

# The three new Physical Sciences faculty

One studies waves and patterns in nature, one studies how climate change will affect agriculture, and one uses math to understand how DNA moves around our cells. Meet the new faculty of the UCI School of Physical Sciences.

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Lucas Van Wyk Joel
UCI Physical Sciences Communications

UCI School of Physical Sciences

From DNA to deserts, these new professors do research at all scales.

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UCI Physical Sciences

This year, the UCI School of Physical Sciences hired three new professors — one in the Department of Earth System Science, and two in the Department of Mathematics. When they join us, they'll be adding to the great diversity of scientific voices in the School, be it through attempts to characterize the way DNA moves

around our cells, or through attempts to understand the role of climate change in drought-stricken countries like Madagascar. Each voice is a world of science in itself, and here are three glimpses into those worlds.

**Paul Carter, Department of Mathematics**

Paul Carter joins the Department of Mathematics this year, and, like his new UCI colleagues, Carter searches for patterns in nature. “Waves and patterns arise in a variety of natural and physical systems,” said Carter, who received his Ph.D. from Brown University in 2016. “From vegetation patterns in semiarid ecosystems, to impulse propagation in nerves fibers, to the formation of traffic jams on highways.” Using differential equations, Carter’s work aims to describe these phenomena. One of the mathematician’s top questions revolves around the exact way in which plant communities depart an ecosystem and, in departing, turn a region into a desert. The work has special significance in this era of climate change, especially when research by scientists by those in the UCI Department of Earth System Science shows declines in desert plant populations in places like Southern California. “We are exploring a mathematical theory which describes how an invading desert state can be unstable to vegetation patterns, so that vegetation can ‘re-invade’ the desert, providing a possible mechanism for reversing desertification,” Carter said.

**Chris Miles, Department of Mathematics**

Math can help characterize the climate change problem — and it can also characterize why the cells in our bodies behave the way they do. Such is the realm of the research of Chris Miles, who joins the Department of Mathematics this year after completing a postdoctoral fellowship at the NYU Courant Institute of Mathematical Sciences. “I’m especially interested in spatial organization within cells, basically trying to understand how and why important molecules move,” Miles said. One of Miles’ projects involves trying to understand how and why DNA moves around when cells divide, using models that have applications to cell biology, but also when it comes to characterizing other phenomena, like human crowd and animal flock movement. “At UCI and especially the Center for Complex Biological Systems, tons of cutting-edge research in cell biology is being done,” said Miles. “I'm eager to start new collaborations and, in the process, learn new exciting biology that will inspire new mathematical theory required to understand it.”

**Angela Rigden, Department of Earth System Science**

Angela Rigden's an Earth scientist who's finishing a postdoctoral fellowship at Harvard University. She'll be joining the Department of Earth System Science in 2022, and when she gets here she'll bring a skillset honed to look at the climate system from the vantage points of three disciplines: plant physiology, surface hydrology and climate science. "My main research aims are to understand how climate change will influence the terrestrial water cycle, and the implications of these changes on plants," said Rigden. "I am particularly interested in quantifying the response of agricultural plants." One place where plants are responding to the changes, and responding poorly and where Rigden is training her skills, is Madagascar, where drought in the country is laying waste to crops in the south. Using remote sensing observations of soil moisture and vegetation health, Rigden, who received her Ph.D. from Boston University in 2017, is working to characterize the scale of the drought threat — no mean feat, Rigden explained, because she has to figure out what spatial scales capture an accurate picture of the problem, and those scales can range anywhere from a micron to the entire globe.

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