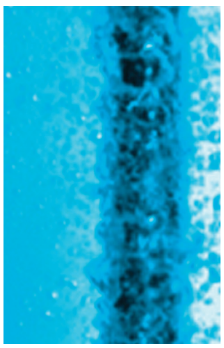
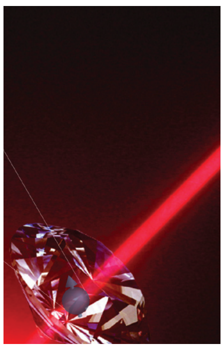
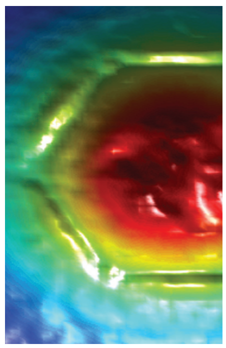
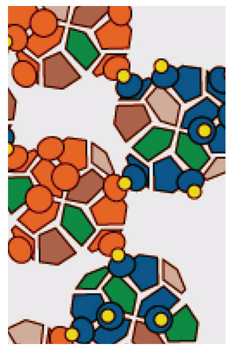
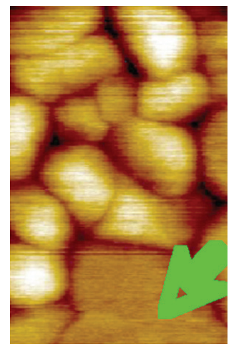
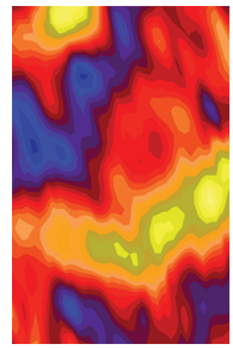
Department of Nuclear Science and Engineering
Massachusetts Institute of Technology

SPOTLIGHT ON NSE | YOUNG FACULTY

Despite higher education's significant economic challenges in recent times, the School of Engineering has maintained its preeminence by remaining committed to our core missions—the creation and dissemination of new knowledge and innovative technologies, and training the brightest young scholars to help lead us onward.

– *Subra Suresh*
Dean, MIT School of Engineering

The faculty of the Department of Nuclear Science and Engineering includes six outstanding young educators and researchers, four of whom only recently joined the Department. The exciting research of these young faculty members is helping the Department achieve its goal of building an exceptionally strong community of researchers in nuclear and radiation science and technology centering on the Department and reaching across MIT.

To learn more about NSE please contact
Professor Richard K. Lester, Head
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Professor Jacopo Buongiorno

By seeding the coolant in nuclear power reactors with nanoparticles — tiny particles of material such as alumina or other metal oxides — it is possible to enhance the rate at which energy is removed from nuclear fuel under both normal and accident conditions, thus improving the reactor's economic and safety performance. Professor Buongiorno's team at MIT studies the heat transfer and colloidal behavior of these 'nanofluids', including boiling and quenching, resistance to nuclear irradiation, and long-term stability. This is a collaboration between the Department of Nuclear Science and Engineering (Prof. Jacopo Buongiorno, Dr. Tom McKrell) and the Nuclear Reactor Laboratory (Dr. Lin-wen Hu).

Professor Paola Cappellaro

Professor Cappellaro's research focuses on the study of few-body quantum systems and their use in quantum information processing. The goals are the realization of practical devices as well as the acquisition of a deeper knowledge of specific quantum systems and their environment. These ideas are being explored experimentally using nitrogen-vacancy centers in diamond. The strength of this system is in a hybrid approach that combines quantum optics, mesoscopic physics, and magnetic resonance.

Professor Benoit Forget

With continual improvements in numerical algorithms and computational performance, modeling and simulation is gaining attention as a way to improve design and reduce costs in all scientific fields. Professor Forget's research group is developing advanced mathematical analyses and computation tools that provide a clearer picture of the complex physics of reactor cores, The ultimate goal is to provide detailed information that enables reactor designers to achieve more power, better efficiency, and well understood safety margins, without costly overbuilding.

Professor Alan Jasanoff

Genetically encoded molecular sensors detectable by MRI could reveal precise information about cellular processes noninvasively in live animals. In a recent study, Professor Jasanoff's lab developed a prototype sensor for protein kinase activity (a key step in intracellular signal transduction) based on the genetically encodable protein ferritin. Next steps include expressing the sensor components inside cells, and applying the design to sense additional cellular targets.

Professor Anne White

Tokamaks are the leading configuration used in magnetically confined fusion experiments. Turbulence in tokamak plasmas is widely believed to result in radial transport of energy away from the core confinement region. Professor White's research at the MIT Plasma Science and Fusion Center (PSFC) focuses on the development of new fluctuation diagnostics for studying turbulence at the MIT Alcator C-Mod Tokamak and on collaboration with the 0111-0 tokamak at General Atomics in the area of transport model validation.

Professor Bilge Yildiz

Perovskite-type mixed ionic-electronic conductors are used as solid oxide fuel and electrolytic cell cathodes, and their surface structure plays an important role in the electrocatalytic activity for oxygen reduction and evolution. An improved understanding of the surface electronic and chemical state at the atomistic level is essential to the design of cathodes with enhanced electrocatalytic activity. Using in situ scanning tunneling microscopy/spectroscopy (STM/STS) at high temperatures for the first time, Professor Yildiz's group found a correlation between the composition and electronic tunneling conductance on the cathode surface that is important for the efficiency of these energy conversion devices.