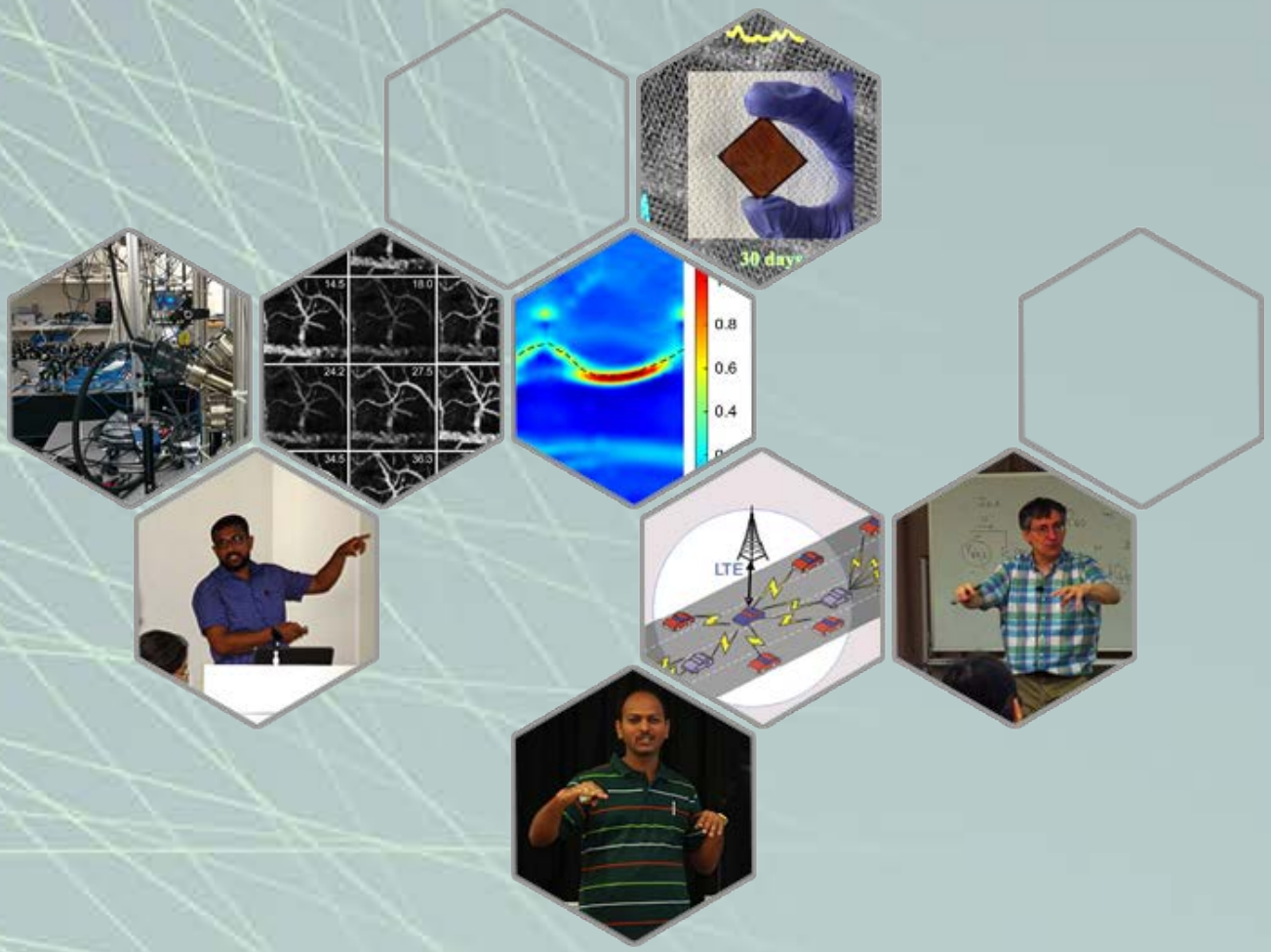
The University of Electro-Communications

UEC e-Bulletin

Updates on research, innovation, and events at UEC:
Unique and Exciting Campus in Tokyo

Vol.18, June 2018



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Photonics research: Controlling photons with a photon

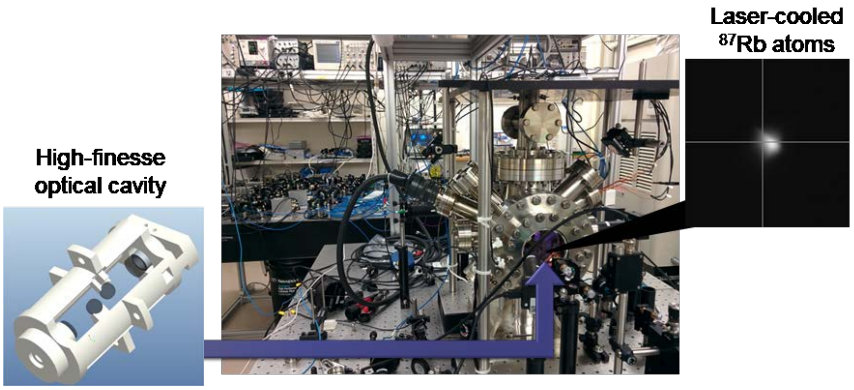
Photons are considered to be ideal information carriers and expected to play important roles in quantum communication and information processing, where quantum mechanics allows for absolutely secure cryptographic key distribution as well as computation much faster than conventional computers. In order to take full advantage of quantum information carried by photons, it is important to make them directly interact with each other for information processing.

However, photons generally do not interact with one another. So it is necessary to mediate such interactions with matter to realize effective photon-photon interaction, but light-matter interaction is usually extremely weak in normal media.

Haruka Tanji-Suzuki and colleagues at the Institute for Laser Science, the University of Electro-Communications, Tokyo, are currently working to develop all-optical quantum devices that are sensitive to a single photon input, such as a single photon switch in which an incoming photon switches the state of another photon.

In order to realize the strong light-matter interaction that is necessary for such devices, Tanji-Suzuki uses a laser-cooled ensemble of ^{87}Rb atoms (~10 uK) trapped within a high-finesse optical resonator (finesse ~50000) in an ultrahigh-vacuum chamber. Notably, in order to switch a photon with a photon in such a system, the researchers use an effect known as 'vacuum-induced transparency' observed recently by Tanji-Suzuki *et al.*, in which an electromagnetic field as weak as a vacuum field (light with no photons) is shown to alter the optical properties of atoms.

"The realization of such all-optical single-photon devices will be a large step towards deterministic multi-mode entanglement generation as well as high-fidelity photonic quantum gates that are crucial for all-optical quantum information processing," says Tanji-Suzuki.



Vacuum chamber with high-finesse optical resonator and cold atoms.

Reference

- Authors: Haruka Tanji-Suzuki, Wenlan Chen, Renate Landig, Jonathan Simon, Vladan Vuletic
- Title of original paper: Vacuum-Induced Transparency
- Journal, volume, pages and year: Science, 333, 1266-1269, 2011
- Digital Object Identifier (DOI): 0.1111/micc.12285
- Affiliations: Department of Physics, Harvard university; Department of Physics, MIT-Harvard Center for Ultracold Atoms, and Research Laboratory of Electronics, Massachusetts Institute of Technology
- Department website: http://kjk.office.uec.ac.jp/Profiles/55/0005461/prof_e.html
- Researcher Video Profiles: http://www.ru.uec.ac.jp/e-bulletin/researcher-video-profiles/2018/haruka-tanji-suzuki.html

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Innovative photovoltaic materials: $CsSn_{1-x}Pb_xI_3$ nanocrystals as phase-stable perovskites

$CsSnI_3$ is a prototype inorganic halide perovskite that has recently been proposed as a strong candidate for photovoltaic applications because of its unique properties as a semiconductor.

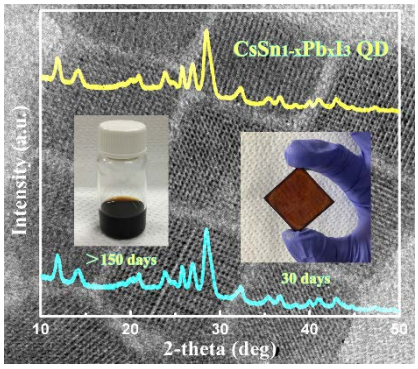
However, pure Sn perovskites are extremely unstable, quickly losing their single crystallinity and degrading into inactive phases on exposure to air in less than five minutes.

Now, Qing Shen and colleagues at University of Electro-Communications, Tokyo, report that alloying $CsSnI_3$ nanocrystals (NCs) with $CsPbI_3$ significantly improves the phase stability of the Sn perovskites.

The alloyed $CsSn_{1-x}Pb_xI_3$ NCs (particle size 10~15 nm) were synthesized using a scalable hot-injection method recently developed by Shen et al. where a mixture of SnI_2 and PbI_2 is dissolved in trioctylphosphine and rapidly injected into an octadecene solution containing Cs precursor at 120 to 170 °C. The reaction was allowed to proceed for approximately 5 s, after which it was rapidly cooled to room temperature. The resulting NCs were precipitated with methyl acetate and redispersed in hexane.

Notably, the resulting phases of the alloyed NCs can be stable for months, and far more superior to the parent $CsSnI_3$ (< 5 minutes).

The successful synthesis of these stable Sn/Pb perovskites opens up new opportunities to improve the stability of other amazing but susceptible perovskite materials, and further expands their possibilities for practical applications.



Stable $CsSn_{1-x}Pb_xI_3$ perovskite nanocrystals.

Reference

- Authors: Feng Liu, Chao Ding, Yaohong Zhang, Taichi Kamisaka, Taro Toyoda, Teresa Ripolles-Sanchis, Shuzi Hayase, Takashi Minemoto, Kenji Yoshino, Songyuan Dai, Masatoshi Yanagida, Hidenori Noguchi, and Qing Shen.
- Title of original paper: Colloidal Synthesis of Air-Stable Alloyed $CsSn_{1-x}Pb_xI_3$ Perovskite Nanocrystals for Use in Solar Cells
- Journal, volume, pages and year: *Journal of the American Chemical Society*, **139**, 16708 (2017).
- Digital Object Identifier (DOI): 10.1021/jacs.7b08628
- Affiliations: Faculty of Informatics and Engineering, The University of Electro-Communications.
- Shen Lab website: http://www.shen.es.uec.ac.jp/index.htm
- Researcher Video Profiles: http://www.ru.uec.ac.jp/e-bulletin/researcher-video-profiles/2018/qing-shen.html

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Technology for visualizing flow of blood to aid neurosurgery in the human brain

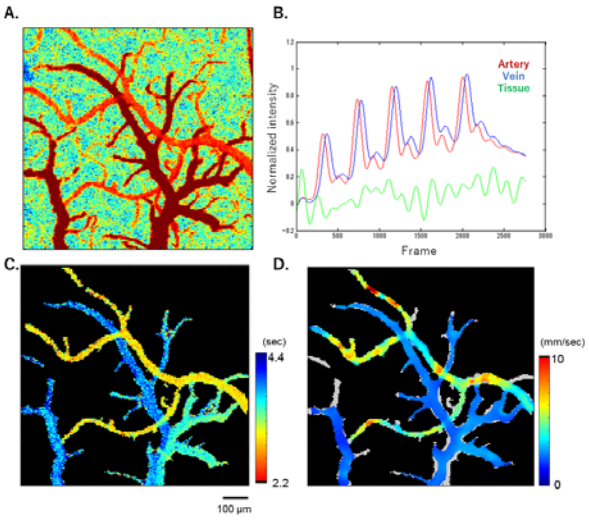
Neurosurgeons conduct vascular recanalization for treatment of cerebrovascular diseases. Successful surgery necessitates surgery the minimization of flow disturbances due to blood during surgical intervention. However, monitoring the flow of blood under surgery is difficult due to a lack of imaging tools for visualizing microcirculation in the brain.

Now, Kazuto Masamoto at the University of Electro-Communications, Tokyo, and colleague at National Institute of Radiological Sciences in Japan have developed fluorescent imaging-based visualization tools for imaging and analyzing cerebral microcirculation.

The principle of the present method is to automatically calculate the distance for movements of fluorescent tracers (e.g., indocyanine green) which were intravenously injected, from movies of the fluorescence. The distance is divide by the rate acquired, resulting in an approximate of the velocity of the fluorescent tracers on each pixel.

The researchers first confirmed the accuracy of their method using phantom-tubes with known flow velocities from the injection of fluorescent dyes that imitated the microcirculation conditions of the body. Then, animal models were used to validate the methods.

"we successfully measured flow velocity in the brain surface of anesthetized rats and mice," says Masamoto. "We are starting collaborative works with medical doctors to test the feasibility of our method for human brains under neurosurgery."



A. Extracted vasculature of the mouse brain surface by using a cross-correlation analysis of time-intensity changes in fluorescent signals. **B**. Typical results for measured time-intensity changes of pixel intensity averaged over artery (red), vein (blue) and tissue (green) areas. **C**. A map of transit-time of fluorescent dyes on each pixel. **D**. Calculated blood flow velocity map.

Reference

- Authors: Hoshikawa R, Kawaguchi H, Takuwa H, Ikoma Y, Tomita Y, Unekawa M, Suzuki N, Kanno I, Masamoto K.
- Title of original paper: Dynamic Flow Velocity Mapping from Fluorescent Dye Transit Times in the Brain Surface Microcirculation of Anesthetized Rats and Mice.
- Journal, volume, pages and year: *Microcirculation*. 23(6):416-425. (2016)
- Digital Object Identifier (DOI): 0.1111/micc.12285
- Affiliations: Faculty of Informatics and Engineering, Brain Science Inspired Life Support Research Center, University of Electro-Communications
- Department website: http://kjk.office.uec.ac.jp/Profiles/55/0005461/prof_e.html
- Researcher Video Profiles: http://www.ru.uec.ac.jp/e-bulletin/researcher-video-profiles/2018/kazuto-masamoto.html

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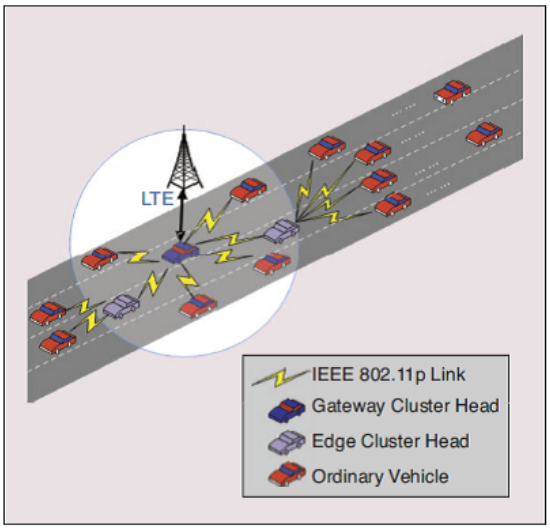
Computational intelligence-inspired clustering in Multi-access Vehicular Networks

There is an increasing demand for distributing large amounts of digital information to vehicles on the move. However, the current widely used cellular networks are not sufficient due to limited bandwidth in dense vehicle environments. Recently, vehicular ad hoc networks (VANETs) have attracted great interest for improving communications between vehicles using infrastructure-less wireless technologies. IEEE 802.11p is the default standard for providing vehicle-to-vehicle (V2V) communications in VANETs.

However, there are two main technical obstacles for the integration of LTE with IEEE 802.11p. First, the selection of gateway nodes must take into account the overall network performance of the LTE as well as the V2V. Second, route creation from a vehicle to a gateway is challenging due to vehicle mobility and varying node density. The vehicle mobility and inter-vehicle wireless link quality must be carefully considered for the selection of routes. For certain hours or road segments, vehicles are densely deployed, and therefore the number of concurrent sending nodes are huge. In IEEE 802.11p, the increase in the number of sending nodes leads to performance degradation due to an exponential backoff based contention scheme at the MAC layer.

To resolve these issue, Celimuge Wu and colleagues at the University of Electro-Communications, Tokyo, have proposed a two-level clustering approach where cluster head nodes in the first level try to reduce the MAC layer contentions for vehicle-to-vehicle (V2V) communications, and cluster head nodes in the second level are responsible for providing a gateway functionality between V2V and LTE.

A fuzzy logic-based algorithm is employed in the first-level clustering, and a Q-learning algorithm is used in the second-level clustering to tune the number of gateway nodes. "Extensive simulation results under various Network conditions show that the proposed protocol can achieve 23% throughput improvement in high-density scenarios compared to the existing approaches," says Wu.



Integration of LTE and IEEE 802.11p with clustering (the edge cluster head nodes are generated by the first-level clustering, and the gateway cluster head nodes are generated by the second-level clustering).

Reference

・[1] Celimuge Wu, Tsutomu Yoshinaga, Xianfu Chen, Lin Zhang, Yusheng Ji, "Cluster-Based Content Distribution Integrating LTE and IEEE 802.11p with Fuzzy Logic and Q-Learning", IEEE Computational Intelligence Magazine, Vol. 13, Issue 1, pp. 41-50, Feb. 2018.
・Website: http://comp.is.uec.ac.jp/wp/clmg-en
・Researcher Video Profiles: http://www.ru.uec.ac.jp/e-bulletin/researcher-video-profiles/2018/celimuge-wu.html

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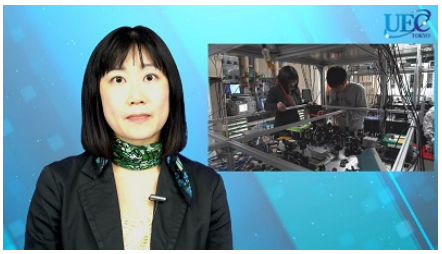
Haruka Tanji-Suzuki, Associate Professor, Institute for Laser Science.

Controlling photons with a photon using cold atoms in an optical resonator



Haruka Tanji-Suzuki is devising methods for controlling photons with photons that are considered to be ideal information carriers in quantum information science. In order to take full advantage of quantum information carried by photons, it is important for them to directly interact with each other for information processing. But achieving this is a challenge. "We are using matter to mediate interaction between photons," says Tanji. "However, light-matter interaction is extremely weak in normal media. We confine matter inside resonators to enhance light-matter interaction, which in turn allows strong photon-photon interaction."

Tanji and her colleagues use laser-cooled atoms trapped inside an optical resonator. She wants to develop all optical quantum devices that are sensitive to a single photon input, such as single photon switches, where incoming photons switch the states of other photons.

"The realization of such all-optical single photon devices will be a major step towards all optical quantum information processing that calls for advanced devices such as high-fidelity photonic quantum gates."

Further information

Haruka Tanji-Suzuki
Associate Professor, Institute for Laser Science, University of Electronic Communications, Tokyo.

Haruka Tanji-Suzuki website: http://www.ils.uec.ac.jp/~tanji/index-e.htm
Research Highlight:
http://www.ru.uec.ac.jp/e-bulletin/research-highlights/2018/photonics-research-controlling-photons-with-a-photon.html

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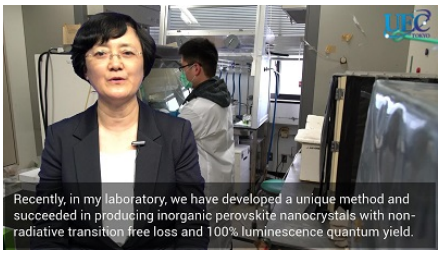
Qing Shen, Professor, Graduate School of Informatics and Engineering.

Perovskite semiconductor nanomaterials for next generation solar cells.

Qing Shen fabricates semiconductor nanomaterials and nanostructures for next generation solar cells. "Research on inexpensive and high efficiency solar cells shows potential for solving problems related to energy and the environment," says Shen. "In particular, perovskite solar cells are attracting attention recently."



A high solar efficiency of over 20% has been reported by using a halogenated perovskite layer of several 100 nm thickness as the light absorbing layer of solar cells. This has attracted great attention. However, improvements in their durability and efficiency are major challenges.

Perovskite nanocrystals show potential for resolving these problems. This is because semiconductor nanocrystals have unique properties compared with conventional bulk materials.

Recently, Shen has developed a unique method and succeeded in producing inorganic perovskite nanocrystals with non-radiative transition free loss and 100% luminescence quantum yield. In addition, she also succeeded in the preparation of very stable perovskite nanocrystals by this method.

When these nanocrystals were applied to solar cells, the energy conversion efficiency reached 11.3% and the devices were stable even after more than two months.

Future research includes exploring the basic properties of these materials as well as applications to solar cells and LEDs.

Further information

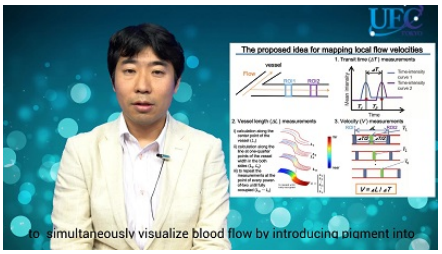
Qing Shen, Professor, Graduate School of Informatics and Engineering, University of Electro-Communications, Tokyo.

Qing Shen laboratory: http://www.shen.es.uec.ac.jp/index.htm
Research Highlight:
http://www.ru.uec.ac.jp/e-bulletin/research-highlights/2018/innovative-photovoltaic-materials-cssn1-xpbxi3-nanocrystals-as-phase-stable-perovskites.html

The University of Electro-Communications
UEC e-Bulletin Vol.18, June 2018

Kazuto Masamoto, Professor, Faculty of Informatics and Engineering.

Visualizing the flow of blood in the body



Kazuto Masamoto developing technology to visualize the flow of blood in the brain. "We believe that if we can easily see the flow of blood in the brain at home, then we will be able to prevent diseases of the brain," says Masamoto. "That key technology in the measurement systems is the use of light."

Currently, it is necessary to use hospital facilities to measure blood flow in the brain of humans. So, at this stage, Masamoto is conducting his research on visualizing the flow of blood using animal models. In addition to blood flow imaging, he is also studying communication of blood with surrounding cells.

Recent achievements include the development of image analysis software to simultaneously visualize blood flow by introducing pigments into blood vessels. Based on the preliminary results, he is working with brain surgeons to investigate how his approach could be used during surgery.

Further information

Kazuto Masamoto, Professor, Faculty of Informatics and Engineering, University of Electro-Communications, Tokyo.

Research Highlight:
http://www.ru.uec.ac.jp/e-bulletin/research-highlights/2018/technology-for-visualizing-flow-of-blood-to-aid-neurosurgery-in-the-human-brain.html

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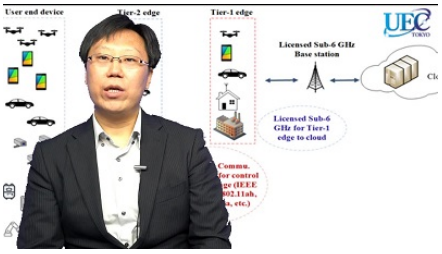
Celimuge Wu, Associate Professor Graduate School of Informatics and Engineering.

Multi-access Vehicular Networks



"My research is mainly focusing on vehicular networks," says Celimuge Wu. "Vehicular communication is very important for supporting intelligent transport systems, autonomous driving, and other such infrastructure."

Wu's approach used computational intelligence to improve networking performance, for example using fuzzy logic to improve the networking performance. "We have developed a new kind of approach which integrates LTE with fuzzy logic and we have got significant improvement of 34% in a content distribution from the cloud to vehicles.

In the future, Wu and colleagues will consider using deep learning to support multiple traffics of wider complex environments by using neural networks.

Further information

Celimuge Wu
Associate Professor
Graduate School of Informatics and Engineering, University of Electro-Communications, Tokyo

Celimuge Wu website: http://comp.is.uec.ac.jp/wp/clmg-en
Research Highlight:
http://www.ru.uec.ac.jp/e-bulletin/research-highlights/2018/computational-intelligence-inspired-clustering-in-multi-access-vehicular-networks.html

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Theoretical aspects of cryptography: How do we know if the system is secure?

Mitsugu Iwamoto, Associate professor, Department of Informatics, Graduate School of Informatics and Engineering, University of Electro-Communications, Tokyo.

Theoretical research on cryptography plays a central role in the development of information security because only mathematical proofs can rigorously guarantee the accuracy of security models. Namely, how can we be sure if the system is secure?

Most of security systems consist of several combinations of the basic building blocks (primitives) of cryptography, such as symmetric-key cryptography, public-key cryptography, and authentication systems. From a mathematical perspective, security of cryptographic primitives is classified into two paradigms: computational security and information-theoretic security.

"Roughly speaking, under computational security, we assume that adversaries are computers (theoretically, Turing machines), and we believe that the primitive is secure because it takes such as long time (e.g., more than the age of universe!) in breaking the system by the computers," explains Iwamoto. "Computational security is very nice trick, since it allows us to realize public-key cryptography which is one of the most important inventions in the history of communications, but it becomes vulnerable if faster computation, e.g., invention of quantum computers, are eventually available."

Information-theoretic security, on the other side, tries to guarantee the security against adversaries with unbounded computing power, that is, computational power is independent of the security. This requirement is so severe that several important cryptographic primitives such as public-key cryptography are not available under this setting. However, due to its strong requirement for security, information-theoretically secure primitives are very important for protecting the data which must be kept secret very long time.

Iwamoto and colleagues are conducting research in many field including information-theoretic security. It is notable that cryptography has been extensively studied since computationally secure cryptography such as RSA (the first public-key cryptography) and DES (data encryption standard, the first standard of symmetric-key encryption adopted by NIST), was invented in late 70's.

In particular, the theory of cryptography has been developed along with the discussion of security notions, which suggest to us why and how we can say "the cryptosystem is secure". On the other hand, study of security notions for information-theoretically secure cryptography has not been explored so deeply although it was initiated by Shannon in 1950 far before the invention of computationally secure cryptography.

Recently, however, there is a much greater realization in the importance of information-theoretic security due to needs for long-term security. Therefore, Iwamoto and colleagues investigated the information-theoretic

security notions from the computational security viewpoint. The researchers have two main concerns: finding the relationship among security notions of information-theoretically secure cryptography; and what would happen by combining information-theoretically secure cryptosystems with other ones. These problems were tackled in the case of symmetric-key cryptography and key-agreement.

The research showed relationships among the information-theoretic security notions. "Technically, it is interesting to find security gaps among the security notions called indistinguishability," says Iwamoto. "Traditionally, computational cryptography requires indistinguishability of messages whereas information-theoretic security requires no information leakage from ciphertexts. We captured both notions from the viewpoint of indistinguishability, and we clarified that information-theoretic security notion requires higher security than the indistinguishability in computational security notion, even if the adversary's computing power is infinite."

Reference

- Authors: Mitsugu Iwamoto, Kazuo Ohta, and Junji Shikata
- Title of original paper: Security Formalizations and Their Relationships for Encryption and Key Agreement in Information-Theoretic Cryptography
- Journal, volume, pages and year: *IEEE Transactions on Information Theory*, vol. **64**, issue 1 pp. 654-685(2018).
- Digital Object Identifier (DOI): DOI: 10.1109/TIT.2017.2744650

- Affiliations: Department of Informatics, Graduate School of Informatics and Engineering, University of Electro-Communications
- Department website: https://www.uec.ac.jp/eng/education/ie_graduate/j/index.html

Associate Professor: Mitsugu, IWAMOTO (Ph. D. from The University of Tokyo 2004/03)
Current research areas: Information Security, Cryptography, Information Theory
Current research subjects: Information Theoretic Security
Personal website:
http://ohta-lab.jp/users/mitsugu/index-e.html
http://kjk.office.uec.ac.jp/Profiles/11/0001044/prof_e.html

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Insights into quantum limits of materials: First observation of 100% valley-polarization in solids

Yuki Fuseya, Department of Engineering Science, University of Electro-Communications, Tokyo.

"A fundamental understanding of spin orbit coupling in crystals is a major area of research in modern solid state physics," explains Yuki Fuseya. "Such knowledge plays a critical role in the development of devices made using materials including topological insulators, and multilayers composites for spintronics and multiferroics. I am looking at the transport properties of bismuth to shed light on spin orbit coupling in crystals."

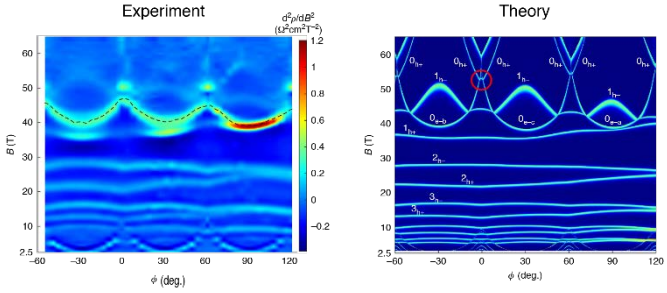
Specifically, the quantum limit is the state of electrons under high magnetic fields, where the properties of solids are believed to be drastically changed due to quantum effects. However, it has been challenging to carry out precise measurements under high magnetic fields, so that, the properties of solids at the quantum limit still require clarification.

With this background, Yuki Fuseya and colleagues at Wuhan National High Magnetic Field Center, China, Los Alamos National Laboratory, USA, and Ecole Supérieure de Physique et de Chimie Industrielles, France, discovered an unexpected sharp increase in the conductivity of bismuth. The researchers proved this to be the 100% valley-polarized state, which has not been achieved in any other solid placed under magnetic fields.

In their experiments, the researchers measured the transverse magnetoresistance for magnetic fields up to 65 Tesla (T) under rotating external magnetic fields maintained to be perpendicular to the direction of electric current that was passed through the bismuth. The angular dependence of magnetoresistance obtained by these measurements was compared with theoretical analysis based on the extended Dirac electron model.

According to the previous theorical reports, the conductivity of bismuth is believed to "decrease" rapidly at the quantum limit. In contrast, the current measurements showed the conductivity to "increase" sharply at approximately 50 T, and more detailed theoretical analysis showed this observation to be due to the fact that one or two of the valleys become totally empty, that is, 100% valley-polarized state.

"This findings offer new possibilities of controlling the degrees of freedom of valleys of bismuth, and new innovations in the field of 'valleytronics'."



Angle resolved magnetoresistance of bismuth.

Reference

・Authors: Zengwei Zhu, Jinhua Wang, Huakun Zuo, Benoît Fauqué, Ross D. McDonald, Yuki Fuseya, and Kamran Behnia
・Title of original paper: Emptying Dirac valleys in bismuth using high magnetic field
・Journal, volume, pages and year: *Nature Communications* **8**, 15297 (2017).
・Digital Object Identifier (DOI): DOI: 10.1038/ncomms15297
・Affiliations: Department of Engineering Science, University of Electro-Communications

Associate Professor: Yuki, FUSEYA (Dr. Sc. From Osaka University 2004/03)
Current research areas: Theoretical condensed matter physics, solid state physics
Current research subjects: Spin-orbit coupling in solids, quantum transport Phenomena
Personal website: http://www.kookai.pc.uec.ac.jp/

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Coherent Optical Science Seminar on Information Optics held at UEC, Tokyo

Coherent Optical Science Seminar on Information Optics was held on 21 May 2018 at the University of Electro-Communications, Tokyo.

This event is part of the Coherent Optical Science Seminar series that are held to expand the university's research activities in coherent optical science. Five seminars have been held during the past year, with four in English.

After a welcome address by Yoko Miyamoto, associate professor at the Graduate School of Informatics and Engineering, the two speakers gave the following talks.

1. Vinu R. V., Utsunomiya University, Japan: "Polarization holography for imaging applications"


Vinu R. V., Utsunomiya University, Japan.

The talk focused on the potential of polarization holographic techniques in imaging applications, with emphasis given to the newly developed Jones matrix microscopy system.

2. Maruthi Manoj Brundavanam, Indian Institute of Technology Kharagpur: "Topological transformation of fractional optical vortex beams using computer generated holograms"


Maruthi Manoj Brundavanam, Indian Institute of Technology Kharagpur.

This talk described results on the spatial structures observed in optical beams after the introduction of a vortex with fractional topological charge.

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UEC-ERATO Symposium on optical frequency combs and ultrashort pulse lasers


A scene of the symposium

Scott Diddams from NIST, USA and Seung-Woo Kim from KAIST, Korea--two scientists renowned for their cutting edge research on optical frequency combs and ultrashort pulse lasers--were invited by Kaoru Minoshima (Research Director of the JST, ERATO Minoshima Intelligent Optical Synthesizer Project) and Masayuki Katsuragawa (Director of the Institute for Advanced Science) to present their latest research findings at the UEC-ERATO Symposium, held on 23 April 2018 at UEC, Tokyo.


Scott Diddams, NIST (USA)

Scott Diddams has been involved in research on optical frequency combs from the early days, including many years of collaboration with Nobel Laureate John Hall, a distinguished visiting professor at UEC, Tokyo. His talk was entitled, "Broad bandwidth synthesis and spectroscopy with laser frequency combs". He presented his group's recent achievements on laser frequency combs that extend spectral coverage from 350 nm to beyond 20,000 nm, with emphasis on generating mid-IR molecular fingerprint regions with brightness comparable to infrared beam lines at synchrotron radiation facilities by using a simple and robust system.


Seung-Woo Kim, KAIST (Korea)

Seung-Woo Kim is acknowledged for the development of the world's first mode-locked fiber laser that successfully operated in space and for its applications to precision mechanical engineering and measurement from nano-scale to long distance. In his talk on, "Advanced optical metrology and fabrication using mode-locked lasers", he described many kinds of ultrashort pulse lasers and their applications, including absolute distance measurements, space missions, and 3D profile measurements for industry.

Approximately 70 people attended the symposium, including members of faculty and students from UEC, Tokyo, as well as researchers from other institutes. These lectures on cutting edge research led to lively discussions after the talks.

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The 33rd AWCC Seminar / IEEE Distinguished Microwave Lecture is held at UEC, Tokyo.


Patrick Robin (Ohio State Univ.)

The 33 AWCC (Advanced Wireless & Communication Research Center) Seminar / IEEE Distinguished Microwave Lecture (IEEE DML) was held on 28 May 2018 at the University of Electro-Communications, Tokyo.

AWCC seminars is held at UEC to strengthen research and engineering on wireless communications. The 33rd AWCC seminar was organized in partnership with IEEE DML that is produced by IEEE MTT-S (Microwave Theory and Techniques Society) to support the activities of researchers studying high frequency technology including micro, millimeter and terahertz waves.

The opening address by Ryo Ishikawa was followed by a speech from IEEE MTT-S by Masashi Nakatsugawa, executive manager of NTT Advanced Technology Corp.

Patrick Robin, Ohio State University, described the measurement and design of high frequency active devices in his talk titled, "Accelerated Design of Power amplifiers using an Embedding Device Model".

More than 50 participants including graduate students attended the seminar.

The University of Electro-Communications (UEC) in Tokyo

is a small, luminous university at the forefront of pure and applied sciences, engineering, and technology research. Its roots go back to the Technical Institute for Wireless Commutations, which was established in 1918 by the Wireless Association to train so-called wireless engineers in maritime communications in response to the Titanic disaster in 1912. In 1949, the UEC was established as a national university by the Japanese Ministry of Education, and moved in 1957 from Meguro to its current Chofu campus Tokyo.

With approximately 4,000 students and 350 faculty, UEC is regarded as a small university, but with particular expertise in wireless communications, laser science, robotics, informatics, and material science, to name just a few areas of research.

The UEC was selected for the Ministry of Education, Culture, Sports, Science and Technology (MEXT) Program for Promoting the Enhancement of Research Universities as a result of its strengths in three main areas: optics and photonics research, where we are number one for the number of joint publications with foreign researchers; wireless communications, which reflects our roots; and materials-based research, particularly on fuel cells.

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