WP-#D turboprops and a Gulfstream IV-SP jet) flown by NOAA's Aircraft Operations Center.

HISTORY

The Division began fifty years ago as the National Hurricane Research Project and has, under various names, continued to conduct scientific research into hurricanes and related tropical weather phenomena, using theoretical studies, computer models, and an annual field program employing NOAA hurricane research aircraft. HRD employs meteorologists, computer scientists, and other professionals who collaborate with governmental and academic scientists worldwide in this ongoing effort to develop scientific knowledge toward the improvement of forecasts and the advancement of public safety.

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NOAA Hurricane Hunters

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Left to right: Dr. Jun Zhang, NOAA/NRC Associate, Dr. Frank Marks, Jr. NOAA/NRC Adviser



Ray Gamble, Ph.D., Director, Research Associateship Programs
Suzanne White, Manager, Newsletter

The NRC Research Associateship Programs *Newsletter* is published quarterly to highlight research and activities of NRC Associates and Advisers who participate in the programs with our many agencies and laboratories. All of our *Newsletters* are posted on our Web site Newsletter Web page in full-color PDFs. In addition, the full-color, high-gloss version is printed by the National Academy Press (NAP); and bulk orders of 10 or more are available from our office for distribution at agencies/laboratories, scientific meetings, NRC meetings, staff visits, and site visits. We accept articles throughout the year-- press releases, profiles, 1 – 2 page articles already written and/or submitted to other publications, images, photos, notices, awards, honors, etc.

Send all inquiries and submissions to Suzanne White
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The Hurricane Research Division's (HRD) mission is to advance the understanding and prediction of hurricanes and other tropical weather. HRD's research is based on a combination of computer models, theories, and observations, with particular emphasis on data obtained with research aircraft.

GOALS

1. Advance the prediction of tropical cyclone intensity change by improving understanding of the processes that modulate internal storm dynamics and storm interactions with the atmosphere and ocean below;
2. Improve the prediction of tropical cyclone tracks through an optimal analysis of observations of field observations that enhance understanding of the interactions between a tropical cyclone and its environment;
3. Improve the understanding of and ability to predict tropical cyclone frequency and intensity on intraseasonal, interannual, decadal and longer time scales; and
4. Enhance the ability to diagnose and predict the impact of tropical cyclones on life and property through wind, rain, waves, and storm surge.

ACCOMPLISHMENTS

- Designing and conducting research experiments in the hurricane to collect and provide data for research and applications;
- Analyzing these data sets and publishing the research in the refereed literature;
- Developing new technology and applications based on this research to improve NOAA's products; and
- Providing outreach to the public through the internet, conferences, presentations, and other means.

FIELD RESEARCH

Much of HRD's research is based on the *in situ* and remotely-sensed observations in the inner core of tropical cyclones and their

NOAA AOML Hurricane Research

surrounding environment collected in our annual field program using the two NOAA turboprop aircraft and jet operated by NOAA's Aircraft Operations Center (AOC). The field program is used to carry out scientific experiments designed to address the goals stated above. Data sets gathered by these experiments, combined with dynamical and statistical models and theoretical development, span the spectrum of spatial and temporal scales, from global to microscale, from seconds to centuries, forming the cornerstone of research at HRD. Because of this extensive field experience HRD scientists are recognized internationally for their knowledge about tropical cyclones, and also for their expertise in technological areas such as airborne Doppler radar, dropsondes, cloud microphysics, and air-sea interaction, to name a few. These assets make HRD unique worldwide, and provide NOAA a unique capability.

for Environmental Prediction (NCEP), in particular the Environmental Modeling Center and the [Tropical Prediction Center/OAR \(NHC\)](#). It maintains active research programs with, and receives funding from other governmental agencies, in particular, the Department of the Navy's Office of Naval Research (ONR) and the National Aeronautics and Space Administration (NASA).

In program areas where it is beneficial to HRD, it arranges cooperative programs with scientists at the [National Center for Atmospheric Research](#), and at a number of universities. One of the highest priority experiments in 2002 was a study of the upper-ocean heat content in collaboration with an NSF sponsored research effort at the University of Miami. Our second-highest priority (through 2004) is the Coupled Boundary Layer Air-Sea Transfer (CBLAST) Experiment focused on improving numerical model parameterization of the air-sea transfer of energy that fuels the storms.

HRD also integrated two recent NASA field experiments, the Third and Fourth Convective and Moisture Experiments (CAMEX-3 & 4), into its field program in 1998 and 2001, respectively. NASA is considering a Fifth CAMEX in 2005. Our current research staff consists of 23 full-time employees and 8 employees



Left to right: Dr. Jun Zhang, NRC/NOAA Associate, Dr. F. Marks, Jr. NRC/NOAA Adviser

COORDINATION & PROJECTS

HRD coordinates parts of its programs with other NOAA organizations, e.g. AOC and the National Center

working under a cooperative joint agreement with the University of Miami's CIMAS, and several students working under various contracts.

NOAA Hurricane Hunters

The fluxes of enthalpy and momentum play a vital role in the development and maintenance of tropical cyclones. The well-known hurricane potential intensity theory states that the intensity of a hurricane depends strongly on the ratio of the exchange coefficient of enthalpy flux to the exchange coefficient of momentum flux (also called drag coefficient). Results from numerical simulations using an axis-symmetric tropical cyclone model demonstrate that to achieve realistic intensity of the simulated hurricanes, the ratio C_K/C_D mostly lies in the range of 1.2-1.5 with $C_K/C_D=0.75$ as a lowest bound to ensure model consistency.

Over the last several decades, although much effort has been made to determine empirically the values of the momentum and heat exchange coefficients through measurements, one clear limitation of the observational results for C_K and C_D is that few direct flux data are available for wind speeds over 20 m/s. As part of the ONR-sponsored Coupled Boundary Layer Air-Sea Transfer (CBLAST) Hurricane experiment carried out in the 2002-2004 hurricane seasons, the first-ever

direct turbulent flux measurements were carried out in the hurricane boundary layers using a research aircraft instrumented with fast-response turbulence sensors. The wind speed range for momentum and enthalpy fluxes and exchange coefficients has been extended by over 50% compared to that in previous studies.

Dr. Jun Zhang, NRC/NOAA Associate, analyzed the CBLAST datasets and found that the average ratio of C_K/C_D is 0.63, significantly below the 0.75 threshold for hurricane development suggested by the hurricane potential intensity theory. The results published by Dr. Jun Zhang in GRL 2008 suggests that the enthalpy flux into the hurricane boundary layer required to initiate and sustain hurricane envelopment may have to come from sources other than air-sea turbulent fluxes, or alternatively that the assumptions used in the hurricane potential intensity theory should be revisited.

Recently, Dr. Zhang, had the opportunity to fly into Hurricane Gustav onboard a NOAA P-3 hurricane hunter aircraft. The primary purpose of the flight was to obtain horizontal and verti-

cal scans of Gustav's structure using the Doppler radar located in the aircraft's tail. Dr. Eric Uhlhorn, hurricane researcher at NOAA's AOML and lead scientist on this flight, had developed a flight track that allowed the crew to sample all quadrants of the hurricane while penetrating Gustav's eye three times to compile observations, surface wind measurements, sea surface temperatures, and many other parameters all transmitted in near-real time from the aircraft to improve forecasts and allow scientists to develop the next generation of hurricane models.

As part of NOAA's commitment to the safety of its employees, the crew first had to complete a mandatory two-day flight safety training with the Federal Aviation Administration, a process that includes simulated survival training in a pool for four hours.

Dr. Zhang was trained to process the GPS dropsonde data that are often used to determine the intensity of a storm for the operational forecast purpose. This experience led him to a greater appreciation of the data he has analyzed and published.

The flight was piloted by CDR Mark Nelson, LCDR Karl Newman, and LT Amelia Ehardt of the NOAA Corps. Included in the crew of 18 was **Dr. Frank Marks, Jr.**, Dr. Zhang's **NRC/NOAA Adviser**, along with an engineering group who meticulously maintained the aircraft and instrumentation.



Left to right: Erica Rule, NOAA AOML Outreach Coordinator who was invited to participate in the training and the flight; Dr. Eric Uhlhorn, and Dr. Jun Zhang.
Photo Credit: Paul Leighton.

See GEOPHYSICAL RESEARCH LETTERS
VOL. 35, L14813, doi:10.1029/2008GL034374, 2008,
"First direct measurements of enthalpy flux in the hurricane boundary layer: The CBLAST results",
Jun A. Zhang,^{1,2} Peter G. Black,^{3,4} Jeffrey R. French,
and William M. Drennan¹, Received 16 April 2008;
revised 19 June 2008; accepted 26 June 2008; published
30 July 2008, Full article: <http://www.agu.org/pubs/crossref/2008/2008GL034374.shtml>

Participating Agencies

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AFRL Sensors Directorate Kozma, Kovalerchuk, Perlovsky



Dr. Robert Kozma, former AFRL/NRC Associate, Hanscomb AFB, Massachusetts

Dr. Robert Kozma, Professor of Computer Science at Memphis University and **Dr. Boris Kovalerchuk**, Professor at Central Washington University significantly contributed to AFRL in-house research in dynamic logic during their tenures as **Senior NRC Associates at AFRL, Sensors Directorate at Hanscom AFB** during 2006, 2007, and 2008. **Dr. Leonid Perlovsky, Technical Advisor, AFRL/Ryhe served as the AFRL/NRC Adviser for this research.**

Dr. Kozma also plans to file for a patent jointly with Dr. Leonid Perlovsky. The patent rights are assigned to Memphis University and the AFRL. The patent will cover a novel technology that significantly improves human-computer interaction. Many research centers tried to develop human-computer interaction technology based on EEG signals. EEG signals are easy to measure and potentially they contain information about the brain cognitive activities. So far success was very limited be-

cause EEG signals are notoriously noisy. Another member of the patent team is Dr. Walter Freeman, Professor Emeritus of Neurobiology at University of California, Berkeley, a pioneer in EEG field. Kozma-Perlovsky team developed a novel technique that can literally pull signals from under the noise. Based on preliminary results they believe that they will be able to extract meaningful significant cognitive events from noisy EEG data.

Dynamic logic technology for extracting signals from under noise was developed originally for finding objects of interest in radar signals; it improves detectability by up to 100 times. It was developed by Dr. Perlovsky team at AFRL/Ryhe, other team members include Dr. Ross Deming, Dr. Robert Linnehan, and branch chief Bertus Weijers. This research has been funded by AFOSR PMs Dr. Jon Sjogren, Dr. Arje Nachman, and Dr. David Luginbuhl. The technology received high recognition within AFRL; it was commended by AFOSR Chief Scientist Dr. Thomas Hussey SES, AFRL Commander Maj Gen Curtis Bedke, and AFRL Executive Director Joe Sciabica SES. Recently the technology was transferred to operations at Electronic Systems Center and received commendations from Maj Edison, Lt Gen Bowlds, Lt Gen Deptula, and other military leaders.

In 2007 Dr. Perlovsky received the highest AF scientific recognition for this discovery, John L. McLucas Award for Basic Research.

Relevant scientific publications, books and about 100 papers, include:

Perlovsky, L.I., Kozma, R., Eds. (2007). *Neurodynamics of Higher-Level Cognition and Consciousness*. Springer-Verlag, Heidelberg, Germany.

Deming, R.W. and Perlovsky, L.I. (2006). *GMTI Tracking Improvement by 20dB*, 52nd Annual Meeting of the MSS Tri-Service Radar Symposium, 19-23 June, 2006, Lincoln Laboratory, Lexington, MA. Best paper award.

Linnehan, R., Schindler, J., Brady, D., Kozma, R., Deming, R., Perlovsky, L. *Dynamic Logic Applied to SAR Data for Parameter Estimation Behind Walls*, Proc. 2007 IEEE Radar Conference RADAR07, IEEE Press, Piscataway, NJ, pp. 850-855, April 2007.

Perlovsky, L.I. Mutz, C., Weijers, B., Linnehan, R., Schindler, J., Brockett, R. (2004). *Synthesis of Formal and Fuzzy Logic to Detect Patterns in Clutter*. IEEE International Conference on Computational Intelligence for Measurement Systems and Applications, CIMS'A'04, Boston, MA.

Kovalerchuk, B. and Perlovsky, L.I. (2008). *Dynamic Logic of Phenomena and Cognition*. World Congress on Computational Intelligence (WCCI). Hong Kong, China.

Kozma, R., Ankishetty, J., and Perlovsky, L.I. (2008). *Model Field Theory for Detection of EEG Phase Cones Using Non-Gaussian Mixture Components*. World Congress on Computational Intelligence (WCCI). Hong Kong, China.

Kozma, R., Puljic, M., and Perlovsky, L. (2009). *Modeling goal-oriented decision making through cognitive phase transitions*, New Mathematics and Natural Computation, in print.



Dr. Leonid Perlovsky, AFRL/NRC Adviser

U.S. AMRMC

(Army Medical Research & Materiel Command)

Institute of Surgical Research

Dr. Andrey Yershov was an **AMRMC/NRC Associate** at the US Army Institute of Surgical Research from October 2001 until April 2005. His project focused on ventilator-associated pneumonia, and he created a new model of streptococcal pneumonia, investigating how different modes of mechanical ventilation affected the development of pneumonia in rabbits.

As part of this work, Dr. Yershov noticed that different modes of mechanical ventilation affected the requirement and duration of anaesthesia in rabbits. This work was written up and published in *Veterinary Anaesthesia and Analgesia* in 2007. The actual citation is: Yershov AL, BS Jordan, JM Fudge, MA Dubick. Influence of the mode of ventilation on ketamine/xylazine requirement in rabbits. *Vet Anaesth Analg* 34:157-163, 2007.

The journal editors submitted this paper for consideration for the Langley Prize for best paper. Although it was not selected, it was considered the 2nd best paper published by the Journal in 2007 and so was awarded the Blackwell Prize for this honor. Dr. Yershov returned to clinical practice in St Petersburg Russia after completing his NRC Associateship. He is head of the department of anaesthesiology, critical care and ambulance in one of St. Petersburg's hospitals. Currently his research involves a new helicopter emergency medical service in St Petersburg.



Dr. Andrey Yershov, former AMRMC/NRC Associate, ISR

Nominated for the Langley Prize, the second-best paper is awarded £100 by Blackwell Publishing

from *Veterinary Anaesthesia and Analgesia*, August 2008:

The sum of £100 is generously awarded by Blackwell Publishing, Ltd. to the author of the second best paper nominated for the Langley Prize. Professor Hunter considered that this year's award should go to Drs. **Andrey Yershov, former AMRMC/NRC Associate, ISR**; Bryan Jordan; James Fudge; and **Michael Dubick, AMRMC/NRC Adviser, ISR**, for their paper "Influence of the mode of ventilation on ketamine/xylazine requirements in rabbits". (May issue, pages 157 – 163). The editorial board congratulates **Andrey** and his team and acknowledges the kind assistance of Wiley-Blackwell for this support.

U.S. Army Medical Research & Materiel Command
Institute of Surgical Research
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Fort Sam Houston, San Antonio, TX 78234
Contact: michael.dubick@amedd.army.mil

USAMRMC Mission and Vision

Mission: Provide medical knowledge and materiel lifecycle management to protect, treat and optimize Warfighter health and performance across the full spectrum of operations.

Vision: We are the world's experts and leaders in the military relevant biomedical research and medical materiel communities, delivering the best medical solutions to enhance, protect, treat, and heal our Warfighters

The U.S. Army Institute of Surgical Research (USAISR) is part of the U.S. Army Medical Research and Materiel Command and is collocated with Brooke Army Medical Center. The USAISR is dedicated to both laboratory and clinical trauma research. Its mission is to provide requirements-driven combat casualty care medical solutions and products for injured soldiers, from self-aid through definitive care across the full spectrum of military operations; provide state-of-the-art trauma, burn, and critical care to Department of Defense beneficiaries around the world and civilians in our trauma region; and provide Burn Special Medical Augmentation Response Teams.



The
American
Society
For
Nondestructive
Testing

The American Society for Nondestructive Testing Recognizes Ralf Arndt

Microwave (Thermo) Reflectometry for Corrosion Detection in Concrete
with gratitude and appreciation for invaluable contributions made toward the growth
and betterment of nondestructive testing methods through participation in a technical
presentation sponsored by this Society



Dr. Ralf Arndt, FHWA/NRC Associate

NDE/NDT for Research and Bridges:
Structural Materials Technology (SMT)
September 8 – 12, 2008, Oakland, California USA

NDE/NDT for Highways and Bridges: Structural Materials Technology (SMT)

For September 8-12 2008 the American Society for Nondestructive Testing (ASNT) invited to a symposium dedicated to the nondestructive testing (NDT) and nondestructive evaluation (NDE) technologies for condition assessment of highways and bridges in Oakland, California. Leading national and international authorities from all facets of the structural materials industries gathered to focus on issues of most significance to highways and bridges, share case studies and reveal new applications. Glenn Washer from University of Missouri-Columbia and **NRC Adviser Frank Jalinoos of Federal Highway Administration** chaired the conference with 22 sessions with over 60 papers and an advanced NDE of concrete structures workshop on topics covering: concrete decks, crack detection, steel bridges and cables, structural health monitoring and more.



Dr. Frank Jalinoos, FHWA/NRC Adviser

NRC Research Associate, Dr. Ralf Arndt, from FHWA NDE Center gave a presentation on his research topic *Microwave (Thermo) Reflectometry for Corrosion Detection in Concrete*. The used method makes use of the fact that a corroded steel bar that has been heated above ambient temperature will cool down more slowly than an uncorroded one, and the difference in rate of cooling can be used to detect the corrosion. The rebar is heated in the concrete by using an AC (alternating current) electrical induction heater, external to the concrete structure. The temperature at the surface of the rebar can be detected nondestructively by the reflectance of a microwave beam, since the reflectivity is temperature dependent. The induction heater can be cycled on and off to produce temperature pulses in the rebar, and thus the heating and cooling can be cycled repeatedly. By scanning the microwave beam over the rebar it is possible to image the corrosion layer. For more details on the research objectives see: <http://www.fhwa.dot.gov/advancedresearch/nrc.cfm>



Left to right: Rick Hale (Technician), Dr. Pranaam Haldipur (Scientist), Dr. Raghu Satyanarayana (Manager), Dr. Ralf Arndt (FHWA/NRC Associate), Frank Jalinoos (FHWA/NRC Adviser and Program Manager), Dr. Shuang Jin (Scientist and former NRC associate), Candace Dickerson (Secretary)

Dr. Kathryn Wahl, NRL NRC Adviser, receives Navy Meritorious Civilian Service Award

Dr. Kathryn Wahl, a research materials engineer at the NRL, has received the Navy Meritorious Civilian Service Award. She is recognized for exceptional contributions to the advancement of Naval Research in the fields of contact mechanics and the chemistry of adhesion, friction, and wear.

Dr. Wahl is recognized as among the most distinguished researchers in her field. Her research has established the role of solid lubricant mobility in controlling contact during sliding, identifying environmental effects on contact dynamics, and correlating friction behavior with the chemistry of the interface. She also developed new methods to quantitatively measure and map the contact stiffness and elastic modulus of materials with submicron spatial resolution.

This new “scanning nanomechanics” technique, which has been commercialized, is capable of mapping elastic and visco-elastic properties of worn surfaces, composites, polymers, and nanostructures. Most recently, she has developed quantitative physical imaging and spectroscopic methods to explain the adhesion and curing of barnacle bio adhesives. Her work is advancing scientists’ understanding of underwater glue curing and approaches to antifouling.

Dr. Wahl received a B.A. in Physics and Mathematics from St. Olaf College in 1987, and a Ph.D. in Materials Science and Engineering from Northwestern University in 1992. She came to NRL as a **NRC Associate** in the Tribology Section of NRL’s Chemistry Division, and studied friction, wear and interfacial film formation of model solid lubricant coatings. Since joining the research staff at NRL in 1995, her research has focused on fundamental physics and chemistry of sliding and adhesive interfaces, for contacts ranging from macroscopic to nanometer-scale. All of these studies have pointed to the importance of interfacial films and their chemistry, rheology, and mechanics.

In research efforts, working with NRL’s Dr. Irwin Singer, they have demonstrated how interfacial films extend the life of sliding contacts through lubricant transfer processes, how coating micro-structure influences friction and wear, and how gas-surface interactions influence super low friction. The *ex situ* surface science studies of worn surfaces motivated development of instrumentation enabling *in situ* (within the sliding contact) tribology coupling chemical analysis with friction and wear sensing. Now, experiments to quantify, in real time, the chemistry, dynamics, thickness, and friction transients are possible through *in situ* instrumentation developed around both micro-Raman and Attenuated Total Reflectance Fourier Transform Infrared (ATR-FTIR) spectroscopies.



CAPT Gahagan, former NRL Commanding Officer (left), and Dr. Jones, Exec. Dir. Office of Naval Research (right) present Dr. Kathryn Wahl (center) with the Navy Meritorious Civilian Service Award certificate and pin.

Dr. Wahl has also conducted investigations of contact mechanics phenomena at the nanoscale by combining scanned probe microscopy and instrumented nano indentation approaches. In collaboration with NRL’s **Drs. Richard Colton, NRL NRC Adviser**, and Syed Asif (now at Hysitron, Inc.), nanomechanics instrumentation applying AC force modulation has resulted in realization of a significant advance in scanned probe microscopy—quantitative mechanical properties measurements in an image format, or stiffness mapping.

These new surface mechanics tools are being used for fundamental studies that explore the limits of continuum contact mechanics in small adhesive junctions, as well as applied materials problems like measuring mechanical anisotropy in spider silk and bio inspired nanofibrillar columnar polymer films.

Dr. Wahl served as interim Program Officer at the Office of Naval Research in Solid State & Materials Chemistry in 2002. Dr. Wahl recently chaired the 2008 Tribology Gordon Research Conference, and is the incoming Program Chair for the International Conference on Metallurgical Coatings and Thin Films (ICMC-TF) in 2009. She also serves on advisory panels for the Swiss Federal Institute of Technology (ETH-Zurich) Department of Materials and the Princeton University Center for Complex Materials.

She is co-editing the upcoming focus issue on “*In Situ Tribology*” of the Materials Research Society’s monthly publication, the *Materials Research Bulletin*. She has served on the Editorial Advisory Board of *Review of Scientific Instruments*, and currently serves on the Editorial Boards of *Tribology Letters* and *Wear*. She is a fellow of American Vacuum Society, and member of the Materials Research Society, American Chemical Society, and Society of Tribologists and Lubrication Engineers. She was awarded the NRL Chemistry Division Young Investigator award in 1997.

Physicist and **NIST/NRC Adviser David J. Wineland** of the Commerce Department's National Institute of Standards and Technology (NIST) was awarded the 2007 National Medal of Science.

The National Medal of Science honors individuals for pioneering scientific research in a range of fields, including physical, biological, mathematical, social, behavioral and engineering sciences, that enhances understanding of the world and leads to innovations and technologies that give the United States a global economic edge. The National Science Foundation administers the award, which was established by the Congress in 1959.

Wineland, 64, was cited for "outstanding leadership in developing the science of laser cooling and manipulation of ions, with applications in extremely precise measurements and standards, quantum computing, and fundamental tests of quantum mechanics, and for his major impact on the international scientific community through training scientists and outstanding publications."

Since the award was established, only about 6 percent of winners have been federal employees. Wineland is internationally recognized for developing the technique of using lasers to cool ions (electrically charged atoms or molecules) to near absolute zero, the coldest possible temperature. Wineland achieved the first demonstration of laser cooling in 1978 and has built on that breakthrough with 30 years of experiments that represent the first or best in the world – often both – in using trapped laser-cooled ions to test theories in quantum physics and demonstrate crucial applications such as new forms of computation.

Wineland's breakthroughs led to work by groups throughout the world on laser cooling and trapping of

2007 National Medal of Science

neutral atoms, culminating in the 1997 Nobel Prize to William D. Phillips of NIST, Steven Chu and Claude Cohen-Tannoudji for development of neutral atom laser cooling. In addition, Wineland's research also helped make possible the work by Eric Cornell of NIST and JILA, a joint institute of NIST and the University of Colorado at Boulder, who with Wolfgang Ketterle and Carl Wieman received the 2001 Nobel Prize for using laser cooling to create the world's first Bose-Einstein condensate.

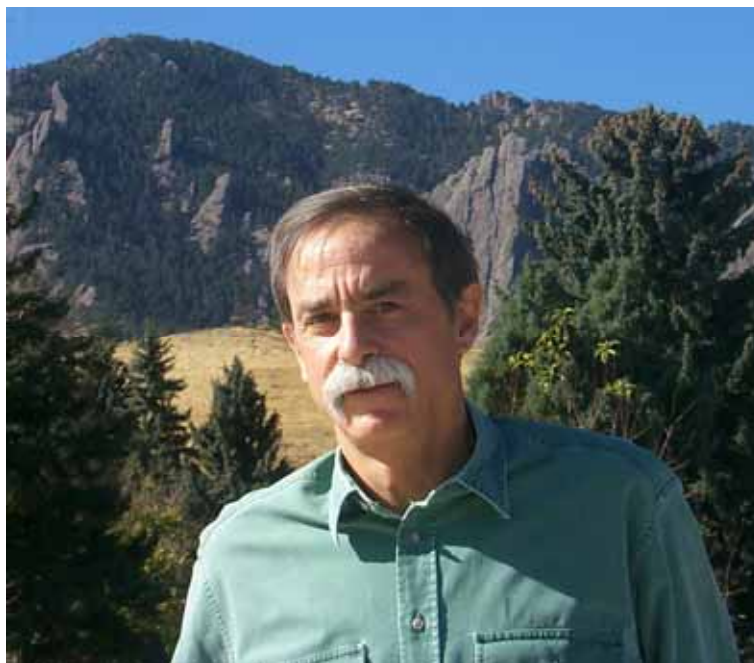
Wineland's work led to the development of laser-cooled atomic clocks, the current state of the art in time and frequency standards. His laser-cooled trapped ion technique was used by members of his group to demonstrate an experimental clock based on a single mercury ion that is

best encryption codes, that are intractable using today's technology. He also helped train new generations of scientists working throughout the world and has published more than 250 refereed articles, many in the most prestigious research journals.

Originally from Sacramento, Calif., Wineland has worked at NIST laboratories in Boulder, Colo., since 1975. He received a bachelor of science in physics from the University of California at Berkeley and master's and doctoral degrees in physics from Harvard University, where his advisor was Norman Ramsey, a 1989 Nobel Laureate in physics. Before joining NIST, Wineland worked as a postdoctoral research associate at the University of Washington with Hans Dehmelt, who shared the 1989 Nobel Physics prize with Ramsey.

Wineland is a member of **the National Academy of Sciences** and has won a host of other awards, including the Department of Commerce Gold Medal, the Society of Optical and Quantum Electronics' Einstein Medal for Laser Science, the American Physical Society's Arthur L. Schawlow Prize in Laser Science, International Award on Quantum Communications, the Optical Society of America's Frederick Ives Award, and the Presidential Rank Award for Distinguished Senior Executives and Professionals.

For more information about the National Medal of Science visit the NIST Web site



Physicist David J. Wineland, NIST/NRC Adviser at Boulder Laboratories, CO

currently the best in the world, as well as a "logic clock" using an aluminum ion that is nearly as accurate. See http://www.nist.gov/public_affairs/releases/logic_clock/logic_clock.html.

Wineland also helped launch the field of experimental quantum computing. Through many pioneering experiments, his group was the first to successfully demonstrate the building blocks of a practical quantum computer, a device that could solve some problems, such as breaking the

Quotations from NIST Management

"Dave Wineland is a prime reason why NIST is world renowned for atomic clocks and quantum computing research that advance U.S. science, innovation, and competitiveness," said James Turner, NIST deputy director. "We are proud to have him on our staff."

"Dave Wineland is an outstanding scientist who has made revolutionary contributions to the development and application of laser cooling and trapping," said Katharine Gebbie, director of NIST's Physics Laboratory. "We are all thrilled by this well-deserved recognition for him and honored that he has chosen to make his career at NIST."

Ghostly Glow Reveals Galaxy Clusters in Collision

A team of scientists, including astronomers from the Naval Research Laboratory (NRL), have detected long wavelength radio emission from a colliding, massive galaxy cluster which, surprisingly, is not detected at the shorter wavelengths typically seen in these objects.

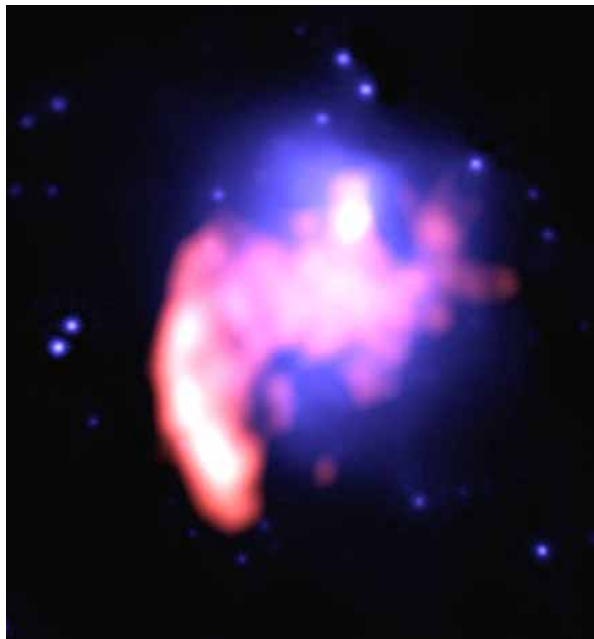
The discovery implies that existing radio telescopes have missed a large population of these colliding objects. It also provides an important confirmation of the theoretical prediction that colliding galaxy clusters accelerate electrons and other particles to very high energies through the process of turbulent waves. The team revealed their findings in the October 16, 2008 edition of *Nature*.

This new population of objects is most easily detected at long wavelengths. Professor Greg Taylor of the University of New Mexico and scientific director of the Long Wavelength Array (LWA) points out, *"This result is just the tip of the iceberg. When an emerging suite of much more powerful low frequency telescopes, including the LWA in New Mexico, turn their views to the cosmos, the sky will "light up" with hundreds or even thousands of colliding galaxy clusters."* NRL has played a key role in promoting the development of this generation of new instruments and is currently involved with the development of the LWA. NRL radio astronomer and LWA Project Scientist and NRL/NRC Adviser Namir Kassim says *"Our discovery of a previously hidden class of low frequency cluster-radio sources is particularly important since the study of galaxy clusters was a primary motivation for development of the LWA."*

The discovery of the emission in the galaxy cluster Abell 521 (or A521 for short) was made using the Giant Metrewave Radiotelescope

(GMRT) in India, and its long wavelength nature was confirmed by the National Science Foundation's (NSF) Very Large Array (VLA) radio telescope in New Mexico.

The attached image shows the radio emission at a wavelength of 125cm in red superimposed on a blue image made from data taken by the Chandra X-ray Observatory. The X-ray emission comes from hot thermal gas, a well-known sign-post of massive galaxy clusters. Furthermore, its elongated shape indicates that the cluster has undergone a recent violent collision or 'merger event' in which another group or cluster of galaxies was swallowed up by the gravitational potential of the main cluster.



Superimposed false-color images of the galaxy cluster A521. The blue color represents hot gas typical of many galaxy clusters detected by the Chandra X-ray Observatory. The shape of the X-ray emission indicates that the cluster has undergone a recent collision or 'merger event' that could generate turbulent waves. The red represents radio emission at 125cm wavelength. The bright radio source on the lower left periphery of the X-ray gas is a separate source. The region of radio emission generated by turbulent waves is located at the center of the cluster, where the colors overlap.
Credits: Radio (NCRA/GMRT/INAF/G.Brunetti et al.); X-ray (NASA/CXC/INAF/S.Giacintucci et al.)

Interferometrics Inc. and NRL scientist Tracy Clarke, who is also the LWA System Scientist, notes that

"In addition to teaching us about the nature of Dark Matter, merging clusters are also important in studies of the mysterious nature of Dark Energy. Understanding these two strange components of the Universe will help us understand its ultimate destiny."

In the radio image there is a strong, oblong source of emission located on the lower left periphery of the X-ray gas detected by Chandra; this is a separate source. In the center of the cluster, there is radio emission which changes significantly with wavelength. At the longest wavelength (125 cm, shown) it is clearly detected, but at a wavelength of 49 cm it is much fainter, and it is almost entirely gone at 21 cm wavelength. This multi-wavelength picture of the diffuse emission is in good agreement with theoretical predictions for particle acceleration by turbulent waves generated by a violent collision.

In a broader astrophysical context, galaxy clusters are the largest gravitationally bound systems in the Universe and their collisions are the most energetic events since the Big Bang. Says team leader Gianfranco Brunetti (Istituto di Radioastronomia, Bologna, Italy), *"The A521 system provides evidence that turbulence acts as a source of particle acceleration in an environment that is unique in the Universe due to its large spatial and temporal scales, and due to the low density and high temperature of the gas."*

The team included scientists from Istituto di Radioastronomia, the University of Bologna, the Smithsonian Astrophysical Observatory, the National Radio Astronomy Observatory, and the Naval Research Laboratory.

Basic research in radio astronomy at the Naval Research Laboratory is supported by 6.1 base funding. The RAO is a facility of the National Science Foundation operated under cooperative agreement by Associated Universities, Inc. The GMRT is run by the National Centre for Radio Astrophysics of the Tata Institute of Fundamental Research. The LWA, funding for which is provided by the Office of Naval Research, is led by the University of New Mexico, and includes NRL, The Applied Research Laboratory at the University of Texas at Austin, Virginia Tech, the Los Alamos National Laboratory, and the University of Iowa, with contributions and cooperation from NRAO.

(The Long Wave-length Array (LWA) website is <http://lwa.unm.edu>)

PROGRAM PROMOTION 2009

Associateship Programs Staff members will be available at an Exhibit Booth.

American Institute of Aeronautics & Astronautics	AIAA	01/05/09-01/08/09	Orlando	FL
Joint Mathematics Meetings	JMM	01/05/09-01/08/09	Washington	DC
American Meteorological Society	AMS	01/11/09-01/15/09	Phoenix	AZ
Johns Hopkins University Science & Tech Career Fair	JHU-STCF	02/11/09-02/11/09	Baltimore	MD
Nat'l Soc of Black Physicists/Nat'l Soc of Hispanic Physicists	NSBP/NSHP	02/11/09-02/14/09	Nashville	TN
Nat'l Org of Black Chemists & Chemical Engineers	NOBCCHE	03/13/09-03/18/09	St. Louis	MO
Society of Toxicology	SOT	03/15/09-03/19/09	Baltimore	MD
American Physical Society	APS	03/16/09-03/20/09	Pittsburgh	PA
Experimental Biology	EB	03/19/09-03/21/09	New Orleans	LA
American Chemical Society (Spring)	ACS -- Spring	03/23/09-03/25/09	Salt Lake City	UT
National Society of Black Engineers	NSBE	03/26/09-03/28/09	Las Vegas	NV
American Society for Microbiology	ASM	05/17/09-05/21/09	Philadelphia	PA
American Association of Petroleum Geologists	AAPG	06/07/09-06/10/09	Denver	CO
American Chemical Society (Fall)	ACS -- Fall	08/17/09-08/19/09	Washington	DC
Science & Engineering Alliance/Student Tech Conference	SEA/STC	Oct	local	local
Advancement of Chicanos & Native Americans in Science	SACNAS	10/08/09-10/11/09	Dallas	TX
Society of Mexican American Engineers & Scientists	MAES	Oct	TBD	TBD
Hispanic Assn of Colleges & Universities	HACU	10/31/09-11/02/09	Orlando	FL
Florida Education Fund/McKnight Fellows Meeting	FEF/McKnight	TBD	Tampa	FL
American Indian Science & Engineering Society	AISES	TBD	TBD	TBD
Annual Biomedical Research Conference for Minority Students	ABRCMS	11/04/09-11/07/09	Phoenix	AZ
American Society for Tropical Medicine & Hygiene	ASTMH	11/18/09-11/22/09	Washington	DC
Materials Research Society	MRS	12/01/09-12/03/09	Boston	MA
American Society for Cell Biology	ASCB	12/05/09-12/09/09	San Diego	CA
American Geophysical Union	AGU	12/14/09-12/18/09	San Francisco	CA

2009 SCHEDULE

February Review

Submission deadline - February 1
 Transcripts and Reference Reports deadline - February 15
 The Board meets March 9—10
 Agencies will be notified within two weeks

May Review

Submission deadline - May 1
 Transcripts and Reference Reports deadline - May 15
 The Board meets on June 19
 Agencies will be notified within two weeks

August Review

Submission deadline - August 1
 Transcripts and Reference Reports deadline - August 15
 The Board meets on September 25
 Agencies will be notified within two weeks

November Review

Submission deadline - November 1
 Transcripts and Reference Reports deadline - November 15
 The Board meets on January 8, 2010
 Agencies will be notified within two weeks

Connecting with Postdocs

Nearly 600 Postdocs and 60 exhibitors in the science, technology, engineering, and math (S.T.E.M.) fields gathered at the National Institutes of Health in October for **S.T.E.M. Talent 2008: A Symposium and Career Fair for Postdocs in the Capital Region**. 38 of the exhibitors were hiring companies, and 20 were resource organizations. The Rockville Economic Development, Inc. (REDI), in partnership with these organizations and federal agencies, produced this event “...to retain the brightest scientific minds in the DC area's workforce.” The Kauffman Foundation for Entrepreneurship participated in the conference as a sponsor and participant, conducting focus sessions and one-on-one meetings with postdocs to spark entrepreneurship. This Kauffman participation shines a national spotlight on postdocs as tech transfer agents. The participating hiring companies spoke enthusiastically about the career fair, praising the quality of the postdocs and their preparedness. The companies believed that some nice matches were made. The strong conference participation **revealed remarkable interest in non-academic careers among postdoctoral fellows.** They were interested in both entrepreneurial and corporate options. It should be noted that postdocs who take positions in corporations are also potential technology transfer agents, as they can serve as strong connectors between their new companies and their former laboratories.



(left to right) Sandra Miller, Senior Fellow, The Kauffman Foundation; Sean Sanders, PhD., Worldwide Commercial Editor, AAAS; Dr. Chad Womack, Founder, President and Executive Director, Philadelphia Biotechnology and Life Sciences Institute and Conference Keynote Speaker; Sally Sternbach, Executive Director, Rockville Economic Development, Inc.; and John Wasilisin, Vice President and Chief Operating Officer, TEDCO.

REDI will re-survey the postdocs and the participating companies in 6-9 months to monitor employment that may have resulted from the event.

NRL Semi-Annual All-Postdoc Poster Sessions

Autumn sessions sponsored by NRL Edison Chapter of Sigma Xi. Spring sessions sponsored by NRL-WISE.

October 30, 2008, 22 National Research Council (NRC), American Society for Engineering Education (ASEE), and university supported postdoctoral Associates presented their research to the Naval Research Laboratory (NRL) community at the semi-annual autumn poster session sponsored by the NRC and the NRL Edison Chapter of Sigma Xi. The Associates represented nine NRL Divisions presenting broad range of topics. The event was well attended with 80—100 NRL personnel viewing and discussing the posters. It remains an excellent media for recruiting and hiring. In attendance were Dr. Basques, NRC Program Administrator, Captain Paul Courtney Stewart, the new Commanding Officer of NRL.