

PROMOTION RECOMMENDATION
The University of Michigan
College of Engineering

Pei-Cheng Ku, assistant professor of electrical engineering and computer science, Department of Electrical Engineering and Computer Science, College of Engineering, is recommended for promotion to associate professor of electrical engineering and computer science, with tenure, Department of Electrical Engineering and Computer Science, College of Engineering.

Academic Degrees:

Ph.D. 2003 University of California, Berkeley, Electrical Engineering and Computer Science, Berkeley, CA
B.S. 1995 National Taiwan University, Electrical Engineering, Taipei, Taiwan

Professional Record:

2006 – present Assistant Professor, Department of Electrical Engineering and Computer Science, University of Michigan
2004 – 2005 Intel Corporation, Senior Process Engineer, Santa Clara, CA

Summary of Evaluation:

Teaching: Professor Ku has taught a total of six different courses. His most recent scores for EECS 429 in Winter 2011 were a Q1 of 4.00 and a Q2 of 4.33. He has introduced two new major courses to the department that help modernize our program at the undergraduate and graduate levels as well as respond to the interests of the students. The first course aims to address student interests in the ‘greening’ of technology: *Solid-State Lighting and Solar Cells*. The second course addresses a growing need in the photonics area: *Nanophotonics and Nanofabrication*. Professor Ku has been very successful in mentoring students in research. He has already graduated three doctoral students with another six in progress. Furthermore, he has provided a remarkable opportunity for undergraduate students in research, with 20 undergraduates having had research projects in his lab. He has also had an impact in the community by supervising a summer research program for local high school students, and serving as a faculty mentor for photovoltaics technology for Seneca Middle School, Clinton, Michigan.

Research: Professor Ku is conducting exciting research at the forefront of three distinct areas with large impact, and has adequately demonstrated his ability to develop and maintain a well-funded experimental research effort, supervise and graduate doctoral students, and publish his research in leading journals. His work on “slow light” as applied to devices has garnered attention worldwide. His work on nano-optoelectronics for improving energy efficiency in various devices including lighting and solar cells is definitely a forefront area where he will rise to even higher prominence, ultimately most likely surpassing his work on slow light. His application of nano-optoelectronic devices to biomedical sensing has also begun to produce results that will definitely be a growth area for his group.

Professor Ku is internationally known for his research focus on semiconductor MOCVD growth of nitride-based nanomaterials for light-emitting devices and solar cells, nanolasers, and quantum optical devices. Through this work, he is also involved in development of photonic materials for renewable energy and solid-state lighting. Professor Ku has established a dynamic experimental research group, conducting research at the forefront of areas with large societal impact. As a graduate student at the University of California, Professor Ku conducted seminal work on slow light generation with semiconductor quantum wells, a relatively new field of research that is important for optical

communication. This research was largely accomplished by his initiative, and his 2004 first-author article in *Optics Letters* has become a highly cited publication. Two more papers and a review article expanded on the ideas of this paper.

Professor Ku also has pursued new and unique research subjects in which he has flourished. It was some of the inadequacies of the quantum wells and dots he was investigating in his slow light research that led him to wide bandgap semiconductors and their nanostructures. Using these nanostructures, he is working and contributing to “green photonics” with four clear application areas: solid-state lighting, photovoltaics, ultra-low-power communication, and bio-sensing. He has developed unique techniques to develop 10nm size quantum dots and nanowires for high-efficiency solar cells and light-emitting diodes and sub-wavelength plasmonic nano-ring lasers with metallic cavities for communication and optical interconnects.

Professor Ku has published a total of 27 journal and letter format papers, 12 from Michigan work, and 49 refereed conference or symposium presentations/proceedings, 35 from Michigan. The publications are all in specialized high impact journals of high quality and are highly cited since publication. The papers have been published in the most valuable archival journals in the field. He has also presented his research in invited and contributed talks at international conferences.

Professor Ku’s funding level demonstrates his ability to successfully support his research. He received the DARPA Young Investigator Award (\$300K), and currently is the PI on a collaborative NSF grant (\$360K) and a single investigator NSF grant (\$298K). He is also a co-PI on several other grants, bringing in significant funding from these sources. Earlier grants during his first six years include a DARPA grant for which his portion was valued at \$558K, and a second DARPA grant for which he is the PI on a sub-contract (\$80K). From this data, we are convinced that he has found research areas that are scholarly and in which he is highly competitive.

Recent and Significant Publications:

- M. W. Kim and P. C. Ku, “Semiconductor Nanoring Lasers,” *Applied Physics Letters*, 16 May 2011, p. 201105 (3 pages).
- M. W. Kim and P. C. Ku, “The metal-clad semiconductor nanoring laser and its scaling properties,” *Optics Express*, 14 February 2011, pp. 3218 – 3225.
- T. Jung, L. Lee, and P. C. Ku, “Novel Epitaxial Nanostructures for the Improvement of InGaN LEDs Efficiency,” *Journal of Selected Topics in Quantum Electronics*, July/August 2009, pp. 1073-1079.
- H. Yu, L. Lee, T. Jung, and P. C. Ku, “Photoluminescence Study of Semi-Polar {10-11} InGaN/GaN Multiple Quantum Wells Grown by Selective Area Epitaxy,” *Applied Physics Letters*, 2 April 2007, p. 141906 (3 pages).
- R. S. Tucker, P. C. Ku, and C. J. Chang-Hasnain, “Slow-Light Optical Buffers: Capabilities and Fundamental Limitations,” *Journal of Lightwave Technology*, December 2005, pp. 4046 - 4066.
- P. C. Ku, P. Palinginis, T. Li, F. Sedgwick, S. Chang, H. Wang, C. J. Chang-Hasnain, and S. L. Chuang, “Slow-light via population pulsation in semiconductor quantum wells,” *Optics Letters*, 1 October 2004, pg. 2291 - 2293.

Service: Professor Ku has been involved in service to the College and his department as well as his professional community. Within the College and department, he has served on seven committees, six of which were aimed directly at the undergraduate program. He worked as reviewer of proposals for various governmental funding agencies and served as reviewer for a number of first tier journals including *Applied Physics Letters*, *Optics Express*, *Optics Letters*, and a number of IEEE journals. His service has been solicited within the larger professional community, where he organized a symposium at a major meeting and served on several conference planning committees.

External Reviewers:

Reviewer A: “He easily ranks in the top few percent of his peers in semiconductor nanophotonics materials and device research.”

Reviewer B: “Prof. Ku [is] well regarded in the international research community for his important research contributions to compound semiconductor materials and device technology...”

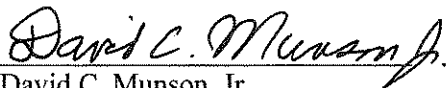
Reviewer C: “...he is an extremely gifted and promising scientist [of his cohort] with a strong record already at his stage of careers and with great potential in the future...made quite a few significant accomplishments in several areas including a novel epitaxial growth of nitride nanostructures and a nanoring metallic cavity lasers.”

Reviewer D: “The impacts of his works related to III-Nitride semiconductor optoelectronics are still at early stage, however it is important to note that the interesting idea of the site-controlled QDs have attracted significant recent funding from US National Science Foundation...The field of nanolaser is relatively at early stage, and Prof. Ku’s contribution to this field is of great value – specifically, the simulation works by Prof. Ku’s group related to this topic are potentially important for future works in this direction.”

Reviewer E: “His recent works on GaN and nanolaser/LED are very innovative...PC is among a handful of elite researchers [of his cohort] in US.”

Reviewer F: “...Pei Cheng Ku’s publication list consists of seminal reports of highly creative and important results. He should be one of [junior] most active researchers in the technical area of nitride-based nano-structure devices.”

Summary of Recommendation: Professor Ku is a very prominent and productive engineer/scientist who has made significant contributions to the field of photonics. He is an excellent teacher and mentor; and has been active in contributing to external and internal service. It is with the support of the College of Engineering Executive Committee that I recommend Pei-Cheng Ku for promotion to associate professor of electrical engineering and computer science, with tenure, Department of Electrical Engineering and Computer Science, College of Engineering.



David C. Munson, Jr.

Robert J. Vlasic Dean of Engineering
College of Engineering

May 2012