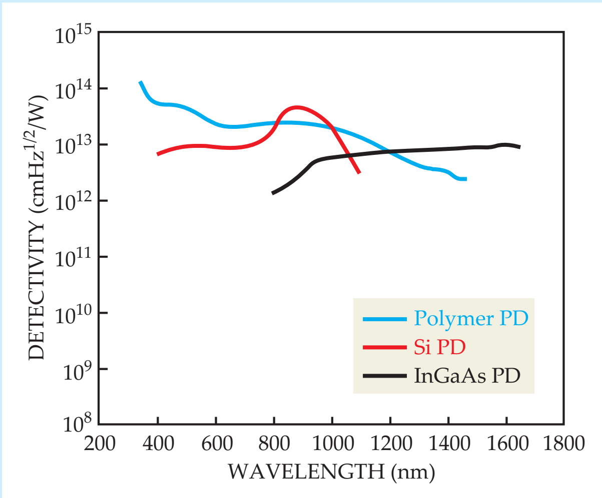
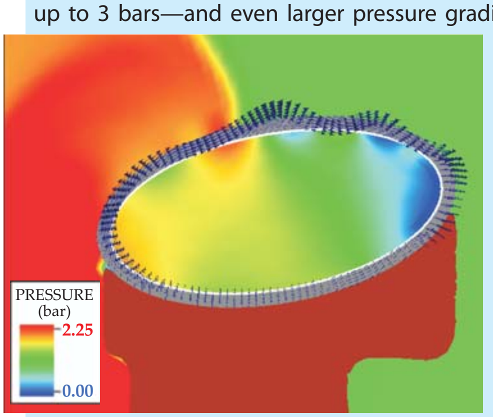
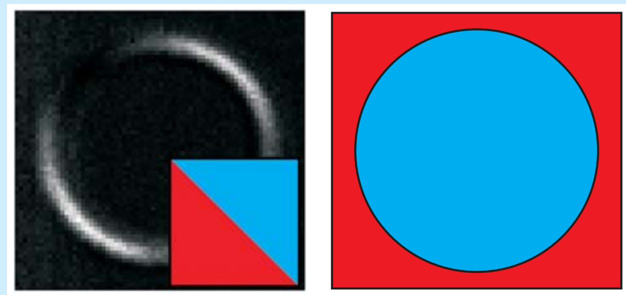


electrodes, the two materials form a phase-separated blend with interpenetrating donor and acceptor networks. Because the new light sensor covers nearly the entire solar spectrum at Earth's surface, the researchers—led by Alan Heeger of the University of California, Santa Barbara, and CBrite Inc—note that it holds promise for photovoltaic cells. The next step is to make addressable arrays of these broadband, high-detectivity photodetectors. (X. Gong et al., *Science*, in press, doi:10.1126/science.1176706.) —SGB

Skulls flex, damage brain, under battlefield explosions. When a person's head strikes, or is struck by, another object, it accelerates. As it begins to decelerate, the brain slams into the skull, then bounces off and oscillates until the impact energy dissipates. The resulting shear and compressive strains can lead to brain damage. But in battlefield explosions, the acoustic waves alone can cause soldiers traumatic brain injuries. To better understand that process, Lawrence Livermore National Laboratory's William Moss and Michael King and the University of Rochester's Eric Blackman compared numerical simulations of a head colliding with a wall to one being struck by an explosion's blast waves. Despite accelerating the head at less than half the rate of the wall collision, the simulated blast produced on the brain surprisingly comparable pressure spikes—ranging up to 3 bars—and even larger pressure gradients. Apparently, those mechanical loads are delivered by the skull, which ripples under the pressure of blast waves—the rippling motion is indicated in the image by velocity vectors. The researchers confirmed the role of the skull's elasticity by making it 1000 times stiffer in their simulations and observing a fivefold drop in the pressure spikes. The simulations also revealed that helmets in contact with the head can impart an additional mechanical load to the skull and helmets that allow for an air cushion geometrically focus and increase the magnitude of blast waves. (W. C. Moss et al., *Phys. Rev. Lett.*, in press.) —JNAM



A ghost image violates a Bell inequality. In conventional photography, photons bounce off an object and imprint its shape onto film. In ghost imaging, an object's shape is revealed after interrogating two light beams, only one of which interacts with the object. Ghost imagers have been practicing their craft for more than 10 years. Some of their schemes are based on photon entanglement, but others use classical light sources. Now Barry Jack of the University of Glasgow and colleagues have reported experiments in which quantum entanglement is manifest; their ghost images violate a generalized Bell inequality—a condition



on correlations that can arise classically. The accompanying figure presents one of their runs. The object to be imaged introduces a π phase difference between a disk (blue) and the surroundings (red). A smaller reference object (inset) introduces the phase difference on either side of a diagonal. After bouncing entangled photons, separated in space, off the object and reference, Jack and company measured photon coincidence counts. The black-and-white ghost image shown here maps those counts, with brighter regions corresponding to a greater coincidence rate. The brightest sections appear along those portions of the disk's bounding circle parallel to the reference bisector. The variation in the coincidence rate along the bounding circle violates the Bell inequality, thus demonstrating the quantum nature of Jack's system. Evidently, the ghost imaging relies on spooky action at a distance, accepted nowadays but so troubling to Albert Einstein decades ago. (B. Jack et al., *Phys. Rev. Lett.* **103**, 083602, 2009.) —SKB

Aerosols from trees. Atmospheric aerosols affect climate: The particles scatter, absorb, and emit radiation, and they also induce cloud formation. (See PHYSICS TODAY, May 2004, page 24.) Much of the aerosol mass is produced by oxidation of organic compounds emitted into the atmosphere through human activity and from the biosphere. But many aspects of aerosol formation are poorly understood. It's thought that biogenic aerosols might be formed from isoprene, a light hydrocarbon given off in large quantities by certain trees. Isoprene itself is volatile—at sea level it boils at 34 °C—so it must undergo a series of chemical reactions before it can form long-lived aerosol particles. Now Caltech's Paul Wennberg, graduate student Fabien Paulot, and their colleagues offer some insight into what those reactions are. In laboratory experiments designed to replicate atmospheric conditions far from any human pollution, they found that isoprene reacts several times with OH radicals to ultimately form large amounts of dihydroxyepoxide, a newly identified airborne molecule and a likely aerosol precursor. Its hydroxyl groups make it hydrophilic, so it should be readily taken up by existing aqueous aerosol particles. And epoxides under acidic conditions can form low-volatility polymers; a similar reaction is used in epoxy adhesive. Knowing the reactants and their mechanisms will help researchers improve atmospheric models to better predict the consequences of human activity such as deforestation and pollution. (F. Paulot et al., *Science* **325**, 730, 2009.) —JLM