The Neutron Scattering Society of America

http:///www.neutronscattering.org

The Neutron Scattering Society of America is pleased to announce the 2018 recipients for its four major prizes.

Prof. Samuel A. Werner
University of Missouri &
National Institute of Standards and Technology

is the recipient of the

2018 Clifford G. Shull Prize

of the Neutron Scattering Society of America (NSSA) with the citation:

"For his seminal contributions to the observation of the fundamental quantum-mechanical nature of spins through the effects of rotation and the gravitational field, using neutron interferometry, including the observation of the Aharonov-Casher effect, for his extensive work with neutron scattering on the magnetic properties of transition metals and their alloys, for his critical role in the NSSA, particularly as its Founding President, and for his wide and lasting influence on the neutron community, including nurturing of many neutron scientists."

Prof. Samuel A. Werner

The Neutron Scattering Society of America (NSSA) established the Clifford G. Shull Prize in Neutron Science to recognize outstanding research in neutron science and leadership promoting the North American neutron scattering community. The prize is named in honor of Prof. Clifford G. Shull, who received the Nobel Prize in 1994 with Prof. Bertram Brockhouse for seminal developments in the field of neutron science. The establishment of the prize was announced at the inaugural American Conference on Neutron Scattering (ACNS) in 2002.

The nominations were reviewed by a committee of experts in the field of neutron science and the NSSA is pleased to announce that the recipient of the 2018 Shull Prize is Prof. Samuel A. Werner, of the University of Missouri & National Institute of Standards and Technology. The prize and a $5000 honorarium will be awarded at the 2018 ACNS in College Park, MD, June 24-29, 2018 (http://www.mrs.org/acns-2018).

"It is a wonderful honor to receive the 2018 Shull Prize given by the NSSA, an organization very dear to my heart," said Prof. Werner. "Cliff Shull was a good friend and an inspiration for my work in neutron physics. This award is actually a recognition of the many people who were my collaborators, students and friends in neutron scattering research over more than 50 years. The list is very long. Collaborations with Helmut Rauch in Vienna, Austria and with Tony Klein in Melbourne, Australia were especially important to our success in neutron interferometry."

Prof. Werner was a key international leader in the development of neutron interferometry facilities and techniques. He has originated other methods as well, including the first use of double silicon crystals for small angle neutron scattering, a technique now widely employed for USANS instruments. Prof. Werner played a major role in the neutron research community by serving on key national committees on the development and assessment of neutron facilities, and as founding president (1993-1996) of the NSSA.

In his long, distinguished career in neutron-based research, Prof. Werner has carried out experiments in major facilities over the world on a wide variety of subjects. He is particularly well-known for his work on Neutron Interferometry. With co-author Helmut Rauch, Prof. Werner has published the major book on the subject (*Neutron Interferometry: Lessons in Experimental Quantum Mechanics*, now in its second edition).

Probing quantum mechanics using neutron waves, Prof. Werner carried out a remarkable neutron interferometry experiment to detect the neutron's phase shift due to the Earth's rotation (neutron Sagnac effect) at the University of Missouri. Even more remarkable was the experimental observation of the topological Aharonov-Casher effect by the Missouri-Melbourne group, in which a neutral fermion in the static electric field encircling a line charge accumulates a phase change predicted only by quantum mechanics (the analogue of the Aharonov-Bohm effect). This *tour de force* series of measurements at the Missouri reactor required delicately sustained (over periods of a month and more) conditions for each setting. He continued these neutron interferometry experiments with the first observation of the scalar Aharonov-Bohm effect.

In condensed matter science, Prof. Werner is renowned for his neutron scattering research, for example on the magnetic behavior of the *3d* correlated electron system Cr, and for showing that dilute alloys of Mn in Cu exhibit spin density wave behavior rather than spin-glass behavior.

Prof. Werner earned his Ph.D at the University of Michigan and then worked as Adjunct Professor there, as well as Staff Scientist at the Ford Motor Company, before becoming a Professor of Physics at the University of Missouri in 1975. He is now Professor Emeritus at the University of Missouri and a Guest Researcher at the Neutron Physics Group at NIST. Prof. Werner is a Fellow of the NSSA, the American Physical Society, and the American Association for the Advancement of Science.

Prof. Norman Wagner
University of Delaware

is the recipient of the

2018 Sustained Research Prize

of the Neutron Scattering Society of America (NSSA) with the citation:

"For his seminal and sustained contributions to our understanding of soft condensed matter physics using neutron scattering."

Prof. Norman Wagner

The Neutron Scattering Society of America (NSSA) established the Sustained Research Prize to recognize a sustained contribution to a scientific subfield, or subfields, using neutron scattering techniques, or a sustained contribution to the development of neutron scattering techniques. The primary consideration is an enduring impact on science. Preference is given to nominees whose work was carried out predominantly in North America.

The nominations were reviewed by a committee of experts in the fields to which neutron scattering contributes. The NSSA is pleased to announce that the 2018 recipient of the Sustained Research Prize is Prof. Norman Wagner of the University of Delaware. The prize and $2500 honorarium will be awarded at the 2018 ACNS in College Park, MD, June 24-29, 2018 (http://www.mrs.org/acns-2018).

Prof. Wagner is an internationally recognized expert on neutron scattering methods applied to complex fluids and soft matter. In addition to his own scientific accomplishments using neutron scattering, Prof. Wagner is a leader in the development and world-wide deployment of specialized SANS sample environments for exploring soft materials and complex fluids under shear flow.

Prof. Wagner is best known for his research on non-equilibrium thermodynamics, at the interface of SANS and rheology, and its concomitant impact on both research fields. His group pioneered several rheo- and flow-SANS methods including spatio-temporal resolved SANS, electric-field assisted self-assembly with SANS, and dielectric-rheo-SANS. Having pioneered these methods, Prof. Wagner's group has used them extensively in revealing novel phenomenology. His group has applied rheo- and flow-SANS to understand the microstructural basis of the rheology of liquid crystalline polymers, colloidal dispersions, polymer blends, multilamellar vesicles, block-copolymer micelles and branched wormlike micelles. His group developed neutron spin echo methods to measure the dynamics and, from theory, extract key topological properties of wormlike micellar solutions and novel, self-assembled peptide networks. Novel applications of time-resolved SANS measurements were used to study self-assembly of colloidal dispersions by flow, block-copolymer self-assembly by dynamic oscillation and electric-field driven self-assembly of colloidal crystals.

Prof. Wagner's group developed the method of SNAFUSANS (scanning narrow aperture flow USANS) to make the first measurements of concentration-flow coupling by transmission USANS measurements. These enabled creation of the first full non-equilibrium phase diagram for shear-banding induced by paranematic formation in wormlike micelles. His group also used neutron reflectometry and SANS to map out the first non-equilibrium state diagram for adhesive hard-sphere model dispersions, which is a "hydrogen atom" of colloidal systems for understanding phase behavior and gelation in colloidal and protein systems.

Most recently, Prof. Wagner's collaborative research with Dr. Yun Liu addresses the phenomenon of reversible cluster formation in colloids and proteins, such as monoclonal antibodies, by a novel combination of SANS and neutron spin echo measurements. Additional research identified critical criteria for stabilizing membrane proteins in protein-detergent complexes revealed by SANS. Prof. Wagner's current research into surfactant self-assembly in ionic liquids used SANS to discover the first sponge phases and spontaneous vesicle formation in such "green" solvents, as well as block-copolymer self- assembly in ionic liquids to create a new class of novel iono-elastomers.

Prof. Wagner earned his Ph.D. at Princeton University and was a postdoc at Fakultät für Physik Universität Konstanz in Germany and Los Alamos National Laboratory before joining the faculty at the University of Delaware in 1991. He has received numerous awards and accolades for his research, including election to the National Academy of Engineering and the National Academy of Inventors, the Bingham Medal of the Society of Rheology, of which he is currently President-Elect, and Fellowship in the American Association for the Advancement of Science and the NSSA.

Prof. Dmitry Pushin
University of Waterloo

is the recipient of the

2018 Science Prize

of the Neutron Scattering Society of America (NSSA) with the citation:

"For the invention and application, in particular to neutron holography, of the five blade, decoherence-free interferometer"

Prof. Dmitry Pushin

The Neutron Scattering Society of America (NSSA) established the Science Prize to recognize a major scientific accomplishment or important scientific contribution within the last 5 years using neutron scattering techniques. Nominees must be within 12 years of receiving their PhD degree. Preference is given to applicants whose work was carried out predominantly in North America.

The nominations were reviewed by a committee of experts in the scientific areas to which neutron scattering contributes, and the NSSA is pleased to announce that the 2018 recipient of the Science Prize is Prof. Dmitry Pushin of the University of Waterloo. The prize and $2500 honorarium will be awarded at the 2018 ACNS in College Park, MD, June 24-29, 2018 (http://www.mrs.org/acns-2018).

Prof. Pushin is a preeminent early career scientist in the neutron interferometry community whose work has ranged widely across neutron physics and applications including far-field neutron phase contrast imaging, limits on dark energy, neutrino oscillations and long-range forces, the introduction of quantum-information concepts into neutron scattering and interferometry, the development of new beam lines at the NIST Center for Neutron Research, and precision measurements of scattering lengths.

Neutron interferometry exploits the wave nature of a neutron to measure subtle, minute quantum-mechanical effects on the neutron wave. This technique has provided stringent test of quantum mechanics including studies of the Aharonov–Bohm effect and the neutron version of the Sagnac effect. Neutron interferometry has also been used to demonstrate phase contrast imaging and for tests of the dynamical theory of diffraction. While it is by far the most precise means of exploring neutron interactions with matter, it is rarely used for this purpose as the instruments are very demanding to work with. This is primarily due to the extreme sensitivity to even miniscule vibrations of the interferometer which leads to decoherence, i.e. loss of signal. Prof. Pushin has directly addressed this shortcoming through the invention of the five-blade decoherence-free interferometer, the biggest technical advance in the field since the neutron interferometer was first invented more than 40 years ago.

To take full advantage of his invention, Prof. Pushin developed an entirely new neutron beamline to house his new interferometer. This new instrument is much more compact than the original neutron interferometer at NIST as it does not require massive vibration isolation equipment, including the sound-proof blockhouse of the original. Prof. Pushin has applied this new interferometer to address areas that were previously extremely difficult, or even impossible, thereby opening new areas of science to investigation using this exquisite tool. Prof. Pushin has been at the forefront of this new wave of neutron interferometry experiments, leading investigations into quantum information, searching for dark matter, and obtaining the first neutron hologram of a macroscopic object.

Prof. Pushin has also made important contributions to the development of far-field neutron interferometry and its application to phase-contrast imaging. Far-field neutron interferometry eliminates the alignment, stability, and fabrication challenges associated with the perfect-crystal neutron interferometer. This type of interferometer may lead to the ability to create tomographs of materials where each voxel contains a small angle scattering data for that region of the sample, thereby providing detailed microstructural information for heterogeneous systems.
In summary, Prof. Dmitry Pushin's work and discoveries are transforming neutron interferometry from a technique that produces excellent science in the hands of expert practitioners into a tool more accessible to the general scientific community, with broad applications to the physics of the standard model, materials science, and biomolecular systems.

Prof. Pushin earned his Ph.D. from the Massachusetts Institute of Technology in 2006 and continued there as a postdoctoral fellow until taking up a joint position as Research Assistant Professor at the University of Waterloo and the National Institute for Standards and Technology in 2010. In 2017 Prof. Pushin took his current position as Assistant Professor of Physics at the University of Waterloo. His work has been recognized by the American Physical Society as a "Top Ten Physics Newsmakers of 2016" and as a Nature "News and Views" article (*Nuclear Physics: Neutrons with a twist*).

Dr. Alannah Hallas
McMaster University

is the recipient of the

2018 Prize for Outstanding Student Research

of the Neutron Scattering Society of America (NSSA) with the citation:

"For her exploration of new families of quantum pyrochlore magnets and elucidating their phase behavior and excitations using forefront neutron scattering techniques."

Dr. Alannah Hallas

The Neutron Scattering Society of America (NSSA) established the Prize for Outstanding Student Research to recognize outstanding accomplishments in the general area of neutron scattering by graduate or undergraduate students who have performed much of their work at North American neutron facilities. Nominees must be either current graduate students or scientists within two years of receiving their PhD.

The nominations were reviewed by a committee of experts in the field of neutron science and the NSSA is pleased to announce that the recipient of the 2018 Prize for Outstanding Student Research is Dr. Alannah Hallas, Ph.D. from McMaster University, and currently a postdoctoral fellow at Rice University. The prize and $1000 honorarium will be awarded at the 2018 ACNS in College Park, MD, June 24-29, 2018 (http://www.mrs.org/acns-2018).

Dr. Hallas was an exceptional Ph.D. student, jointly supervised by Profs. Chris Wiebe, Graeme Luke and Bruce Gaulin, who has been working at the boundary between materials physics and chemistry. Her research focused on forefront elastic and inelastic neutron scattering techniques applied to topical problems in exotic magnetic ground states, mainly involving geometric frustration. Her main project involved the synthesis and characterization of new pyrochlore compounds through high pressure techniques. The pyrochlore lattice is a structure type which exhibits strong magnetic frustration that often leads unconventional magnetic ground states. Alannah succeeded in preparing about a dozen new pyrochlore materials while on a visit in Japan, working almost completely independently. These materials have been investigated using neutron scattering in a series of publications, with a particular highlight being two Physical Review Letters as first author on $Tb_2Ge_2O_7$ and $Er_2Pt_2O_7$.

The neutron scattering work she was involved in required the use of a wide range of new forefront instrumentation for neutron scattering, primarily at Oak Ridge National Laboratory and NIST, but also at the Institute Laue Langevin and the FRM II Reactor in Germany. It also included a wide range of neutron scattering applications, using both time-of-flight inelastic scattering, triple axis inelastic scattering, and sophisticated neutron diffraction, both polarized and unpolarized, from both single crystals and powder samples of topical materials –and mostly from materials which she synthesized herself.

To date she has co-authored a remarkable 25 publications in total, mostly in Phys. Rev. B and Phys. Rev. Lett., and venues of similar high impact, and a prestigious review article "*Experimental Insights Into Ground State Selection in Quantum XY Pyrochlores*" which is in press.

Dr. Hallas earned her B.Sc. in Chemistry and Mathematics at the University of Winnipeg, her M.Sc. in Chemistry at the University of Manitoba, and her Ph.D. in Physics at McMaster University (2017). She is currently the Smalley-Curl Postdoctoral Fellow in Quantum Materials at Rice University. She is the recipient of numerous prestigious awards from the National Sciences and Engineering Research Council (NSERC) of Canada, including the NSERC Postdoctoral Fellowship and the Vanier Canada Graduate Scholarship. Dr. Hallas was appointed to the NSSA Executive Committee as a student representative in 2017.