$3.5 Million DARPA Grant Supports Research on Chip-Scale Wavelength Division Multiplexing

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Santa Barbara, Calif.--A team of five University of California at Santa Barbara (UCSB) researchers has been awarded a four-year, $3.5 million grant by the Defense Advanced Research Projects Agency (DARPA) to investigate how to pipe digital and analog information through a photonic circuit on a single compound semiconductor chip.

The principal investigator for the grant is Electrical and Computer Engineering Professor Daniel Blumenthal, who also serves as associate director of the UCSB Multidisciplinary Optical Switching Technology (MOST) Center. Blumenthal said, "Our team at UCSB is pleased that DARPA's Microelectronics Technology Office has enabled us to tackle this very difficult problem. We are gratified to have been chosen to figure out and implement an approach to a question that is challenging both scientifically and technologically."

Digital signals are made up of discrete pieces of information or bits (i.e., 0 or 1). Analog signals convey information in terms of the amplitude of waves. Wavelength division multiplexing (WDM) allows multiple digital or analog signals to be transmitted on different colors of light in the same optical fiber. All-optical wavelength conversion refers to modulating or imprinting a photonic signal from one color (wavelength of light) to another without resorting to electronics to control the process.

The research project deals with chip-scale integration of all-optical wavelength converter technology, which imparts the ability to imprint information from one color of light onto another color of light without passing the signal through electronics. The level of integration required for this project is comparable in difficulty to that faced by the electronics industry in the early days of analog electronics.

The requirements for imprinting a digital signal differ from the requirements for imprinting an analog signal. Basically, a digital signal requires clarity in imprinting -- i.e., the "0" or the "1" precisely conveyed from one color to another. With an analog signal, the emphasis is on replicating little variations in amplitude over a wide amplitude range. The daunting task the UCSB researchers have before them is to integrate different devices on a single chip as well as meet both analog and digital requirements for a single photonic circuit.

Blumenthal said that the group has mapped out a 10-year plan, beyond the current program, for advancing this goal to future generations of photonics system integration at the chip-scale.

The other four UCSB researchers are all professors of electrical and computer engineering: John Bowers, director of MOST; Larry Coldren, director of the Optoelectronics Technology Center (OTC); Evelyn Hu, science director of the California NanoSystems Institute (CNSI) at Santa Barbara; and Nadir Dagli.

Images

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