New Scientist

July 5, 1997

SECTION: This Week, Pg. 2121

LENGTH: 394 words

HEADLINE: A switch in time

BYLINE: Mike May

BODY:
THE smallest light switch in the world has been built by researchers at Northwestern University in Illinois. By coupling it to a tiny laser, the scientists hope to open up a route to circuits that use light rather than electrons and, one day, optical computers.

The tiny semiconductor switch uses a ring of gallium arsenide just 10.5 micrometres in diameter. Deana Rafizadeh, the graduate student who made the switch, says it could be even smaller - between 1 and 2 micrometres across. Previously, the smallest ring-shaped optical resonator was a mighty two millimetres across.Magazine

Rafizadeh made her switch, which she describes as a nanoscale waveguide-coupled microcavity resonator, at Cornell University's Nanofabrication Laboratory. The finished device consists of the resonator ring and two straight waveguides just 0.5 micrometres wide that pass within 0.1 micrometres of opposite sides of the ring. The waveguides channel light into the resonator. If the ring is resonating at the same frequency as the light, the light passes across. If not, it stops. Rafizadeh says, "If the light is in resonance with the ring, then the incoming light is fully coupled from one waveguide into the ring and out the other waveguide."

The ring can be tuned by applying a voltage or changing its temperature. This alters its refractive index, and hence its resonant frequency. Once tuned, this resonator acts like an extremely selective filter that allows only light within a very narrow band of frequencies to pass.

The resonator can be made to separate many more frequencies than larger devices can. Such a tunable resonator could perform a variety of tasks, including filtering one frequency of light from another and combining, or switching between, many different communication lines.

Despite this success, the researchers are still a long way from producing an integrated circuit that runs on light alone. The mechanics of controlling the resonator have to be fully worked out. What's more, the resonator only works with photonic-wire lasers built to the same scale. The first such laser was developed in 1995, by the same laboratory at Northwestern University. Seng -Tiong Ho, head of the laboratory, says the first completely optical integrated circuit lies a couple years away.

For more science news see http://www.newscientist.com

LOAD-DATE: July 4, 1997