lines cross a given output line, only one input line is allowed to put a signal on that output line; in other words, the connections between the other input lines and the given output line are required to be of high impedance in order to block signals.

Figure 2 depicts a proposed QCA-based crosspoint switch and a 3 × 3 crossbar network. The crosspoint switch would contain several branched QCA subarrays excited by suitably phased clock signals, and one of the quantum cellular automatons would serve as a control switch. The input signal I_i would propagate toward the output line along one branch and, by suitable clocking and coupling, would be converted to another signal, I_f, propagating toward the output line along another branch. The application of a "0" signal to the control switch would cause I_i and I_f to be of the same state (both 0 or both 1), thereby causing the signal I_i to be coupled onto the output line; in effect, the crosspoint switch would be in a low-impedance state. On the other hand, the application of a "1" signal to the control switch would cause I_f to be the opposite of I_i, thereby preventing coupling of either I_i or I_f onto the output line; in effect, the crosspoint switch would be in a high-impedance state.

This work was done by Amir Fijany, Nikzad Toomarian, Katayoon Modarress, and Matthew Spotnitz of Caltech for **NASA's Jet Propulsion Laboratory**. *For further information, access the Technical Support Package (TSP)* **free on-line at www.nasatech.com**.
NPO-20855

Laterally Coupled Quantum-Dot Distributed-Feedback Lasers

These lasers show promise for single-frequency, single-spatial mode operation.

NASA's Jet Propulsion Laboratory, Pasadena, California

InAs quantum-dot lasers that feature distributed feedback and lateral evanescent-wave coupling have been demonstrated in operation at a wavelength of 1.3 μm. These lasers are prototypes of optical-communication oscillators that are required to be capable of stable single-frequency, single-spatial-mode operation.

A laser of this type (see figure) includes an active layer that comprises multiple stacks of InAs quantum dots embedded within InGaAs quantum wells. Distributed feedback is provided by gratings formed on both sides of a ridge by electron lithography and reactive-ion etching on the surfaces of an AlGaAs/GaAs waveguide. The lateral evanescent-wave coupling between the gratings and the wave propagating in the waveguide is strong enough to ensure operation at a single frequency, and the waveguide is thick enough to sustain a stable single spatial mode.

In tests, the lasers were found to emit continuous-wave radiation at temperatures up to about 90 °C. Side modes were found to be suppressed by more than 30 dB.
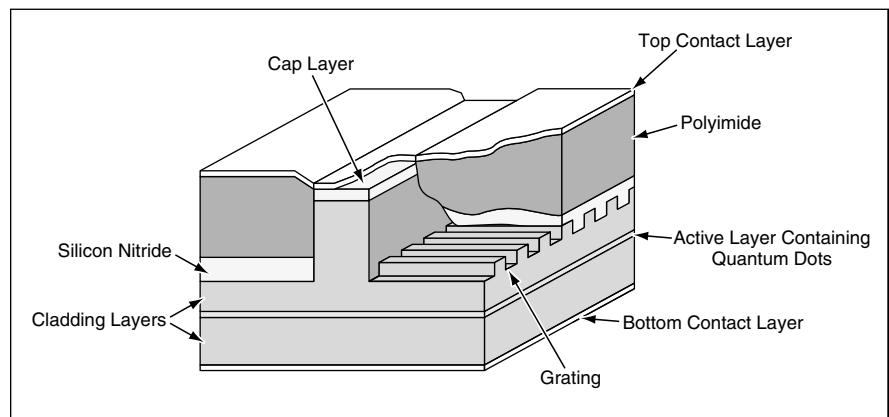
This work was done by Yueming Qui,

Pawan Gogna, Richard Muller, Paul Maker, and Daniel Wilson of Caltech and Andreas Stintz and Luke Lester of the University of New Mexico for **NASA's Jet Propulsion Laboratory**. *For further information, access the Technical Support Package (TSP)* **free on-line at www.nasatech.com**.

A **Laterally Coupled Quantum-Dot Distributed-Feedback Laser** contains structures that favor oscillation at a single frequency in a single spatial mode.

Bit-Serial Adder Based on Quantum Dots

Adders like this could be used to develop advanced, compact computers.

NASA's Jet Propulsion Laboratory, Pasadena, California

A proposed integrated circuit based on quantum-dot cellular automata (QCA) would function as a bit-serial adder. This circuit would serve as a prototype building block for demonstrating the feasibility of quantum-dots computing and for the further development of increasingly complex and increasingly capable quantum-dots computing circuits. QCA-based bit-serial adders would be especially useful in that they would enable the development of highly parallel and systolic processors for implementing fast Fourier, cosine, Hartley, and wavelet transforms.

The proposed circuit would comple-ment the QCA-based circuits described in "Implementing Permutation Matrices by Use of Quantum Dots" (NPO-20801), *NASA Tech Briefs*, Vol. 25, No. 10 (October 2001), page 42 and "Compact Interconnection Networks Based on Quantum Dots" (NPO-20855), which appears elsewhere in this issue. Those