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Rice University NanoJapan Program: Connecting US Undergraduates with Leading Japanese Nanotechnology Research Laboratories

NSF PIRE: U.S.-Japan Cooperative Research and Education Ultrafast and Nonlinear Optics in 6.1 Angstrom Semiconductors

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This report was prepared by Prof. Junichiro Kono of Rice University. Prof. Kono is the Principal Investigator for this NSF-PIRE grant and works directly on this research project with his co-PIs Prof. Chris Stanton of the University of Florida and Prof. Alexey Belyanin of Texas A&M University. Japanese research collaborators for this project include Prof. Hiroo Munekata of the Tokyo Institute of Technology and Prof. Masataka Inoue of the Osaka Institute of Technology. For more information on Prof. Kono's research please see http://www.ece.rice.edu/~irlabs/ or email kono@rice.edu.

Fellow co-PIs Dr. Cheryl Matherly of the University of Tulsa directs the international education programs funded by this grant in conjunction with co-PI Sarah Phillips of Rice University. For more information on the NanoJapan program please see http://nanojapan.rice.edu or email nanojapan@rice.edu.

As international partnerships are becoming increasingly indispensible to solving major science and engineering problems, U.S. researchers and educators must be able to operate effectively in teams comprised of partners from different nations and cultural backgrounds. The NanoJapan Program was developed to address this need by attracting undergraduate students to the emerging areas of electrical engineering and the physical sciences, especially the study of nanotechnology. By involving and training students in cutting-edge research projects in nanoscale science and engineering, this program aims to increase the numbers of US students who choose to pursue graduate study in this field while also cultivating a generation of globally aware engineers and scientists who are prepared for international research collaboration. Funded by a Partnership for International Research and Education grant from the National Science Foundation (NSF-PIRE), this program is administered through the Electrical and Computer Engineering Department of Rice University and the Center for Global Education at the University of Tulsa.

Rice University Department of Electrical & Computer Engineering: By many measures, the most critical outcome of a university-industry research relationship is educating engineers and scientists for the company, its customers, suppliers and industry partners. Rice has an outstanding record of accomplishment in educating first-rate students and placing them in the global marketplace. The diverse yet synergistic research interests, centers, groups and the scope of multi and interdisciplinary research collaborations are virtually unmatched among universities throughout the world. In fact, our department is internationally known for its extensive reach across the many engineering disciplines ranging from designing the next generation of wireless networks and embedded systems architectures to nano photonics and terahertz laser spectroscopy.

Research awards and expenditures have climbed steadily throughout past several years with current major research grants nearing the $10 million mark. In the recently announced Academic Analytics' Faculty Scholarly Productivity Index Rice University ranked first among all Electrical and Computer Engineering departments at US universities. This index is a ranking of graduate programs at research universities based on what the company purports to be the first objective measurement of per-capita scholarly accomplishment. It is the endeavor of each ECE faculty member to ensure that our students *learn how to learn and how to become leaders and pioneers*, emphasizing fundamental principles as well as practical applications that respond to challenges and revolutionize technology. The faculty is actively working on revolutionary changes in ECE curriculum which will make a global impact in the way we educate undergraduates and integrate them into our world class research.

Nanotechology at Rice University: Over 10 years ago in 1993, Rice University established a major development effort in nanoscale science and technology with the foundation of the Center for Nanoscale Science and Technology. This effort was based on the pioneering work of the late Dr. Richard Smalley and Dr. Robert Curl, whose groundbreaking work in nanotechnology won them the 1996 Nobel Prize in Chemistry and firmly established Rice as a true leader in nanoscale research and development, a position that Rice remains committed to maintaining. Since 1993, new cutting-edge facilities have been constructed, the number of faculty working in the nanosciences has grown rapidly, and funding for

nanotechnology research at Rice exceeded $30 million in 2004. Indeed, Rice's reputation in nanoscience research is among the top tier of US institutions, as evidenced by a peer review of 100 universities recently conducted by Small Times Magazine, a nanotechnology trade publication. In this peer review, Rice ranked #1 in the commercialization of nanotechnology, and #2 in facilities and resources.

Why Nanotechnology in Japan: As the two main leaders in nanotechnology research and development, the US and Japan currently account for well over 50% of global R&D funding in this field. To continue to make further advances in the science and to bring ideas out of the lab into useful commercial products, it is therefore important to stimulate further cooperation between these two countries. However, there remain obstacles to further collaboration between Japan and the US in the nanosciences; primarily the language and cultural barriers that still divide our students and researchers. Participation in the NanoJapan program will help break down these barriers by providing US students with not only the professional research skills but also the inter-cultural and language skills needed to work closely with their Japanese and other international research collaborators. These are skills that students will utilize throughout their future academic and professional careers.

NanoJapan Program Description: NanoJapan, established by an NSF-PIRE grant in 2005, is a twelve-week summer program that involves sixteen freshman and sophomore science and engineering students from US universities in research internships with Japanese nanotechnology laboratories. It is a natural fit that the program was established between the US and Japan. These countries are the global leaders in nanotechnology research, accounting for more than 50% of all funding worldwide, and almost equal share between the two countries. Investment in 2003 for Japan ($1.610 billion) actually exceeded that in the United States ($1.524 billion), making Japan the leader in nanoscience research. NanoJapan was one of only twelve projects funded by the NSF in the first round of PIRE grants. The program includes:

- ***Intensive Japanese Language & Culture Orientation:*** Students complete a three-week orientation program in Tokyo that introduces them to nanotechnology research and the competencies required to work successfully in the global science community. Since most of the NanoJapan participants have not had previous experience in Japan, the students complete 60 hours of intensive Japanese language instruction. Additionally, they participate in a colloquium on the history and culture of Japan, taught by local Japanese faculty. Finally, they participate in a seminar series that introduces them to nanotechnology research that has been taught by a Rice University electrical engineering graduate student and supplemented by talks by the heads of the research groups in which the NanoJapan students worked. The goal of the orientation program is to provide participants with the basic language and intercultural communication skills that give them a firm foundation upon which they can build during their research internships.
- ***International Research Experience (IRE) in Nanotechnology:*** Students are assigned to leading nanotechnology labs throughout Japan for seven week summer internships. During the research internships, students conduct a hands-on research project in the field of nanotechnology under the supervision of their research advisor and graduate student mentors. The projects are carefully selected to match the students′ academic interests and their readiness to complete academic research. Students also have the opportunity to continue their Japanese language studies and further develop their scientific research skills in an international setting. Research internships and projects are arranged by Prof. Junichiro Kono, the Principal Investigator for the grant that funds the program, in consultation with his research collaborators throughout Japan. The primary language of all research labs is English.

- ***Nanotech Symposium:*** Upon the conclusion of the IRE, students return to Rice University for the Rice Quantum Institute Summer Colloquium, where they present posters on their research experience in Japan along with other students who have completed nanotechnology-related summer research experiences at Rice University. In addition to the colloquium, students also participate in a program that provides them with information on re-entry to the US and methods to make the most of their international experience throughout their academic and professional careers.
- ***Cultural Programming:*** The orientation program includes organized excursions to major sites and festivals in Japan. The students convene for a mid-program debriefing in Kyoto and participate in a full-day Japanese Traditional Arts program that includes sessions on Japanese tea ceremony, martial arts, Noh drama and calligraphy. In addition to the workshop students also participate in walking tours of key historical and cultural sites in Kyoto. Finally, most students continue their Japanese language study during the period of their internship through lessons arranged by their hosting research labs.
- ***Other program logistics:*** All students receive a stipend funded by the NSF to partially cover their living and travel expenses. Their housing, typically in university dorms, is arranged by their hosting research labs.

Participants: The NanoJapan program recruits freshmen and sophomore engineering students from all US universities. Since the inaugural year in 2006, 32 students have completed the program. The NSF-PIRE grant will fund this program through 2010. Students are recruited on the basis of their interest in nanotechnology research. For many, the program represents their first exposure to Japan. Students are selected on the basis of several criteria, including their interest and previous experience with academic research, interest in the field of nanotechnology, and interest in Japan. Many of the students are attracted first to the NanoJapan program because it is an academic research program. Most have also indicated that they consider this their best alternative to a traditional study abroad program, which they would be unlikely to pursue since it would require them to miss a regular semester of courses.

Research Hosts in Japan: Principal Investigator Prof. Junichiro Kono of Rice University coordinates all arrangements for the research hosts for NanoJapan students. (See table of host institutions below.) Drawing on his professional network of colleagues in the field of nanotechnology Prof. Kono is able to arrange placements for NanoJapan students at leading academic research laboratories throughout Japan. In order to be accepted into the program NanoJapan students must express a demonstrated interest in the field of nanotechnology as it relates to nanoscale semiconductor devices, nanophotonics, and/or carbon nanotubes. Prof. Kono then works collaboratively with the Japanese hosts to identify a specific project available at their lab that summer and seeks the most suitable candidate from the NanoJapan students for placement at that lab.

Upon arrival the NanoJapan student will meet with their research advisor to further discuss their project and compile a formal research project timeline and identify key research goals. The NanoJapan student is then assigned a graduate student or post-doc as a research mentor and they work closely with this individual on all aspects of their research project over the course of the summer. The NanoJapan student is fully integrated into all aspects of their Japanese research group and is expected to attend and participate fully in group meetings and other events. Due to the nature of scientific research projects often change or alter their focus slightly throughout the summer and Prof. Kono will remain in close contact with both the hosts and NanoJapan students regarding their research projects. In mid-July Prof. Kono personally visits each NanoJapan student and research advisor at their Japanese research laboratory to discuss the progress of their projects and address any inter-cultural communication issues that may have arise. This visit also provides an opportunity for discussion of current and potential future research

collaborations between the Kono Group at Rice University and the Japanese research laboratory. The NanoJapan program concludes with students returning to Rice University and participating in the Rice Quamtum Institute's Summer Research Colloquium where they present scientific posters on their summer research projects.

NanoJapan 2006 Research Hosts & Projects		
AIST	Prof. Kazu Suenaga & Prof. Sumio Iijima	High Resolution Electron Microscopy of Er@C-90 in Peapods
Keio University	Prof. Kohei Itoh	Self-Assembly Mechanisms for Silicon and Germanium Nanostructures
NTT Basic Research Laboratory	Prof. Akira Fujiwara	Purification and AFM Analysis of P2X4 Receptor and Bacteriorhodopsin for Nanobiological Devices
Osaka Institute of Technology	Prof. Masataka Inoue & Prof. Shigehiko Sasa	Ballistic Rectifiers
Osaka University	Prof. Masayoshi Tonouchi	Overcoming Resolution Limits in Terahertz Spectroscopy
RIKEN	Prof. Koji Ishibashi	Fabrication of Single Electron Transistor using SWNT
	Prof. Satoshi Kawata	Parallel Fabrication of Three-dimensional Nanostructures Utilizing Two-Photon Polymerization
Shinshu University	Prof. Morinobu Endo	The Effect of Single Walled Carbon Nanotubes on Lithium-Ion Batteries and Electric Double Layer Capacitors
Tohoku University	Prof. Yoshihiro Iwasa	Parallel Fabrication of Three-dimensional Nanostructures Utilizing Two-Photon Polymerization
Tokyo Institute of Technology	Prof. Hiro Munekata	Spin Injection into GaAs Quantum Wells with Light
University of Tokyo	Prof. Yasuhiko Arakawa	Design of High Quality Factor Modes in 2D Photonic Crystals
	Prof. Hidefumi Akiyama	How to Make and Study Quantum Wire Lasers
	Prof. Yukio Hasegawa	Non-Contact Atomic Force Microscopy Fabrication of Gold Nanowire Electrodes
	Prof. Shigeo Maruyama	ACCVD Synthesis and Raman Characterization of Vertically Aligned Single Wall Carbon Nanotubes
	Prof. Shojiro Takeyama	Cyclotron Resonance and Magneto-photoluminescence in Quantum Wells
	Prof. Kazuhiko Hirakawa	Towards Single-Molecule Probing: Using Gold Electroplating to Close the Gap on the Mystery of Molecules
NanoJapan 2007 Research Hosts & Projects		
Hokkaido University	Prof. Kanji Yoh	Graphene as a Superconducting Weak Link
	Prof. Takaaki Koga	Fabrication, Characterization and Simulation of Spin-based Electronic Device
Keio University	Prof. Kohei Itoh	Surface Study of Silicon for Atomic Placements
Osaka Institute of Technology	Prof. Shigehiko Sasa & Prof. Masataka Inoue	InAs Ballistic Rectifier
Osaka University	Prof. Satoshi Kawata	Imaging and analysis of cells using laser technology
	Prof. Satoshi Kawata	Metallic nano-probe microscopy to see nano-materials with photons
	Prof. Masayoshi Tonouchi	Measuring the Spatial Resolution of the Laser Terahertz Emission Microscope System
RIKEN	Prof. Satoshi Kawata	Photo-fabrication of metamaterials (metallic nanostructures)
Shinshu University	Prof. Morinobu Endo	The effect of the changing temperature and catalyst on the growth of Carbon Nanotubes
Tohoku University	Prof. Yoshihiro Iwasa	Making Electronic Devices with Molecules
	Prof. Go Yusa	Controlled Quantum State of Nuclear Spins in a Nanoscale Semiconductor
	Prof. Riichiro Saito	Nanotube Physics
	Prof. Hiroyuki Nojiri	Measurement of non-contacting magnetoresistance and magneto-dielectric/magnetic response of nanomolecules and nanotubes with microwave cavity techniques
Tokyo Institute of	Prof. Hiro Munekata	Observation of Magnetic Domains in Ferromagnatic Semiconductor

Technology		Nano-structures
University of Tokyo	Prof. Shigeo Maruyama	Growth of Vertically Aligned Single-Walled Carbon Nanotubes from Alcohol
	Prof. Kazuhiko Hirakawa	Fabrication and characterization of atomic-scale nanogap electrodes for molecular devices

Funding and Stipend: The NSF-PIRE grant provides almost full funding to the NanoJapan program. Participants are charged a $500 program fee that must be paid prior to departure. During the three-week language and culture orientation program in Tokyo the program provides housing, daily breakfast, intensive Japanese language courses, the Introduction to Japanese Culture seminar, the Introduction to Nanotechnology Seminar and weekend/evening cultural excursions. NanoJapan students are responsible for lunches and dinners, transportation expenses in Tokyo via the Tokyo Metro, the cost of a Japanese cell phone, and personal and other miscellaneous expenses.

The NSF-PIRE funding also enables the NanoJapan program to provide a stipend of up to $3,500 per student to be used towards the cost of their international airfare and living costs during the research internship period. Students may use the remaining balance of their stipend (less the international airfare costs) towards housing, transportation, meals and other necessary expenses while at their research internship. If students wish to continue their Japanese language students during the internship period they must pay this cost individually. Japanese research hosts are asked to assist in locating appropriate low-cost, short-term housing for the NanoJapan students and many are able to arrange access to subsidized on-campus dormitory housing for our students. The NanoJapan program also asks that whenever possible research hosts make arrangements for students to have access to the university cafeteria and any Japanese language classes that may be offered on-campus or in the local community.

The NanoJapan program also fully funds the Mid-Program Meeting in Kyoto, Japan which includes a full-day Japanese Traditional Arts Workshop conducted by the IORI corporation. NanoJapan students must cover the cost of their travel to/from Kyoto for this Mid-Program Meeting, some meals and personal sight-seeing costs while in Kyoto. Two nights lodging, some meals and the full-day workshop are included in the program fee.

NanoJapan participants report that on average they spend approximately $1,200 - $1,500 of their own funds during their summer in Japan in addition to the $500 program fee. These costs are for basic living costs not covered by the NanoJapan students, language coursework during the internship period and/or personal spending on individual sight-seeing/travel throughout Japan.

Impact and Benefits: As noted in "*Open Doors, Report on International Educational Exchange,"* currently only 2.9% of US students studying abroad are engineering students. Yet, the nature of the academic research all but demands that scientists have the skills to be able to collaborate in an international environment. There is a clear need that exists to expand and develop international programs that address the unique needs of this student population. In the past, most engineering students were forced to choose between spending their summer in a traditional study abroad program that was likely not directly related to their future academic or professional career or staying within the US and completing a traditional research internship in academia or industry. While a domestic internship in their field may be highly relevant to their future graduate careers, these opportunities typically do not provide students the ability to gain the international and intercultural skills that are increasingly sought out by employers in our globalized world. By combining a traditional study abroad experience in Japan with a targeted research internship in the field of nanotechnology, the NanoJapan program provides students with an international experience that is tightly integrated with their academic program. They not only have the opportunity to conduct high-level research in the field of nanotechnology but the experience they gain through this research internship lays a solid foundation upon which they can build during the remainder of their undergraduate and graduate careers. The majority of returning NanoJapan

students go on to join research labs at their home universities and a number of students have continued to pursue Japanese language studies or other international opportunities. Moreover, by providing students with the opportunity to participate in NanoJapan early in their academic career we hope to encourage them to pursue further international and research opportunities throughout the remainder of their undergraduate careers.

Program Assessment: We use several approaches to assess the NanoJapan program including:
Weekly blogs: Throughout the summer, students submit weekly reports providing updates on the progress of their research along with directed journaling through which they consider in greater detail the various intercultural adjustment issues they are experiencing. These blogs not only allow the directors to monitor students' progress from the US, it also provides a critical opportunity for students to reflect on their cross-cultural experiences, including adapting to living abroad, learning another language, and cultural differences between US and Japanese research labs.

Intercultural Development Inventory: To assess student gains in intercultural learning, the researchers used the Intercultural Developmental Inventory (IDI). This instrument is theoretically grounded in Milton Bennett's "Developmental Model of Intercultural Sensitivity," (DMIS) a frequently-cited developmental model that identifies six progressive stages through which individuals pass in adapting interculturally. The results of the IDI place an individual at a point along this six-stage developmental continuum. The students completed the IDI as an online instrument as a pre and post-test, administered by a certified IDI administrator. We have not received the results of the IDI post-test for the participants in the 2007 program. Of the 2006 participants, six students demonstrated progress on the DMIS scale; 3 students demonstrated no change; and seven students demonstrated regression, which suggests that the program positively affected the intercultural competencies of at least half of the participants. We do not have enough data to evaluate the statistical significance of these changes, and will continue to collect this data throughout the duration of the grant.

Oral Proficiency Interview: The OPI (Oral Proficiency Interview), an instrument designed by American Council on the Teaching of Foreign Languages, was used to assess language proficiency. The OPI stresses students' oral communication skills and is conducted by a certified tester. The OPI provides a rating based on the ACTFL Proficiency Guidelines, ranging from Novice-Low to Superior. We contracted with a certified OPI administrator who conducted the proficiency interviews by telephone when the students returned from the NanoJapan program.

Of the 32 participants in the 2006 and 2007 programs, 31 students completed post-test OPIs. Six of these students had some prior Japanese language study and the remaining students were all novice learners. Their results indicated the following:

- One student was rated as *Novice-Low*, roughly equivalent to a beginning language student.
- Thirteen students rated as *Novice-Mid*, roughly equivalent to a student who has completed the first semester of a college-level language course. These students communicated by using a number of isolated words and memorized phrases, limited by the context in which the language has been learned.
- Nine students scored as *Novice-High*, or roughly equivalent to the second semester of foreign language study. These students are able to manage successfully a number of uncomplicated communicative tasks in straightforward social situations.
- Eight students rated as *Intermediate Low*, or roughly the same as three semesters for college-level language study. The students can operate in simple social situations and their conversation is

restricted to some of the concrete exchanges and predictable topics necessary for survival in the target language culture. Six of these students had completed at least one semester of Japanese study prior to participation in the NanoJapan program.

The OPI suggests that even the novice learners demonstrated progression with their study of Japanese language throughout the summer. The results are no doubt affected by the motivation of individual students to learn the language and the resources available at their host internship sites to continue their formal study. The students who made the most significant progress were those where were able to continue their Japanese language studies during their research internships though even students who did not have this option available showed significant progress over the course of the summer.

NanoJapan Alumni Activities: The impact of this program is already being shown through the further accomplishments of program alumni. Of the 16 students who participated in the 2006 program, six have taken immediate steps to continue their studies in Asia. Two students enrolled in Japanese language classes when they returned to their home university. One student is completing a second major in Asian Studies and has chosen a graduate program that will allow him to continue studying Japanese while completing his PhD in electrical engineering. One student was selected by the JETRO Japan International Internship Program for a summer internship with the NTT Corporation and is currently applying to graduate school in Japan. Two students completed semester exchange programs at Hong Kong University of Science and Technology, and one received a 2007 Freeman-Asia Scholarship for a summer study abroad program in Taiwan. We expect the 2007 participants to show similar interest in further international opportunities throughout Asia.

NanoJapan Participant Quotes: Perhaps nothing speaks more eloquently to the impact of the program than the words of the NanoJapan students themselves. Below are some quotes from the final weekly reports submitted by the students prior to departing Japan:

"My biggest sense of accomplishment does not come from having surmounted some great challenge, but from just being able to have made myself so well at home in a foreign culture. The ease with which I feel I adapted to Tokyo has made me feel much more confident about being able to adjust to new situations in the future."

~ Aydin Akyurtlu, Virginia Institute of Technology, NanoJapan 2006

"I am most proud of some of the interesting discoveries I made in the lab, and my development of a scientific intuition and deductive process that I did not know I was capable of. I am looking forward to returning to my home lab with a new eye for research. I am also looking forward to introducing some new research habits to my home lab, such as the style of organization many of the Japanese researchers employ."

~ Ryan VanGundy, North Carolina State University, NanoJapan 2006

"The summer research experience offered by the NanoJapan program has definitely become an essential part of my college academic experience... After coming back to Rice University, I will possibly continue research activity in Rice's CMC laboratory. Although dealing with different research areas and topics, I believe the experience will further enhance my understanding, involvement, and ability of research."

~Yiming Wang, Rice University, NanoJapan 2007

"For me, NanoJapan is a unique program that allows science and engineering students the chance to travel halfway around the world, build international experience and connections, and still have the ability to focus on research.... not only have I made friends and connections abroad, but I've also been able to continue research in a similar vein here at Rice under the supervision of a post-doc in Professor Naomi Halas' laboratory. I am also continuing to study

Japanese, although classes don't really match the opportunity that living in Japan for eleven weeks offered (understandably)!

~ Paul Thompson, Rice University, NanoJapan 2007

"...this summer has excited me about academic research, especially in a graduate school setting. This next semester I will continue to participate in undergraduate research."

~ Nathan Brooks, University of Tulsa, NanoJapan 2007

"This experience has shown me how unpredictable and unexpected academic research can be. It has also shown me how easily it is to stumble across some results that you weren't necessarily looking for. I think the mindset you must have in interpreting any data is not so much that you are looking for a certain feature, but simply that you're looking. I think you have to keep your mind open to all the possibilities and interpretations available that a couple of data points can show you."

~ Liang Liu, Rice University, NanoJapan 2007

"I think the experience has not significantly changed my goals yet, but it has given me a better perception of daily research life and how progress works in any sort of project."

~ Valla Fatemi, Columbia University, NanoJapan 2007

"I have known for a while that I wanted a career in science. However, I learned that I would definitely enjoy doing research for a career, rather than another science-oriented position. I think that I did learn that I would not like to work in an engineering type position, and that pure physics is better suited for me."

~ Andrew Bradshaw, Texas A&M University, NanoJapan 2007

"This program has gotten me more interested in doing future research projects, and has given me a hands-on experience of managing and reporting on a research project almost entirely on my own. I still don't know whether I will go into business or research after my undergrad, but this has given me a taste of what research would be like."

~ Matthew Carlson, University of Wisconsin, Madison, NanoJapan 2007

Appendix : NanoJapan Student Participants
(For details, see http://nanojapan.rice.edu/studentprofiles.html)

NanoJapan 2007 Participants					
Name	**University**	**Major**	**Research Institution**	**Research Advisor**	**Research Project**
Andrew Bradshaw	TX A&M University	Physics	RIKEN	Satoshi Kawata	Photo-fabrication of metamaterials (metallic nanostructures)
Nathan Brooks	University of Tulsa	Computer Science	Osaka Inst. of Technology	Shigehiko Sasa & Masataka Inoue	InAs Ballistic Rectifier
Matthew Carlson	University of WI, Madison	Mechanical Engineering	Osaka University	Satoshi Kawata	Metallic nano-probe microscopy to see nano-materials with photons
Kriti Charan	Rice University	Electrical & Computer Engineering	Osaka University	Masayoshi Tonouchi	Laser Terahertz Emission Microscope
Craig Cocoran	Rice University	Mechanical Engineering	Tohoku University	Yoshihiro Iwasa	Making Electronic Devices with Molecules
Valla Fatemi	Columbia University	Materials Science and Engineering	Hokkaido University	Kanji Yoh	Fabrication and Characterization of Graphene Nano-structures
Stephen Goebel	Rice University	Physics	Tohoku University	Go Yusa	Controlled Quantum State of Nuclear Spins in a Nanoscale Semiconductor
Austin Head	University of Houston	Biomedical Engineering	Tohoku University	Hiroyuki Nojiri	Measurement of Non-contacting magnetoresistance and magneto-dielectric/magnetic response of nanomolecules and nanotubes with microwave cavity techniques
Liang Liu	Rice University	Civil Engineering	University of Tokyo	Shigeo Maruyama	Growth of Vertically Aligned Single-Walled Carbon Nanotubes from Alcohol
Jeffrey Russom	Rice University	Physics	Hokkaido University	Takaaki Koga	Fabrication, Characterization and Simulation of Spin-based Electronic Device

Kanes Sutuntivorakoon	Rice University	Electrical & Computer Engineering	Shinshu University	Morinobu Endo	The effect of the changing temperature and catalyst on the growth of Carbon Nanotubes
Paul Thompson	Rice University	Biochemistry and Cell Biology	Osaka University	Satoshoi Kawata	Imaging and analysis of cells using laser technology
Alec Walker	Rice University	Chemical Engineering	Keio University	Kohei Itoh	Surface Study of Silicon for Atomic Placements
Yiming Wang	Rice University	Electrical & Computer Engineering	Tokyo Institute of Technology	Hiro Munekata	Observation of Magnetic Domains in Ferromagnatic Semiconductor Nano-structures
Seung Chan (Ethan) Woo	University of Pittsburgh	Electrical Engineering	University of Tokyo	Kazuhiko Hirakawa	Fabrication and characterization of atomic-scale nanogap electrodes for molecular devices
Gleb Zhelezov	TX A&M University	Physics	Tohoku University	Riichiro Saito	Nanotube Physics
Aydin Akyurtlu	Virginia Institute of Technology	Electrical Engineering	University of Tokyo	Yasuhiko Arakawa	Design of High Quality Factor Modes in 2D Photonic Crystals
Carlos Alfaro	University of Florida	Electrical Engineering	Osaka University	Masayoshi Tonouchi	Overcoming Resolution Limits in Terahertz Spectroscopy
Lily Banerjee	Rice University	Chemical Engineering	University of Tokyo	Hidefumi Akiyama	How to Make and Study Quantum Wire Lasers
Tyler Barth	University of Florida	Electrical Engineering	RIKEN	Satoshi Kawata	Parallel Fabrication of Three-dimensional Nanostructures Utilizing Two-Photon Polymerization
Zak Bennett	University of Tulsa	Engineering	Osaka Institute of Technology	Masataka Inoue & Shigehiko Sasa	Ballistic Rectifiers
Christopher Corbet	Rice University	Physics	Tohoku University	Yoshihiro Iwasa	Parallel Fabrication of Three-dimensional Nanostructures Utilizing Two-Photon Polymerization
Jennifer Gillenwater	Rice University	Electrical Engineering	University of Tokyo	Yukio Hasegawa	Non-Contact Atomic Force Microscopy Fabrication of Gold Nanowire Electrodes

Amneet Gulati	Rice University	Chemical Physics	RIKEN	Koji Ishibashi	Fabrication of Single Electron Transistor using SWNT
Jason Holden	Rice University	Electrical Engineering	Tokyo Institute of Technology	Hiroo Munekata	Spin Injection into GaAs Quantum Wells with Light
Dvir Kafri	Rice University	Chemical Physics	University of Tokyo	Shigeo Maruyama	ACCVD Synthesis and Raman Characterization of Vertically Aligned Single Wall Carbon Nanotubes
Yu-Heng (Jaret) Lee	Rice University	Electrical Engineering	AIST	Kazu Suenaga & Sumio Iijima	High Resolution Electron Microscopy of Er@C-90 in Peapods
Christine Moran	Rice University	Bioengineering	Shinshu University	Morinobu Endo	The Effect of Single Walled Carbon Nanotubes on Lithium-Ion Batteries and Electric Double Layer Capacitors
Scott Steger	Rice University	Electrical Engineering	Univ. of Tokyo	Shojiro Takeyama	Cyclotron Resonance and Magneto-photoluminescence in Quantum Wells
Ryan VanGundy	North Carolina State University	Chemical Engineering	Univ. of Tokyo	Kazuhiko Hirakawa	Towards Single-Molecule Probing: Using Gold Electroplating to Close the Gap on the Mystery of Molecules
Tianhe Yang	Rice University	Electrical Engineering	Keio University	Kohei Itoh	Self-Assembly Mechanisms for Silicon and Germanium Nanostructures
Tiffany Yeh	Rice University	Biochemistry	NTT Basic Research Lab	Akira Fujiwara	Purification and AFM Analysis of P2X4 Receptor and Bacteriorhodopsin for Nanobiological Devices