

UC Berkeley Press Release

UC Berkeley, UCLA, UC Santa Barbara and Stanford join to establish Western Institute of Nanoelectronics

By Liese Greensfelder, Media Relations | 09 March 2006

BERKELEY – The University of California, Berkeley; UCLA's Henry Samueli School of Engineering and Applied Science; UC Santa Barbara; and Stanford University are teaming up to launch what will be one of the world's largest joint research programs focusing on the pioneering technology called "spintronics."

The Western Institute of Nanoelectronics' administrative headquarters will be located at UCLA Engineering, with scientific and technical responsibilities for the program distributed across all four campuses.

UCLA Engineering professor Kang Wang will serve as director of the institute, working closely with co-principal investigators David Awschalom at UC Santa Barbara, Jeff Bokor at UC Berkeley, and Philip Wong at Stanford. All of the nearly 30 eminent researchers taking part in the institute will explore critically needed innovations in semiconductor technology. The program will be co-managed by the four participating campuses and the semiconductor industry sponsors, with nearly 10 researchers from the semiconductor companies working with students and faculty on all of the university campuses. This close collaboration, with research and responsibilities shared by four campuses and six industry sponsors, represents an innovative model for cooperative research.

"With this new institute, we are talking about an unprecedented opportunity to help define a technology that can exploit the idiosyncrasies of the quantum world to provide key improvements over existing technologies," Wang said. "As rapid progress in the miniaturization of semiconductor electronic devices leads toward chip features smaller than 65 nanometers in size, researchers have had to begin exploring new ways to make electronics more efficient.

"Simply put, today's devices, which are based on complementary metal oxide semiconductor standards, or CMOS, can't get much smaller and still function properly and effectively. That's where spintronics comes in."

The Western Institute of Nanoelectronics (WIN) has been organized to leverage what are now considered the world's best interdisciplinary talents in the field of nanoelectronics. Its mission is to explore and develop advanced research devices, circuits and nanosystems with performance beyond conventional devices.

The researchers agree that the fundamental limits of CMOS technology will be reached in 10 to 15 years. "The semiconductor industry is facing a huge challenge, which is to come up with a technology successor for CMOS," said Bokor, a professor of electrical engineering and computer science who is heading UC Berkeley's participation in the project. "That seems like a long way off. But since the next technology has still not been invented, in a sense we are already late.

"What's exciting about the WIN program is that these semiconductor companies are placing a large bet on our university team to come up with the needed innovation. This new model for research collaboration will greatly facilitate getting our research results into the industry for development much more readily and quickly than has been the case in the past. If we are successful, the consequences could be enormous."

UC Berkeley Chancellor Robert Birgeneau said he was "delighted" that through CITRIS - the Center for Information Technology Research in the Interest of Society that is headquartered at UC Berkeley - the campus is joining UCLA, UC Santa Barbara and Stanford to establish the institute.

"My students and I did extensive research on quantum spin magnetism, which is the fundamental basis for spintronics," he said. "I am very excited that this promising area for next-generation electronics will be featured in the work of the institute. I am sure that WIN will help secure California's leadership in developing these important new technologies."

Spintronics relies on the spin of an electron to carry information and holds promise in minimizing power consumption for next-generation electronics. Information-processing technology has relied so far on charge-based devices, ranging from vacuum tubes to million-transistor microchips. Conventional electronic devices simply move these electric charges around, ignoring the spin that tags along for the ride on each electron. Spintronics aims to put that extra spin action to work -- effectively corralling electrons into one smooth reactive chain of motion.

The institute is being established with starting grants of \$18.2 million: an industrial support total of \$14.38 million and a matching \$3.84 million UC Discovery Grant from the Industry-University Cooperative Research Program, which seeks to strengthen California's research-and-development economy in partnership with California research-and-development companies. The \$18.2 million includes \$2.38 million from a Nanoelectronics Research Initiative grant funded by six major semiconductor companies -- Intel Corporation, IBM Corporation, Texas Instruments, Inc., Advanced Micro Devices, Inc., Freescale Semiconductor, Inc. and MICRON Technology, Inc.

The \$18.2 million also includes an additional Intel grant of \$2 million. The institute will also receive a \$10 million equipment grant from Intel. These grants will ensure that long-range research is properly resourced to address the need for semiconductor technologies beyond complementary metal oxide semiconductors. Funds will be distributed over a four-year period. Infrastructure and personnel support from the participating universities is estimated to exceed \$200 million.

Hans Coufal, director of the Nanoelectronics Research Corp., which has been chartered to implement the Nanoelectronics Research Initiative, said, "The participating companies are delighted to closely engage with some of the best scientists in this field and to provide support for their research towards the common objective, to extend Moore's Law for many more years to come." (Moore's Law refers to the prediction made in 1965 by Gordon Moore, one of Intel's founders, that innovative research would allow for a doubling of the number of transistors in a given space every year. In 1975, he adjusted this prediction to a doubling every two years.)

A portion of the institute will be housed in new laboratories within the new California NanoSystems Institute (CNSI) buildings currently under construction at UCLA and UC Santa Barbara. Members of the new institute will also take advantage of the Center for Spintronics and Quantum Computation, a CNSI research organization with coordinated scientific programs spanning universities around the world. The institute will use new infrastructures and laboratories at all the participating universities, including those at UC Berkeley's CITRIS and at the National Nanotechnology Infrastructure Network at both Stanford and UC Santa Barbara.

Intel fellow Paolo Gargini, director of technology strategy and chair of the Nanoelectronics Research Initiative Governing Council said, "The long-standing partnerships that Intel has with California's great institutions of higher learning and research made it logical to team up with them in this new consortium to establish a West Coast platform for exploratory science feeding into industry research and development.

"It is critical that we look farther out in such research to lay the groundwork for continuing Moore's Law, which is the foundation for the robust growth of our industry and the key role it plays in the economies of California and our nation. We appreciate the universities dedicating their pre-eminent intellectual capital and facilities to the effort, and the support of UC Discovery in helping to address the funding required to maintain leadership in semiconductor technology and manufacturing."

On behalf of UC Discovery Grants, Susanne L. Huttner, associate vice provost for research and UC's executive director of the Industry-University Cooperative Research Program, said the new institute "takes California another big step ahead of the competition in other states. The joint investment we are making with companies doing research and development in California and the Nanoelectronics Research Corporation is positioning the state for world leadership in emerging markets for nanoscale

materials and devices."