Princeton University

Honors Faculty Members Receiving Emeritus Status

May 2020

The biographical sketches were written by staff and colleagues in the departments of those honored.

Published by the Office of the Dean of the Faculty
Coordinated by the Office of Communications

Printed on recycled paper 250109

In the Nation's Service and the Service of Humanity

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for Receiving Emeritus Status

Emily A. Carter

Emily A. Carter, the Gerhard R. Andlinger Professor in Energy and the Environment, Emeritus, and professor of mechanical and aerospace engineering and applied and computational mathematics, emeritus, served on the Princeton faculty from 2004–19. After an international search, she was selected to be the founding director of Princeton's Andlinger Center for Energy and the Environment. From 2010–16, she oversaw the construction of its facilities, the development of its educational and research programs, and the hiring of its faculty and staff. After a national search, she served from 2016–19 as Princeton's dean of the School of Engineering and Applied Science, where she spearheaded major research, education, outreach, and diversity initiatives. In September 2019, she moved to the University of California-Los Angeles (UCLA) as executive vice chancellor and provost (EVCP), and Distinguished Professor of Chemical and Biomolecular Engineering.

Emily earned a B.S. in chemistry from UC-Berkeley in 1982 (graduating Phi Beta Kappa) and a Ph.D. in chemistry from Caltech in 1987, followed by a brief postdoc at the University of Colorado-Boulder. She began her independent academic career at UCLA in 1988, rising through the chemistry and biochemistry faculty ranks before moving to Princeton University in 2004, where she spent the next 15 years jointly appointed in mechanical and aerospace engineering and in applied and computational mathematics.

Emily is a theorist/computational scientist first known in her independent career for her research combining *ab initio* quantum chemistry with molecular dynamics and kinetic Monte Carlo simulations, especially as applied to etching and growth of silicon. Later, she merged quantum mechanics, applied mathematics, and solid state physics to construct a linear scaling orbital-free density functional theory (OFDFT) that can treat unprecedented numbers of atoms quantum mechanically, embedded correlated wavefunction theories that combines quantum chemistry with periodic DFT to treat condensed matter ground and excited electronic states and strongly correlated materials (furnishing, e.g., the first *ab initio* view of the many-body Kondo state of condensed matter physics and treatment of charge transfer and excited states of adsorbates on surfaces), and

fast algorithms for *ab initio* multi-reference correlated electronic wavefunction methods that permit accurate thermochemical kinetics and excited states to be predicted for large molecules.

Emily was a pioneer in quantum-based multiscale simulations of materials that eliminate macroscopic empirical constitutive laws and that led to new insights into, e.g., shock Hugoniot behavior of iron and stress-corrosion cracking of steel. Earlier, her doctoral research furnished new understanding into homogeneous and heterogeneous catalysis, while in her postdoctoral work she presented the condensed matter simulation community with the widely used rare event sampling method known as the Blue Moon Ensemble. Her research into how materials fail due to chemical and mechanical effects furnished proposals for how to optimally protect these materials against failure (e.g., by doping, alloying, or coating). Her current research includes the development of efficient and accurate quantum mechanics simulation techniques such as her embedded correlated wave function and orbital-free density functional theories. She uses these and other quantum simulation techniques to enable discovery and design of materials for sustainable energy technologies, including converting sunlight to electricity, producing chemicals, fuels, and desalinated water from renewable energy, and optimizing liquid metal alloys for the confining walls of future fusion reactors.

The author of over 400 publications, Emily has delivered more than 550 invited and plenary lectures worldwide and serves on advisory boards spanning a wide range of disciplines. Her scholarly work has been recognized by a number of national and international awards and honors from a variety of entities, including the American Chemical Society (ACS), the American Vacuum Society, the American Physical Society, the American Association for the Advancement of Science, and the International Academy of Quantum Molecular Science. Among other honors, she received the 2007 ACS Award for Computers in Chemical and Pharmaceutical Research, and was elected in 2008 to the American Academy of Arts and Sciences and the National Academy of Sciences. In 2009, she was elected to the International Academy of Quantum Molecular Science; in 2011 was awarded the August Wilhelm von Hoffmann Lecture of the German Chemical Society; in 2012 received a Docteur Honoris Causa from the École Polytechnique Fédérale de Lausanne; in 2013 was awarded the Sigillo D'Oro (Golden Sigillum) Medal of the Italian Chemical Society; in 2014 was named the Linnett Visiting Professor of Chemistry at the University of Cambridge; in 2015 was awarded the Joseph O. Hirschfelder Prize in Theoretical Chemistry from the University of Wisconsin-Madison;

in 2016 was elected to the National Academy of Engineering; in 2017 was awarded the Irving Langmuir Prize in Chemical Physics from the American Physical Society; in 2018 was awarded the ACS Award in Theoretical Chemistry; and in 2019 was honored with a Distinguished Alumni Award from the California Institute of Technology, a Graduate Mentoring Award from Princeton, and the 2019 John Scott Award—the oldest science prize in the United States.

Emily has left an indelible mark on the Department of Mechanical and Aerospace Engineering, and the entire School of Engineering and Applied Science at Princeton. Her research, and her invaluable contributions in charting the trajectory of research and education in the engineering school, as well as building community, have been inspirational and aspirational. Her impact in the school will still be felt in years to come. We will continue to cheer her on in her new role at UCLA and celebrate with her on her future accomplishments.