

A new mode for desorption has been uncovered. The detachment of atoms and molecules from a surface is one of the fundamental processes of surface science. One of two mechanisms is generally invoked. Thermal desorption calls for the material to be heated, which can stretch and eventually break the bonds of adsorbed atoms and molecules through the action of phonons. In contrast, electronic desorption calls for an external stimulus—say, from an incident electron or photon—to induce an electronic transition of sufficient energy to promote the adsorbed atom or molecule from a bound to an unbound state. The two mechanisms operate on vastly different time scales, with electronic transitions being faster. Studying bromine adsorbed on silicon, John Weaver and his colleagues at the University of Illinois at Urbana-Champaign have found a third mode, one that has elements of both of the others. The researchers examined bromine's desorption kinetics as a function of silicon doping and of temperature. A detailed analysis revealed the rare but crucial event of 10–20 phonons simultaneously interacting with a single electron. Rather than directly breaking a bond as in the thermal case, the phonons induce an electronic transition that promotes the adsorbate to an unbound state. Thus, the Illinois group found the surprising result that electronic desorption prevails in this system without needing any external excitation. Multiphonon processes are common during a system's relaxation, but the Illinois work may show that they can also play an important role in surface chemistry. (B. R. Trenhaile et al., *Surface Science*, in press.) —SGB

A search for the hypothetical axion has produced a new limit on the axion–photon interaction strength. The putative axion, a leading candidate for cosmological dark matter, could be produced in a two-photon interaction with an electric or magnetic field. Now, the CERN Axial Solar Telescope (CAST) collaboration has investigated how axions produced at the Sun interact with a laboratory magnetic field to back-convert into x rays. In the CAST experiment, which ran for about six months in 2003, a 10-m-long, 9-T magnet refurbished from the Large Hadron Collider followed the Sun like a telescope. It was outfitted with x-ray detectors and an x-ray telescope recovered from the German space program. No axions were seen, but for lightweight axions of 0.02 eV or less, the data analysis improved the previous state-of-the-art laboratory limit on the axion–photon interaction strength by a factor of five. The CAST group expects further improvement after analyzing their 2004 data. (K. Zioutas et al., *Phys. Rev. Lett.* **94**, 121301, 2005.) —SKB

Direct detection of extrasolar planets has been achieved. Previously, the existence of planets around other suns has been inferred from subtle modulation of the starlight, either as a planet gravitationally tugged its star or as a star's light decreased when a planet eclipsed it. Now, two groups have used the *Spitzer Space Telescope* to directly record infrared light from eclipsing planets. The planets—with the prosaic names of HD 209458b (153 light years away) and TrES-1 (489 light years away)—have circular orbits a tenth the size of Mercury's, which makes the Jupiter-sized planets hot enough to be viewed by *Spitzer*. Unlike observations of other eclipsing systems, these detections relied on the planet being hidden *behind* the star. When the starlight was subtracted from the light of the complete system, only the planet's IR emission remained. (D. Deming et al., *Nature* **434**, 740, 2005; D. Charbonneau et al., *Astrophys. J.*, in press.) —PFS

Seeing the Brillouin zones of photonic lattices. The properties of periodic photonic systems depend on fundamental features of periodic structures, as described in standard condensed-matter physics texts. Periodic photonic structures and their defects (for example, the hollow core of a photonic-crystal fiber) have been directly imaged routinely for some time, but their characterization is incomplete without knowledge of the momentum-space (reciprocal-lattice) structure of the system—its Brillouin-zone (BZ) structure. Researchers from the Technion–Israel Institute of Technology, the University of Zagreb in Croatia, and Princeton University in the US, have now directly imaged the extended BZs of two-dimensional square and trigonal photonic lattices. Their technique relies on Bragg diffraction of laser light that was made spatially incoherent with a rotating diffuser, and on an optical Fourier transform. The result is textbooklike pictures previously obtainable only by computer calculations. Shown here is a typical image of the first, second, and third BZs of a trigonal lattice with an embedded defect. According to the group's leader, Moti Segev, the BZ characterization technique is general and may be used to map the momentum space of any periodic photonic structure, as well as of periodic systems beyond optics. (G. Bartal et al., *Phys. Rev. Lett.*, in press.) —SGB ■

