Turning Laser Physics Upside Down

Everyone knows how energy gets pumped into a laser cavity to stimulate a burst of coherent light. By exploiting nonlinear optical theory, however, a research team in Austria has shown how a coupled pair of tiny lasers can do exactly the opposite.

As demonstrated by a group at the Vienna University of Technology (Nature Commun., doi:10.1038/ncomms5034), an increase in the pump power in a pair of microdisk quantum cascade lasers (QCLs) can shut off the laser beam, and a drop in pump energy can switch it back on. The researchers hope the results will aid the development of photonic circuitry on the microchip level.

The team, led by Stefan Rotter, fabricated two terahertz QCLs shaped like thin disks with the active semiconductor region sandwiched between two metal contacts. The emission wavelength of the QCLs was roughly the size of the microdisks—100 μm. The disks were placed side by side to induce mode coupling. The scientists measured the pump strength in one disk while holding the other disk at a constant pump value just about the threshold for laser action, and recorded the characteristic reversal in the first disk’s pump dependence.

—Patricia Daukantas