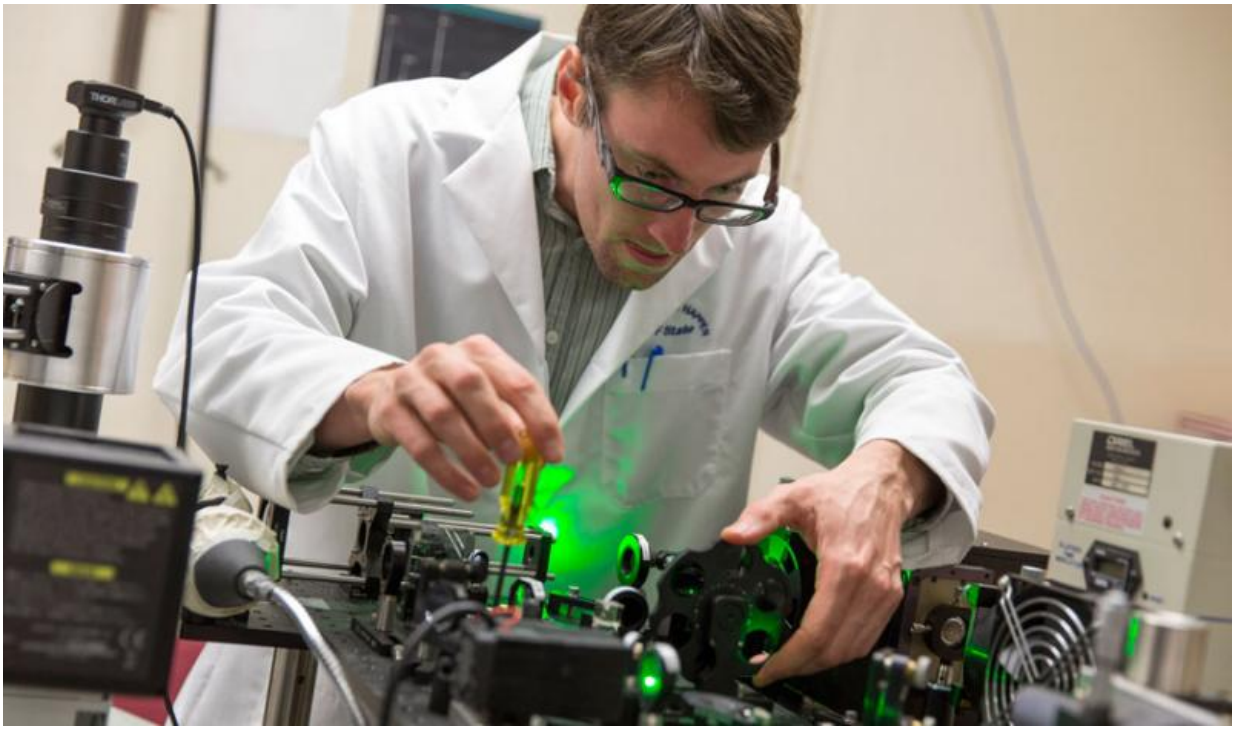
Student researchers shed light on ultrathin materials

December 12 2016, by Jonathan Morales



Undergraduate engineering student Alex Yore was the lead author on a recently published research paper that shed light on the properties of ultrathin materials. Credit: San Francisco State University

In 2014, electrical engineering major Alex Yore was looking for a way to get some hands-on experience in materials science when he stumbled upon something fortuitous—a new physics faculty member looking to

get his lab up and running.

"It turns out professors love having extra hands in their lab, so Newaz was ready to let me in and we started building up the lab and getting things going," Yore said.

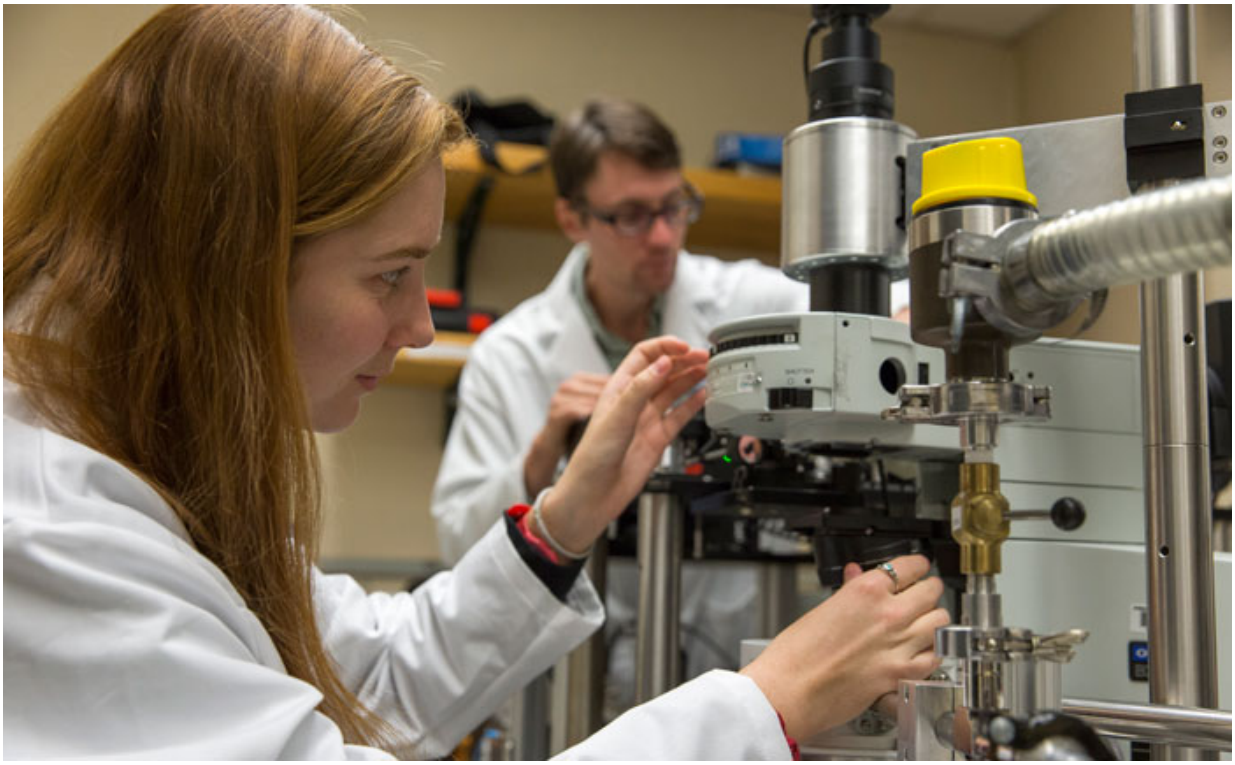
Assistant Professor of Physics and Astronomy AKM Newaz was more than happy to have Yore and other undergraduate students work in his lab and, at the same time, live out SF State's motto of "experience teaches."

The first fruits of their labor arrived in October, when a research paper with Yore as the lead author and several other SF State students as co-authors was published in the *Journal of Physical Chemistry*.

The research looked at "low dimensional materials"—materials that are just one to five atoms thick—and how a specific material called molybdenum disulfide (MoS2) responds when hit with highly focused laser light. The students found that a flake of MoS2 emits less light at its center while reflecting higher-energy light back at its edges, results that could help future researchers better understand how to manipulate the material, for example by controlling what color is emitted off the edge.

"Computers are getting smaller and smaller, so if we can really control these few-atom-sized materials, it can allow us to shrink even smaller with computers for things like displays, cameras or computer chips, bringing the cost down," Yore said.

Other SF State students who participated in the research included graduate student Wendy Crumrine and undergraduate students Jonathan Aaron Tuck and Brittany Redd. Addison Miller, a high school student at St. Ignatius College Preparatory school, also took part.



Brittany Redd, an undergraduate physics student, created the ultrathin samples of molybdenum disulfide used in the research by stripping them apart using tape and by "growing" them in the lab using high-temperature gasses. Credit: San Francisco State University

Redd, a physics major who joined Newaz's lab for the opportunity to work with her hands and learn more about how various materials work, created the small flakes of MoS2 used in the research by both using tape, for example Scotch tape, to break apart large pieces into small strips and by using high-temperature gasses to create the layers from scratch.

In addition to getting hands-on lab experience, Redd says the opportunity to conduct undergraduate research has been helpful in the classroom.

"What you learn in class, you realize you use it in research, and vice versa," Redd said. "It bridges the gap between your studies and how you apply it." The experience has also provided skills that will be useful once she begins graduate studies and enters the workforce, such as the ability to coordinate and collaborate with other researchers.

Redd will graduate in December and is applying for graduate programs in condensed matter research, after which she hopes to work in industry. Yore also plans to attend graduate school after taking a year off to work, hopefully in the solar energy field.

"This experience has made me a much more confident student," he said. "It's been a challenge, but I've gained what I believe to be excellent job skills and interpersonal skills."

As for Newaz, his lab door is open to any undergraduate students willing to step in and do the work.

"This is a mostly undergraduate institution, so I decided not to make the demarcation between the graduate and undergraduate students," he said. "It worked out pretty well."

More information: A. E. Yore et al. Visualization of Defect-Induced Excitonic Properties of the Edges and Grain Boundaries in Synthesized Monolayer Molybdenum Disulfide, *The Journal of Physical Chemistry C* (2016). DOI: 10.1021/acs.jpcc.6b06828

Provided by San Francisco State University