THE NATIONAL ACADEMIES

RESEARCH ASSOCIATESHIP PROGRAMS

The Postdoc

Summer 2014

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NPS & NRL applied-math researchers use tools of film industry to visualize cloud simulations

The solution comes from a surprising direction—the film industry, which already has many tools for rendering pictures of clouds. Jeffrey Weekley (MOVES institute) suggested to use the Maya® 3D computer graphics software. *continued on page 2*

^ Visualization of a cloud simulation combined in the Maya software with a landscape photo from Pacific Grove, taken by Andreas Mueller on March 10th, 2014.

< Visualization of a cloud simulation in a night scene.

"The Postdoc" newsletters, which highlight research and activities of NRC Associates and Advisers, are available in PDF via our website: http://sites.nationalacademies.org/PGA/RAP/PGA_047804, or in GoogleDoc via our Facebook Page, or in hardcopy (National Academy Press) via the newsletter manager.

Ray Gamble, Director
NRC Postdoctoral Associateship Programs
Suzanne White, newsletter manager

NATIONAL RESEARCH COUNCIL
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NRC Representation at 2014 Meetings

AIAA	American Institute of Aeronautics and Astronautics	01/13/14-01/17/14	National Harbor	MD
AMS	American Meteorological Society	02/02/14-02/06/14	Atlanta	GA
APS-RAP	American Physical Society	03/03/14-03/07/14	Denver	CO
REDI/NRC	STEM Postdoctoral Conference and Career Fair	04/24/2014	Bethesda	MD
EB	Experimental Biology	04/26/14-04/30/14	San Diego	CA
ASM	American Society for Microbiology	05/17/14-05/20/14	Boston	MA
ACS-Fall	American Chemical Society -- Fall	08/10/14-08/14/14	San Francisco	CA
FEF-McKNIGHT	FEF - McKnight Scholars Conference	10/01/14-10/01/14	Tampa	FL
HACU	Hispanic Association of Colleges and Universities	10/04/14-10/06/14	Denver	CO
MAES	Mexican American Engineers and Scientists	10/15/14-10/18/14	San Diego	CA
SACNAS	Soc for Adv of Chicanos & Native Americans in Science	10/15/14-10/19/14	Los Angeles	CA
ASTMH	American Society of Tropical Medicine and Hygiene	11/02/14/11/06/14	New Orleans	LA
ABRCMS	Am Biomedical Research Conf for Minority Students	11/12/14-11/15/14	San Antonio	TX
AISES	American Indian Science and Engineering Society	11/13/14-11/15/14	Orlando	FL
AGU	American Geophysical Union	12/15/14-12/19/14	San Francisco	CA

continued from front cover

The visually appealing while still scientifically correct representation of results is a challenge for many scientific disciplines. A group led by **Dr. Francis X. Giraldo, NRC Adviser at Naval Postgraduate School** (NPS) is developing a numerical model for the atmosphere called NUMA (Non-hydrostatic Unified Model of the Atmosphere). NUMA stems from a collaboration between the Naval Postgraduate School and the **Naval Research Laboratory - Monterey** where it is slated to be used as the dynamical core within the Navy's next-generation weather prediction system NEPTUNE. **Dr. Simone Marras, NRC Associate, in Dr. Giraldo's group**, successfully added the capacity to simulate clouds in NUMA. The challenge was how to visualize the cloud simulation in a realistic looking way.

Dr. Simone Marras,
NRC Associate, NPS

Dr. Andreas Mueller,
NRC Associate, at NPS

Andreas Mueller, another NRC Associate in Dr. Giraldo's group explains: ***"The main challenge for us was to import our scientific data into the Maya software. To our knowledge the Maya software has not been used by researchers for visualizing scientific cloud simulations. However it turned out to be much easier than expected."***

On his website (http://anmr.de/cloudwithmaya/), Andreas offers a Python script for importing scientific data into the Maya software and gives instructions to make the cloud look real. Any researcher whose work includes the simulation of clouds can use these instructions for rendering photo-realistic pictures of their results.

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16 de febrero de 2014

GALLEGOS EN LA CIMA

ANTONIO J. VÁZQUEZ ÁLVAREZ

"El dinero que se destina al sector aeroespacial revierte en las empresas"

El ingeniero ourensano estudia cómo mejorar la comunicación con los satélites para el Laboratorio de Investigación de las Fuerzas Aéreas en Albuquerque, Nuevo México

SANDRA PENELAS

El campus de la Universidad de Nuevo México se extiende a lo largo de la mítica Ruta 66 a su paso por Albuquerque. Allí desarrolla su carrera investigadora el ingeniero Antonio J. Vázquez (Ourense, 1986), uno de los miembros del equipo original del XaTcobeo que ahora intenta mejorar en EE UU la comunicación con los satélites desde tierra gracias a una beca del Consejo Nacional de Investigaciones Científicas, el organismo equivalente al CSIC español.

Aunque su oficina se encuentra en las instalaciones universitarias, Antonio trabaja para el Laboratorio de Investigación de las Fuerzas Aéreas, que tiene una de sus sedes en la cercana base militar de Kirtland. Allí se encuentra su supervisor, el científico Richard Scott Erwin. "A veces me desplazo para reunirme con él. Aunque los niveles de seguridad son muy altos, es habitual que los estudiantes visiten a menudo la base para hacer proyectos. Se potencian las sinergias entre las Fuerzas Aéreas, la universidad y las empresas", señala.

La ciudad de Albuquerque, con unos 545.000 habitantes y donde todavía es visible la impronta colonial española, acoge a los investigadores del campus, a empresas tecnológicas como Intel, cuya sede es Río Rancho, y también a los Laboratorios Nacionales Sandia, gestionados por una filial de la multinacional Lockheed Martin y el Gobierno para garantizar la seguridad del Estado y trabajar en misiones relacionadas con la ciberseguridad, las armas nucleares o la energía.

La estancia en EE UU, adonde llegó hace casi un año, ha supuesto un reto para Antonio, pues su investigación actual está muy relacionada con las matemáticas. "Salimos con buena base de la Escuela de Telecomunicaciones de Vigo pero los primeros meses fueron duros y me pasaba los fines de semana estudiando algoritmos. Es un desafío, pero me gusta. Estoy muy contento", reconoce el ingeniero ourensano, que acaba de revalidar su beca para continuar en Nuevo México hasta 2015.

"El Consejo Nacional, que depende de las National Academies, atrae a investigadores prometedores de todo el mundo gracias a estas ayudas para que trabajen durante un tiempo en campos de interés para el país. Por un lado, contribuyen a mejorar el conocimiento que hay aquí y por otro, también se busca fomentar el intercambio cultural", explica.

Antonio se doctoró en Vigo con una tesis en la que desarrolló una nueva funcionalidad para conseguir más tiempo de comunicación con los satélites. Su campo de actuación en EE UU sigue siendo el segmento terreno, esto es, los elementos que permiten a los ingenieros controlar y operar las misiones espaciales, aunque ahora echa mano de métodos matemáticos y técnicas de inteligencia artificial para optimizar estos tiempos de comunicación de forma autónoma.

"Se trata de tener en cuenta todos los parámetros relacionados con la planificación de los pases de los satélites sobre una red de estaciones. Es un problema parecido al que se plantea en las rutas del transporte por carretera o de las aviones para lograr que sean más eficientes. En el último año hemos publicado artículos y ahora, con el conocimiento que hemos acumulado, la intención es pasar a la fase de desarrollo del sistema", comenta.

Antonio mantiene el contacto y la colaboración con el equipo vigués del profesor Aguado que puso en órbita el primer satélite gallego en 2012, lanzó su segundo cubesat el pasado noviembre y ahora busca financiación para continuar la carrera aeroespacial: "He seguido la misión del HumSat-D y están trabajando mucho. Al principio hubo apoyos pero la situación actual es complicada. Sin embargo, este sector reporta muchas ventajas. El dinero revierte en las empresas. Si el viveiro de Zona Franca va adelante será bueno para Vigo y la Universidad. Eso seguro".

"Cuando estás fuera te das cuenta de que es posible establecer sinergias con la industria y con instituciones. EE UU es una potencia porque invierte muchísimo en tecnología", apunta. "Salir te da otra perspectiva. En Vigo nos exigimos a nosotros mismos y eso da resultados. Con muchos menos recursos de los que pueden tener aquí somos capaces de hacer un buen trabajo y ya nos empiezan a conocer", añade Antonio.

Además da reputado económico, el sistema de I+D estadounidense es reconocido socialmente: "Aquí te valoran por ser investigador. En España cuando dices que estás en la universidad la gente piensa que llevas muchos años sin acabar la carrera".

Dr. Antonio J. Vazquez,
NRC Associate, AFRL

Money devoted to the aerospace sector reverts to businesses

Engineer from Ourense studies ways to improve satellite communication for the Air Force Research Laboratory in Albuquerque, NM

The campus of the University of New Mexico extends through the legendary Route 66 at Albuquerque. There is where **Dr. Antonio J. Vázquez** (Ourense, 1986) is developing his career. He is one of the members from the Xatcobeo initial team which is now trying to improve satellite communication under a **National Research Council (NRC) Associateship**. The NRC is the organization equivalent to the Spanish CSIC (Consejo Superior de Investigaciones Científicas)

Although his office is located inside the university facilities, Antonio works for the Air Force Research Laboratory, which has one of its headquarters in the nearby Kirtland military base. There is where his supervisor is, the scientist Richard Scott Erwin. ***"Sometimes I go to meet him. Although the security is very high, it's usual that students visit the base regularly to work in projects. Synergies among the Air Force, the university and the business are encouraged"***, he points out.

The city of Albuquerque, with around 545,000 inhabitants and where the Spanish colonial mark is still visible, hosts university researchers, technological businesses like Intel, with headquarters in Rio Rancho, and also the Sandia National Laboratories, managed by a company subsidiary of the multinational Lockheed Martin and the Government for guaranteeing State's security and working in missions related to cybersecurity, nuclear weapons or energy.

His stay in the United States, where he arrived almost one year ago, meant a challenge for Antonio, since his current research is highly related to Mathematics. ***"We leave the School of Telecommunications Engineering of Vigo with good foundations, but the first months where hard and I passed the weekends studying algorithms. It's a challenge, but I like it. I'm very happy"***, acknowledges the engineer from Ourense, which has just renewed his fellowship to stay in New Mexico until 2015.

"The National Research Council, which depends on the National Academies, brings promising researchers from all around the world through these fellowships for them to work for a period of time in fields of interest for the country. On one hand, they improve the knowledge here, and on the other hand, cultural exchange is also fostered", he explains.

Antonio got his PhD in Vigo with a thesis wherein he developed a new feature for increasing communication time to satellites. His research field in the United States is still related to ground segment, this is, the elements which allow the engineers to control and operated space missions; even though he is now hands-on the mathematical methods and artificial intelligence techniques for optimizing these communication times autonomously.

"It's about taking into account all the parameters related to the scheduling of passes of satellites over a ground station network. It's a problem similar to those posed in road transport routes or planes for increasing their efficiency. This year we've published papers and now, with the reached knowledge, the intention is to start the phase of development of the system", he comments.

Antonio keeps contact and collaboration with the Vigo team of the professor Aguado which put in orbit the first Galician satellite in 2012, launched their second CubeSat on past November, and are now looking for funding for continuing their Space Race: ***"I followed the HumSat-D mission and they're working hard. There was support initially, but the current situation is complicated. However, this sector yields lots of benefits. Money reverts to businesses. If the business incubator in the "Zona Franca" (an industrial area in Vigo) goes ahead, it will be good for Vigo and for the university, that's for sure".***

"When you're abroad you realize that it's possible to establish ***synergies with industry and other institutions. United States is a world power because they invest a lot of funds in technology", he points out. "Going abroad gives you a new perspective. In Vigo we demanded more from ourselves and that gives results. With less means than they could have here we are able to do a good job, and we are starting to be known",*** Antonio adds.

Besides the economic support, the American R&D (Research and Development) system is socially recognized: ***"Here you are well-regarded for being a researcher. In Spain when you say you're in the university, people think you haven't finished your degree yet".***

Online version: http://www.farodevigo.es/sociedad-cultura/2014/02/16/dinero-destina-sector-aeroespacial-revierte/968362.html

NRC Associate awarded National Eye Institute Travel Grant

At the 2014 annual Association for Research in Vision and Ophthalmology (ARVO) meeting held in Orlando Florida, **Dr. Jae Hyek Choi**, doing his Postdoctoral Research Associatesip (RAP), under the mentorship of **Dr. Heuy-Ching H. Wang, NRC Adviser**, at United States Army Institute of Surgical Research/Ocular Trauma Task Area, was awarded the National Eye Institute Travel Grant. He presented the following abstract: *Assessment of apoptosis along the optic nerve after low-level repeated blast exposure.*

Explosions are defined as the rapid transformation of a liquid or solid into a gas, resulting in the sudden release of a huge amount of energy. This rapid expansion of gas produces a shock, or blast, wave that travels supersonically in all directions away from the point of detonation. The blast wave causes an increase in pressure relative to ambient pressure. The maximum pressure generated by the explosion is referred to as the blast overpressure (BOP). The physical properties of BOP that will determine the severity of the primary blast injuries are the energy of the explosion, distance from the point of detonation; the time elapsed since detonation, and the environment in which the explosion occurs. For example, in an enclosed space, the explosive forces are contained, resulting in amplification of the maximum pressure. For many years, it was thought that BOP only damaged the auditory system and gas-filled organs of the respiratory and gastrointestinal systems. However, since the late 1990's and early 2000's, physicians and researchers alike have established that exposure to non-lethal levels of BOP can inflict mild to serious damage to the neurological system characteristic of traumatic brain injury (TBI). Approximately 80% of the casualties among service members serving in Iraq and Afghanistan have been caused by improvised explosive devices (IEDs). From 2000 to 2011, the total number of military personnel affected by TBI was reported to be over 220,000. A study published in 2011 revealed that 43% of combat veterans with documented TBI from blast exposure also suffered from previously undiagnosed closed eye injuries. In 7% of the patients, the degree of damage to the eye was considered to be serious enough that immediate or delayed loss of vision was possible without medical intervention. Another study reported that 33% of patients with cranial injuries treated at combat support hospitals in Iraq also had concomitant ocular injuries. Of all the patients seen for cranial and/or ocular trauma, 65% had been wounded by IEDs.

As seen in Figure 1, the blast shock tube at the Ocular Trauma Division at the Army Institute of Surgical Research has been used for biological research protocol of Dr. Heuy-Ching H. Wang to determine the acute or chronic effect of BOP for vision system and ocular tissues. Cell apoptosis of the retina and the optic nerve after blast exposure has been reported at the annual meeting of Military Vision Symposium, ARVO, Military Health System Research Symposium (MHSRS) and these findings have been accepted for publication in the Journal of Military Medicine under the title: "Pathophysiology of blast-induced ocular trauma with apoptosis in the retina and optic nerve". Future studies will be performed to better understand battlefield eye injuries. Simulation of BOP tests with animal experimentation can provide scientists with crucial information to understand injury mechanisms, targets, and timing which will allow identification of potential protective or therapeutic measures to mitigate blast-related visual injury.

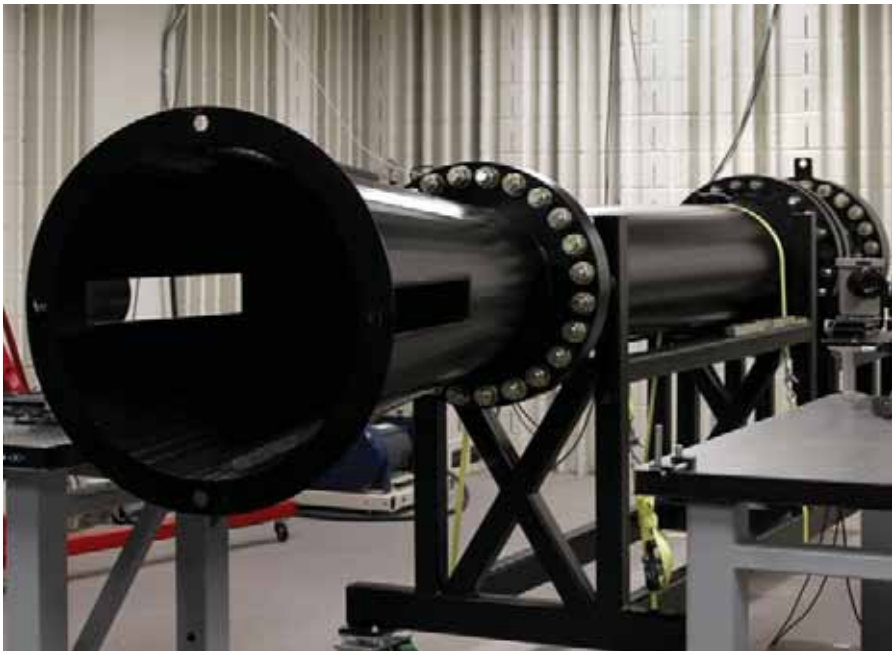


Figure 1: Blast Tube located at United States Army Institute of Surgical Research, JBSA, Fort Sam Houston, Texas

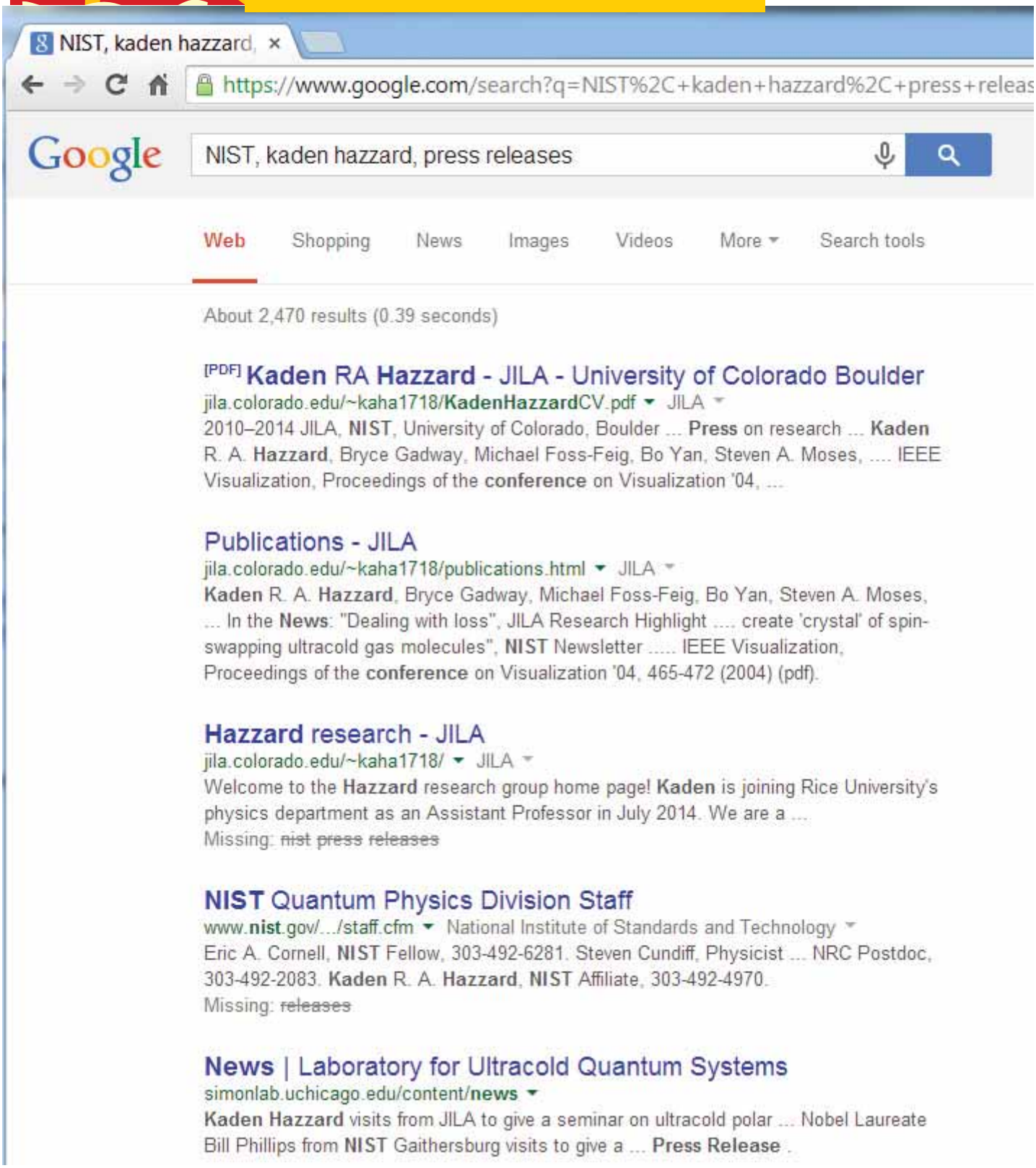
Dr. Jae hyek Choi
NRC Associate
USArmy

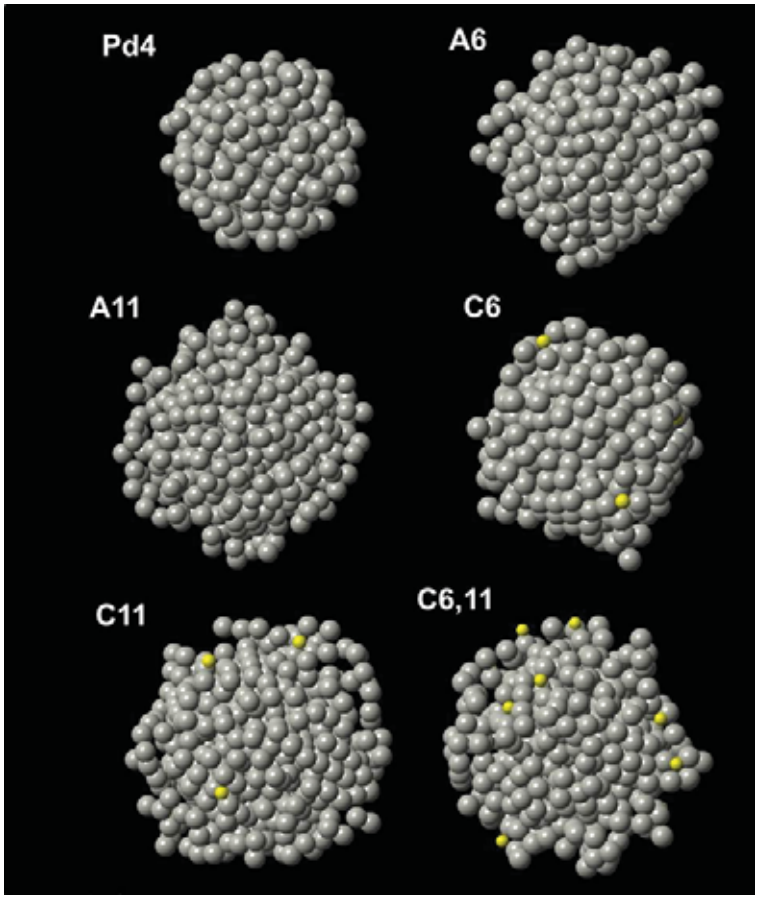
Dr. Heuy-Ching H. Wang
NRC Adviser
USArmy

Spotlight on NIST NRC Research

Kaden Hazzard

https://www.google.com/search?q=NIST%2C+kaden+hazzard%2C+press+releases&oq=NIST%2C+kaden+hazzard%2C+press+releases&aqs=chrome..69i57.12288j0j8&sourceid=chrome&es_sm=122&ie=UTF-8





AFRL NRC Associate & Adviser uncover structure / function relationships in bio-inspired nanomaterials for sensing, optics, and energy applications

In his 1954 work, *The Nature of Science*, Edwin Powell Hubble said, ***"Equipped with his five senses, man explores the universe around him and calls the adventure Science."*** During his tenure with the **Air Force Research Laboratory (AFRL), Dr. Nick Bedford**, **NRC Associate,** embarked on such an adventure that applied both biological and physical principles prevalent in the world around him to uncover scientific phenomena and understanding.

"For over millennia, nature has devised methods for the creation of hierarchical nano/micro scale inorganic structures under benign aqueous conditions," Dr. Bedford explained.

Figure 1. Reverse Monte Carlo fitting of the high-energy X-ray diffraction data showing the effect of the various peptides on the palladium nanocrystals. The yellow dots indicate the sulfur atoms for the cysteine residues in the peptide that interact with the Pd atoms

"The precise synthesis and arrangement of biogenic inorganic materials is only achievable because of the level of functional and structural sophistication found in biomolecules such as proteins, peptides, and nucleic acids. Inspired by such processes, the material science community has seen a significant increase in the use of biological molecules to create nanomaterials."

"Further, scientists recognize that by exploiting the inherent complexity/programmability of peptides, it may be possible to achieve tunable materials functionality and spatial arrangement by simple alteration of the amino acid sequence", Dr. Bedford added. ***"However, such precise nanoscale control can only be accomplished if a thorough understanding of biotic/abiotic interactions is known."***

With this understanding, **Dr. Bedford came to Dr. Rajesh Naik, NRC Adviser at AFRL**,with whom he'd collaborated during a Dayton Area Graduate Studies Institute fellowship program. The NRC Adviser suggested he submit the proposal to AFRL via the **NRC Postdoctoral Research Associateship program**. Dr Naik and his team at the Materials and Manufacturing Directorate at AFRL are actively engaged in understanding the design rules that govern the interaction between biomolecules and abiotic materials such as metal, carbon nanomaterials and polymers.

"The proposal scored well and I was invited to begin working in March 2013," Dr. Bedford said.

The collaborative research effort is already yielding results that represent a critical step forward to fully understand the complete biotic/abiotic scope of materials, and uncovering fundamental science that has never previously been understood.

According to Dr. Bedford, the discovery has the potential to enhance the properties and change the structures of materials allowing them perform in different and better ways. Uncovering better, stronger materials with enhanced capabilities is of paramount importance to Air Force scientists working towards next generation aerospace systems.

Until now, experimental and theoretical techniques have been used to help understand peptide surface morphology at this critical interface, yet virtually nothing is known about the underlying inorganic structure. ***"Research I conducted with peers at AFRL, Argonne National Laboratory, the University of Miami, Florida, University of Akron, Central Michigan University and Brookhaven National Laboratory illuminates the precise relationships and interactions at the biotic/abiotic interface and within the inorganic nanomaterial,"*** Dr. Bedford said.

Using synchrotron radiation characterization techniques, Bedford and collaborators at AFRL can determine atomic scale structural differences in nanoparticles generated with peptides of varying amino acid diversity. ***"Using bio-inspired Palladium (Pd) nanocatalysts as a model system, we were able to generated nanoparticle configurations by modelling atomic pair distribution functions (PDF), obtained from high-energy X-ray diffraction data, using a reverse Monte Carlo (RMC) algorithm."***

"Potential structural differences caused by slight changes in the amino acid content of the capping peptide, ultimately have a direct impact on the catalytic activity," Dr. Bedford added.

continued on next page

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Dr. Nick Bedford, NRC Associate

"The results from the RMC fitting, shown in the accompanying figure, corroborate this hypothesis, demonstrating different amounts of surface disorder for each peptide analog. Such structural information is important, as it can help elucidate sequence dependent structure/function relationships needed to create a nanomaterial with tunable properties."

While peptide-capped Pd is a noteworthy material in terms of its catalytic properties, other bio-inspired materials are also being studied in a similar manner to obtain universal and material specific peptide induced structure/function relationships. These materials include Gold, and Titania with applications in sensing, optics, energy storage and energy harvesting.

Moving forward, computational methods will also be used in conjunction with atomic PDF data to help determine the morphology of the peptide on these surface disordered structures. With the combined diffraction/computational characterization efforts, it is envisioned that a set of "design rules" will be developed for the creation of highly programmable nanomaterials and nanomaterial assemblies, potentially allowing for creation nanomaterials with the precision of nature.

Dr. Rajesh Naik, NRC Adviser

Dr. Bedford and his collaborators are currently completing a research paper and will publish their discoveries. In the meantime Dr. Bedford is searching for new opportunities and weighing his career options as an independent researcher, in academia or at another government laboratory.

"The opportunity, collaborations and freedom this NRC associateship provided were extremely valuable and fruitful," Dr. Bedford admitted. ***"The result is the discovery of new, fundamental science nobody knew about."***

Toward Enhanced MIQE Compliance: Reference Residual Normalization of qPCR Gene Expression Data

Abstract

Normalization of fluorescence-based quantitative real-time PCR (qPCR) data varies across quantitative gene expression studies despite its integral role in accurate data quantification and interpretation. Identification of suitable reference genes plays an essential role in accurate qPCR normalization because it ensures uncorrected gene expression data reflect normalized data. The reference residual normalization (RRN) method presented here is a modified approach to conventional $2^{-\Delta\Delta Ct}$ qPCR normalization that increases mathematical transparency and incorporates statistical assessment of reference gene stability. RRN improves mathematical transparency through the use of sample-specific reference residuals (RR_i) that are generated from the mean thresh old cycle (C_t) of one or more unaffected (i.e., stable) reference gene(s). To determine stability of putative reference genes, RRN employs analysis of variance (ANOVA) to assess the effect of treatment on expression and subsequent equivalence threshold testing to establish the minimum permitted resolution. Step-by-step instructions and comprehensive examples that demonstrate the influence of reference gene stability on target gene normalization and interpretation are provided. Through mathematical transparency and statistical rigor RRN promotes compliance with Minimum Information for Quantitative Experiments (MIQE) and, in so doing, provides increased confidence in qPCR data analysis and interpretation.

Authors: Richard C. Edmunds, Jenifer K. McIntyre, J. Adam Luckenbach, David H. Baldwin and John P. Incardona

Citation: Edmunds, et al., 2014. Toward Enhanced MIQE Compliance: Reference Residual Normalization of qPCR Gene Expression Data. *Journal of Biomolecular Techniques* 25(2): 10.7171/jbt.14-2502-003.

Available online:http://jbt.abrf.org/index.cfm/page/jbt_early_access.htm

Dr. Richard C. Edmunds, NRC Associate, NOAA

NRC Associate enables mobile energy solutions for AFRL

The utilization of solar energy represents an important approach to helping meet the U.S. Air Force's future mobile energy needs. Although organic photovoltaic (OPV) devices offer ease of materials processing, low cost, and physical flexibility, they have power conversion efficiencies (PCEs) of only 5 to 10 percent. These efficiencies are below those of silicon devices (15 to 20 percent) due to OPV's exciton dissociation and charge carrier recombination problems.

OPV devices using single-walled carbon nanotubes (SWNTs) offer the potential to significantly increase PCEs beyond the current state-of-the-art through better exciton dissociation at the nanotube/conjugated polymer interface, and better charge transport due to the large aspect ratio of SWNTs and an effective semiconducting nanotube network.

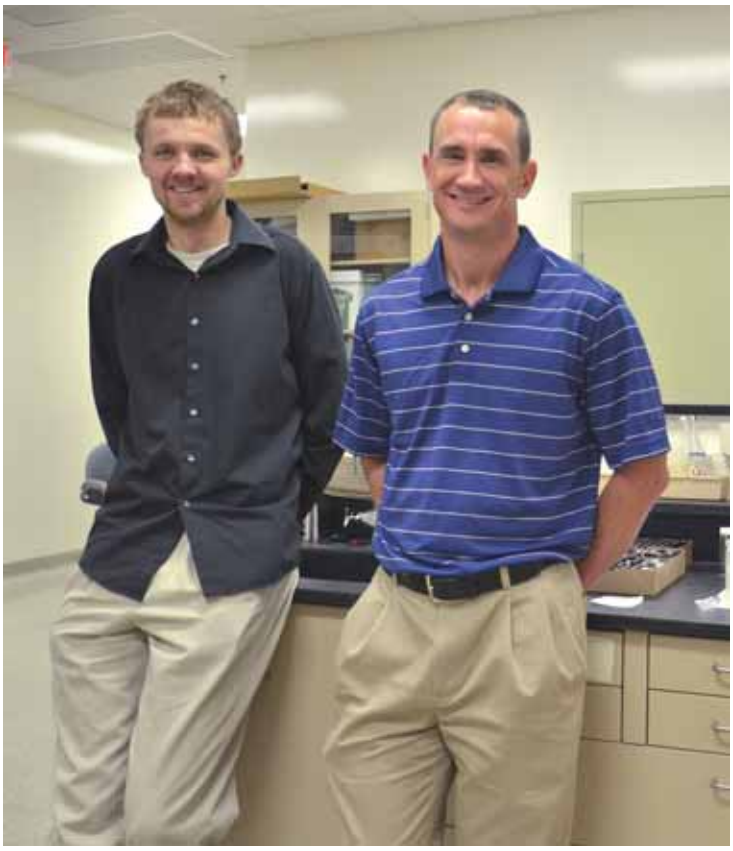
However, severe problems associated with bulk nanotube mixtures have led to poor PCEs in all previous SWNT OPV devices. Recognizing this challenge, **Dr. Ryan Kohlmeyer**, **NRC Postdoctoral Research Associate at Air Force Research Laboratory (AFRL) ,** addressed the issue using single-chirality semiconducting SWNTs in OPV devices, which he believes will lead to a substantial improvement in PCEs.

Originally from Wisconsin, Dr. Kohlmeyer was hired as a contractor at AFRL's Materials and Manufacturing Directorate following his doctoral studies in organic chemistry at the University of Wisconsin Milwaukee. Although initially a chemist, Dr. Kohlmeyer considers himself more a materials scientist now and focuses his research and development activities on carbon-nano and smart materials.

"These materials have the potential to revolutionize clean energy applications, leading to increased flight and lifetimes for Air Force systems, increased battery life, better photovoltaics, and a decreased logistical burden related to transporting and carrying batteries," Dr. Kohlmeyer said. ***"A great deal of the Air Force's current focus in these areas is on increased power conversion efficiencies, flexible substrates, and increasing power per unit mass to create solutions targeted towards real world applications."***

His collaborations with **Dr. Mike Durstock**, **NRC Adviser,** as well as other AFRL colleagues, provides Kohlmeyer with the opportunity to see technologies move from bench-level testing to larger scale applications, which he admits is a source of great personal pride. ***"There is a great opportunity to collaborate with incredibly talented and dedicated Air Force and industry researchers,"*** Dr. Kohlmeyer added.

As an example, Dr. Kohlmeyer said he is currently working with a robotics expert on a growth chamber for carbon nanotubes. ***"I believe that having access to incredible resources and people is where the solution to great scientific and technical challenges lies. AFRL has state-of-the-art facilities and the best and brightest minds the world has to offer,"*** he said.



L-R: Dr. Michael Durstock, NRC Adviser; Dr. Ryan Kohlmeyer, NRC Associate

Career Fair

8th Annual Postdoc Conference & Career Fair connects nation's brightest STEM talent with local companies

On April 24, 2014, an estimated 300 post doctoral fellows from over 80 institutions in the science, technology, engineering, and mathematics (STEM) fields from around the Mid-Atlantic region gathered at the Bethesda North Marriott Conference Center for the annual Postdoc Conference and Career Fair. There they met with STEM talent-seeking companies in hopes of furthering their careers. The hiring entities which participated in this industry-leading conference included:

Children's National Health Systems
Defense Threat Reduction Agency
FDA Center for Veterinary Medicine
I.M. Systems Group, Inc.
MedImmune, LLC.
MesoScale Diagnostics, LLC
Michelin North America
National Institute of Standards and Technology (NIST)
Noblis
Oak Ridge Associated Universities
SameGrain, Inc.
Schafer Corporation
Social & Scientific Systems, Inc.
Syracuse University
Technical Resources International, Inc.
The Henry M. Jackson Foundation
United States Pharmacopeial Convention
Westat, Inc.

	A	B	C	D
1	**How Many Citizens/Non US Citizens?**		**Totals :**	Percentage of total Respondents
2	Non US Citizens		153	49.4%
3	US Citizens		157	50.6%
4	Total Respondents		310	
5				
6	**Postdoctoral Field of Study**			
7	Astronomy		7	2.3%
8	Atmospheric and Hydrospheric Sciences		3	1.0%
9	Biological Sciences		151	49.0%
10	Chemical Engineering		8	2.6%
11	Chemistry		36	11.7%
12	Computing		5	1.6%
13	Electrical Engineering		2	0.6%
14	Engineering		5	1.6%
15	Geology and Geography		2	0.6%
16	Industrial Science and Technology		1	0.3%
17	Information		2	0.6%
18	Material Engineering		12	3.9%
19	Mathematics		4	1.3%
20	Mechanical Engineering		5	1.6%
21	Medical Sciences		28	9.1%
22	Other		6	1.9%
23	Other Engineering		1	0.3%
24	Physics		27	8.8%
25	Psychology		2	0.6%
26	Societal Impacts of Science and Engineering		1	0.3%
27	Total Respondents		308	

The conference provided postdocs with a wealth of job searching, networking, and professional development skills sessions, along with access to potential job opportunities. The educational conference ran concurrently with the career fair, and featured panels and speakers on such topics as interviewing skills, preparing for an industry career, networking for scientists, working for large or small companies, and steps to taking an entrepreneurial path.

Beyond the hiring companies recruiting at this year's event, the Postdoc Conference & Career Fair also featured participation from myriad resource organizations, which provided postdocs with information on programs and opportunities available to them at both the regional and national level. This year's participating resource organizations were:

"The Postdoc Conference allows scientists, engineers and others to discover new opportunities and offers a venue for employers to meet highly talented people. I first attended the event as a postdoc and found my current job, not even knowing ones like it existed" says Ziggy Majumdar, Ph.D. who now works at Booz Allen Hamilton. ***"It is a great opportunity for networking and to learn from people that have been in your shoes searching for a satisfying career path. I highly recommend the conference and career fair for job seekers, employers and Ph.D.'s interested in learning about a wide variety of career paths."***

The Postdoc Conference and Career Fair is organized by a group of volunteers from federal and university laboratories, local businesses and economic development organizations.

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Institutions Represented		
American Dental Association Foundation	1	0.3%
Alabama A&M University	1	0.3%
Alfred University	1	0.3%
Armed Forces Radiobiology Research Institute	1	0.3%
ASDAS	1	0.3%
Auburn University	1	0.3%
Center for Biologics Evaluation and Research	1	0.3%
Chungbuk National University	1	0.3%
Colorado State University	1	0.3%
Coppin State University	1	0.3%
Food & Drug Administration	4	1.3%
Feinstein Institute for Medical Research	2	0.6%
Federal Highway Administration	1	0.3%
Geophysical Laboratory, Carnegie Institution of Washington	1	0.3%
George Washington University	2	0.6%
Georgetown University	1	0.3%
Goddard Space Flight Center	1	0.3%
Henry Jackson Foundation	1	0.3%
Howard Hughes Medical Institute at University of Maryland, Baltimore County	2	0.6%
Howard University	3	1.0%
Indiana University	1	0.3%
INRS Institut Armand-Frappier	1	0.3%
Institute for Bioscience and Biotechnology Research	1	0.3%
Institute of Human Virology, University of Maryland School of Medicine	1	0.3%
The John Hopkins Medical Institute	9	2.9%
The Johns Hopkins School of Public Health	1	0.3%
The Johns Hopkins University	18	5.8%
Laboratory of Cell Biology, Division of Monoclonal Antibodies	1	0.3%
Leidos Biomedical Research, Inc.	1	0.3%
MedImmune	1	0.3%
NASA Goddard Space Flight Center	2	0.6%
National Cancer Insititute-Frederick	17	5.5%
National Center for Advancing Translational Sciences (NCATS)	1	0.3%
National Eye Institute	1	0.3%
National Heart Lung and Blood Insitute (Office of Technology Transfer and Development)	18	5.8%
National Institues of Health	72	23.2%
National Institute of Alcohol Abuse and Alcoholism	1	0.3%
National Institute of Allergy and Infectious Diseases (NIAID)	5	1.6%
National Institute of Biomedical Imaging and Bioengineering	2	0.6%
National Institute of Neurological Disorders and Stroke	3	1.0%
National Institute of Standards & Technology	33	10.6%
National Institute on Drug Abuse	2	0.6%
National Institute of Child Health and Human Development	2	0.6%
Naval Research Laboratory	3	1.0%
National Human Genome Research Institute	2	0.6%
NIBIB (National Institute of Biomedical Imaging and Bioengineering)	2	0.6%
National Institute of Diabetes Diagestive and Kidney Diseases	2	0.6%
NOAA/National Ocean Service	1	0.3%
Ohio State University	1	0.3%
Other	1	0.3%
Oak Ridge Associated Universities	1	0.3%

Career Fair

Institutions Represented		
Penn State University	1	0.3%
Purdue University	1	0.3%
Shenandoah University	1	0.3%
Space Telescope Science Institute	2	0.6%
Stevens Institute of Technology	2	0.6%
Temple University	1	0.3%
U.S. National Library of Medicine	1	0.3%
U.S. Naval Research Lab	1	0.3%
Uniformed Services University	4	1.3%
University of Akron	1	0.3%
University of Arizona	1	0.3%
University of Bradford	1	0.3%
University of Calgary	1	0.3%
University of California, Davis	1	0.3%
University of Illinois at Urbana-Champaign	1	0.3%
University of Maryland at College Park	17	5.5%
University of Maryland Baltimore County	12	3.9%
University of Maryland School of Medicine	6	1.9%
University of Pennsylvania	1	0.3%
University of Puerto Rico	1	0.3%
University of Richmond	1	0.3%
University of Tennessee	1	0.3%
University of Texas at Austin	1	0.3%
University of Virginia	1	0.3%
US Army Medical Reserach Institute of Infectious Diseases	2	0.6%
United States Deparment of Agriculture	1	0.3%
University of Texas El Paso	1	0.3%
Veterans Affairs Medical Center	1	0.3%
Virginia Commonwealth University	6	1.9%
Virginia Commonwealth University Medical School	1	0.3%
Weinberg Medical Physics	1	0.3%
Yale University	1	0.3%
Total Respondents	310	

NRL material that makes self-decontaminating clothes may also purify biofuel

The military wants fabrics that don't just filter out nerve agents and other toxins, but also self-decontaminate. **Dr. Brandy White**, **Naval Research Laboratory (NRL) Center for Biomolecular Science and Engineering**, is making materials that capture entire classes of contaminants, then break them down into something harmless. Her technology is stable and can be used for clothing, air filters, or even coated on windows and vehicles.

Today's filters are carbon—like in your water pitcher at home, or in military suits and gas masks. Carbon is great at capturing and holding contaminants—but they're still there. ***"You still can't take that suit and go to a populated place. The fabrics that we're talking about with my coating, they grab it and they hold it in just like carbon would, but then they convert it into something else."***

As U.S. Marines moved in on Baghdad in 2003, they were wearing hot, unbreathable, full-body suits day and night. When they were finally able to take off their Mission Oriented Protective Posture (MOPP) gear, you can imagine how it felt to have air circulation for the first time in weeks—and then you can just imagine the smell. ***"If they've actually been exposed to something, then putting on their MOPP gear no longer protects them, they're just trapping it all inside. So the idea behind this type of fabric was it could be used to give them time to get their MOPP gear on."***

White's made chemical materials that target a wide range of classes. She's also, at a lab-scale, bonded them to fabrics and powders to verify their potential for military or commercial applications. White's research complemented efforts by the Defense Threat Reduction Agency (DTRA) to think beyond just clothes. "If you think about air filters," she says, "like for your HVAC system at home, you have those pleated things. That's a fabric." With filters to break down airborne toxins at every air intake, a terrorist couldn't expose an entire building.

Or industry could use such filters to reduce ammonia smells in hospitals and improve air quality around industrial processes. "Air purification technology could be in the ductwork of the building, it could be on stack gases for exhaust from industrial processes."

Because her material also works when wet, "You can capture the organics out of your waste stream and make your water safe." She's already proven, with perchlorate, that she could help industry and federal agencies monitor and cleanup water pollutants.

Better than carbon: applications for military and industry

Carbon materials bind both things you care about and things that are totally harmless, then stop working once saturated. White's materials are specific, so ***"you can use all of your space for the things that you care about and you don't bind things that don't matter, like perfume off the guy standing next to you."***

Because her materials also break down targets naturally, they don't become saturated and have to be thrown out. Depending on the target and with a little time, she says, ***"it can go to complete mineralization, which means you get products like water and CO2 [carbon dioxide] and things like that."*** In water, the harmless products are released; in air, they move away from the active site so target capture can continue. She's put these chemical material wonders into useful formats, including a powder that goes into a gas mask; a surface coating for windows or electronics; or ***"you dip fabric through them, so the material's covalently part of the fabric; not just a coating on the fabric."*** By dipping fabric through different sorbents, or layering different fabrics, or mixing multiple powders, she can screen for and breakdown multiple target classes. She's also working with another group at NRL on a portable sensor, ***"about the size of a soda can."*** The sensors quantitatively measure concentrations of a target. She adds, ***"They will Wi-Fi communicate so you can use them for perimeter monitoring."***

The applications for the combat environment are so promising, in part because White's material is washable and stable in extreme conditions. ***"This is what I know,"*** she says. ***"I know that you can stick them out in a July sun at 100 degrees for a week and nothing about their performance characteristics changes. As far as I can tell, the materials are identical to when I stuck them out there."*** This is true whether they are dry or in water.

The chemistry: a sorbent structure with porphyrin photocatalysts

White's chemistry starts with an organosilica sorbent, which has an organized, very porous structure. ***"That means that they have solid parts and they have open air parts," she says. "The solid parts give you binding affinity."*** The open pores give ***"lots of surface area, [which] means lots of binding sites."*** With colleague Brian Melde, she designs specific pockets or imprints for the target into the skeleton-like structure.

continued on next page

Dr. Brandy White, former NRC Associate at NRL Now, NRC Adviser

http://www.nrl.navy.mil/media/news-releases/2014/clothes-that-self-decontaminate-nrl-material-may-also-purify-biofuel#sthash.v9ZHZRc3.dpuf

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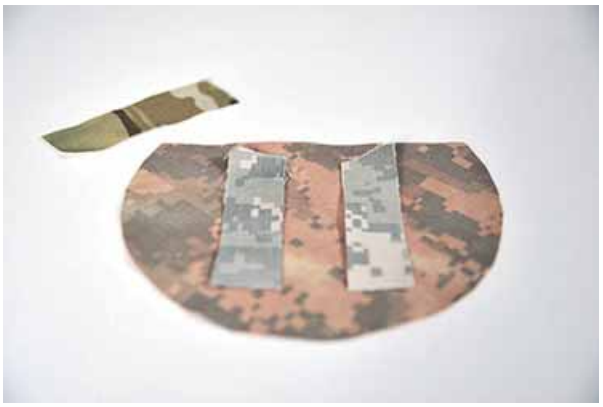


Dr. Brandy White's sorbent-porphyrin materials work for fabrics, and can be coated on hard surfaces or used in sensors. Wet or dry, "I know that you can stick them out in a July sun at 100 degrees for a week and nothing about their performance characteristics changes." She's looking into potential for biodiesel purification. ***(Photo: U.S. Naval Research Laboratory/Jamie Hartman)*** -

To make the structure even better at capturing her target, she adds specific precursors to the sorbent. ***"The precursor gives you the chemical affinity that you're looking for, so that might be a benzene group or it might be an ethane group or some mixtures of those things."***

With a process she's patented, she then couples a porphyrin into the organosilica structure. ***"The sorbent part captures the material and pulls it in close to where we've immobilized the porphyrins within the material,"*** she says, ***"and the porphyrin takes light and converts the molecule into something that's less toxic." "Porphyrins are all of a basic shape that's very similar,"*** she says. ***"You've got double bonds running around everywhere,"*** which makes them good at photocatalysis. The porphyrins absorb light, then transfer energy to the target to break it down.

Choosing from the library of commercially available porphyrins she keeps in the lab, ***"I can screen 96 porphyrin variants at a time to look for affinity for the targets that I'm interested in."*** Adding a coordinated metal can further increases reactivity.

The photocatalysis happens under any light conditions; but, says White, ***"more blue is better."*** Without light, the system will eventually stop. ***"However, you can pass a current through the materials to restart catalysis." And it doesn't have to be a lot. "We're only using 9 volt batteries."***

White's materials are class-specific. ***"So if I design a material that will bind organophosphonate pesticides, it will also bind sarin and VX [nerve agents] and compounds with a similar structure."*** She's made sorbent-porphyrin materials for a range of targets, including nerve agents, blister agents (like mustard gas), and nitroenergetics (explosives, like TNT).

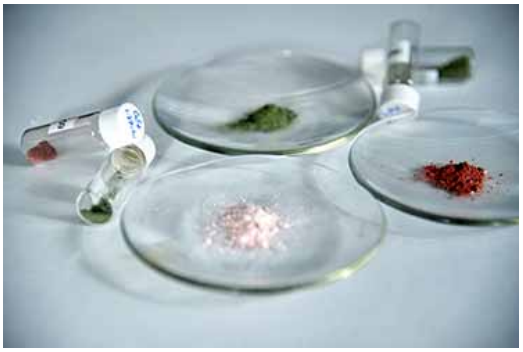
She's also made them for toxic industrial chemical (TIC)/ toxic industrial material (TIM) targets, as listed by the Department of Defense (DoD) Chemical and Biological Defense Program TIC/ TIM Task Force and for first responders by the National Institute of Standards and Technology (NIST). ***"Industrial waste products in stack gases fall into this class of targets,"*** she says.

"The risk of something is assessed based on how bad it would be if you were exposed to it and how likely it would be that someone could initiate that attack." As an example, ***"You could breathe some ammonia, you probably do it when you clean your house,"*** says White, ***"but if you breathe more it can make your lungs uncomfortable, it can start to cause damage to you, and it's really easy for people to get their hands on."*** VX may be more dangerous; but it's also harder to make and less stable to move around.

A better biodiesel? NRL evolves with military requirements, future threats

White continues to expand the types of targets against which she can defend with a class-specifically designed material. DoD calls emerging threats non-traditional agents. She has the agility, expertise, and resources to ever evolve our defenses. ***"There's always a new threat. I know how to make materials, I know what they're going to behave like."***

White's PhD is in photonics from Oklahoma State, and she's been at NRL since she came as a postdoc in 2004. She credits both the culture and access to federal funding across a wide variety of research areas for her achievements. ***"The culture at NRL is fantastic, because we all loosely interact within divisions and across divisions."*** She's also quick to say she's never felt, as a young woman in science, any kind of disadvantage. ***"If you look at my division, we are more than 50 percent female. It's a special division."***



The porphyrin-functionalized organosilicate sorbents Dr. Brandy White desgined at NRL capture and break TIC/TIM and other targets down into things that are harmless. ***"Air purification technology could be in the ductwork of the building, it could be on stack gases for exhaust from industrial processes,"*** she says.
(Photo: U.S. Naval Research Laboratory/Jamie Hartman

Recently, White began a project to purify biodiesel. ***"There's been a big push recently within the Navy to switch to alternative fuels,"*** she says. The Navy and Marine Corps already run ships and jets on biofuel blends. But part of the expense of biofuel is due to the purification process. White's already shown she can capture nitroenergetics from water. Her idea is to do something similar to purify biodiesel: ***"To design sorbents to capture the things out of the slurry that impact stability and cold weather performance."*** Her concept would be more efficient, and reduce waste water associated with the washing process. ***"In three years,"*** she says, by the time the project's funding has ended, ***"I hope to have been able to demonstrate that I can take unprocessed biodiesel and capture out the things that need to be captured so that it will pass the ASTM*** **[American Society for Testing and Materials]** ***standard."***

In memory of … Alex Vergara Tinoco

Dr. Alexander Vergara Tinoco, 35, a NRC Postdoctoral Research Associate in MML's Biomolecular Measurement Division, collapsed after jogging in Querétaro, Mexico, on March 8 and died of a heart attack. A citizen of Mexico who had permanent-resident status in the U.S., he was visiting Mexico to look into a possible university position.

Vergara came to NIST in the summer of 2012 as a fellow of the **joint NIST/NIH NRC postdoc program** to carry out research on artificial olfaction, also known as electronic nose technology. In simple terms, his research involved using chemical microsensors to detect or "smell" particular chemicals. His two-year postdoctoral fellowship was scheduled to end in July 2014.

His work was focused not only on detecting chemicals, but on learning how to do it as fast as possible. ***"Alex developed new methods with the potential to make artificial nose devices detect chemicals more than 10 times faster than before,"*** says physicist Steve Semancik, leader of NIST's Chemical and Biochemical Microsensor Program, who was Vergara's research advisor. Rapid detection is important if artificial olfaction technology is eventually to be used in process-control applications or to detect chemical or explosive hazards, for example, in airports.

Vergara was extremely interested in the cross-disciplinary relationship between National Institutes of Health research focused on how insects sense chemicals and his NIST work centered on artificial chemical detection.

Vergara published 31 original research papers and three book chapters, and edited the book *Improving the* Administration *Performance of Micro-Machined Metal Oxide Gas Sensors*, which was published by VDM Verlag in 2009. He presented 42 talks at meetings around the world.

Nine days after his death, attendees of the International Meeting on Chemical Sensors in Buenos Aires, Argentina, commemorated Vergara as ***"one of the rising stars of the chemical sensors community."***

"Alex was kind. He was a great team player," says Semancik. ***"He made an incredible number of friends throughout Building 221 [at NIST Gaithersburg]. Alex wasn't loud but he was very friendly, and he made friends with scientists who were working on projects quite different than his own. When NIST staff got the news of his death, it was touching how many people came to me to express their condolences."***

Vergara graduated with a B.S. in electronic engineering from Mexico's Durango Institute of Technology, and earned an M.S. and Ph.D. in electronic engineering from Spain's Rovira i Virgili University.

He went on to conduct research in the electronic engineering departments of the Rovira i Virgili University and Italy's University of Rome II. He also worked briefly for the government of Mexico under the Secretary of Education and Culture, taught at Mexico's Autonomous University of Durango, and worked as a supervisor for maintenance and quality engineering at General Motors Mexico/Mitsubishi Co./Armas Group.

His first postdoctoral position in the U.S. was in the Bio-Circuits Institute of the University of California, San Diego, in the years before he came to NIST. Vergara worked long hours, from 7:30 a.m. to 6:30 or 7 p.m., typically eating his lunch while working at his computer, says his office mate, NIST associate Maria Lorna De Leoz, a research chemist.

He knew several languages—Spanish, English, Italian, French, and Catalan. ***"I would hear him talk on the phone in Spanish, put down the phone, call another person and talk to them in Italian,"*** says De Leoz, who adds that Vergara gave flowers to his wife every week. Away from work, Vergara loved spending time with his family, going to the movies, travelling, running (he finished a marathon in 2012), watching soccer, drinking Coca-Cola Light (with every meal), and joking around with people he liked.

He is survived by his wife Joanna, his parents Vincente and Juana, his brother Jaime Vincente, and his sisters Evelyn and Juana Berenice. At the time of this writing, conference and journal tributes are being planned to celebrate Vergara's contributions to the chemical sensor research community.

Dr. Alex Vergara Tinoco, NRC Associate, NIH/NIST

NPS high-energy laser research gets Navy attention

U.S Naval Academy, Naval Research Laboratory at Washington DC and SPAWAR San Diego extended invitations and scheduled back to back seminars by **Dr. Jonathan Gustafsson and Dr. Vaibhav Kukreja, National Research Council Associates at the Center for Decision, Risk, Controls and Signals Intelligence (DRCSI)** to get briefed on the ground breaking High Energy Laser research advances made by these two young NPS scholars. A dry run of their presentation was held at NPS on Wednesday May 14, at 10 AM-12 Noon in Herrmann Hall RM 410W to prepare them for the subsequent seminars and this session. A description of the scope of the research is given below.

- PART-I (NRC Fellow Dr. Jonathan Gustafsson): DRCSI has already successfully developed a software capability for the computational simulation of High Energy Laser and High Power Microwave propagation and beam control in diverse media, including in particular, propagation in maritime environment and deep turbulence. The purpose of this research is to validate this code against realistic naval operational conditions to assess lethality of power delivery at given distances. The project will also offers a comparison between ship mounted and airborne (helicopter mounted) Laser and microwave weapon viability. We can address issues such as: (1) Lethality (of a 50~100 KW Laser at 20 to 30 km) on small boat targets, cruise missiles and UAVs; (2) Constraints/limiting factors to increasing Laser energy in an airborne Laser pod; (3) Beam transmission and control in near and deep turbulence; (4) Trade & feasibility of peak output power (assumed at 1.06 micron wavelength) vs. beam quality, efficiency, scalability, power required.

- PART-II (NRC Fellow Dr. Vaibhav Kukreja): A second and very important task is off-axis detection of Laser attack by bi-static sensors based on atmospheric scattering of the beam. DRCSI has developed a software that can predict the initial power, geo-location and orientation of a high energy Laser attack based on off-axis sensor located kilometers away from the path of the beam. This capability is crucial for rapidly sensing enemy attack and also important for assessing the vulnerability of our own High Energy Laser system to enemy detection. This capability is also important in assessing blinding of pilots due to laser attack off-axis scattering.

Center for DECISION, RISK, CONTROLS & SIGINT (DRCSI)
https://www.nps.edu/Academics/Centers/DRCSI/

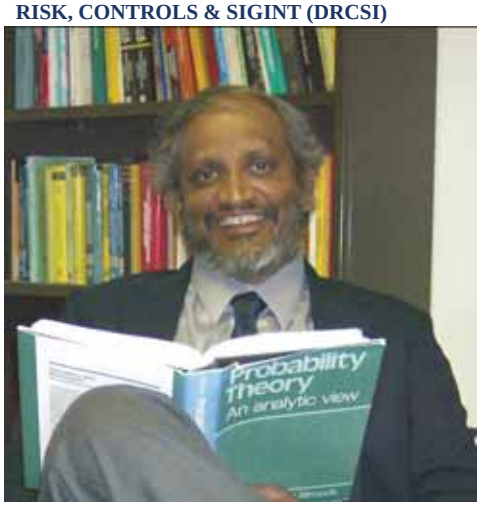
Herrmann Hall West, Room 415W
Naval Postgraduate School
Ph: 831-656-2660.

NPS Vita: http://faculty.nps.edu/vitae/cgi-bin/vita.cgi?p=display_vita&id=1216324461

Google Scholar: http://scholar.google.com/citations?user=XYwmvdoAAAAJ&hl=en

Mathscinet: http://www.ams.org/mathscinet/search/publications.html?pg1=IID&s1=226666

Dr. Sivaguru S. Sritharan, NRC Adviser; also Director of NPS Center for DECISION, RISK, CONTROLS & SIGINT (DRCSI)



Solar power & microbes energize AFA biology program

Microorganisms have adapted to live in the many different environments that exist on our planet, from mundane conditions under which humans live to more exotic environments found in the deepest oceans or hottest springs in Yellowstone. In every case, survival depends upon microbial metabolism, often taking on unusual forms in order to profit from the particular chemistries offered by the local environment. Although fascinating in its own right, microbial metabolism often provides unique opportunities that researchers can exploit for the generation of fuels, or environmental sensing. Several aspects are currently under investigation at the United States Air Force Academy Department of Biology, including the further development of microalgae for liquid fuels, including biojet fuels, and the investigation of microorganisms capable of communicating with electrodes, either for use in microbial fuel cells (MFCs), or for the development of sensing devices with exquisite sensitivity and specificity. In the long term, ongoing research could lead to renewable, sustainable production of liquid fuels, robust miniaturized threat detection, remote power generation, increased organic-inorganic electrical connectivity, and increased design capabilities for increasing protein/enzyme stabilities. >>

Back row, left to right: Cadet Stephen Beaton, Dr Don Veverka, LSRC Director, Cadet Mark Williford, Cadet Danny Hicks, Front row, Dr Patrick C. Hallenbeck, NRC Senior Research Associate, Ms Megan Mraz, Lab Technician

Ongoing research will expand in the near future to the isolation and study of extremophiles that are active in MFC type devices, thanks to a recently awarded research grant from AFOSR for a collaborative project, the "Mechanistic Basis for Biological Polymer Stability, Electron Transfer and Molecular Sensing in Extreme Environments," between USAFA, Montana State and the Colorado School of Mines. In conjunction with the start of this project, one cadet is spending part of the summer at Montana State, learning methods in expressing and purifying proteins from select thermophilic enzymes of interest. It is anticipated that extremophilic organisms will be isolated and characterized which may well have novel mechanisms for electronic coupling with their environment and with inorganic electrode materials.

Dr. Patrick C. Hallenbeck, NRC Senior Research Associate at the Life Sciences Research Center (LSRC), Department of Biology, USAFA, uses his expertise in microbial metabolism and the physiology of photosynthetic micro-organisms at USAFA, to engage in several projects whose aim is to adapt the natural photosynthetic capacity of micro-organisms to the production of alternative energy sources, both liquid fuels and electrical energy. Studies underway have elucidated the effects of media components on growth and lipid production and a series of optimization studies have determined the best conditions of light intensity, inoculum size and carbon dioxide concentration for biomass production by a well-studied marine microalga. His work has expanded to the isolation and characterization of photosynthetic organisms from local extreme environments, hot springs and acid mine run-off. Dr. Hallenbeck presented his work at the American Society for Microbiology (USA, 2013), the Zing Conference on Hydrogen and Fuel Cells (USA, 2013) and has been invited to make presentations at the International Union of Microbiological Societies (Canada, 2014), the World Hydrogen Energy Conference (South Korea, 2014) and the Asia Biohydrogen and Biorefinery (ABB) Symposium (Malaysia, 2014).

The Life Sciences Research Center's primary mission is to support the Air Force Office of Scientific Research (AFOSR) basic research program though faculty and cadet research efforts. The United States Air Force Academy (USAFA) has a long-term vision to establish a multi-year alternative energy program of planning, research and infrastructure investment. This vision involves a mix of research and alternative energy production in solar electric, geothermal, waste to energy, hydropower and other multiple conservation efforts. The USAFA LSRC has begun a Biosystems Research Program, focusing on the use of MFCs in alternative energy production. In conjunction with this, the LRSC has established research partnerships with the Colorado School of Mines and Montana State University to develop the bacterial and photosynthetic properties of extremophiles for optimizing energy production. Researchers know relatively little about energy transformation within these biosystems. One goal is to establish a deeper, comprehensive knowledge of how photosynthetic organisms can be used to capture solar energy for conversion to chemical energy or electrical energy in such emerging technologies such as bioelectrochemical systems. This research would be in direct support of AFOSR research objectives that include the "exploration of natural and synthetic processes, mechanisms and/or pathways for understanding energy production in biosystems." A special aspect includes significant involvement of cadets, either through the Cadet Summer Research Program (CSRP) where cadets travel to various sponsoring institutions or through Independent Study Projects conducted throughout the academic year.

NRC Associate (now Adviser), Jeffrey Long — DoD NRL "Laboratory Scientist of the Quarter"

Dr. Jeffrey W. Long, former NRC Associate, now NRC Adviser at NRL, and staff scientist in the Surface Chemistry Branch of the Chemistry Division, has been selected as the first recipient of the Department of Defense's "Laboratory Scientist of the Quarter" Award. Mr. Frank Kendall, Under Secretary of Defense for Acquisition, Technology, and Logistic, presented the award in a special ceremony at the Pentagon on April 18. Also in attendance were Mr. Alan Shaffer (Principal Deputy, Assistant Secretary of Defense for Research and Engineering), Dr. John Fischer (Director, Defense Laboratories Enterprise), Rear Admiral Matthew Klunder (Chief of Naval Research), as well as Dr. Long's entire NRL chain of command. The Laboratory Scientist of the Quarter Award was recently established to recognize outstanding achievement by mid-career individuals within the Department of Defense science and technology work force.

NRL's Dr. Jeffrey Long receives the inaugural DOD Laboratory Scientist of the Quarter Award. From left to right, Dr. Bhakta Rath, RADM Matthew Klunder, Dr. Richard Colton, Dr. John Montgomery, Mr. Frank Kendall, Dr. Jeffrey Long, Dr. Michelle Anderson, Mr. Alan Schaffer, Dr. John Russell, Jr., and Dr. Debra Rolison.

Dr. Long engages in basic and early applied research projects at the NRL that focus on the development, characterization and validation of advanced nanostructured materials that enhance the performance of military-critical technologies ranging from electrochemical power sources to air filtration. The present award specifically recognizes Dr. Long's advancements in the field of electrochemical energy storage (EES), where his recent work has centered on redesigning the electrodes used in electrochemical capacitors (a.k.a., "supercapacitors") and Zn-air batteries to impart unprecedented pulse-power capability, efficiency, and rechargeability.

A fundamental roadblock in advancing EES for pulse power has been retention of a high-power capability in the electrochemical device, while simultaneously increasing areal-specific energy storage. Dr. Long was the first to recognize this could be accomplished by using self-limiting deposition protocols to apply nanometers-thick conformal coatings of charge-storing materials (electroactive polymers or metal oxides) at the surfaces of ultraporous carbon "nanofoam" scaffolds. His innovation made it possible to rapidly charge and discharge these otherwise modest electron conductors (the oxide or polymer) by maintaining nanoscale proximity to the highly conductive network of the carbon nanofoam and ensuring efficient electrolyte flux via the through-connected pore network of the nanofoam. He is currently building prototype electrochemical capacitors comprising manganese and iron oxide-modified nanofoams as the active positive and negative electrodes, respectively, and a moderate-pH aqueous electrolyte in a device that can supply tens of Farads of capacitance in seconds, operating over a 2-Volt window.

NRL's Dr. Jeffrey Long receives the inaugural DOD Laboratory Scientist of the Quarter Award. From left to right, Dr. Bhakta Rath, RADM Matthew Klunder, Dr. Richard Colton, Dr. John Montgomery, Mr. Frank Kendall, Dr. Jeffrey Long, Dr. Michelle Anderson, Mr. Alan Schaffer, Dr. John Russell, Jr., and Dr. Debra Rolison. ***(Photo: U.S. Navy)***

Dr. Long further recognized that lessons learned from the development of electrochemical capacitors could be extended to the redesign of the air-breathing cathode used in the Zn-air battery, a military-validated portable power source that is highly desired because of its excellent energy density and safety. Using nanoscale manganese oxide on carbon nanofoams to provide a repository of charge capacity, Long and his colleagues demonstrated that true pulse-power bursts can be delivered from thier redesigned air cathode, even under conditions where oxygen supply is temporarily disrupted. This new "dual function" air cathode solves one of the remaining roadblocks to realizing high-performance Zn-air batteries.

Dr. Long received his bachelor's degree in Chemistry from Wake Forest University in 1992, and his doctorate in Chemistry from the University of North Carolina at Chapel Hill in 1997. He came to NRL as a National Research Council Postdoctoral Associate in 1997, working with Dr. Debra Rolison. He was hired as a staff scientist in the Advanced Electrochemical Section in 2000. While at the NRL he has served as principal investigator, co-principal investigator, and team member on multiple internal NRL programs and on external projects supported by Office of Naval Research, Defense Advanced Research Projects Agency, Defense Threat Reduction Agency, and Advanced Research Projects Agency-Energy. Other notable recognition includes the Edison Patent Award (2012), Berman Publication Awards (2000, 2010, 2013), the R. A. Glenn Award (2007) and A. K. Doolittle Award (2009) from the American Chemical Society, "Young Investigator" awards from the NRL-Edison Chapter of Sigma Xi (2004), the Society for Electroanalytical Chemistry (2004), and the 6th International Symposium on Aerogels (2000).

http://www.nrl.navy.mil/media/news-releases/2014/nrls-dr-jeffrey-long-selected-as-inaugural-dod-laboratory-scientist-of-the-quarter#sthash.DUx1Avz1.dpuf

NRC NRL Adviser elected SPIE Fellow

Dr. Weilin (Will) Hou, center NRC Adviser and oceanographer with NRLSSC (U.S. Naval Research Laboratory Stennis Space Center), has made significant contributions to the field of ocean optics. His focus on underwater visibility and optical turbulence has resulted in the recent breakthrough on quantifying the impacts of underwater turbulence on optical transmission for the first time. One of the aspects of Hou's work that shows his exceptional breadth of knowledge and experience has been the mixture of theory and laboratory work with field collections. He has experience in both manned and unmanned ocean vehicles and understands their utility as sensor platforms. He gathers a variety of sensors into an integrated package to investigate difficult optical problems, collects the data, and then has the deep level of understanding to relate the theory to the real-world data. Will is able to complete these scientific accomplishments while managing and directing a team of researchers participating on these projects.

A leader in ocean optics research, Hou has published over 60 journal and conference proceeding papers, 6 books and 4 patents. He actively serves the optical community by reviewing papers, chairing conferences and editing proceeding volumes. Hou makes himself available to young professionals through frequent visits to colleges and universities to deliver invited talks. He also actively promotes STEM (Science Technology Engineering and Math), by mentoring students through Science and Engineering Apprenticeship Program, Naval Research Enterprise Internship Program, NRC and ASEE postdoctoral programs, and serving as a judge for numerous science fairs from elementary school to high school, from Tampa to New Orleans, for the past twenty years.

Hou has been an author and speaker at SPIE conferences since in the early 1990s. He developed and chaired the Ocean Sensing and Monitoring conference since 2008, and is the editor/co-editor of Proc. SPIE 8724, 8372, 8030, 7678 and 7317. He has also developed and taught the SPIE short course “Introduction to Optical Oceanography”, and written a book titled Ocean Sensing and Monitoring: Optics and Other Methods for the course. He is a reviewer for Optical Engineering, and the author/co-author of 16 papers in SPIE journal and conferences proceedings. He is the guest editor for Optical Engineering on the subject of ocean optics.

NRLSSC Press Release!

Professionals from related fields looking for insights and students needing an introduction to optical techniques for remote sensing of the ocean and ocean engineering will find answers in *Ocean Sensing and Monitoring: Optics and Other Methods*, a new book published by SPIE, the international society for optics and photonics.

Author **Dr. Weilin (Will) Hou, NRC Adviser and oceanographer with NRLSSC (U.S. Naval Research Laboratory at Stennis Space Center)**, starts with an overview of oceanography and presents the background, basic principles, and insights on the latest developments in the field needed to develop these systems.

Optical remote sensing technologies provide the ability to monitor short- and long-term changes in coral reefs, deep-sea fisheries, and off-shore oilfields, and to supply real-time information about seismic activity, water conditions, and equipment functionality.

Because there are many specialized areas in oceanography, Hou takes a narrative approach and focuses on the science and reasons behind methods and approaches to ocean science. A significant portion of the book uses sketches and illustrations to convey ideas -- ideal for readers who are professionals from related fields or students exploring careers in remote sensing of the ocean or ocean engineering.

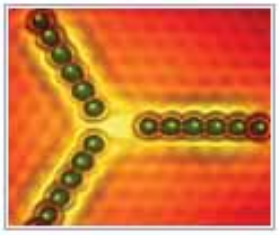
An overview of ocean research includes physical, chemical, biological, and geological oceanography as well as biogeochemistry. Basic optical properties of the ocean are discussed, followed by underwater and remote sensing topics including diver visibility; active underwater imaging and its comparison to sonar; ocean color remote sensing; and separate chapters on lidar, microwave, and infrared remote sensing techniques. The book concludes with a discussion of platforms and instrumentation, and integrated solutions and future needs in ocean sensing and monitoring.

"I believe, and I hope, we can work hard to explore new technologies to adapt different advances in the underwater environment to benefit society," said Hou in an SPIE Newsroom video interview.

Dr. Weilin Hou and fellow NRL SSC oceanographer Bob Arnone, have cochaired a conference on Ocean Sensing and Monitoring as part of the annual SPIE DSS Defense + Security symposium since 2008. The next conference: May 5-9, 2014 in Baltimore, Maryland.

NRL Media Highlights

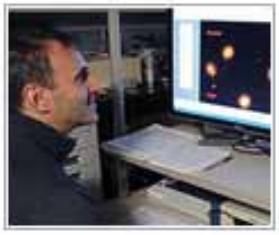
Scientific & Technical Interest



June 29, 2014

Researchers Create Quantum Dots with Single-Atom Precision

NRL physicists have joined with researchers from Germany and Japan, using a scanning tunneling microscope to create quantum dots with identical, deterministic sizes. This achievement opens the door to quantum dot architectures completely free of uncontrolled variations, an important goal for technologies from nanophotonics to quantum information processing as well as for fundamental studies.



June 11, 2014

Inspired by Combat Amputees, NRL is First to Image Cell Protein Secretions in Real-Time

Dr. Marc Raphael, a physicist at the U.S. Naval Research Laboratory (NRL), leads a team that has become the first to image protein secretions from cells in real-time using live-cell microscopy. A major breakthrough for biology and medicine, they've invented a way to put protein-specific nanosensors on microscope coverslips; the sensors change in brightness as the cell sends proteins into its environment.

May 1, 2014

The GelMan Quest: NRL Materials Science Informs Helmet and Armor Design

"GelMan" is not the latest comic book superhero—though he has been: shot at, stood near explosions, dropped from towers, and been held underwater. Made up of synthetic bones and soft tissue, the GelMan surrogates help U.S. Naval Research Laboratory (NRL) Materials Science and Technology Division scientists understand how helmets and armor protect our real heroes in uniform.

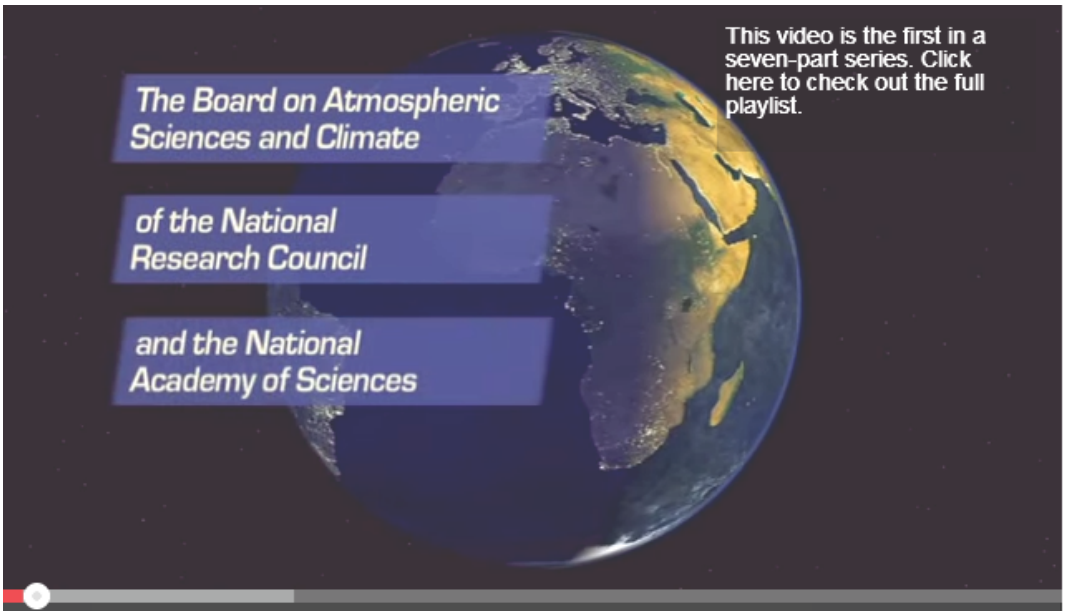
- Naval Research Laboratory
- Naval Research Laboratory
- Octavia the Robot
- Naval Research Laboratory
- Naval Research Laboratory
- Naval Research Laboratory
- NRL News Releases

NAS NRC
(National Academy of Sciences/ National Research Council)
Video Highlight

http://www.youtube.com/watch?v=qEPVyrSWfQE&list=PL38EB9C0BC54A9EE2

What is Climate? Climate Change, Lines of Evidence:

http://www.youtube.com/watch?v=qEPVyrSWfQE&list=PL38EB9C0BC54A9EE2



NRC RAP Website Highlight

http://sites.nationalacademies.org/pga/rap/

Explore Among 26 Programs — **Participating Agencies** — http://nrc58.nas.edu/RAPLab10/Opportunity/Programs.aspx

Name	Abbreviation	Reviews
Air Force Research Laboratory	AFRL	All
Armed Forces Radiobiology Research Institute	AFRRI	All
Army Aviation & Missile Research, Development, & Engr Center	AMRDEC	All
U.S. Army Medical Research & Materiel Command	AMRMC	All
U.S. Army Research Laboratory	ARL	All
Army Research Laboratory - U.S. Military Academy	ARL/USMA	All
U.S. Army Research Office	ARO	All
Chemical and Biological Defense Funded Laboratories	CBD	All
U.S. Army Edgewood Chemical Biological Center	ECBC	All
U.S. Environmental Protection Agency	EPA	All
EPA/Faculty Fellowship Program	EPA/FFP	All
FAA-Civil Aerospace Medical Institute	FAA/CAMI	All
Federal Highway Administration	FHWA	All
US Army Corps of Engineers Institute for Water Resources	IWR	All
Naval Marine Mammal Program	MMP	All
National Energy Technology Laboratory	NETL	All
Methane Hydrates Fellowship Program	NETL/MHFP	Feb., Aug.
National Institute of Standards and Technology	NIST	Feb., Aug.
Naval Medical Research Center/Naval Health Research	NMRC/NHRC	All
National Oceanic & Atmospheric Administration	NOAA	All
Naval Postgraduate School	NPS	All
Naval Research Laboratory	NRL	Feb., May, Aug.
U.S.Army Natick Soldier Research, Development & Engr Center	NSRDEC	All
U.S. Army Res, Dev & Eng Com/Armament Res, Dev & Eng Ct	RDEC/ARDEC	All
U.S. Army Research, Development & Engineering Command, NVESD	RDEC/NVESD	All
U.S. Army Criminal Investigation Laboratory	USACIL	All

2014 SCHEDULE

February Review

February 1	Application deadline
February 15	Deadline for supporting documents (transcripts/letter of recommendation)
March 18	Review results finalized
March 25	Review results available to applicants

August Review

August 1	Application deadline
August 15	Deadline for supporting documents (transcripts/letter of recommendation)
Sept 19	Review results finalized
Sept 26	Review results available to applicants

May Review

May 1	Application deadline
May 15	Deadline for supporting documents (transcripts/letter of recommendation)
June 20	Review results finalized
June 27	Review results available to applicants

November Review

Nov 1	Application deadline
Nov 15	Deadline for supporting documents (transcripts/letter of recommendation)
Jan 5, 2015	Review results finalized
Jan 12, 2015	Review results available to applicants

Join your LinkedIn group!

http://www.linkedin.com/groups?gid=4109187&trk=hb_side_g

Or...

NRL Extended Video http://www.nrl.navy.mil/media/videos/nrl-extended video

Competitive awards are available for scientists and engineers to conduct independent research in federal laboratories and affiliated institutions. Awards include attractive stipends, health insurance, professional travel and relocation.

Story of NRL's world-class science and technology