

# External Awards

## **Prize for Science and Technology, Research Category, The Commendation for Science and Technology by the Minister of Education, Culture, Sports, Science and Technology**

**Winner:** Hiroshi Yamaguchi, NTT Basic Research Laboratories

**Date:** April 16, 2013

**Organization:** Ministry of Education, Culture, Sports, Science and Technology

For “Optoelectromechanical Hybrid Devices Using Compound Semiconductor Heterostructures”.

A new research field is being developed by integrating conventional optoelectronic and electromechanical devices using compound semiconductor heterostructures.

## **The Young Scientists’ Prize, The Commendation for Science and Technology by the Minister of Education, Culture, Sports, Science and Technology**

**Winner:** Katsuhiko Nishiguchi, NTT Basic Research Laboratories

**Date:** April 16, 2013

**Organization:** Ministry of Education, Culture, Sports, Science and Technology

For “Nanometer-scale Semiconductor Devices with High Functionality”.

Single-electron-based electric circuits and sensors by using nanometer-scale transistors play an important role in research on low-power-consumption circuits and other fields.

## **2013 JSAP Fellow Award**

**Winner:** Hiroshi Yamaguchi, NTT Basic Research Laboratories

**Date:** September 16, 2013

**Organization:** The Japan Society of Applied Physics (JSAP)

For “Pioneering Contributions to the Application of Compound Semiconductor Heterostructures to Mechanical Devices”.

Novel functional devices have been developed by applying compound semiconductor heterostructures to mechanical structures.  
<http://journals.jsap.or.jp/english/awards/jsap-fellow-2013.html>

## **JSAP Outstanding Paper Award**

**Winners:** Katsuhiko Nishiguchi and Akira Fujiwara, NTT Basic Research Laboratories

**Date:** September 16, 2013

**Organization:** JSAP

For “Single-electron Stochastic Resonance Using Si Nanowire Transistors”.

We demonstrate stochastic resonance (SR) with single electrons (SEs) using nanoscale metal-oxide-semiconductor field-effect transistors (MOSFETs). An input signal applied to a MOSFET modulates SE transport in an average manner based on nonlinear characteristics. On the other hand, an individual SE goes through the MOSFET in a completely random manner, which corresponds to shot noise. SEs transferred to a storage node are counted precisely by the other MOSFET and used as an output signal. The correlation between the input and output signals is improved by taking advantage of extrinsic noise as well as the intrinsic shot noise composed of SEs. It is confirmed that the shot-noise-assisted SR allows fast operation with a simple system. Pattern perception utilizing SR is also demonstrated.

**Published as:** K. Nishiguchi and A. Fujiwara, “Single-electron Stochastic Resonance Using Si Nanowire Transistors,” Jpn. J. Appl. Phys. Vol. 50, 06GF04, 2011.

## **IEICE Human Communication Award**

**Winner:** Masumi Yamaguchi, NTT Basic Research Laboratories

**Date:** December 19, 2013

**Organization:** The Human Communication Group, the Institute of Electronics, Information and Communication Engineers (IEICE)

For “A Case Study of the Communication between Families Living in Remote Locations: Report of the Communication Style Using “Denwa-channel” for Five Years”.

Important elements for family-use video communication system were proposed, and a case study of communication between families living in remote location was performed. A lot of benefits of video communication were revealed through this study.

**Published as:** M. Yamaguchi, “A Case Study of the Communication between Families Living in Remote Locations: Report of the Communication Style Using “Denwa-channel” for Five Years,” IEICE Tech. Rep., Vol. 112, No. 455, HCS2012-91, pp. 73–78, 2013.

# Papers Published in Technical Journals and Conference Proceedings

## **Cortical Stimulation Consolidates and Reactivates Visual Experience: Neural Plasticity from Magnetic Entrainment of Visual Activity**

Hsin-I Liao, Daw-An Wu, N. Halelamien, and S. Shimojo  
Scientific Reports, Nature Publishing Group, Vol. 3, p. 2228, 2013.

Delivering transcranial magnetic stimulation (TMS) shortly after the end of a visual stimulus can cause a TMS-induced 'replay' or 'visual echo' of the visual percept. In the current study, we find an entrainment effect that occurs after repeated elicitations of TMS-induced replay with the same visual stimulus. The replay can be induced by TMS alone, without the need for the physical visual stimulus. In Experiment 1, we used a subjective rating task to examine the phenomenal aspects of TMS-entrained replays. In Experiment 2, we used an objective masking paradigm to quantitatively validate the phenomenon and to examine the involvement of low-level mechanisms. Results showed that the TMS-entrained replay was not only phenomenally experienced (Exp. 1), but was also able to hamper letter identification (Exp. 2). The findings have implications in several directions: (1) the visual cortical representation and iconic memory, (2) experience-based plasticity in the visual cortex, and (3) their relationship to visual awareness.

### Wavelength Path Reconfiguration Design in Transparent Optical WDM Networks

A. Kadohata, A. Hirano, F. Inuzuka, A. Watanabe, and O. Ishida  
Journal of Optical Communications and Networking, IEEE/OSA, Vol. 5, No. 7, pp. 751–761, 2013.

This paper studies the reconfiguration design and migration from an old path set to a new path set in multifiber wavelength-division-multiplexing networks. For the reconfiguration design phase, we introduce the functions of wavelength fragmentation cost and reconfiguration cost, and we propose a reconfiguration design that minimizes both wavelength fragmentation and the number of changed wavelengths. For the migration phase, we propose a migrating sequence algorithm that uses spare wavelengths to break the dependency cycle between before and after reconfiguration design sets and thus prevent service disruption. A numerical evaluation shows that the number of fibers is suppressed 4%–15% compared to the design without employing fragmentation cost and that the number of changed wavelengths is reduced by approximately 50%–90%.

### Model-based Noise Suppression Using Unsupervised Estimation of Hidden Markov Model for Non-stationary Noise

M. Fujimoto and T. Nakatani  
Proc. of the 14th Annual Conference of the International Speech Communication Association (Interspeech 2013), pp. 2982–2986, Lyon, France.

Although typical model-based noise suppression including the vector Taylor series-based approach employs a single Gaussian distribution for the noise model, it is insufficient for non-stationary noise which has a complex structured distribution. As a solution to this problem, we have already proposed a method for estimating a Gaussian mixture model (GMM)-based noise model by using a minimum mean squared error estimate of the noise. However, the state transition process of the non-stationary noise is not modeled in the noise GMM. In this paper, we propose a way of modeling the noise with a hidden Markov model (HMM) as an extension of our previous method. The proposed method proves that the HMM-based noise model outperforms a GMM-based noise model composed of the same number of Gaussian components. In addition, we discuss the appropriate topology for the noise HMM, i.e., a left-to-right HMM and an ergodic HMM.

### Video-based Tracking, Learning, and Recognition Method for Multiple Moving Objects

H. Sakaino  
IEEE Trans. on Circuits and Systems for Video Technology, Vol. 23, No. 10, pp. 1661–1674, 2013.

This paper presents an extended Markov chain Monte Carlo (MCMC) method for tracking and an extended hidden Markov model (HMM) method for learning/recognizing multiple moving objects in videos with jittering backgrounds. A graphical user interface (GUI) with enhanced usability is also proposed. Previous MCMC and HMM-based methods are known to suffer performance impairments, degraded tracking and recognition accuracy, and higher computation costs when challenged with appearance and trajectory changes such as occlusion, interaction, and varying numbers of moving objects. This paper proposes a cost reduction method for the MCMC approach by taking moves, i.e., birth and death, out of the iteration loop of the Markov chain when different moving objects interact. For stable and robust tracking, an ellipse model with stochastic model parameters is used. Moreover, our HMM method integrates several different modules in order to cope with multiple discontinuous trajectories. The GUI proposed herein offers an auto-allocation module of symbols from images and a hand-drawing module for efficient trajectory learning and for interest trajectory addition. Experiments demonstrate the advantages of our method and GUI in tracking, learning, and recognizing spatiotemporal smooth and discontinuous trajectories.

### An Exploratory Study of Proxemics and Impression Formation among Video Communication Users

M. Matsuda, I. Daibo, S. Kumano, K. Otsuka, and J. Yamato  
The Transactions of Human Interface Society, Vol. 15, No. 4, pp. 433–442, 2013 (in Japanese).

This article aims to examine how proxemics affects interpersonal impression formation among video communication systems users. Ordinary video chat systems abstract each user's physical location when more than three users are involved. Therefore, it is difficult to use directional non-verbal cues to control their conversation, and the users tend to compensate directional information with verbal cues. Such an unnatural way of communicating might affect the speaker's impression. Our experimental results confirmed this phenomenon that interpersonal impressions could be different between the party and the bystanders. We propose a future design and usage of video communication systems based on our findings.

### Insensitivity to the Coherence of Interaural-time-difference Modulation across Frequency Channels

S. Furukawa, T. Nishida, T. Kondo, and K. Takehi  
Acoust. Sci. & Tech., Vol. 34, No. 6, pp. 397–403, 2013.

The present study examined the dynamic properties of the across-frequency integration mechanism, specifically the extent to which the information about the direction of changes in the interaural-time difference (ITD) is integrated or compared across frequencies. The stimulus was a complex tone consisting of two sinusoidal carriers, one at 400 and the other at 700 Hz. A sinusoidal modulation in the ITD was imposed on one carrier alone or the two carriers simultaneously. The ITD of each carrier was centered at 0 ms, and the modulation started and ended with the zero phase. ITD modulations, when imposed on the two carriers simultaneously, were in-phase or anti-phase between them. Experiment 1 measured the threshold modulation depth for detecting the modulation with an adaptive method. The

thresholds were generally lower when both carriers were modulated than when only one was, indicating across-frequency integration of the information about the presence of modulation. The threshold, however, was not significantly different between the in-phase and anti-phase conditions, even when the modulation rate was as low as 1 Hz. Experiment 2 measured the discriminability between in-phase and anti-phase modulations. Modulation depth was fixed at a supra-threshold value (600 ms). The performance varied largely among the listeners, and it was near the chance level for half of listeners even for a 1-Hz rate. The study failed to present compelling evidence that the auditory system is sensitive to the relative phase of ITD modulations for the conditions tested. This suggests that the directional information of even slow (approx. 1 Hz) ITD modulation is not combined effectively across frequencies, at least for the conditions tested.

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#### **Advantages of IP over Elastic Optical Networks Using Multi-flow Transponders from Cost and Equipment Count Aspects**

T. Tanaka, A. Hirano, and M. Jinno

Optics Express, Vol. 22, No. 1, pp. 62–70, 2014.

To evaluate the cost efficiency of IP over elastic optical network architectures, we use a multi-layer network design scheme that covers the network to node equipment level. An evaluation in a static traffic environment shows that the multi-flow optical transponder-based elastic optical network reduces the total cost as well as the

equipment count compared to other elastic network models based on fixed-rate, mixed-line-rate and bandwidth-variable transponders.

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#### **Language Runtime Support for Non-volatile Main Memory Management**

S. Saito, G. Nakagawa, and S. Oikawa

Proc. of the 8th International Conference on Innovative Computing, Information and Control (ICICIC 2013), Kumamoto, Japan.

The recent performance improvement of non-volatile (NV) memory enables NV memory to be used as the main memory of computer systems. In order to realize such systems, system software needs to manage NV memory in accord with its characteristics, such as slower write speed and limited write durability. In order to cope with these characteristics, it is important to selectively store data in NV memory because there are unsuitable data that should be stored in dynamic random access memory. Such selection can be done by collecting the information about data access tendency. This paper proposes a method that utilizes the write-barrier mechanism supported by language runtime in order to collect the write access tendency. We implemented an access logging system and investigated the effectiveness of utilizing data access tendency for data selection. As a result, we show it is useful to utilize the data access tendency for the efficient selection of data suitable for NV memory.

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