Tech Publication Awards 2019

JULY 2019 | RESTON, VA

2019 Publication Award Categories

3D Nonlinear Calculation of the 2017 North Korean Nuclear Test

Jeff Stevens | Michael O'Brien

Winner of the 2019 Publication Prize for Best Publication

Published in Seismological Research Letters, August 2018

Seismic waves from the North Korean nuclear tests are affected by the strong topography at the test site. We estimate the yield of the 2017 test as 180 kt and perform a calculation of the explosion. We calculate large displacements of 2–4 m on the mountain surfaces near the explosion, consistent with observations. The North Korean explosions generate much larger surface waves than are expected based on surface waves from underground explosions in other areas. Calculations show that explosions at the base of a mountain have amplified surface waves, which explains part of the anomaly. The remaining anomaly is explained by a negative bias in the global data set, caused by nonlinear free surface interaction and compressive tectonic release. We find that topography increases the amplitude of the surface reflected pP phase for all events at this test site; however, the effect is reduced for the 2017 explosion because of strong nonlinear interaction with the free surface.

> …The topic (North Korean Nuclear Test) is of such significance, not just for science, but for world affairs, that it does not require elaboration. It is so gratifying to see hard science of such high quality being put to the public service..

Kinetic energy reconstruction with a single layer particle telescope

Martin Kroupa | Carey Zeitlin

Winner of the 2018 Publication Prize for Physical Sciences

Published in Applied Physics Letters, March 2018

We demonstrate the implementation of a low-mass, single-layer pixel detector as a multicomponent telescope for measuring the kinetic energy of charged particles. Rather than relying on several separate detection layers, we utilize the detector's individual pixels as the basis for multiple sampling of the stopping power of a particle under a shallow incidence angle. We present results from a single layer device corresponding to nearly 50 telescope layers. As the measured dE/dx response is highly stochastic, we utilize a maximum likelihood approach for which we calculate a probability function in the energy domain for each interacting particle. Using accelerator data, we show the limitations of the single-component approach and the advantages of our single-layer, multiple-sampling technique. Inferred energy spectra from accelerators show high accuracy and precision for protons with kinetic energies up to 400 MeV. For higher energies, the low energy limit is still very accurate.

> …[This is] the kind of work Leidos is known for - solid numerical physics solving a problem - creating innovative solution.

Nonlinear Simulation of a Rogue Wave and its Impact on a Ship

Thomas O'Shea | Devin Conroy | Donald Wyatt | Robert Hall

Winner of the 2019 Publication Prize for Physical Sciences

Published in Proceedings of the 32nd Symposium on Naval Hydrodynamics, August 2018

Rogue waves are known to cause a significant amount of damage to naval vessels as a result of the large induced pressures on the hull during the wave's impact. The slamming loads are so severe that they can cause buckling and tearing of the outer hull, which can result in large repair and replacement costs. We believe this sudden appearance is due to a particular set of circumstances known as dispersive focusing. Nonlinear effects steepen the wave packet and slow its dispersion, similar to their effects in an envelope soliton. In this paper we outline an approach to simulate a rogue wave in an ambient wave field and how to use it to initialize a fully non-linear Computational Fluid Dynamics (CFD) code. We test our strategy on the evolution of a Joint North Sea Wave Project (JONSWAP) spectrum wave field with a container ship and discuss the effect of the wave's impact on the hull.

There is a very high "wow" factor in this, particularly in the analysis which leads to computationally-accurate graphics of the wave-ship interaction. Their approach is inventive, unique, and rigorous.

Elevated HLA-A expression impairs HIV control through inhibition of NKG2A-expressing cells.

Maureen P. Martin | Yuko Yuki | Gregory Q. Del Prete
Douglas K. Schneider | Jeffrey D. Lifson
Mary Carrington

Winner of the 2019 Publication Prize for Life & Health Sciences and Medicine, LBR Track

Published in Science, January 2018

The highly polymorphic human leukocyte antigen (HLA) locus encodes cell surface proteins that are critical for immunity. HLA-Aexpression levels vary in an allele-dependent manner, diversifying allele-specific effects beyond peptide-binding preference. Analysis of 9763 HIV-infected individuals from 21 cohorts shows that higher HLA-A levels confer poorer control of HIV. Elevated HLA-A expression provides enhanced levels of an HLA-A-derived signal peptide that specifically binds and determines expression levels of HLA-E, the ligand for the inhibitory NKG2A natural killer (NK) cell receptor. HLA-B haplotypes that favor NKG2A-mediated NK cell licensing (i.e., education) exacerbate the deleterious effect of high HLA-A on HIV control, consistent with NKG2A-mediated inhibition impairing NK cell clearance of HIV-infected targets. Therapeutic blockade of HLA-E:NKG2A interaction may yield benefit in HIV disease.

Versatility of the adenovirus-vectored foot-and-mouth disease vaccine platform across multiple foot-and-mouth disease virus serotypes and topotypes using a vaccine dose representative of the AdtA24 conditionally licensed vaccine

Jose Barrera | Barbara Kamicker
Mariceny Zurita | Melia Pisano

Winner of the 2019 Publication Prize for Life & Health Sciences and Medicine

Published in Vaccine, October 2018

Foot-and-Mouth Disease (FMD) afflicts livestock and threatens global food security and trade because FMD is endemic in Eurasia, Asia, and Africa. FMD virus (FMDV) is the most infectious animal virus, and due to its poor fidelity during replication, variants arise quickly, e.g. during an outbreak. Therefore, we need multiple vaccines covering the major FMDV strains. The adenovectored FMD vaccine platform (AdtFMD) can be tailored quickly to react to FMDV changes by incorporating the new outer capsid coding sequences. For cattle clinical trials, we constructed and tested 16 AdtFMD vaccines targeting 12 FMDV strains. All AdtFMD vaccines were immunogenic in ~90% of 375 cattle on the day of FMDV infection. Importantly, the vaccines prevented FMD at commercially viable doses. This comprehensive set of FMD vaccine studies highlights the versatility of the AdtFMD vaccine platform for further development, licensure, and application in FMD outbreak control and disease eradication efforts.

> The research addresses a significant unmet need to identify a veterinary FMD vaccine that is able to protect against the wide range of FMD serotypes/topotypes.

Agnostic detection of genomic alterations by holistic DNA structural interrogation

John Dresios | Rachel Abrams
Challise Sullivan | Thomas Thompson

Winner of the 2019 Publication Prize for Life & Health Sciences and Medicine

Published in Plos One, November 2018

In this work, we exploit the relationships between primary DNA sequence, secondary and tertiary chromatin structure, and transcriptional activity, to show that multidimensional DNA organization analysis can be used to identify a wide range of genomic alterations in mammalian samples. We characterized and compared genome-wide histone occupancy, DNA accessibility, and chromosomal conformation for six CRISPR/Cas9-modified samples and their parent strains. We found that the impact of genomic alterations on each level of DNA organization varied depending on mutation type, size, and location. The largest alterations we identified included chromosomal rearrangements and deletions in four of the modified samples, which can be difficult to identify by standard whole genome sequencing analysis. This multi-level analysis provides a novel approach for identifying exposure to a wide range of environmental and physiological factors that can be utilized for biomedical and biosecurity applications.

> … a significant … work describing the…methodology for detecting certain mutation types (large base-pair insertions, deletions, or translocations) that are difficult to detect using whole genome sequencing.

Acceleration-induced pressure gradients and cavitation in soft biomaterials

Wonmo Kang

Winner of the 2018 Publication Prize for Engineering

Published in Nature, Scientific Reports, October 2018

The transient, dynamic response of soft materials to mechanical impact has become increasingly relevant due to the emergence of numerous biomedical applications, e.g., accurate assessment of blunt injuries to the human body. Despite these important implications, acceleration-induced pressure gradients in soft materials during impact and the corresponding material response, from small deformations to sudden bubble bursts, are not fully understood. Both through experiments and theoretical analyses, we show that the local pressure in a soft sample is proportional to the square of the sample depth in the impact direction. The critical acceleration that corresponds to bubble bursts increases with increasing gel stiffness. Bubble bursts are also highly sensitive to the initial bubble size. Our study gives fundamental insight into the physics of injury mechanisms, from blunt trauma to cavitation-induced brain injury.

> ...an important topic - has real world applications to understanding potential brain injuries and implications in the design of protective gear.

High Reynolds Number Stratified Wakes: Comparisons of Numerical Simulations with Field Experiments

Devin Conroy | James Rottman | Laura Brandt

Winner of the 2019 Publication Prize for Engineering

Published in Proceedings of the 32nd Symposium on Naval Hydrodynamics, August 2018

Very little is known about turbulence in stratified wakes at high Reynolds number, Re ≥ 106 (Re = UD/v, where U is the speed of the sphere, D is the diameter of the sphere and v is the kinematic viscosity of the fluid). In the present study the computational fluid dynamics code "Numerical Flow Analysis", Rottman et al. (2010), is used to simulate the turbulent wake generated by a sphere moving through a realistically stratified ocean (weak stratification) at high Reynolds number. These simulations are compared with the high Reynolds number experimental results reported by Brandt and Kalumuck (2016). In these experimental studies detailed turbulent velocity and temperature measurements were made in the nearfield wake of a sphere towed in a weakly stratified reservoir. In all cases, the -5/3 energy cascade is present in the inertial subrange indicating that the simulations and experiments have consistent energy transfer.

> The research contributions address real-world needs and rely on simulation technology that is being implemented and refined, and on a data collection measurement apparatus created by the authors… these flow simulations are likely to have a significant impact on naval design.

The Leidos Technical Publications Competition could not have been conducted without the expert review of the following members. This review committee comprises members of the Leidos Technical Fellows Community (LTFC) and senior members of Leidos Biomedical Research (LBR). Their deep knowledge spanning the diverse fields of study reported in these peer-review publication venues drives the award selection process, which enables Leidos to spotlight these authors as among the most creative and well-recognized researchers in the scientific community.

Steve Auerbach
Rakesh Bahadur
Trent Balius
Eckart Bindewald
Bill Bocik
Chris Case
Raj Chari
Ana Cheng
Noah Christian
Mark Delong
Marina Dobrovolskaia
John Dresios
Joe Dudley
Chuck Fralick
Robert Franceschini
Len Freedman
Bill Gillette
Meghan Good
Jim Hartley
Tina Holden-Anderson
Augie Ifarraguerri
David Keever
Eric Keydel
David Lindsay
Xi Liu (Hill)
Keith McLaughlin
John Mears
Katea Murray
Dwight Nissley
Amy Noe
Laura Peitersen
John Petillo
Vlad Popov
Dave Pratt
Mary Quinn
Julie Rosen
David Rubenstein
Bill Samuels
Ananthakrishna Sarma
Robert Shaw
Dan Soppet
Andy Stephen
Jeff Stevens
Greg Strauch
Sergio Torres
Jim Trolier
Yaroslav Tsybovsky
Greg Wade
Xiaolin Wu
Donald Wyatt
Convers Wyeth
Ferit Yegenoglu

NOTES:

NOTES:

LinkedIn: Leidos

Facebook: Leidosinc

YouTube: Leidosinc

Twitter: @Leidosinc

leidos