PHYSICS

Microwave Manipulation

Optical lattices populated by neutral atoms are a good candidate for storing quantum information. Normally, internal degrees of freedom such as the hyperfine state are used to create the basic information unit, the qubit. However, atoms also possess motional degrees of freedom; for example, the confinement of atoms in the lattice wells creates quantized vibrational states. These motional degrees of freedom are usually controlled by introducing time-dependent lattice potentials. Now, Förster et al. use microwave fields to effect transitions between vibrational levels of opposite hyperfine states of Cs atoms. Atoms in the two hyperfine states are loaded into two lattices spatially offset from each other. This arrangement enables transitions between different vibrational states, but the probability depends on the overlap of the (offset) wave functions. If the lattice is deep, transitions only happen between neighboring, slightly offset wells; if it is shallow, the offset can be increased and the atom becomes delocalized. Effective initialization into the lowest vibrational state is achieved, and Rabi oscillations between arbitrary vibrational states are demonstrated. This approach may lead to full control of quantum transport, likely a necessity for processing quantum information in this system. — JS


NEUROSCIENCE

The Next Top Model

Consumers may be familiar with high-end graphic processing components in video game consoles, such as the PlayStation3, or as a consequence of outfitting personal computers ordered online with NVIDIA graphics cards; these advances in hardware have also attracted the attention of procurement officials in the military services. In the academic realm, Pinto et al. have harnessed the power of clustered graphics processors to assess the relative performance of machine vision models of object recognition. The availability of massively parallel processing power at reasonable cost allowed them to explore, in 1 week versus 2 years, sizable regions of parameter space by varying the number of filters, the learning rate, and so forth. They generated a library of 7500 models that were trained on individually rendered objects during an unsupervised learning phase, and then screened on the basis of recognizing cars versus planes, which were presented in a range of orientations and on a variety of backgrounds. The top-ranked models were then evaluated broadly across other objects and on one of the toughest recognition tasks—photographs of human faces—and compared to a number of sophisticated algorithms, which yielded a small set of parameter values that were associated with high object recognition accuracy. — GJC


BIO MEDICINE

Sealed with a Platelet

The fetal circulatory system has distinctive anatomical features because the fetus obtains oxygen through the placenta rather than through its lungs. Before birth, a blood vessel called the ductus arteriosus (DA) allows blood to bypass the nonfunctional fetal lungs by connecting the pulmonary artery, which supplies blood to the lungs, with the aorta, which supplies blood to the rest of the body. This vessel normally closes a day or two after birth, but in some newborns, it remains open and can lead to life-threatening complications. Studying newborn mice, Echtler et al. make the surprising observation that platelets—cells noted for their role in blood clotting—were recruited to the lumen of the DA within 20 minutes after birth of the mice; when platelet production or function was disrupted, the DA failed to close completely, leading to abnormal patterns of blood flow. The recruited platelets play a dual role in DA closure—by forming a physical plug that seals the lumen of the constricted DA and by altering the behavior of other cell types involved in blood vessel remodeling. — PAK

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In the Wild

Malaria is one of the most prevalent infectious diseases and kills around 900,000 people per year. It is caused by parasites of the genus Plasmodium, which are transmitted to humans by mosquitoes and enter red blood cells, causing fever and, if left untreated, death. Human pathogens of all kinds can develop resistance to the most effective drugs, such as artemisinin, so there is a constant need to identify new compounds. Animal models of malaria have proven problematic to establish, and most studies have used laboratory cultures of human blood cells to grow the parasites. While important insights into the life cycle and pathogenic action of Plasmodium have come from these in vitro studies, a recent study of clinically isolated samples of Plasmodium in comparison to laboratory cultures revealed differences in gene expression profiles. Acharya et al. have analyzed the protein expression profiles of two species of Plasmodium that were isolated from the blood of patients; they identified about 100 proteins, some of which had not been found in laboratory cultures and could make promising drug or vaccine targets. — HP

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