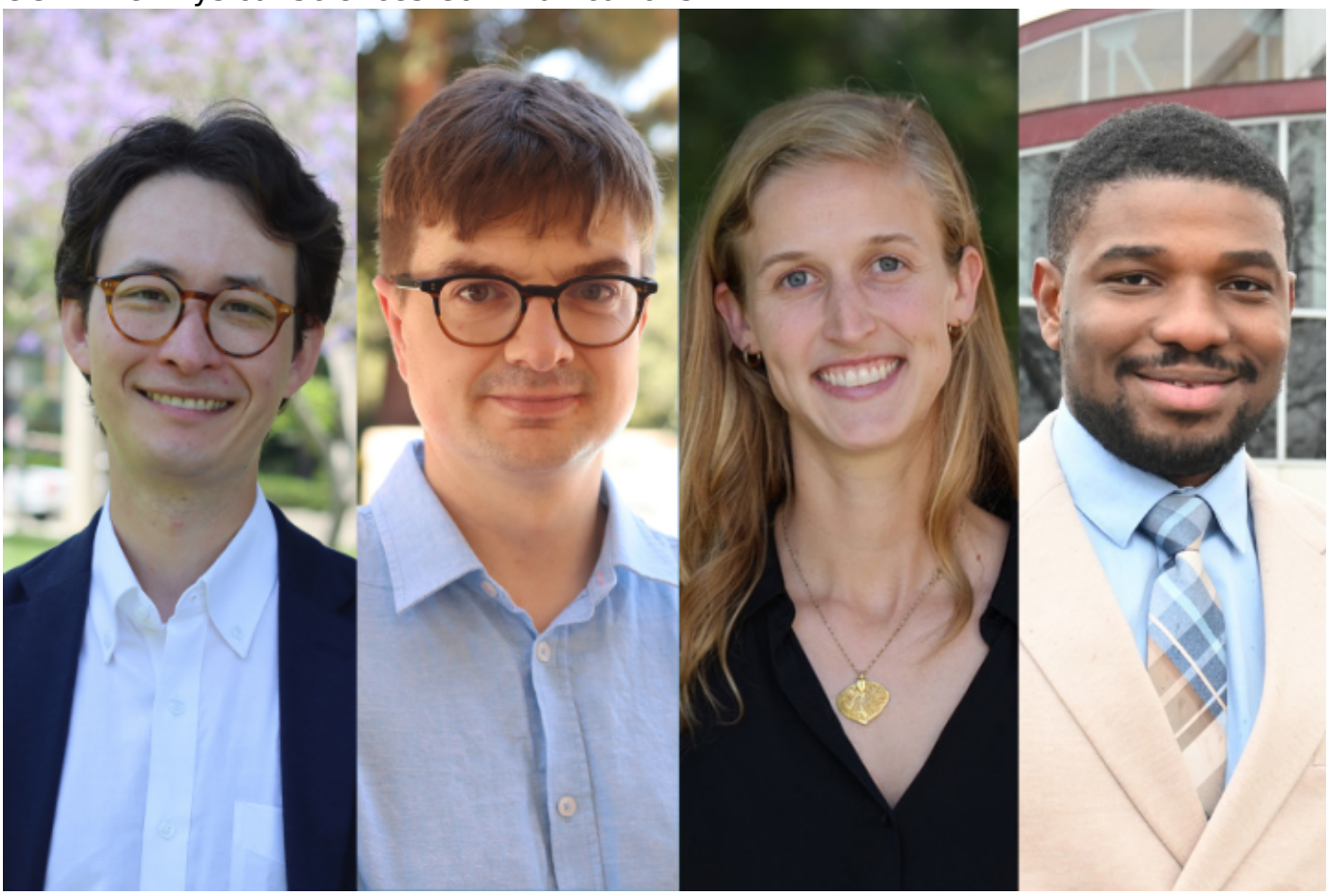
UC Irvine Physical Sciences welcomes four new faculty members

Their research ranges from chemical catalysis to climate change impact mitigation.

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Lucas Van Wyk Joel
UC Irvine Physical Sciences Communications



The four new Physical Sciences faculty. From left to right: Rex Handford, Mark England, Lyssa Freese, Leonard Ohenhen.

Picture Credit:
UC Irvine

Rex Handford, Department of Chemistry

Professor Rex Handford is joining the UC Irvine Department of Chemistry, where his research will focus on the chemistry involved in converting typically inert chemicals into potent fuels as part of a low-carbon energy economy. At UCI, he and his new lab will be working to understand the molecules that spark the conversion of those inert chemicals into sustainable fuels.

“In both nature and industry, exquisitely complex catalysts exist which can convert ‘unreactive’ molecules, such as nitrogen or carbon dioxide, into reactive energy sources, such as ammonia and hydrocarbons, respectively,” said Handford. “In spite of the central importance of these catalysts, particularly in at-scale industrial processes, little is known about the nature of the catalysts themselves.”

Handford explained how catalysis, though it occurs everywhere in the natural and industrial worlds, is often a black box, and he and his lab will be designing inorganic molecules that function as precisely-engineered catalysts for use in reactions that produce fuels from chemical waste.

“High-energy X-ray techniques and extremely powerful computational methods are more accessible than ever before, particularly at UCI, and in collaboration with California’s national synchrotron facilities,” said Handford, who completed his Ph.D. in chemistry at UC Berkeley followed by a postdoctoral fellowship at Harvard University. “It’s the combination of these tools with the inherent power of molecular inorganic chemistry that makes me so incredibly excited to examine problems in catalysis.”

Handford is just starting to piece together his lab space in the Interdisciplinary Science & Engineering Building with the help of two new undergraduate assistants. As he launches his research program, Handford aims to champion not just research excellence, but also a culture in his lab that fosters community and joy in the pursuit of new knowledge.

“If I do my job right, my students will be able to join in that spirit,” he said.

Mark England, Department of Earth System Science

Mark England has joined the UC Irvine Department of Earth System Science, where he’ll be using climate models to simulate and understand the driving forces and impacts behind our changing climate, with a special focus on Earth’s polar regions.

“I have an open curiosity about the climate system, understanding how it works and why the world is the way it is. I think this came from my background in engineering and applied mathematics,” said England. “And the polar regions are some of the fastest changing places on the planet, giving lots of interesting puzzles to solve. For example, why didn’t Antarctic sea ice loss occur for much of the past half century, and why has it started to melt so rapidly now? Does this mean we are in a new regime of low Antarctic sea ice cover?”

The modeling work England does informs the wider research community about the exact nature of how climate change is unfolding, and how that may help inform climate policy action.

“I’m excited to grow my research group at UCI to try and answer some of these puzzles about polar and global climate,” said England. “Longer term, I hope to start new projects which are at the interface of climate modelling, climate policy and polar climate change.”

Prior to joining UCI, England received his Ph.D. from Columbia University, completed postdoctoral fellowships at Scripps Institute of Oceanography and UC Santa Cruz, and was a senior research fellow at the University of Exeter funded by the Royal Commission for the Exhibition of 1851.

Lyssa Freese, Department of Earth System Science

Lyssa Freese has joined the UC Irvine Department of Earth System Science, where she’ll be building a research program focused on climate science, atmospheric chemistry and social systems research, with a special focus on analyzing the impacts of and solutions to climate change and air pollution.

“The key question I aim to address is: How can we both mitigate and adapt to climate change and air pollution in a way that is equitable and resilient?” said Freese, who received her Ph.D. in Earth, atmospheric and planetary science from MIT. “This means my work spans from basic physical and chemical science to very applied work, and, critically, involves collaborations with economists, public health scientists and energy systems researchers.”

Freese’s research aims to inform a just transition, mitigating pollution and economic impacts on populations due to both climate change and the energy transition. This involves a long-term goal of building out interdisciplinary teams of experts –

including not just Earth scientists, but also economists and social scientists – to fashion the best-possible tools communities can use to adapt to changing climate and air pollution conditions.

For Freese, the core inspiration behind the work – and her overall life mission – has always been to help people.

“I want to help people and reduce inequities in health and economic outcomes at the local and international level,” said Freese. “As I went further down the track of my studies and in my work for NGOs, I learned how critical the environment you are exposed to is for your health and economic outcome, and I decided that doing research on climate and pollution was a way I could impact the well-being of a broad range of people. So, at the root of what I do is a desire to make sure people have equitable access to a healthy environment, both now and in the future.”

Leonard Ohenhen, Department of Earth System Science

Professor Leonard Ohenhen joined the UC Irvine Department of Earth System Science, where he’ll be investigating how alteration and deformation of the surface of the planet by natural processes and human activities changes the environmental risks posed by those changed regions.

“I am particularly interested in the physical, hydrological, and anthropogenic processes that govern surface deformation and how they act as threat multipliers and intersect with climate-driven or pre-existing hazards to produce compound and cascading risks,” said Ohenhen. “A key focus of my work is the hazard posed by land subsidence. Subsidence has emerged as a critical yet underappreciated component of the climate security landscape, affecting over 1.2 billion people globally. It functions as a silent amplifier of other hazards, most notably sea-level rise by introducing non-linear effects.”

California is a state rife with land subsidence, and Ohenhen’s work aims to understand what such changes mean for how the state needs to adapt to its near- and long-term futures.

“My research is motivated by the recognition that while climate change-related hazards are recognized as important threats for most coastal communities, land deformation remains a critical yet underappreciated geophysical process that affects the functionality of urban environments,” said Ohenhen, who received his Ph.D. from

Virginia Tech. “Additionally, the intersection of anthropogenic activities and natural processes in subsidence dynamics presents a compelling research imperative for me.”

Because it incorporates insights from a slew of different fields, Ohenhen intends for his work to provide comprehensive frameworks that can guide sustainable development worldwide.

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