

Department of Nuclear Science and Engineering

The faculty and students of the [Department of Nuclear Science and Engineering](#) (NSE) study nuclear reactions and radiation, their applications, and their consequences. The work of the department involves generating, controlling, and applying nuclear reactions and radiation for the benefit of society and the environment. The mission of the department is to help develop the next generation of leaders of the global nuclear enterprise and to provide technical leadership in energy and non-energy applications of nuclear science and technology. As a leading academic department in the field, NSE also has a responsibility to inform public debates on the wise and humane uses of nuclear science and technology.

Increasing global energy needs and rising concerns over climate change are bringing new attention to the role of nuclear energy around the world, even as the safety of nuclear fission power plants is receiving renewed public scrutiny in the aftermath of the Fukushima nuclear accident in Japan. Many important non-energy applications of nuclear science and technology are also under development. The department offers what is probably the widest spectrum of research and educational activities of any nuclear science department in the country. Its faculty and students develop nuclear reactors for electricity generation as well as other diverse uses, including waste management, fluid fuels production, and space propulsion. They work on demonstrating the scientific and technical feasibility of fusion power and on developing the underlying capabilities that are needed for this. They contribute to security by developing new ways to monitor nuclear materials and to detect nuclear threats. They apply nuclear technologies to the physical and life sciences in areas ranging from neutron interferometry to radiation modeling, magnetic resonance imaging, and quantum information processing.

Faculty and Administration

Professor Richard Lester was appointed associate provost for international activities. He continues to serve as faculty chair of the MIT Industrial Performance Center.

Professor Jacopo Buongiorno was promoted to full professor.

Professors Ben Forget and Anne White were promoted to the rank of associate professor with tenure.

Professor Emilio Baglietto was promoted to the rank of associate professor without tenure.

Professor Dennis Whyte was appointed director of the MIT Plasma Science and Fusion Center.

Dr. Alan Hanson, executive director of the International Nuclear Leadership Education Program, retired. He continues as a research affiliate in NSE.

Professor Areg Danagoulian joined the NSE faculty this year.

Professor Mujid Kazimi died suddenly while attending a conference in China. Professor Kazimi, who had served as director of the Center for Advanced Nuclear Energy Systems since its founding, was one of the world's most distinguished educators and researchers in the field of nuclear technology. All in the department are deeply saddened by his death.

Research Highlights

Fission energy research is mainly conducted through the Center for Advanced Nuclear Energy Systems. Research on advanced reactor designs, new fuel-cycle technologies, advanced modeling and simulation, and innovative reactor materials is carried out by the faculty and staff of the center, working with more than 70 graduate students and postdoctoral fellows.

NSE continues to play a leading role in the Consortium for Advanced Simulation of Light Water Reactors (CASL), the US Department of Energy (DOE) Nuclear Energy Innovation Hub based at the Oak Ridge National Laboratory. The CASL-MIT project was renewed for an additional five years and MIT continues to play an important role in the materials, radiation transport, and thermal-hydraulics areas. Professor Baglietto serves as the thermal-hydraulic area lead. Professor Smith is a member of the Scientific Council and will also succeed Professor Kazimi on the board of directors of the project.

NSE is also an important contributor to the Center for Exascale Simulation of Advanced Reactors (CESAR), a co-design center of the DOE's Office of Science. Professors Smith and Forget are developing advanced algorithms for improved performance on modern computing architectures. Recent highlights include a novel approach for a three-dimensional (3-D) method-of-characteristic neutron transport solver, efficient domain decomposition algorithms for full-core Monte Carlo simulations, and transport-based low-order acceleration techniques for high-fidelity simulations.

Professor Kazimi (principal investigator), Professor Kord Smith (co-principal investigator) and Dr. Koroush Shirvan won a DOE Nuclear Energy University Program (NEUP) Integrated Research Project grant to develop computational tools to evaluate accident tolerant fuels for near-term applications. The MIT team, which also includes Professors Michael Short and Jacopo Buongiorno and Dr. Thomas McKrell, will collaborate with the Idaho National Laboratory, AREVA, Inc., Anatech Ltd., and university partners from the University of Wisconsin, Texas A&M University, and Pennsylvania State University.

Professor Michael Short also won a NEUP award to develop, manufacture, and weld a new multimetallc layered composite that is designed to provide enhanced severe accident tolerance and improved manufacturability in light water reactor (LWR) fuels.

The Fluoride Salt-Cooled High-Temperature Reactor (FHR) project sponsored by DOE and led by principal research scientist Dr. Charles Forsberg received a three-year renewal for further development of a new strategy to provide zero-carbon electricity to meet variable electricity demand while the reactor itself operates at full capacity to minimize costs. The FHR is coupled to an air-Brayton combined-cycle plant that is

similar to natural gas plants. The nuclear reactor, which operates in base-load modes, achieves a thermal efficiency of 42% with 40% less cooling water requirements than LWRs; the thermal efficiency of natural gas combustion exceeds that of the most efficient stand-alone combined-cycle systems.

In other fission research, Professor Kazimi and Drs. Tom McKrell and Koroush Shirvan continued their studies of silicon carbide and coated zirconium alloys as cladding materials in LWRs. They also continued their research on a novel reduced-moderation boiling water reactor concept. Support for these activities is provided by DOE, Hitachi, Exxon Mobil, and Lockheed Martin.

The computational reactor physics group, led by Professors Ben Forget and Kord Smith, have pursued the development of high-fidelity open-source software. The flagship code is OpenMC, a general geometry Monte Carlo neutron transport code designed specifically for leadership-class computing. Recent highlights include the development of neutron tracking in materials with varying temperature profiles and the extension of direct temperature feedback to the unresolved resonance range. Another code developed by the computational reactor physics group is OpenMOC, a 2-D deterministic neutron transport code that is being used for performance analysis on innovative computing platforms. Recent highlights include the development of transient capabilities and extensions to three dimensions. Work is also under way for multigroup cross section generation using unconverged OpenMC simulations and machine learning algorithms to develop accurate cross section sets rapidly for use in deterministic codes such as OpenMOC.

Professors Jacopo Buongiorno, Neil Todreas, and Michael Golay have made progress in the development of the offshore floating nuclear plant (OFNP) concept. Major advances have taken place in the integration of the nuclear reactor into the platform, the design and performance analysis of the ocean-based safety systems, the study of the dynamic response of the plant to waves, wind, and currents in hurricane-strength storms, the dispersion of radioactive cesium and iodine in the ocean following a hypothetical severe accident, and the development of a security plan for the OFNP. The concept has been presented at three major nuclear engineering conferences [the 2014 International Conference on Nuclear Engineering (CONE-22) in Prague, Czech Republic; the 2015 International Congress on Advances in Nuclear Power Plants (ICAPP) in Nice, France; and the 2015 National Nuclear Security Conference in Orlando, Florida] and has received significant industrial attention.

Professor Buongiorno and Dr. Thomas McKrell have started a new project on suppression of nucleate boiling in annular flow. This work is relevant to fast-transient conditions in both boiling water reactors and pressurized water reactors; it is sponsored by Knolls Atomic Power Laboratories. The project also includes a collaboration with Professor M. Prasser of ETH-Zurich to develop a new sensor that measures liquid film thickness and surface temperature simultaneously.

Professor Buongiorno has also started a new project on simulation of bubble growth in nucleate boiling. The focus is on the formation and evaporation of the so-called

microlayer, a thin liquid film underneath a bubble growing at a heated wall that greatly affects both the bubble growth time and, ultimately, the heat transfer coefficient in nucleate boiling. The project uses the level-set and volume-of-fluid methods to capture and track the interface between the liquid and vapor phases. This project is sponsored by Electricite de France and includes a collaboration with Professor Stephane Zaleski at Universite Pierre et Marie Curie in Paris.

Emeritus Professor Michael Driscoll, working with Professors Baglietto, Buongiorno, and Lester and several students, together with collaborators at Sandia National Laboratories, are nearing completion of a three-year project supported by a NEUP grant to conceptualize and evaluate advances in disposal of used nuclear fuel and high-level waste in deep boreholes. The results were sufficiently promising to attract new support by TerraPower LLC for application of this approach to spent fuel assemblies from TerraPower's innovative traveling wave reactor. Encouraging initial results, including laboratory tests carried out with the help of Dr. McKrell, suggest that features such as the use of a zinc-aluminum alloy void filler plus a copper waste canister can solve the challenges imposed by the high-end peaked decay heat power of this fuel.

Professors Neil Todreas and Ronald Ballinger continued their evaluation of the potential for aggressive power upgrades for nuclear power plants as part of life-extension programs for operations beyond 60 years. A list of research topics was prepared to elaborate on the integrated decision analysis methodology they have developed and discussed with electrical utility users and DOE. The methodology is based on analysis of the performance, safety, and economics associated with plant performance at the added capacity afforded by the adoption of advanced technologies.

Professors Neil Todreas and Emilio Baglietto are developing a methodology to assess uncertainties in the measurement of key operating nuclear and environmental parameters critical to maintaining reactor safety and meeting environmental regulations. They are drawing on insights being developed in the conduct of a series of five case studies of uncertainty sources and their magnitude for a series of relevant individual measurements. This research is sponsored by Electricite de France in collaboration with the Electric Power Research Institute (EPRI).

Professor Emilio Baglietto continues his research in the field of computational fluid dynamics (CFD) to improve the safety and reduce operating costs of nuclear power plants. A new physics-based representation of boiling is being developed in CFD to address the need for improved predictions of boiling heat transfer in reactor fuel up to critical heat flux conditions. The work was featured as a keynote lecture at the Ninth International Conference on Boiling and Condensation Heat Transfer in Boulder, Colorado. Professor Baglietto's work on multiphase CFD is also the heart of the CASL thermal-hydraulics activities. A new scale-resolving turbulence model has been proposed and is undergoing extensive validation for predictive simulation of the unsteady flow behavior that drives vibrational and thermal failures in reactor components. The model is seeing application to support the design of both LWRs and sodium-cooled fast reactors. The group's CFD applications also support a number of other research areas, including the design of concentrated solar power on demand, led

by Professor Alex Slocum, and the design of an ultra-long life core for the TerraPower traveling wave nuclear reactor.

Professor Ju Li's group has synthesized nanocomposite materials made of metal (aluminum, zirconium, and magnesium) and carbon nanotubes that show superior radiation resistance. They have led the development of IM3D, a parallel Monte Carlo code for efficient simulations of primary radiation damage with the ability to describe arbitrary 3-D geometries and microstructures, replacing the one-dimensional stopping and range of ions in matter (SRIM) software. With modeling, neutron scattering, and electron microscopy, the Li group has investigated structures of topological insulators and magnetic coupling in topological insulators. Under the theme of elastic strain engineering, they have participated in the development of improved niobium-based superconductors that show improved critical temperature and upper and lower critical magnetic fields, as well as 2-D and 3-D semiconductors with strain-engineered bandgaps. The Li group has also developed scalable synthesis of high-capacity anode (aluminum, silicon, and titania yolk-shell nanostructures) and cathode (sulfur with carbon black, lithium sulfide with graphene paper) materials for next-generation lithium-ion batteries.

Professor Michael Short is carrying out a number of projects generally aimed at discovering the multiscale mechanisms responsible for accelerated corrosion, fouling, and irradiation damage in energy systems. With funding from Transatomic Power, Inc., EPRI, and Westinghouse, he is studying corrosion, fouling, and irradiation-assisted corrosion. He is also developing a 3-D nanoprinter and massive colloidal crystal growth capability with support from the SUTD-MIT International Design Center. Another project involves the deconvolution of microstructural damage mechanisms, using transient grating spectroscopy. Using a four-laser, nondestructive, noncontact technique, Professor Short is studying the separate and combined effects of radiation damage on key material properties (elasticity, thermal conductivity, acoustic damping) in support of a new, universal unit of radiation damage.

Professor Anne White's research focuses on the study of turbulent transport in fusion plasmas, with the goal of controlling the transport and improving the performance of tokamaks. Her group develops diagnostics, conducts experiments, and leads validation projects using advanced turbulence simulation codes at three major tokamaks (the National Spherical Torus Experiment [NSTX-U] at Princeton University's Plasma Physics Laboratory, the Alcator C-Mod at MIT's Plasma Science and Fusion Center, and the Axially Symmetric Divertor Experiment [ASDEX] Upgrade at the Max Planck Institute for Plasma Physics in Garching, Germany). At the NSTX-U tokamak, they are using a high-k scattering diagnostic to measure electron-scale density fluctuations directly and compare the measured turbulence with theory and simulation. At MIT's C-Mod tokamak, they are tracking the propagation of electron temperature "heat pulses" to measure plasma thermal diffusivity. At the ASDEX Upgrade at the Max Planck Institute, Professor White's group is installing new instruments to enable the measurement of electron temperature fluctuations and correlations between density and temperature fluctuations.

Professor Ian Hutchinson's computational plasma physics group continued its development of particle-in-cell codes that are providing a comprehensive understanding of the interaction of flowing plasmas with obstacles. The representation of electrons at true mass ratio in the massively parallel simulations has revealed a new mechanism for the disruption of plasma wakes: nonlinear growth of electron holes. This mechanism is predicted to be the dominant electrostatic instability in the solar-wind wake of the moon. It also appears to occur in the wakes of Mach probes used to measure the edge plasma of tokamaks. Demonstrating the understanding of this plasma phenomenon across widely different applications helps to unify the plasma physics field. The Alcator group continues experiments and analysis of plasma flow and the resulting effects on asymmetries that are essential to impurity transport, with a particular emphasis on the plasma edge and divertor.

At the Laboratory for Nuclear Security and Policy (LNSP), Professor Scott Kemp is studying how science-based analysis can inform the development of nuclear-related public policies. This year, Professor Areg Danagoulian joined LNSP's core faculty and Professors Richard Lester and Shafi Goldwasser joined as affiliate faculty. Professor Kemp, in collaboration with Professor Ben Forget, is exploring the feasibility of converting US naval reactors to low-enriched uranium fuel. This year, Professor Kemp also started a collaborative research project with Professor Barry Posen and Dr. Jim Walsh of the MIT Security Studies Program in the Department of Political Science to evaluate the proliferation risks of laser enrichment.

Professor Areg Danagoulian specializes in nuclear security. He is collaborating with Dr. Richard Lanza in developing a system that uses various nuclear reactions to produce monochromatic gammas for cargo radiography and active interrogation while delivering minimal doses to the containers. The early results from this work, which is funded jointly by the National Science Foundation and the Domestic Nuclear Detection Office of the US Department of Homeland Security, have indicated that this technique is very promising. If successful, it will allow for a new approach to cargo scanning to detect hidden fissionable materials.

Professor Danagoulian is collaborating with Professor Scott Kemp in helping to solve one of the long-standing challenges associated with nuclear arms reduction: lack of verification protocols that protect classified information about nuclear weapons. Professors Kemp and Danagoulian are developing a "physical zero knowledge" proof system that relies on nuclear resonance fluorescence to verify a weapon's authenticity and eliminate credible cheating scenarios that have plagued all previous verification systems. Early analysis has shown that this path is promising; if successful, it will enable more ambitious arms reduction treaties than before.

As part of a three-year, multi-university collaboration (MIT, Texas A&M University, and Pennsylvania State University), Dr. Richard Lanza developed and taught a series of five courses in nuclear security education. The program, sponsored by the National Nuclear Security Administration through the Global Threat Reduction Initiative, had as its goal the development of courses with a broad approach that combined policy and laboratory experiments and was primarily aimed at nuclear engineers in the three participating universities. The program included courses from the International Atomic Energy Agency as well.

Professor Paola Cappellaro leads the Quantum Engineering Group, which is investigating the dynamics and control of quantum systems to build novel devices that exceed the power of their classical counterparts, with applications in quantum computation, simulations, and sensing. In the past year, the group achieved enhanced sensing and control of individual electronic spin defects in diamond by exploiting electrons' entanglement with nearby nuclear spins. By entangling the electronic spin with a nuclear spin qubit ancilla, Professor Cappellaro experimentally demonstrated protection against naturally occurring dephasing noise, extending the electronic spin qubit coherence time by three orders of magnitude without employing any active controls to decouple the qubit from noise. This result was also the first implementation of a feedback control algorithm with an electronic spin qubit. These results will make it possible to use the nuclear spin qubits as a resource in many quantum algorithms, with enhanced speed and fidelity of control.

A versatile system for quantum simulations are the nuclear spins in crystals of Fluorapatite (FAP), because of FAP's quasi-one-dimensional geometry. With collaborators, the Cappellaro group measured for the first time the spin diffusion coefficient in this crystal, which shows different behavior than do more isotropic, 3-D systems. In addition, multi-pulse control sequences were used to simulate the effects of a noisy magnetic field on the coherence and transport properties of linear spin chains in FAP.

Professor Emeritus Sidney Yip is participating in three research projects—chemo-mechanics of far-from-equilibrium interfaces, the Concrete Sustainability Hub, and the Sustainability of Kuwait's Built Environment project. These are sponsored by the US Department of Energy, the Portland Cement Association, and the Kuwait-MIT Center for Natural Resources and the Environment, respectively.

Water is the most important and abundant liquid on earth. All life depends on it. For the past decade, Professor Sow-Hsin Chen and his students have been studying various properties of water, supported by DOE. In particular, their studies of the phase behavior of deeply supercooled water have achieved breakthrough results. Using various neutron scattering techniques, they have proved the long-standing conjecture of the existence of two forms of liquid state in low-temperature water—high-density liquid and low-density liquid—in contrast to the single state found in most other one-component liquids. They have also shown the consequences of the existence of a second low-temperature liquid-liquid critical point, which is unique to water.

Education

A total of 110 students pursued graduate degrees in nuclear science and engineering. Fifty-seven percent of these students worked in the fission energy field, 18% in fusion and plasma physics, and 25% in other nuclear science and technology applications, including materials, nuclear technology management and policy, nuclear security, and quantum engineering. The department awarded 22 SM degrees, 12 PhD degrees, and 2 ScD degrees. Thirty-four students entered the graduate program in fall 2014.

A total of 33 students were enrolled in the undergraduate program during the past year, including 16 sophomores, 9 juniors, and 8 seniors. Eight students completed the requirements for the bachelor's degree in nuclear science and engineering from September 2014 through June 2015.

Faculty Awards, Honors, and Activities

Emeritus Professor George Apostolakis received the Henry DeWolf Smyth Nuclear Statesman Award from the American Nuclear Society.

Professor Emilio Baglietto serves as Thermal Hydraulics Focus Area Lead for the DOE-sponsored CASL-MIT project.

Professor Ron Ballinger continues his service as a member of the U.S. Nuclear Regulatory Commission's Advisory Committee on Reactor Safeguards.

Professor Jacopo Buongiorno received the Ruth and Joel Spira award for distinguished teaching in the Nuclear Science and Engineering Department. He continued to serve as a member of the Accreditation Board of the National Academy for Nuclear Training of the Institute for Nuclear Power Operations. He is associate director of the Kuwait-MIT Center for Natural Resources and the Environment. He is also a member of the Defense Science Study Group.

Professor Paola Cappellaro received the Merkator Fellowship from the Deutsche Forschungsgemeinschaft (Germany). She serves on the Committee on Scientific Publications of the American Physical Society.

Professor Sow-Hsin Chen's new book, *Scattering Methods in Complex Fluids*, co-authored with Professor Piero Tartaglia of the University of Rome, was published by Cambridge University Press.

Professor Ben Forget continues to serve on the Executive Committee of the Reactor Physics Division of the American Nuclear Society.

Principal research scientist Dr. Charles W. Forsberg was awarded the Seaborg Medal by the American Nuclear Society (ANS). Dr. Forsberg was honored for his work advancing innovative nuclear fuel cycle concepts, high-temperature reactors, and applications for sustainable hybrid energy systems.

Professor Ian Hutchinson continued his service as international advisor to the journal *Plasma Physics and Controlled Fusion*, and as plasma physics sectional member of the editorial board of *Physical Review E: Statistical, Nonlinear, and Soft Matter Physics*. Professor Hutchinson's book, *A Student's Guide to Numerical Methods*, which sprang from his development of the department's new half-term module on computational nuclear science and engineering, was published by Cambridge University Press.

Professor Richard Lester received the Special Award for 2015 from the American Nuclear Society for “demonstrating the value of nuclear energy to a wide audience.” He was also named chair of the National Academies’ Board on Science, Technology and Economic Policy. He continues to serve as a board member of the Massachusetts Technology Collaborative and the New England Clean Energy Council.

Professor Ju Li was elected a fellow of the American Physical Society “for seminal work on understanding the fundamental properties of ultra-strength materials and formulating the concept of elastic strain engineering.” Professor Li was also selected by Thomson Reuters for inclusion in its Highly Cited Researchers list, one of 147 scientists worldwide named in the materials science category on the basis of papers published between 2002 and 2012.

Professor Michael Short received the PAI Outstanding Faculty Award, presented by the student chapter of the American Nuclear Society.

Professor Emeritus Neil Todreas presented the inaugural lecture in the Distinguished Lecture Series of the Department of Nuclear and Quantum Engineering at the Korean Advanced Institute of Science and Technology in October 2014. His lecture topic was Nuclear Thermal Hydraulic Technology: Its Evolution and Future Developments.

Professor Anne White received the 2014 Excellence in Fusion Engineering Award at the Fusion Power Associates 35th Annual Meeting and Symposium. Professor White continues to serve on the MIT Radiation Protection Committee; she recently served on the MIT Faculty Policy Committee.

Professor Emeritus Sidney Yip’s textbook, Nuclear Radiation Interactions, was published in October 2014. Professor Yip also presented a Distinguished Lecture, Nuclear Science and Technology in a Sustainable World, at the Hong Kong City University on March 3, 2015.

He serves as a member of the Visiting Committee of the Department of Nuclear Engineering and Radiological Sciences at the University of Michigan.

Student Awards and Activities

Alex Andriatis and Amelia Trainer received Outstanding Undergraduate Research Opportunities Program awards for their contributions to an NSE research project by a freshman or sophomore.

Outstanding Student Service Awards in recognition of exceptional service to the department were awarded to Alexandre Cooper-Roy, Ruairidh Macdonald, and Aditi Verma.

Daniel Curtis, Jake Jurewicz, and Matthew Ellis represented MIT in the 17-member Nuclear Engineering Student Delegation to Washington, D.C., in the summer of 2014. Minh Dinh received the Roy Axford Award for academic excellence by a senior in the Department of Nuclear Science and Engineering.

Andrew Dykhuis won a poster award for best technical content at the Nuclear Plant Chemistry Conference in Sapporo, Japan, in October 2014. He also received a second-place award in the DOE's Innovation in Fuel Cycle Awards competition.

Sara Ferry served as a member of the Design Committee for the Sean Collier Memorial at MIT.

Derek Gaston and his team at Idaho National Laboratory received an R&D 100 award from R&D Magazine.

Miaomiao Jin won the award for the best poster presented at the 2015 CASL Annual Education Workshop.

Sterling Harper received the NSE Outstanding Undergraduate Research Opportunities Award and was awarded a DOE Nuclear Energy University Programs graduate fellowship.

Colin Josey was one of 33 graduate students across the country to be awarded a Nuclear Energy University Programs Fellowship by the US Department of Energy.

Jake Jurewicz won Best Student Paper Award at the 10th International Topical Meeting on Nuclear Thermal-Hydraulics, Operation and Safety (NUTHOS-10) in Okinawa, Japan (December 2014).

Lulu Li won the award for the best poster presented at the 2014 CASL Annual Education Workshop.

Mingda Li received the Outstanding TA Award for exceptional contributions as a teaching assistant in Nuclear Science and Engineering. Mingda also received the Outstanding Grader of the Year Award, presented by the student chapter of the American Nuclear Society.

Mareena Robinson received a 2015 MIT Graduate Woman of Excellence Award. This award is based on leadership and service contributions at the Institute and on dedication to mentoring and improving the student experience. Mareena also won Best Overall Poster at the 2014 National Nuclear Security Administration Stockpile Stewardship Graduate Fellowship Conference. She also received the 2015 Member of the Year Award from the MIT Black Graduate Student Association.

Jimmy Rojas received the Irving Kaplan Award for academic achievement by a junior in Nuclear Science and Engineering.

Guanyu Su won the Third Place Poster Award at the 9th International Conference on Boiling and Condensation Heat Transfer in Boulder, Colorado. The poster, Experimental Study of Boiling Inception Under Exponentially Escalating Heat Flux, was co-authored by Matteo Bucci, Thomas McKrell, and Jacopo Buongiorno, and was among 60 posters presented at the conference.

Lixin Sun received the Manson Benedict Award for excellence in academic performance and professional promise by a graduate student in Nuclear Science and Engineering.

Vivian Tran received a DOE NEUP undergraduate scholarship. She also won first prize in MIT's 2015 Isabelle de Courtivron Prize competition, which is administered by the MIT Center for Bilingual/Bicultural Studies, and the Boit Manuscript Prize for Poetry, awarded by Comparative Media Studies and the Writing Program.

Richard K. Lester

Department Head

Japan Steel Industry Professor of Nuclear Science and Engineering