BERKELEY science review

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Lab on a chip

Artificial leaves

Green chemistry

Digging up the past • *Spam* • *HHMI investigators* • Born to Be Good • *Bending light* • *Brain magnets* problem, Professors Peidong Yang and Arun Majumdar turned to silicon nanowires that decouple electrical and thermal conductivity. The nanowires are so tiny (about 100 nanometers in diameter, or one-thousandth the diameter of a human hair) that they cannot sustain the vibrations that would result in heat transfer, and etching the nanowires to roughen their surface restricts the vibrations even further. While the heat conductivity is greatly restricted, the electrical conductivity remains relatively robust, leading to an efficient thermoelectric device. While these devices are not yet ready for large-scale use, they may bring us one step closer to the thermoelectric dream. As graduate student Michael Moore says, "You're basically getting something from nothing."

—Jasmine McCammon

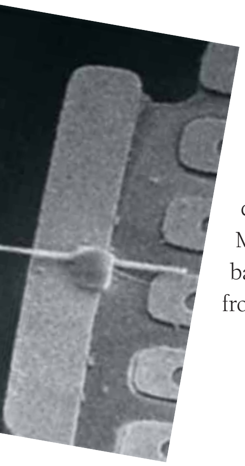


Image courtesy of Austin Roorda

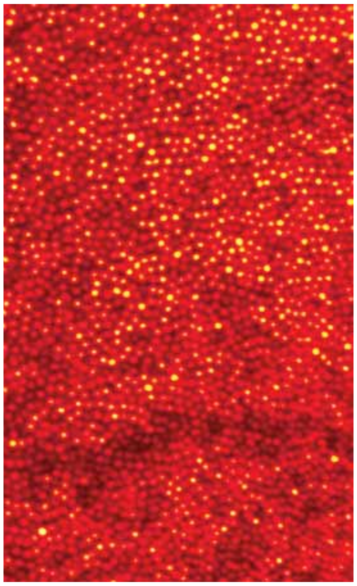
Mars in your backyard

Most canyons result from gradual geological processes over millions of years, but short, massive deluges of water can also scoop out a chasm. For example, geomorphologist Michael Lamb and his colleagues from the UC Berkeley BioMARS project believe that a sudden megaflood carved the amphitheater-headed Box Canyon in southern Idaho. Amphiteater-headed canyons, so named because they end in round, steep walls, are usually found in soft, sandy conditions and are thought to result from groundwater emerging as springs to erode the canyon walls, but Box Canyon is carved into much harder basalt, which made Lamb and his coworkers give it a second look. The canyon currently has no surface water flow, but Lamb believes that the many depressions, or "plunge pools," at the canyon's base were formed by ancient waterfalls. Its head also has telltale scour marks likely left by surface water. And the team's calculations indicate that only vast amounts of very fast-flowing water could have moved the massive boulders downstream to their current resting places. They estimate that the canyon, up to 70 meters deep in some places, was formed by a flood lasting only 35 to 160 days. Of particular interest are the similarites between Box Canyon and amphitheater-headed canyons on Mars, also carved into basalt. If the Martian canyons evolved in the same way, through flooding rather than groundwater erosion, this could shed light on unanswered questions about water's role in the Red Planet's past.

—Sharmistha Majumdar

Look both ways

Not satisfied with your 20/20 vision? How about 20/8? Austin Roorda can give it to you, as long as you're looking into his machine. Roorda, chair of the UC Berkeley Vision Science Graduate Group, has developed the Adaptive Optics Scanning Laser Ophthalmoscope, or AOSLO, a machine that allows him to see your retina—and you to see images—with unprecedented clarity. Adaptive optics was originally developed by astronomers to eliminate distortions in their images by measuring and correcting for fluctuations in the atmosphere between the stars and their telescopes. For Roorda's application, he says, "adaptive optics is a way to remove the blur caused by imperfections in the eye's optics," including the lens, cornea, vitreous humor, and even the film of tears that covers the eye, all of which are constantly changing. AOSLO uses a laser to detect aberrations in the eye and then corrects the image—or adapts—in real time. The correction works both ways: Roorda sees clearer images of patients' retinas, and patients see extremely crisp images projected by the laser directly onto their retinas. Roorda's first goal is to screen patients for eye diseases by examining the retina on a cellular level. He also aims to test the limits of human vision. Theoretically the retina limits our visual acuity to roughly 20/8, and one subject, with the help of the AOSLO, has achieved this limit. Whether it's peering into the furthest skies or depths of eyes, adaptive optics provide great insight.



—Chat Hull