UCLA receives DARPA grant to research ultra-low-power, non-volatile logic technologies

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The Defense Advanced Research Projects Agency (DARPA) has awarded the UCLA Henry Samueli School of Engineering and Applied Science an $8.4 million grant for research on a technology known as non-volatile logic, which enables computers and electronic devices to keep their state even while powered off, then start up and run complex programs instantaneously.

The research has broad implications across a range of technologies, including portable electronics, remote sensors, unmanned aerial vehicles and high-performance computing.

UCLA Engineering researchers will conduct studies into the materials, design, fabrication and tools used to develop such technologies.

"The technologies developed in this project will form the basis for a paradigm shift, not only in spintronics, but in the electronics industry as a whole," said Kang Wang, UCLA's Raytheon Professor of Electrical Engineering and joint principal investigator on the project. "The support from DARPA is critical, since it will allow the U.S. to take the lead in developing this new non-volatile electronic technology."

Today's digital electronics rely on complimentary metal-oxide semiconductor (CMOS) integrated circuits, which use an electron's charge to store and transfer information. But as devices and chips have

become smaller and more compact, down to the nanometer scale, the fundamental limits of CMOS are being approached. The emerging field of spintronics exploits another aspect of electrons — their spin — to transfer information, taking advantage of ferromagnetic materials, which are inherently magnetic.

Devices using ferromagnetic materials can be non-volatile, maintaining their computational state even when power is removed, and they consume much less power when switched on.

The UCLA researchers are aiming to develop a prototype non-volatile logic circuit, which could lead to the development of new classes of ultra–low-power, high-performance electronics. The research program will explore three technical areas: the behavior of nanoscale magnetic materials; the fabrication and testing of a non-volatile logic circuit; and the development of novel circuits and circuit-design tools.

Researchers at the Western Institute of Nanoelectronics (WIN) and the Center for Functional Engineered Nano-Architectronics (FENA), both housed at UCLA Engineering and both led by Wang, have made several research breakthroughs in spintronics materials and design over the past several years. This research will be leveraged into the DARPA-funded non-volatile logic program.

"To achieve the ambitious goals of this program, we are planning to introduce key innovations in terms of both material and device structures. This is an opportunity to study new nano-magnetic physics while developing an exciting technology," said research associate Pedram Khalili, who will be the project manager at UCLA.

The project will be led by UCLA under principal investigators Kang Wang and Alex Khitun, an assistant research engineer, and will involve researchers from UCLA, UC Irvine, Yale University and the University

of Massachusetts.

Provided by University of California - Los Angeles