External Awards

The 19th International Conference on the Application of High Magnetic Fields in Semiconductor Physics and Nanotechnology (HMF-19): Best Poster Award for Young Researchers

Winner: Keiko Takase, NTT Basic Research Laboratories
Date: Aug. 6, 2010
Organization: HMF-19 Conference Committee

For "Density-imbalance Stability Diagram of the ν_T=1 Bilayer Electron System at Full Spin Polarization".

The bilayer ν_T=1 Quantum Hall (QH) system has been an intriguing topic in relation to quantum Hall ferromagnets. Therefore, the stability of this state for density imbalance has been investigated. Recently, it has been revealed that the spin degree of freedom plays a critical role in the stability of the ν_T=1 QH state in the balanced density condition. In this work, we studied the stability of this system for a wide range of density imbalance at full spin polarization to separate the effect of spin degree of freedom. We found that the transition point from the ν_T=1 QH state to the fractional QH system shifted compared with that at unconstrained spin degrees of freedom. The shift in the transition point depended on the density imbalance, and a notable feature was observed at ν_T=1/3+2/3. We discuss such a feature in terms of the spin polarization of the system and associated with the phase diagram in Zeeman-energy space.

Distinguished Technical Papers Award

Winner: Hiroshi Yamada, NTT Service Integration Laboratories
Date: Sept. 1, 2010
Organization: OPNET Technologies, Inc.

For "Generating Configlets Using NetDoctor API and Making Failure Scenario from Router Syslog Data".

Two workflows in our network management processes using the OPNET Network Planner are explained. One generates configlets using NetDoctor API. The other makes a failure scenario using syslog information. These management workflows are related to management tools and actual systems.

Published as: Online proceedings.
http://www.opnet.com/opnetwork2010/proceedings/
* OPNET user account and password are required.

The Japan Society of Applied Physics Outstanding Paper Award 2010

Winners: Hajime Okamoto, Daisuke Ito, Koji Onomitsu, Tetsuomi Sogawa, and Hiroshi Yamaguchi, NTT Basic Research Laboratories
Date: Sept. 14, 2010
Organization: The Japan Society of Applied Physics

For "Controlling Quality Factor in Micromechanical Resonators by Carrier Excitation".

The quality factor (*Q*-factor) of GaAs microcantilevers consisting of Si-doped and undoped GaAs layers can be controlled by tuning the wavelength of the incident laser used for carrier excitation. With laser irradiation to [110]-oriented cantilevers at near-absorption-edge wavelengths, the *Q*-factor increases with increasing laser power, whereas shorter-wavelength irradiation decreases the *Q*-factor. We observed the opposite laser power dependence for [110]-oriented cantilevers. These results suggest that the *Q*-control is due to the piezoelectric stress generated by the photovoltaic effect.

Published as: Appl. Phys. Express 2 (2009) 035001.

International Conference on Solid State Devices and Materials Paper Award

Winners: Hajime Okamoto, Daisuke Ito, Koji Onomitsu, Haruki Sanada, Hideki Gotoh, Tetsuomi Sogawa, and Hiroshi Yamaguchi, NTT Basic Research Laboratories
Date: Sept. 22, 2010
Organization: International Conference on Solid State Devices and Materials

For "Carrier-induced Dynamic Backaction in GaAs Micromechanical Resonators".

Vibration amplification, damping, and self-oscillations induced in GaAs micromechanical resonators by carrier excitation are demonstrated. Thermomechanical vibration of a [110]-oriented n-GaAs/i-GaAs bilayer cantilever is amplified by laser irradiation with near-band-gap photon energy, whereas the vibration is damped in a [-110]-oriented cantilever. Moreover, the [110]-oriented cantilever exhibits optically excited self-oscillations when the damping factor becomes negative above the threshold laser intensity.

Published as: SSDM2009abstOkamoto.pdf (application/pdf).

Papers Published in Technical Journals and Conferences Proceedings

The Effects of Catechol-O-methyltransferase (COMT) Val^{158}Met Polymorphism on Auditory and Visual Bistable Perception

M. Kashino, H. M. Kondo, N. Kitagawa, M. S. Kitamura, and M. Nomura

Proc. of the 33rd ARO Midwinter Meeting, the Association for Research in Otolaryngology (ARO), Vol. 33, No. 1, pp. 339–340, Anaheim, CA, USA, 2010.

The present study examined the effects of catechol-O-methyltransferase (COMT) polymorphism on spontaneous switching of percepts in auditory streaming and visual plaids. COMT is related to the metabolism of released dopamine: the activity of the enzyme containing methionine (Met) is lower than that containing valine (Val). The COMT polymorphism of 72 participants was genotyped and the participants were classified into three groups: 13 Met/Met, 32 Val/Met, and 27 Val/Val carriers. Participants were instructed to listen passively to a triplet-tone sequence in an auditory streaming task, whereas they were asked to observe two moving gratings in a visual plaid task. The number of perceptual switches was larger for the Met/Met group than for the Val/Met and Val/Val/ groups in the auditory streaming task but not in the visual plaid task. Our findings support the idea that auditory and visual perceptual organization depends on different neural mechanisms.

A Sparse Component Model of Source Signals and Its Application to Blind Source Separation

Y. Kitano, H. Kameoka, Y. Izumi, N. Ono, and S. Sagayama

Proc. of the 35th International Conference on Acoustics, Speech, and Signal Processing (ICASSP), Vol. 1, No. 1, pp. 4122–4125, Dallas, Texas, USA, 2010.

In this paper, we propose a new method of blind source separation for music signals. Our method has the following characteristics: 1) the method is a combination of the sparseness-based model of source signals and the factorized basis model in nonnegative matrix factorization (NMF), 2) it is assumed that only one basis that structures source signals is active in each time-frequency bin of the observed signals, in order to degrade the degree of freedom, and 3) the parameter estimation algorithm is based on the EM algorithm regarding the index of the single active basis as the hidden variable. We developed the formulation differently from NMF and observed the source separation performance in some simulation experiments.

Smooth Pursuit Eye Movements Improve Temporal Resolution for Color Perception

M. Terao, J. Watanabe, A. Yagi, and S. Nishida

PLoS ONE, Public Library of Science, Vol. 5, No. 6, pp. 1–7, 2010.

Human observers see a single mixed color (yellow) when different colors (red and green) alternate rapidly. Accumulating evidence suggests that the critical temporal frequency beyond which chromatic fusion occurs does not reflect simply the temporal limit of peripheral encoding. However, the way in which the central processing controls the fusion frequency remains poorly understood. Here, we show that the fusion frequency can be elevated by extra-retinal signals during smooth pursuit. This eye movement can keep the image of a moving target in the fovea, but it also introduces a backward retinal sweep of the stationary background pattern. We found that the fusion frequency was higher when retinal color changes were generated by pursuit-induced background motions than when the same retinal color changes were generated by object motions during eye fixation. This temporal improvement cannot be ascribed to a general increase in contrast gain of specific neural mechanisms during pursuit since the improvement was not observed with a pattern flickering without changing position on the retina or with a pattern moving in the direction opposite to the background motion during pursuit. Our findings indicate that chromatic fusion is controlled by a cortical mechanism that suppresses motion blur. A plausible mechanism is that eye-movement signals change spatiotemporal trajectories along which color signals are integrated so as to reduce chromatic integration at the same locations (i.e., along stationary trajectories) on the retina that normally causes retinal blur during fixation.

Medical Diagnosis Support System for Disease Prevention and Its Interface

M. Mori, T. Tsukahara, K. Shinozawa, N. Hagita, M. Furutani, Y. Furutani, and R. Matsuoka

Proc. of the 4th International Conference on Bioinformatics and Biomedical Engineering (iCBBE 2010), IEEE, Vol. 2, No. 8, pp. 29–32, Chengdu, China.

This paper describes the prototype of a diagnosis support system for preventing disease and its interface. The paradigm shift from disease treatment to its prevention is to be advocated. Moreover, improving lifestyles at an early stage of diseases and gaining a better comprehension of clinical data are important. To promote this paradigm shift, we constructed a prototype medical diagnosis system that supports not only counselors but also clients. Our system is implemented as a web server linked to the public network so counselors and clients can easily access the system from remote clinics and even private homes. Its user-friendly interface allows clients to comprehend the clinical data even without the counselor's support. Subjective evaluations using the semantic differential method show that our system is superior to printed material and receives high scores for favorability and functionality.

Development of Basic Techniques for Five-senses Theater—Multiple-modality Display for Ultra-realistic Experience

T. Yoshioka, K. Nishimura, W. Yamamoto, T. Saito, Y. Ikei, K. Hirota, and T. Amemiya

Proc. of ASIAGRAPH 2010 in Shanghai, ASIAGRAPH, Vol. 1, No. 1, pp. 89–94, China.

This paper describes the first development stage of a five-senses theater (FiveSTar) that gives participants multiple-modality sensations. This project is part of the research on the ultra-realistic communication technology. An early stage prototype of FiveSTar that incorporates three-dimensional stereo vision, spatial audio (5.1 channels), force and tactile feedback, wind and scent presentation, feet motion, and vibratory body stimulation was demonstrated. The exhibit was presented at ARTEC in Asiagraph 2009 in Tokyo under the name "One-day school of witchcraft and wizardry" where participants enjoyed a fantasy world in which they could perform

wizardry by using a magic wand. The prototype system demonstration successfully provided preliminary evaluation results for initial construction of some elements for FiveSTar.

Fundamental Oscillations at ~900 GHz with Low Bias Voltages in Resonant Tunneling Diodes with Spike-doped Structures

S. Suzuki, K. Sawada, A. Teranishi, M. Asada, H. Sugiyama, and H. Yokoyama

IEE Electron. Lett., Vol. 46, No. 14, pp. 1006–1007, 2010.

Fundamental oscillations were demonstrated at around 900 GHz with low bias voltages in resonant tunneling diodes (RTDs) having spikedoped structures. Voltages at the current peak were 0.67 and 0.4 V for RTDs with spike-doping concentrations of 2×10^{18} and 1×10^{19} cm^{-3}, respectively, and 0.94 V for the RTD without spike doping. The peak current densities were around 18 $mA/\mu m^2$ and remained almost unchanged even after spike doping. The highest oscillation frequency observed in this study was 898 GHz in the 0.53 μm^2 mesa area for the RTD with a spike-doping concentration of 2×10^{18} cm^{-3}.

Instablity of a Punishment Strategy in Correlated Equilibria

T. Mitsunaga, Y. Manabe, and T. Okamoto

AlgoGT 2010, European Association for Theoretical Computer Science (EATCS), Vol. 1, No. 1, pp. 1–6, Bordeaux, France.

In game theory, to achieve correlated equilibria without a trusted mediator, we propose the idea of replacing the mediator with a protocol executed by players. In game theory, to achieve correlated equilibria without a trusted mediator, the idea of replacing the mediator with a protocol executed by players has been suggested. Before players take actions in a game, they communicate with each other by following a protocol. In that model, the concept of a punishment strategy is defined for cases in which a player (or some players) aborts the protocol. In this paper, we present an example of a game in which a punishment strategy does not work and suggest an improved definition of a punishment strategy.

Impacts of Propagation Delay on Long-distance Wireless Access Networks with IEEE 802.11 CSMA/CA

M. Tanaka, D. Umehara, S. Denno, M. Morikura, and T. Sugiyama

Proc. of the 25th International Technical Conference on Circuits/Systems, Computers and Communications (ITC-CSCC 2010), The Institute of Electronics Engineers of Korea, Vol. 1, No. 1, pp. 508–511, Pattaya, Thailand.

This paper analyzes the impacts of propagation delay on long-distance point-to-point wireless access networks with the IEEE 802.11 carrier sense multiple access with collision avoidance (CSMA/CA) protocol. Uplink and downlink throughput decrease with increasing propagation delay, that is, with increasing distance between access points. A Markov chain model is used to analyze the behavior of the IEEE 802.11 CSMA/CA binary exponential backoff algorithm. It is shown that the slot time, the receiver-to-transmitter turnaround time, and the clear channel assessment time all affect the total throughput degradation caused by a large propagation delay. When the propagation delay is less than 8 μs, the theoretical throughput is in good agreement with the throughput obtained from simulations performed using Qualnet 4.5.1.

Saturation Throughput Analysis of Unslotted CSMA-CA Networks

Y. Fujii, D. Umehara, S. Denno, M. Morikura, and T. Sugiyama

Proc. of the 25th International Technical Conference on Circuits/Systems, Computers and Communications (ITC-CSCC 2010), The Institute of Electronics Engineers of Korea, Vol. 1, No. 1, pp. 688–691, Pattaya, Thailand.

This paper proposes an analytical model for evaluating the saturation throughput of IEEE 802.15.4 in a non-beacon-enabled mode. A "preferred" node is defined as the node that obtains an opportunity to send a packet, while the others are referred to as "normal" nodes. The preferred node is more likely to send a packet next time than the normal nodes because its backoff stage is lower than that of the normal nodes. The binary exponential backoff mechanism is modeled as a Markov chain. The packet transmission process of nodes is assumed to be a Poisson process. The Markov chain and the Poisson process are used to formulate two nonlinear equations. The throughput is calculated by solving these nonlinear equations within an error of a few percent and compared with the throughput obtained from computer simulations. The proposed analytical model provides more accurate estimations when the packet length is large. The receiver-to-transmitter turnaround time is also considered.

Throughput Enhancement by AIFS Control in Single-relay Wireless Networks

Y. Nakato, D. Umehara, S. Denno, M. Morikura, and T. Sugiyama

Proc. of the 25th International Technical Conference on Circuits/Systems, Computers and Communications (ITC-CSCC 2010), The Institute of Electronics Engineers of Korea, Vol. 1, No. 1, pp. 740–743, Pattaya, Thailand.

This paper deals with single-relay multi-user wireless networks in which the IEEE 802.11 carrier sense multiple access with collision avoidance (CSMA/CA) protocol is used. Relay link flows are suppressed by a large number of user link flows when the network operates in the 802.11 basic access mode. The total throughput deteriorates owing to unfairness between user links and relay links. This paper proposes a scheme for controlling the arbitration interframe space (AIFS) of user stations so as to achieve fairness between user links and relay links. The analysis of the IEEE 802.11e backoff mechanism enables us to determine the appropriate AIFS number (AIFSN) for a given number of user stations. AIFSN is determined by numerically solving a nonlinear system, which is formulated as a Markov chain with backoff counter states. Computer simulations were conducted to evaluate the throughput of single-relay multi-user wireless networks for different numbers of user stations. The results show that fairness can be achieved by controlling the AIFSN. Furthermore, it is clarified that the AIFSN obtained by the analysis is close to that obtained by computer simulations.

StochasticSIFT: Interest Point Detection Based on Stochastically Derived Stability

U. Watchareeruetai, A. Kimura, R. C. Bao, T. Kawanishi, and K. Kashino

Proc. of the 13th Meeting of Image Recognition & Understanding (MIRU2010), Vol. 1, No. 1, pp. 593–599, Kushiro, Japan, 2010.

We propose a novel framework for detecting interest points (IPs) in video sequences called StochasticSIFT. It incorporates a stochastic model that considers the temporal dynamics of videos into the SIFT detector to improve robustness against some fluctuations inherently included in video signals. Instead of detecting IPs and then removing

unstable or inconsistent IP candidates, we introduce IP stability derived from a stochastic model of inherent fluctuations to detect IPs more stably. Experimental results show that our IP detector outperforms the SIFT detector in repeatability and matching rates.

VC-1 to H.264/AVC Intra Transcoding Using Encoding Information to Reduce Re-quantization Noise

T. Yoshitome, Y. Nakajima, K. Kamikura, S. Makino, and N. Kitawaki

Proc. of Signal and Image Processing (SIP), Vol. 1, No. 1, pp. 170–177, Maui, Hawaii, USA, 2010.

We propose a VC-1 to H.264/AVC intra transcoding method. This method uses the encoding information from a VC-1 stream and keeps as many discrete cosine transform coefficients of the original VC-1 bitstream as possible. Experimental results show that this method improves the peak signal-to-noise ratio by about 0.44–1.34 dB compared with a conventional method.

Speech Spectrum Modeling for Joint Estimation of Spectral Envelope and Fundamental Frequency

H. Kameoka, N. Ono, and S. Sagayama

IEEE Trans. Audio, Speech & Language Process., Vol. 18, No. 6, pp. 1507–1516, 2010.

Although considerable effort has been devoted to both fundamental frequency (F0) and spectral envelope estimation in the field of speech processing, the problem of determining F0 and spectral envelopes has mainly been tackled independently. If F0 were known in advance, then the spectral envelope could be estimated very reliably. On the other hand, if the spectral envelope were known in advance, then we could obtain a reliable F0 estimate. F0 and the spectral envelope, each of which is a prerequisite of the other, should thus be estimated jointly rather than independently in succession. On this basis, we are developing a parametric speech spectrum model that allows us to estimate the F0 and spectral envelope simultaneously. We confirmed experimentally the significant advantage of this joint estimation approach for both F0 estimation and spectral envelope estimation.

Max Margin Learning for Statistical Machine Translation: Toward Improvement of Machine Translation Accuracy

K. Hayashi, T. Watanabe, H. Tsukada, H. Isozaki, and S. Yamamoto

Journal of JSAI, The Japanese Society for Artificial Intelligence (JSAI), Vol. 25, No. 5, pp. 593–601, 2010.

Minimum error rate training (MERT) has been widely used as a learning method for statistical machine translation to estimate the feature function weights of a linear model. MERT has the advantage of incorporating an automatic translation evaluation metric as BLEU scores in its objective function. A weight vector can be directly optimized with a line search algorithm using the error surface on a given set of candidate translations. It efficiently searches for the best parameter resulting in the highest BLEU scores. In this paper, we present a new training algorithm for statistical machine translation, inspired by MERT and structural support vector machines. We performed MERT optimization by maximizing the margin between the oracle and incorrect translations under the L2-norm prior. Our experimental results for a Japanese-to-English speech translation task showed that the BLEU scores obtained by our method were much better than those obtained by MERT. The best improvement in BLEU that we achieved was about +3.0 over the standard MERT.
