Association of Korean Physicists in America

AKPA Newsletter

재미 한인 물리학자 협회

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Message from the 29th President of AKPA

Eun-Suk Seo (University of Maryland)

Dear Fellow AKPA Members,

I would like to congratulate and thank the Publicity and Editorial Committee chaired by Prof. Sung-Won Lee, for the successful release of the second issue of the AKPA Newsletter on time. Frequent publication of Newsletters will help us stand closer to the community, and it will play an important role in building a stronger organization.

Since the inauguration of the 29th administration, AKPA officers have been busy with various activities. In addition to frequent e-mail, officers have been having a regular bi-weekly telecon. An active membership drive is under way. The first lunch seminar was held at the University of Maryland on August 5, 2011, and more activities and events are planned. Building on success of the Korean Physicist Symposium at the last American Physical Society (APS) April meeting in Anaheim, CA, AKPA will promote and facilitate Korean meetings at specialized conferences, e.g., various APS division meetings, American Geophysical Union (AGU), American Astronomical Society (AAS) meetings, etc. Please look for announcements and do join us.

There has been a series of meetings with Korean Physical Society (KPS) leadership to strengthen corporation between KPS and AKPA. I would like to thank the AKPA Vice President (VP), Prof. J. Yu, for attending the meeting with the KPS President, Prof. S. C. Shin, and a KPS VP, Prof. J. W. Wu, on May 24, 2011, and the meeting with KPS particle physics division leaders, Profs. B. H. Lee, S. K. Nam, I. K. Park, and P. Ko. The Task Force for International Cooperation, which was formed at the last AKPA annual meeting in Anaheim, CA, continued related discussions via telecons. My special thanks to the former AKPA President, Prof. C. R. Ji, and the AKPA Award Committee Chair, Prof. K. S. Joo, for another meeting with the KPS President et al. including Profs. Z. G. Kim and H. J. Lee on August 25, 2011. Main topics include the Memorandum of Understanding (MOU) with APS, and the KPS 60th Anniversary, which will be celebrated in Spring 2012. I would like to encourage many AKPA members to attend the KPS Spring meeting. Please feel free to contact me if you have suggestions on the AKPA's role for this special occasion.

Our relationship with Korean-American Scientists and Engineers Association (KSEA) has also been strengthened significantly as I started serving on the Executive Committee of KSEA as the Physics Councilor and the Technical Group Director. AKPA was well represented at the US-Korea Conference on Science, Technology and Entrepreneurship (UKC 2011), Park City, Utah, August 10-14. I would like to thank the attendees including the VP, Prof. J. Yu, and former Presidents, Profs. C. R. Ji, K. H. Kim, and K. U. Kim.

I would like to welcome new members and thank all those who paid their dues, particularly the new life time members, Prof. Y. K. Kim, Deputy Director of the Fermi National Accelerator Laboratory and Professor of University of Chicago, Prof. K. S. Joo, a National Science Foundation Program Director and Professor of University of Connecticut, Prof. P. Yoon, Senior Research Scientist of University of Maryland and World Class University Professor of Kyunghee University, and Prof. H. Lee, Louisiana State University. Please join both KSEA and AKPA. It is important for you to select "AKPA" as your Affiliated Professional Society (APS) on the KSEA web site.

As discussed at the 6th annual East Coast Conference of Korean-American Women in Science and Engineering (KWiSE), which was held in Vienna, VA, May 14, 2011, I would like to form a special committee "Korean Women in Physics." Please feel free to send me your nomination if you know any Korean women physicists around you.

All the best,
Eun-Suk Seo
29th President of AKPA

A photo from the AKPA-KPS meeting of May 24, 2011: from the left, a KPS VP Prof. J. W. Wu, the AKPA President, Prof. E. S. Seo, the KPS President Prof. S. C. Shin, and the AKPA VP Prof. J. Yu.

Featured Article 1: Radionuclide Molecular Imaging Physics

Youngho Seo (UCSF)
Email: youngho.seo@ucsf.edu

Use of radionuclides in medicine

Radionuclides, when meeting requirements for human or animal use, are powerful signal mediators in viewing structure and function within the living systems non-invasively. The widely used radionuclide tomographic imaging techniques, single photon emission computed tomography (SPECT) and positron emission tomography (PET) utilize these radionuclides that emit photons at energies in the range of approximately 100-500 keV with half-lives in the range of approximately 1 minute – 8 days. For PET, the photons of 511 keV are generated from the positron-electron annihilation.

The field of medicine using radionuclides is called Nuclear Medicine, the discipline that both physicists and medical professionals have had strong collaborations to advance the medical applications using radionuclides for human disease diagnosis and treatment.

Molecular imaging using radionuclides

Molecular imaging has been known for a while, but its definition is still vague. Pertaining to "molecular", researchers investigate molecular events using noninvasive imaging techniques. SPECT and PET utilize radiopharmaceuticals (also known as radiotracers) that combine pharmaceuticals with a certain function interrogating biomolecular processes of normal and diseased cells, and radionuclides emitting energetic photons directly or through the position and electron annihilation for noninvasive imaging. For this reason, SPECT and PET are considered among the best translational molecular imaging modalities. Using radiotracers, noninvasive SPECT and PET imaging modalities can reveal heart function, bone anomalies, neurological disorders, cancer spread, and many more.

Physics of radionuclide imaging instrumentation

Hardware implementation for SPECT and PET imaging is based on particle detector technologies that are designed to efficiently detect and record photons at medically useful (e.g., approximately 100-500 keV) energy levels. Tc-99m and F-18 are the most commonly used radionuclides that are labeled with pharmaceuticals for SPECT and PET applications, respectively. Tc-99m emits photons at the photopeak of 140 keV, and F-18 emits positrons, thus generating 511 keV photons. At these energy levels, the common combination of high-energy photon detection systems such as high-Z scintillators (NaI, CsI, BGO, LSO to name a few) and

photodetectors including photomultiplier tubes or avalanche photodiodes is the basic instrumentation for SPECT and PET imaging. The technological advances for SPECT and PET hardware depend on how the imaging performance is optimized. The current efforts in technological advances include fast electronics, efficient and bright scintillators and photodetectors, and smart designs of photon tracking systems including advanced radionuclide collimators for SPECT and the time-of-flight decoding for PET.
Our laboratory, UCSF Physics Research Laboratory, has a long history of developing novel radionuclide imaging systems in combination with x-ray computed tomography (CT). The research focus of our laboratory in terms of imaging hardware development is to evaluate novel detector systems for combined SPECT/CT or PET/CT imaging, and system integration as well as evaluation for novel clinical or preclinical imaging applications. For this reason, we collaborate very closely with major vendors and manufacturers of medical imaging equipment such as General Electric, Siemens, and Philips. In addition, we also collaborate closely with smaller companies that develop more basic instrumentation technologies.

Physics of radionuclide molecular imaging modalities also involves software aspects. There are three major categories that physical principles are extensively used in the software used in radionuclide imaging. First, it is required to understand mathematics and extensively for the development of quantitative image reconstruction. In tomographic image reconstruction, physical modeling of imaging systems and source-through-medium interactions is often implemented through Monte Carlo simulations. The photon statistics and quantitative image reconstruction algorithm development are fundamentally linked together. The software that overcomes the limitations in imaging systems needs intensive research. Second, physical principles are applied to correct acquired tomographic images. During the postprocessing, after the data are required and the preliminary images are processed, additional corrections can be applied to account for system-level errors or improvement that helps quantitative accuracy. The accuracy and reproducibility of the finally processed images are essential when the imaging results are used to evaluate new therapeutic drugs or even new imaging agents. Third, it is possible for pharmacokinetics and kinetic modeling to derive physiologic parameters by using SPECT and PET in vivo. The pharmacokinetics in vivo can be derived based on mathematical modeling, mostly using compartmental models.

In vivo clinical and preclinical molecular imaging

For biomedical research, evaluations within living systems (in vivo) are eventually the step prior to the clinical translation. Our laboratory is particularly interested in and pursuing in vivo imaging applications when we perform hardware and software developments for SPECT, PET, (and CT). For this reason, we have been involved in numerous biomedical projects, working with biologists and physicians to perform molecular imaging research using animal models and human subjects. The feedbacks from our collaborations always help designing new imaging systems and identifyung areas that need improvements using existing imaging technologies.

Examples

Our laboratory designed and implemented a heart/brain radionuclide collimator set (see the picture) that has over 10 times higher in photon detection efficiency than the existing radionuclide collimator set, while keeping the spatial resolution performance. This collimator pair is fit in a commercially available SPECT/CT scanner (Infinia Hawkeye 4, GE Healthcare, Chalfont St. Giles, UK).

Another example is quantitative radionuclide molecular imaging using small animal PET/CT. The left figure shows a transgenic oncogene-driven hepatocellular carcinoma (liver cancer) mouse model with 18F-fluorodeoxyglucose (FDG) distribution. The orange color of the FDG uptake is shown at 1 hour after injection, and the grey outline is from CT acquired after PET data acquisition. The right figure shows a prospectively respiratory-gated mouse heart CT image using iodinated contrast agent. Both blood pool and myocardium (heart muscle) are clearly visualized.

Future perspectives and concluding remarks

My perspectives on the future of radionuclide molecular imaging physics research are neutral. Most importantly, for this field of research to be viable and flourish, it will be essential to have some balance between the cost of advancing technologies and biomedical benefits that this imaging modality can bring to both the health of people and the cutting-edge research questions in biology. As the global economy worsens in general, there is always an affordability issue of any healthcare solution, and also research for research may not survive over the current era of the economic turmoil. Radionuclide-based molecular imaging for patient care is still an expensive option for many people and many countries. However, I believe that the quality of research and technological advances are not truly proportional to the amount of money spent. We are aware that molecular imaging and molecular medicine for personalized healthcare and advanced biological discoveries have their unique promises; thus the future of this exciting area of research with the significant contribution of physics has also its own strong potential going forward.

Featured Article 2: Excited State Properties from Many-Body Perturbation Theory

Cheol-Hwan Park (Massachusetts Institute of Technology)
Email: chpark77@mit.edu

Research fields in physics can be divided mainly into two different categories: experiment and theory. Although not much less known to public than these two, there is another field called 'computational physics' positioned somewhere in between them. On the one hand, computational physics is close to theoretical physics not just because researchers do not need any real fabrication or measurement tools for solving physical problems but more importantly because computational methods are based on theories developed by theoreticians. This is why often some people consider themselves as theoretical and computational physicists. On the other hand, computational physicists are close to experimentalists in that they perform experiments albeit numerical: the thing is that, computational physicists do not know what the results of their simulations – or numerical experiments – will be just like experimental physicists cannot know all the experimental results in advance before doing the actual experiments.

Especially, in condensed matter physics, computations play a crucial role both in explaining the available experimental data and in predicting results of experiments that have not been performed, thus drawing the attention of experimentalists to new and unexplored problems. In that perspective, first-principles approaches (methods based only on the basic atomic nuclei information of a material and not on the empirical or experimentally obtained results) are important. In condensed matter physics, density-functional theory is the most commonly used theoretical tool among different first-principles methods because of its accuracy and its low computational cost. Density-functional theory is a theory for the electronic ground state properties; hence, it is in general very successful in explaining a variety of electronic ground state properties such as the total energy, equilibrium lattice parameter, bulk modulus, and phonon (lattice vibration) frequencies. On the other hand, although many researchers have been trying, density-functional theory fails severely in predicting the excited state properties of materials; however, these failures are not the fault of density-functional theory because it is a theory for ground state properties.

Excited state properties are very important in science in general – not only in physics, but also in chemistry, biology, materials science, etc. – because what people measure from all the spectroscopy experiments are the excited state properties. In a spectroscopy experiment, (1) the system of interest is perturbed by injection of an electron [Fig. 1(a)] or a hole [Fig. 1(b)], or by creation (through an incident photon) of an electron-hole pair [Fig. 1(c)], or any other elementary excitation. Note in Fig. 1 that all the other electrons of the system move and screen the external perturbation. This figure demonstrates that many-body interaction effects (or, screening) are very important in investigating the excited state properties. And then, (2) the response of the system to this external perturbation is measured. Therefore, it is of utmost importance to establish a theoretical framework to understand the excited state properties and to calculate those properties.

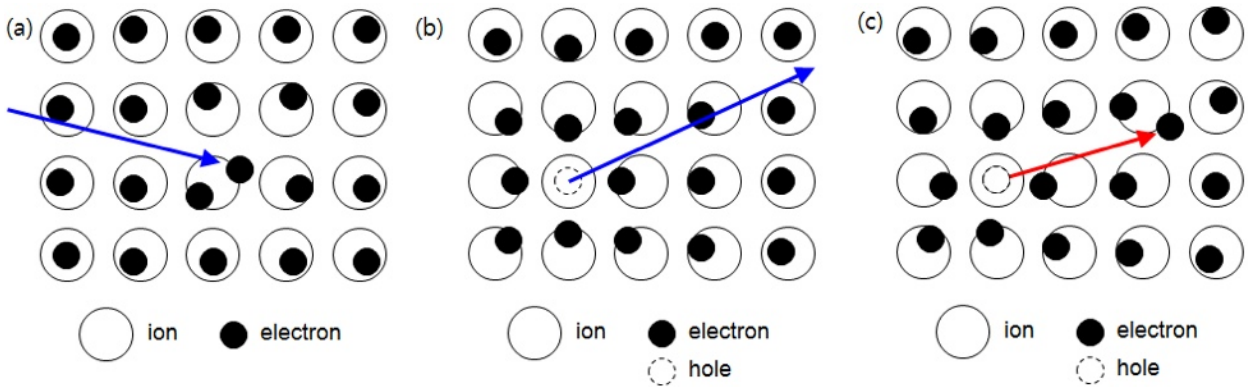

Fig. 1. Schematic showing the generation of elementary excitations during spectroscopy experiments and the subsequent relaxation, or screening, of the environment. (a) Electron injection. (b) Hole injection. (c) Electron-hole pair creation.

Currently, the most successful approach, again in terms of accuracy and computational cost, for studying the excited state properties is many-body perturbation theory. (The previous sentence is strongly biased due to the author's background.) Many-body perturbation theory was initially developed in the field of high-energy physics and applied to solve problems therein in the old days, which then was considered the most important and the only field of physics. Over the past several decades, condensed matter theoreticians are very actively applying this method to investigate many different kinds of topics in many-body physics of condensed matter such as electron-electron interactions, electron-phonon interactions, excitonic effects, plasmonic effects, exciton-photon coupling, to name a few.

Here is an important application of many-body perturbation theory in studying the excited state properties of real materials. In order to describe the optical response of a material, (1) one first obtains the electron wavefunctions and energy eigenvalues (which cannot directly be compared with the single-particle excitation energies measured for example by photoemission experiments), and, (2) with those results, one performs perturbation theory calculations to obtain correct single-particle excitation energies [Figs. 1(a) and 1(b)], and finally (3) solve two-particle many-body Green function equation of motion to describe the interaction between the electron and hole created by an incident photon, which is screened by all the other electrons in the system [Fig. 1(c)]. There could be other important interactions for the optical response such as the interaction between an electron-hole pair and phonons, which I will not discuss here.

In this article, I will take the optical response of single-walled boron nitride nanotubes as an example for explaining how many-body perturbation theory is used in investigating the key issues in the excited state properties of solids and nanostructures.

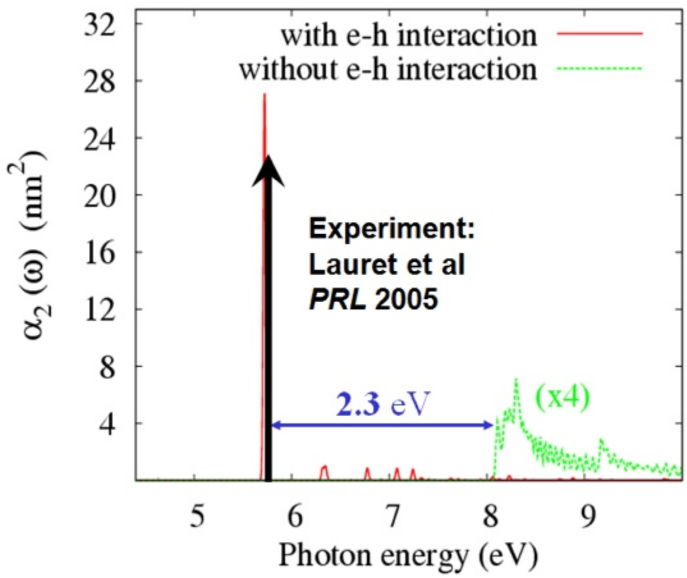

Fig. 2. Absorption spectra of the (8,0) single-walled boron nitride nanotube. The imaginary part of the polarizability per tube versus photon energy, or in short, the absorbance spectrum. This figure is a modification of Fig. 2 in Phys. Rev. Lett. 96, 126105 (2006) by Park, Spataru, and Louie.

Fig. 3. People crossing a narrow bridge in Yeongju, Korea. This picture is from the web site of Munsu Myon in Yeongju Si.

Fig. 2 shows that the excitonic effects – interaction between electron and hole screened by all the other charge carriers surrounding them – change the optical response of a single-walled boron nitride nanotube dramatically. Moreover, in order to explain the measured absorbance peak position (the upward arrow in Fig. 2), we have to consider the excitonic effects. The many-body perturbation theory scheme described here works surprisingly well.

Another thing to note here is that the binding energy of excitons – onset energy difference between the cases where we include and not include the excitonic effects – in boron nitride nanotubes is very high (~2.3 eV), significantly higher than the exciton binding energy of 0.72 eV in hexagonal boron nitride bulk structure [Arnaud et al., Phys. Rev. Lett. 96, 026402 (2006)]. Why are the excitonic effects in boron nitride nanotubes so much larger than those in similar bulk structure? Or, a more general question is, why are the excitonic effects larger in nanostructures than in bulk counterparts? There are two reasons for that. First, in nanostructures, there are not many charge carriers which can screen the interaction between electrons and holes. Second, in nanostructures, an electron and a hole cannot easily avoid each other due to the reduced dimensionality in one or more dimensions. Fig. 3 shows people moving on a very narrow bridge. Apparently, they cannot avoid each other if they come and cross the bridge from the opposite direction. The same argument can be applied to nanostructures: now, the people are electrons or holes and the bridge is, for example, a single-walled boron nitride nanotube.

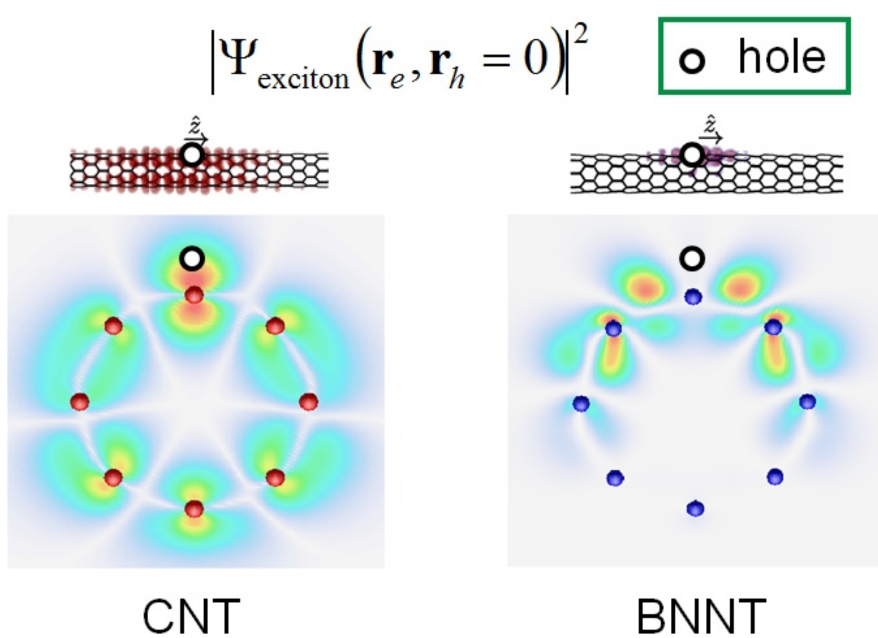

Fig. 4. Spatial electron probability when the hole is fixed at the origin (denoted by disks) in a (8,0) single-walled carbon nanotube and in a (8,0) single-walled boron nitride nanotube. This figure is a modification of Fig. 3 in Phys. Rev. Lett. 96, 126105 (2006) by Park, Spataru, and Louie.

Using the many-body perturbation theory technique, we can also obtain the exciton wavefunctions, or, how the electron and hole is localized in space. Fig. 4 compares the exciton wavefunctions in carbon nanotube and boron nitride nanotube. Because of the larger band gap in boron nitride nanotube, and hence much weaker screening therein, the exciton in boron nitride nanotube is much more localized in space than that in carbon nanotubes. Calculated exciton wavefunctions can provide very important insights for understanding the fundamental excited state properties of nanostructures and for applying them to electronics and optoelectronics devices.

In conclusion, we have seen that many-body perturbation theory is a useful tool to calculate the excited state properties of real materials. Considering the rapid development of spectroscopy techniques and the increase in the computational power, we can expect that computations based on many-body perturbation theory will play an even more important role in the future in many important problems of condensed matter physics.

Report on KWiSE 6th Annual East Coast Conference

Ji Hye Han (University of Maryland)
Email: jhhan@umd.edu

On Saturday May 14, 2011 the 6th annual East Coast Conference of KWiSE (Korean-American Women in Science and Engineering, http://kwise.org/) was held at KUSCO Headquarters in Vienna, VA. (Fig. 1). It is an annual conference exploring about women's role in science and engineering-related fields, promoting their career development, and providing or receiving mentoring from members with similar backgrounds. I attended the meeting with Prof. Eun-Suk Seo. There were many experts from government agencies such as FDA, academia, NIH, and industry in the greater DC area.

The registration started at 9:30 am, and participants exchanged greetings. Around 10am, Dr. Seongeun Cho, President of KWiSE East Coast Chapter provided the overview of the conference in her opening chapter, and introduced the other general co-chairs, Dr. Jae Hoon Kim, the KSEA president, and Dr. Teak Jin Kwon, the KSEA technical group director for their welcoming remarks.

The first session began around 10:30am. Dr. Seongeun Cho (FDA) opened the session titled "Science and Beyond". The next speaker, Dr. Ildiko Antal (PMP, Bristol-Myers Squibb, NJ) started her talk with a scientist's life. The final speaker, Dr. Jessica Kim (CBER.FDA) presented statistical considerations on non-inferiority study design in clinical trials. Following the first session, participants took a group photo and introduced themselves to the group during their lunch break. Right after lunch, around 1pm, the next session began (chair: Hey-Kyoung Lee, Ph.D., UMD) as scheduled. In this session, speakers gave excellent talks about the neurogenesis in the forebrain and interfacing nanotechnology with biology and medicine. After a 20 minutes coffee break, there was a panel discussion about women scientists in the job markets. The participants discussed key issues and how to deal with them.

It was a very fruitful gathering filled with interesting discussions and mutual encouragements, but I felt that it would have been better if there were more physicists. Most attendants were people who major in biology and chemistry. Prof. Seo proposed for AKPA to work closely with KWiSE for future meetings to cover broader areas. Prof. Seo, Dr. Jae Hoon Kim and Dr. Teak Jin Kwon discussed further on the cooperation between AKPA and KSEA (Fig. 2). I hope for a lot more participation of women in physics at the future meetings.

Fig. 1: KUSCO/KSEA building, Vienna, VA

Fig. 2: From the left, Teak Jin Kwon (Technical group of director, KSEA), Eun-Suk Seo (President of AKPA) and Jae Hoon Kim (President of KSEA).

Report from AKPA-KSEA Lunch Talk

Zaeill Kim (University of Maryland)
Email: zkim@umd.edu

The AKPA (Association of Korean Physicist in America)-KSEA Lunch TALK was held on Friday, August 05, 2011 at the University of Maryland in College Park, MD. The event was organized by the 29th executive committee members of the AKPA including the AKPA president, Prof. Eun-Suk Seo, at the University of Maryland in College Park in order to encourage young Korean scientists to participate in the AKPA and KSEA. This lunch talk was supported by the KSEA advance funding program Prof. Ki-Hyon Kim, former president of both AKPA and KSEA, graciously donated $100 to the AKPA to encourage more this kind of event. The talk started at 11:30 am and ended at 1:30 pm. 18 Korean scientists attended the seminar and enjoyed lunch, exchanging personal information and being exposed to the announcement of the AKPA and the KSEA. Four invited speakers followed the introduction of the AKPA and the KSEA given by Dr. Zaeill Kim, a treasury secretary of the AKPA. Dr. Peter H. Yoon at Inst. Phys. Sci. & Tech., Univ. Maryland, College Park, MD, and visiting School of Space Research, Kyung Hee University, Korea talked about “Superhaloelectrons and turbulent quasi-equilibrium”. Prof. Ki-Yong Kim, Department of Physics & Institute for Research in Electrons and Applied Physics, University of Maryland, College Park, MD, talked about ”Research Overview at Kim Lab”. Dr. Jonghee Lee, Department of Materials Science and Engineering, University of Maryland, College Park, MD, talked about “The Picometer-Per-Second Superconducting Vortex Dynamics”. Young-Noh Yoon, Ph.D. candidate, Department of Physics, University of Maryland, College Park, MD, talked about “Sliding elastic lattice: an explanation of the motion of superconducting vortices”. All presentation files are on the AKPA web (http://akpa.org).

From the left, Jayoung Wu, Ji Hye Han, Myoung Hwan Kim, Young Soo Yoon, Jung Joon Seough, Peter H. Yoon, Kiyong Kim, Eun-Suk Seo, Young-noh Yoon, Jounghoon Beh, Hongki Min, Jonghee Lee

Report from UKC 2011

Jaehoon Yu (University of Texas at Arlington)
Email: jaehoonyu@uta.edu

UKC2011, dubbed as the “US-Korea Summit on Science and Engineering”, was held in Park City, Utah, Aug. 10 – 14. This conference had a special meaning since it celebrated the 40 years of KSEA. Over 850 people participated in the conference with a large number of dignitaries both from Korea and from the US participating in and giving talks that stimulate food for thoughts! Many Korean government agencies partially supported the conference and sent their representatives to the conference. A memorandum of understanding

(MOU) was signed between KSEA and National Fusion Research Institute (NFRI) to tighten the collaboration between the two organizations.

Presentations at various sessions range from fundamental sciences of the technology of bending light to green and sustainable energy development, to advanced traffic control systems and urban planning. Many special sessions cover numerous topics of high profile, including a forum of the Korea Rare Isotope Accelerator and its future. It was a true mixture of various disciplines in sciences and engineering that could trigger inter-disciplinary collaborations.

Figure 1. Group photo of the Physics Technical Group session

Participants range from young generation KSEA members to the first president of KSEA, professor Kiuck Lee, making the conference vibrant mix of culture and tradition. The members and non-members from all walks of lives gathered together not only to discuss state-of-the-art technologies but also that of lives and future of Korea and Korea-US relations. We saw that a mix of young generations with current and past leaders of science and engineering fields engaging in active discussions at lunch and the dinner.

The atmosphere at the conference was both professional and cultural, topped with the Utah symphony orchestra’s 1812 overture on the lawn with big bangs of canons and presentation of awards. The awardees include professor Philip Kim of Columbia University for the Scientist of the Year award and several students, such as Mr. Jungsu Lee of SUNY Buffalo.

Figure 2. Picture of the Scientist of the Year awardee, professor Philip Kim of Columbia, and AKPA Vice president, professor Jaehoon Yu of the University of Texas at Arlington.

Below is presented a detailed summary of the Physics Technical Group Session A at UKC 2011 that consisted of six talks on physics research, one by an established senior searcher and five by Ph.D. students whose degree programs are close to their ends. The overall quality of the research

and the presentation was that of the highest level. Audiences asked many questions that stimulated much more interesting discussions.
Dr. Yongkyoon In from Far-Tech Inc. located in San Diego, CA, presented magnetic feedback against instabilities of fusion plasmas. Nuclear fusion has a great potential to provide an inexhaustible energy for mass production of electricity. Tolamak is a device to confine fusion plasmas magnetically and is regarded as one of the most promising fusion devices for achieving reactor relevant high-b plasmas for high performance. Such high-b plasmas, however, are challenged by the instabilities that disrupts fusion plasmas. Dr. In's research focuses on achieving stabilities using magnetic feedback control of the resistive-wall-mode (RWM). Dr. In's work specified the requirements necessary for active TWM stabilization using magnetic feedback. The investigation not only confirmed the integrity of the magnetic feedback control algorithm used for active RWM stabilization but also elevated a level of confidence about the future of fusion reactors.

Mr. Janghwan Bae from University of Central Florida presented his research on the effect of spatial coherence on scattering from optically inhomogeneous materials. Mr. Bae studied a method of characterization of materials, such as that of the surface of the paper, by measuring the reflected light intensity variations due to the coherence of the light from the material surface. He found that the higher inhomogeniety of material causes higher coherence of the reflected light due to the scattering on the surface.

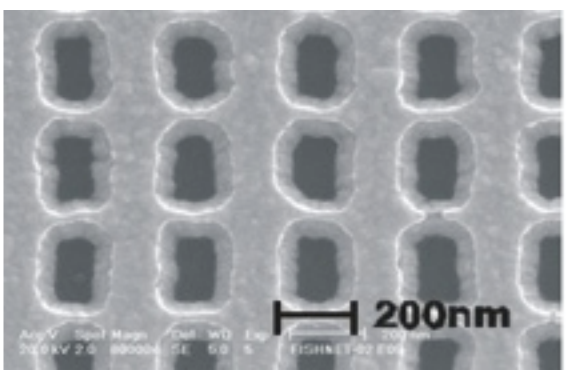

Figure 3 SEM image of the fabricated fishnet meta-material which shows a negative refractive index.

Mr. David Cho from UC Berkley presented his research on metamaterials which have attracted great interest as they exhibit properties that natural crystals do not possess. Especially at optical frequencies, their special properties come from the excitation of plasmon resonances. Desired applications such as sub-diffraction limited imaging and invisibility cloaking require the knowledge of these resonances on the propagation direction of light. Hence, he carried out angle-dependent linear spectroscopy to study resonance at different directions for a fishnet metamaterial shown in Fig. 3. The observed angle dependence of the plasmon resonance can be explained by the interaction between adjacent units. He also carried out nonlinear spectroscopy to study second-harmonic generation. The nonlinear signal is significantly enhanced due to the excitation of plasmon resonance and thus this may be possibly used for efficient wave-mixing devices.

Mr. Jeongsu Lee from SUNY Buffalo presented a theoretical and modeling framework for semiconductor lasers injected with spin-polarized carriers. We elucidate many advantages of such spin-lasers over their conventional (spin-unpolarized) counterparts. In steady-state operation of the spin-lasers, we show spin-filtering regime in which the output is completely polarized even with a modest injection polarization. In the dynamical regime, the spin modulation leads to bandwidth enhancement with injected spin polarization and drastically improved switching properties compared to conventional lasers as depicted in Fig. 4. These lasers can be viewed as spin-amplifiers, since high circular polarization in the output can be achieved even with nearly spin-unpolarized electrical injection.

Dr. Seungjoo Nah from Georgia Tech University presented his research on the mesoscopic fluctuations in single electron transistors. In a quantum dot system, a small number of electrons is confined in a finite region of space (the dot), which in turn is coupled via tunneling junctions to conducting leads. Transport characteristics of quantum dot systems exhibits a very strong dependence on the externally controlled parameters, such as gate potential, magnetic field, etc. This strong dependence forms the basis for the potential applications of quantum dot systems as nanoscale alternatives of the conventional field-effect transistors. The tunneling between the dot and the leads induces transitions within the otherwise degenerate ground state manifold of the dot. These transitions give rise to the well-known many-body phenomenon - the Kondo effect, which dominates the properties of quantum dot system at temperatures of the order of or below the so-called Kondo temperature as shown in Fig. 4. However, the mesoscopic fluctuation inherent in systems may prevent the Kondo temperature from well defining, which turns out not to be substantial due to either single-level dominance or many-level contribution depending on the gate voltage.

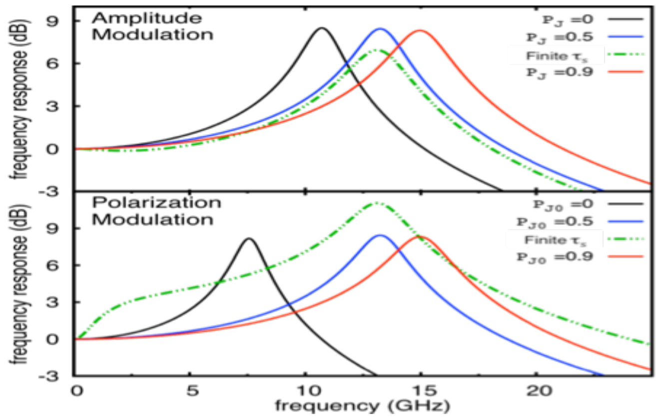

Figure 4. Small Signal Analysis of Amplitude and Polarization Modulation. Relaxation oscillation frequencies and bandwidths are enhanced with injection polarization.

Mr. Junsuk Rho from UC Berkley presented the results from his first experimental demonstration of near to far-field imaging at visible light. His research focuses on spherical Hyperlens for two-dimensional sub-diffractional imaging in visible frequency range. Hyperlens has generated a great deal of interest in recent years, not only because of the intriguing physics but also for its ability of imaging sub-diffractional scale objects into the far-field in a real-time fashion. While constituting the first proof of concept, all previous efforts were limited to sub-wavelength confinement in one dimension only and at ultra-violet (UV) frequency, hindering the practical applications of the hyperlens. Mr. Rho's experiment demonstrated near- to far-field imaging at visible light with resolution beyond the diffraction limit in two lateral dimensions. Designing a spherical hyperlens shown in Fig. 5 with flat hyperbolic dispersion that supports wave propagations with very large spatial frequency, and yet same phase speed, we are able to faithfully resolve sub-diffractional features down to 160 nm, much smaller than the diffraction limit at visible wavelength of 410 nanometers. Such a hyperlens can readily be integrated in conventional microscopes, critically expanding their capabilities beyond the diffraction limit and opening a new realm in real-time nanoscopic optical imaging of biological machineries in living cells.

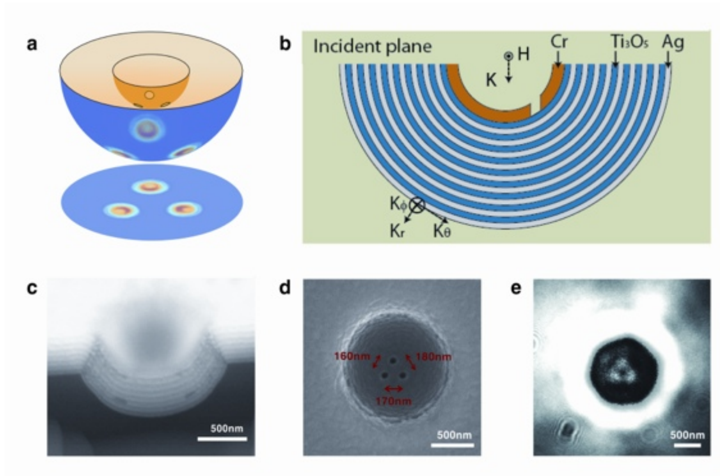

Figure 5. (a) A finite element analysis shows the magnified image of a sub-diffraction limited object. (b) Cross section of the spherical hyperlens along the green incident plane. (c) A SEM image of the cross-sectional view of spherical hyperlens. (d) SEM image of the object: three dots positioned triangularly with gaps of 180nm, 170nm, and 160nm. (e) Image of the object after being magnified

Solicitation for Nominees for 2012 AKPA OYRA

PURPOSE:
In order to recognize and promote excellence in research by outstanding young ethnic Korean physicists in North America, the Outstanding Young Research Award (OYRA) has been awarded annually since 1994 by the Association of Korean Physicists in America (AKPA) (see the list of Previous Recipients in the AKPA webpage http://www.akpa.org).

QUALIFICATION:
Candidates are limited to young ethnic Korean physicists who are working at research universities/institutions or at industrial/government laboratories in North America. At the time of nomination, each candidate should be within five years from the completion of his/her PhD. Exceptions to the five-year rule may be allowed for extenuating circumstances such as military services and any extended medical leaves. In such cases, interruptions will not count toward the five-year rule.

NOMINATION:
Each candidate must be nominated by the Chair or Head of the department where the candidate is employed or by the candidate's former doctoral dissertation advisor. The nomination letter

should describe the importance and impact of the candidate's work. Supporting documents should include the candidate's curriculum vitae with representative publications and three letters of recommendation. Nominations and supporting letters are to be sent electronically, preferably in PDF format, to Professor Kyungseon Joo (kjoo@phys.uconn.edu), Chair of the AKPA OYRA Committee and a copy to Professor Eun-Suk Seo, the President of AKPA (seo@umd.edu) by the dates given below.

Nomination Deadline: November 15, 2011
Deadline for Supporting Documents: December 15, 2011

AWARD COMMITTEE:
One or two winners will be selected by the OYRA Award Committee and will be announced in early 2012. The committee consists of:

Prof. Kyungseon Joo (U. Conn. & NSF), Chair
Prof. Kyungwha Park (Virginia Tech.)
Dr. Inseob Hahn (NASA JPL)
Dr. Hoydoo You (Argonne Nat. Lab).

PRESENTATION:
The award of $1,500 with a plaque will be presented at the AKPA annual meeting, which will be held in conjunction with an American Physical Society Meeting in spring. The exact location of the annual meeting and time will be announced later.

Around AKPA

- On August 4, 2011, as the Principal Investigator of Cosmic Ray Energetics and Mass (CREAM), Professor Eun-Suk Seo (University of Maryland, College Park) received a NASA Group Achievement Award on behalf of the CREAM recovery team "For exceptional achievement in support of NASA's Antarctic Long Duration Balloon Program".

- Professor Taekjip Ha (University of Illinois at Urbana-Champaign, Howard Hughes Medical Investigator) received Ho-Am prize in Science in June, 2011. He pioneered a new biophysics research area by applying fluorescence resonance energy transfer (FRET) phenomenon to the studies of single biological molecules for the first time.

  Related news article: http://physics.illinois.edu/news/story.asp?id=1230
  Ho-Am Prize winners: http://hoamprize.samsungfoundation.org/eng/prize/medalist/winnerview.asp

- Dr. Ryunyoung Kwon (NASA/Goddard Space Flight Center) will give a seminar at Computer & Space Science Building, Room 2400, at University of Maryland, at 4:30 pm on September 19. Abstract will be available at http://space.umd.edu:8080/ later.

- Dr. Philip Kim in Columbia University will give a talk in University of Maryland on Sep 27, 2011 about "Spin and Pseudo-Spin in Graphene." The colloquium will be held in Physics building (John S Toll bldg) Room 1410 at 4 pm at University of Maryland. Abstract can be found at http://www.umdphysics.umd.edu/events/physicscolloquia/542-spin-and-pseudo-spin-in-graphene.html.

Upcoming Meetings

Korean Physicist Symposium in APS DPP

Place: Salt Palace Convention Center, Salt Lake, Utah (APS meeting site) - Pending
Time: 6:00-7:30pm, Wednesday, November 16, 2011 - Pending
Registration fee: $20 including the dinner (Students will be subsidized)

This symposium will be held as a satellite meeting, during the APS Division of Plasma Physics (DPP) meeting. There will be contributed talks by several participants, and their plasma physics researches will be briefly introduced. If you are interested in introducing your physics research or related activities, please send email to jpark@pppl.gov by October 1. Small beverages and snacks will be prepared for the meeting, and a dinner is planned at a local restaurant after the meeting. Any Korean physicist will be welcome.

Specify AKPA as your APS on the KSEA web site

1) Go to the KSEA member site https://hq.ksea.org/login.aspx, and log-in.
2) Go to My profile (from the top menu bars).
3) Go to the bottom of "Personal information" (Most left table).
4) Click on "edit personal information".
5) At the bottom of the table, select "AKPA" from the "APS" drop down menu.

When you make a payment for the KSEA membership fee, choose "pay to my APS". Your first year membership fee will be refunded.

New Life Time Members and Donators

New life time members

	**Dr. Young-Kee Kim** Professor, Department of Physics, University of Chicago & Deputy Director, Fermi National Accelerator Laboratory • e-mail: ykkim@fnal.gov • Research Area: Experimental Particle Physics • Rochester Distinguished Scholar Medal (2010), Science/Education Service Medal by Korean Government (2008), Ho-Am Prize (2005)
	**Dr. Kyungseon Joo** Professor, Department of Physics, University of Connecticut & Nuclear Physics Program Director, Division of Physics, NSF • e-mail: joo@phys.conn.edu • Research Area: Experimental Nuclear Physics • The 29th AKPA Award Committee Chair
	**Dr. Peter H. Yoon** Senior Research Scientist, Institute for Physical Science and Technology, University of Maryland, & World Class University Professor, School of Space Research, Kyung Hee University, Korea • e-mail: yoonp@umd.edu • Research Area: Plasma Physics • The 29th AKPA E-link Committee
	**Dr. Hwang Lee** Associate Professor, Department of Physics & Astronomy, Louisiana State University • e-mail: hwlee@phys.lsu.edu • Research Area: Quantum Optics/Quantum Information Processing • The 29th AKPA E-link Committee • OYRA award (2003)

Donators

Dr. Kinney H. Kim
Professor, Department of Physics, North Carolina Central University

- e-mail: khk@nccu.edu
- Former President: AKPA (1985), KSEA (1986), AKUPA(1995)
- Medal of Honor "Mokryun Jang" (Science & Technology) (1988)
- KSEA Distinguished Service Medal (1987, 1991)

AKPA Membership Registration and Payment Information

AKPA membership registration, update and due payment have been made easy. Please visit http://akpa.org/membership/membership-registration.html for your membership!! Your memberships are greatly appreciated.

AKPA values your contributed articles!!

AKPA solicits your articles in the area of your research for the publication as a featured article or your thoughts and opinions in upcoming Newsletters.

If you want your article to be considered for publication in upcoming AKPA Newsletters, please send your title and abstract to pec@akpa.org anytime of the year.

The next AKPA Newsletter is scheduled to be issued in December 2011.