

# ABSTRACTS OF PUBLISHED PAPERS

(Accepted April, 1998)

## CONDENSED MATTER AND MATERIAL

### Simulation of Phthalocyanine Dimer Spectra by Extended Dipole Model

Youichi SAKAKIBARA, Kazuhiro SAITO  
and Toshiro TANI

*JPN. J. APPL. PHYS.* **37-I** 2 (1998) 695-699

Optical absorption spectra of phthalocyanine (Pc) dimers are simulated for a series of assembling structures in which two Pc molecules are parallel to each other. Intermolecular interaction that induces change of spectra is calculated by extended dipole model and extended double-dipole model. The splitting feature of the dimer spectra shows several spectral patterns, depending on a structural parameter, namely, the slipping distance. Among the patterns we find spectral characteristics of major crystals such as  $\alpha$ -form and  $\beta$ -form by choosing the appropriate parameter values. By using dipole lengths of realistic molecular dimension, simulated interaction energy approaches the experimental scale for a coaxial face-to-face structure.

### Systematic Characterization of Excited States in $\pi$ -Conjugated Polymers

Michael CHANDROSS<sup>1</sup>, Yukihiro SHIMOI,  
and Sumit MAZUMDAR<sup>2,3</sup>

<sup>1</sup>*NCCOSC, RDT&E Division*

<sup>2</sup>*Department of Physics, University of Arizona*

<sup>3</sup>*Optical Sciences Center, University of Arizona*

*Chem. Phys. Lett.* **280** 1-2 (1997) 85-90

Exact finite chain calculations within a diagrammatic exciton basis give pictorial descriptions of all excited states of  $\pi$ -conjugated polymers. In linear chain polymers the  $1B_u$  is an exciton, and the fundamental two-photon states can be

broadly classified into triplet-triplet, charge-transfer and singlet-singlet excitations. The  $mA_g$ , a two-photon state that plays a strong role in nonlinear optics, is a correlated charge-transfer state. The singlet-singlet states occur higher in energy and split into bound biexcitons and a continuum of free two-exciton states.

### High Quality GaAs Quantum Wires Grown by Flow Rate Modulation Epitaxy

A. HAMOUDI, M. OGURA, X. L. WANG,  
T. OKADA, H. MATSUHATA  
*Appl. Phys. A* **66** (1998) 137-141

Transmission electron microscopy, photoluminescence and photoluminescence excitation studies pointed out the significant impact of the flow rate modulation epitaxy technique in the growth of nanoscale quantum wires. Our results confirmed experimentally its ability to grow GaAs quantum wire layers of high crystalline and optical quality.

### Highly Excited Luminescence in InGaN Epitaxial Films: Origins of the Blue Green Emission

F. SASAKI, S. KOBAYASHI, T. TANI  
Y. YAMADA, T. TAGUCHI, S. NAKAMURA  
and G. SHINOMIYA

*Journal of Luminescence* **76/77** (1998) 242-245

Luminescence dynamics of Si-doped  $\text{In}_x\text{Ga}_{1-x}\text{N}$  epitaxial films has been studied by means of time-resolved luminescence spectroscopy at low temperature. Under the band to-band excitation the recombination dynamics shows a typical model of exciton localization in ternary alloyed mixed crystals and/or donor induced luminescence centers. With the increase of the excitation density the sharp luminescence band

appears from the high energy side of the luminescence peak. The sharp peak shifts to the low energy side as time proceeds. The observed feature can neither be explained by the usual models of biexciton nor by a electron-hole plasma.

## ELECTRONIC DEVICES

### Characteristics of Large Nb-Based Tunnel Junctions for X-Ray Detection

Keisuke MAEHATA<sup>1</sup>, Kenji ISHIBASHI<sup>1</sup>

Hiroshi NAKAGAWA Hiroshi AKOH, Koen JOOSSE

Susumu TAKADA<sup>2</sup>, Masaki KATAGIRI<sup>3</sup>

<sup>1</sup>*Kyushu University*

<sup>2</sup>*Saitama University*

<sup>3</sup>*Japan Atomic Energy Research Institute*

*IEEE Transaction on Applied Superconductivity*

7 2 (1997) 3371-3374

A high quality Nb-based tunnel junction with a dimension of 200  $\mu\text{m}$   $\times$  200  $\mu\text{m}$  was tested by irradiating with x-rays. Two kinds of stable operation modes were observed by applying a magnetic field with different ramping speeds. The junction exhibited a good response to x-rays of 5.9 keV, and FWHM (full width at half maximum) of 93 eV was obtained.

## INFORMATION SCIENCE

### Automatic Generation of "Sokoban" Problems

Yoshio MURASE<sup>1</sup>, Hitoshi MATSUBARA

and Yuzuru HIRAGA<sup>1</sup>

<sup>1</sup>*University of Library and Information Science*

*Transactions of Information Processing Society of Japan*

39 3 (1998) 567-574

This paper describes a program that generates Sokoban problems automatically. Sokoban is a one-player puzzle invented in Japan. The rule is simple, but advanced problems are difficult to solve and very interesting for players. The program consists of three stages: generation, solving, and evaluation. The candidates for problems are generated randomly from a prototype and three templates. Unsolvable candidates are removed by the Sokoban solver. Finally trivial

or uninteresting candidates are removed by the evaluator. Some problems that the program generated are judged good by human experts. Our work can be characterized as an attempt to pursue creative tasks on computers, which is increasingly becoming an important target in AI.

### Qualitative Analysis of Causal Graphs with Equilibrium Type-Transition

Koichi KURUMATANI, Mari NAKAMURA

*Proc. of IJCAI'97* 542-548

In this paper, we present a method to qualitatively compute the global characteristics of causal graphs by the analysis of the underlying dynamical systems, rather than traditional qualitative simulations which suffer from intractability and difficulty in understanding their simulation results. The key idea is to translate a given causal graph into an autonomous dynamical system and to analyze equilibrium points in the system. The method requires no numerical information and it has the advantage of computing the conditions under which a certain equilibrium type holds and when equilibrium type-transitions occur. The method is firmly based on mathematical grounds, and the result is guaranteed to be valid for linear systems under the specified conditions.

### Robust Real-Time Tracking on an Active Vision Head

Sebastien ROUGEAUX<sup>1</sup>, Yasuo KUNIYOSHI

<sup>1</sup>*University of Evry*

*Proceeding of IEEE Int'l Conf. Intelligent Robot and*

*Systems (IROS) 1997* 2 873-879

Achieving the first step of a framework for human-robot interaction, we have designed a binocular tracking system which uses disparity and velocity information for the detection and pursuit of moving objects in cluttered environments without a-priori knowledge of the target shape or texture. The implemented system robustly tracks in real-time deformable objects such as human hands and faces, taking advantage of the mechanical and optical properties of ESCHeR, a high performances active vision head equipped with foveated wide-angle lenses.

## **Humanoid As a Research Vehicle Into Flexible Complex Interaction**

Yasuo KUNIYOSHI, Akihiko NAGAKUBO

*Proceeding of IEEE Int'l Conf. Intelligent Robot and Systems (IROS) 1997 2 811-819*

This paper positions humanoid research as an approach to understanding and realizing complex real world interactions between a robot, an environment, and a human. As a first step towards extracting a common principle over the three term interactions, a concept of action oriented control has been investigated with a simulation example. The complex interaction view casts unique constraints on the design of a humanoid, such as whole body, smooth shape, non-functional-modular design. A brief description of ongoing design of ETL-Humanoid which conforms to the above constraints is presented.

## **Velocity and Disparity Cues for Robust Real-Time Binocular Tracking**

Sebastien ROUGEAUX<sup>1</sup>, Yasuo KUNIYOSHI

<sup>1</sup>*University of Evry*

*Proc. Int. Conf. on Computer Vision and Pattern Recognition (CVPR'97) 1-6*

We have designed and implemented a real-time binocular tracking system which uses two independent cues commonly found in the primary functions of biological visual systems to robustly track moving targets in complex environments, without a-priori knowledge of the target shape or texture: a fast optical flow segmentation algorithm quickly locates independently moving objects for target acquisition and provides a reliable velocity estimate for smooth tracking. In parallel, target position is generated from the output of a zero-disparity filter where a phase-based disparity estimation technique allows dynamic control of the camera vergence to adapt the horopter geometry to the target location. The system takes advantage of the optical properties of our custom-designed foveated wide-angle lenses, which exhibit a wide field of view along with a high resolution fovea. Methods to cope with the distortions introduced by the space-variant resolution, and a robust real-time implementation on a high performance active vision head are presented.

## **RoboCup - A Challenge Problem for AI -**

Hiroaki KITANO<sup>1</sup>, Minoru ASADA<sup>2</sup>

Yasuo KUNIYOSHI, Itsuki NODA, Eiichi OSAWA<sup>1</sup>

Hitoshi MATSUBARA

<sup>1</sup>*Sony Computer Science Laboratory*

<sup>2</sup>*Osaka University*

*AI Magazine 18 1 (1997) 73-85*

The Robot World-Cup Soccer (RoboCup) is an attempt to foster AI and intelligent robotics research by providing a standard problem where a wide range of technologies can be integrated and examined. The first RoboCup competition will be held at the Fifteenth International Joint Conference on Artificial Intelligence in Nagoya, Japan. A robot team must actually perform a soccer game, incorporating various technologies, including design principles of autonomous agents, multiagent collaboration, strategy acquisition, real-time reasoning, robotics, and sensor fusion. RoboCup is a task for a team of multiple fast-moving robots under a dynamic environment. Although RoboCup's final target is a world cup with real robots, RoboCup offers a software platform for research on the software aspects of RoboCup. This article describes technical challenges involved in RoboCup, rules, and the simulation environment.

## **Humanoid Interaction Approach: Exploring Meaningful Order in Complex Interactions**

Yasuo. KUNIYOSHI, Akihiko. NAGAKUBO

*Proc. Int. Conf. Complex Systems*

Humans seem to handle extremely complex interactions quite robustly and effortlessly. A whole body dynamic action entails a coordinated dynamic control of many dozens of joints, dealing with indefinite vast variety of effects from physical contacts between the body and other objects. Nevertheless we rarely have difficulty in accomplishing our goals in our everyday life. We are also quite robust in recognizing someone else's actions and generating meaningful responses such as helping, hindering, or sometimes learning by imitation. Characteristic to these examples is the capability to robustly explore/identify/achieve a variety of different dynamics and to detect the right points of intervention to such dynamics. This paper presents our approach using a whole

body humanoid robot as a research tool and exploring new principles of handling complex interactions along the idea of segmentation of global dynamics. The principles are expected to provide new insights to more general issues of "control vs. complex systems".

### **Possibility of Self-Recognizing Robots: From the Perspective of Research on Nonhuman Primates**

Luc BERTHOUBE, Shouji ITAKURA<sup>1</sup>

<sup>1</sup>*Emory University*

*COGNITIVE STUDIES : Bulletin of the Japanese Cognitive Science Society* 4 3 (1997) 120-127

Despite roboticists' endeavours to endow their robots with cognition, robots do not exhibit as complex interactive behaviours as those of their animal counterparts. Our belief is that this failure partially originates from a lack of self-awareness of those robots. Indeed, it is difficult for a robot which cannot discriminate between his own body and its environment or understand his physical configuration to map the behaviours of other agents living in its environment onto his body and therefore exhibit social communication such as imitation (unless such a mapping is explicitly encoded in its behavior). We address here a particular aspect of self-awareness, namely self-recognition, because self-recognition reveals an awareness of stable categorical features of self. The understanding of self-recognition in nonhuman primates has been recently extensively studied and some well-defined experimental tests have been proposed. However, no model has been proposed, partly because, from a psychological point of view, it is difficult to estimate the bias of hidden factors inherent to the experimental setup in the inference of a mechanism. Robotics instead provides an alternative mean for testing theories of behavior, by implementing tentative mechanisms and analyzing the obtained behaviours along lines similar to those used for analyzing animal behaviours. In this paper, we review some work done in self-recognition in nonhuman primates and we propose a framework for exploring this process on a robot.

### **Deferred Imitation of Human Head Movements by an Active Stereo Vision Head**

John DEMIRIS<sup>1</sup>, Sebastien ROUGEAUX<sup>2</sup>

G. M. HAYES<sup>1</sup>, Luc BERTHOUBE,  
Yasuo KUNIYOSHI

<sup>1</sup>*University of Edinburgh*

<sup>2</sup>*University of Evry*

*Proc. 6th IEEE International Workshop on Robot and Human Communication (ROMAN'97) 88-93*

Designing a mechanism that will allow a robot to imitate the actions of a human, apart from being interesting for opening the possibilities for efficient social learning through observation and imitation, is challenging since it requires the integration of information from the visual, memory and motor systems. This paper deals with the implementation of an imitation architecture on an active, stereo vision head, and describes our experiments on the deferred imitation of human head movements.

### **Supervised Self-Organization of User's Kansei Model for Image Retrieving**

Nadia BIANCHI<sup>1</sup>, Luc BERTHOUBE

Toshikazu KATO

<sup>1</sup>*University of Milano*

*Proceeding of 2nd IEEE International Conference on Cognitive Technology (1997) 185-189*

In this paper, we propose a Kansei-oriented system dedicated to image retrieval. By "kansei"-oriented, it is understood that the user is at the center of a system sensitive to and actively using his/her cognitive abilities as well as his/her sensitivity. The definition of this sensitivity is very difficult to elicit even for the user him/herself and therefore should emerge from his/her interaction with the system. We propose a dynamic multiagent architecture in which a language, through which the user and the system establish mutual understanding over visual perceptions, develops. We describe the mechanisms underlying the development of this language and which allow the user to have full control, both functionally and structurally, of the system.

## On Why Should a Robot Recognize Itself

Luc BERTHOUCHE, Shouji ITAKURA<sup>1</sup>

<sup>1</sup>*Emory University*

*Proceeding of Third International Symposium on Artificial Life and Robotics (AROB III '98) 2 678-681*

With roboticists' recent endeavours to provide their creatures with cognition, robots are beginning to exhibit some simple form of interactive behaviours, albeit not as complex as those of their animal counterparts. In this paper, we suggest that the robots' lack of body-awareness partially accounts for the above disparity. Lack of body-awareness implies the absence of abilities, such as discrimination between one's body and the environment, understanding of one's physical configuration and mapping of other's behaviours onto one's body, which would otherwise enable social interaction as complex (and beneficial) as imitation. With roboticists increasingly investigating the issue of embodiment and sensory-motor coordination, self-recognition appears as a good first milestone towards body-aware robots. Indeed, a process during which it is shown that human and non-human primates become aware of stable categorical features of self, self-recognition appears as a form of sensory-motor awareness from which robots' interactive behaviours should greatly benefit.

### BIOSCIENCE

#### Task-Dependent Laterality for Cue Decoding During Spoken Language Processing

Satoshi IMAIZUMI<sup>1</sup>, Koichi MORI<sup>1</sup>, Shigeru KIRITANI<sup>1</sup>

Hiroshi HOSOI<sup>2</sup> and Mitsuo TONOIKE

<sup>1</sup>*Department of Speech and Cognitive Sciences and Speech Physiology, Graduate School of Medicine, University of Tokyo*

<sup>2</sup>*Otolaryngology, School of Medicine, Kinki University*  
*NeuroReport 9 5 (1998) 899-903*

The task-dependent laterality of the auditory cortices was investigated by measuring the magnetic fields elicited by three forms of a Japanese verb, which differed in terms of prosodic and phonetic cues. Significant task-dependent magnetic fields were found in both hemispheres during a prosody-related task, but only in the left during a phoneme-related task. The latency

was similar to the mismatch negatively which reflects the neural activity of automatic cue decoding. These results suggest that task-dependent schemata are activated at least partially in parallel with automatic cue-decoding processes such that those in the left hemisphere process linguistic information irrespective of acoustic cues whereas those in the right hemisphere process prosodic information.

#### Cerebellar Complex Spikes Encode Both Destinations and Errors in Arm Movements

Shigeru KITAZAWA, Tatsuya KIMURA<sup>1</sup>, Ping-Bo YIN<sup>2</sup>

<sup>1</sup>*University of Tsukuba*

<sup>2</sup>*Japan Science and Technology Corporation*  
*Nature 392 (1998) 494-497*

Cerebellar Purkinje cells discharge complex spikes (CS) with a frequency of approximately 1 Hz during arm movements. In spite of the low frequency of firing, the CS has been proposed to contribute to the initiation of arm movements, or to the gradual improvement of motor skills. We recorded Purkinje cell activity from the hemisphere of lobules IV-VI, while trained monkeys made short-lasting reaching movements (~200 msec) to touch a visual target that appeared at a random location on a tangent screen, and examined the relationship between CS discharges and 1) the absolute touch position, and 2) errors relative to the target. We have used information theory to show that the CS occurring at the beginning of the reach encode the absolute destination, and the CS occurring at the end of the short-lasting movements encode the relative errors. Thus, CS convey multiplexed information consistent with the idea that they contribute to both the generation of movements and their gradual, long-term improvement.

## OPTICS AND RADIATION

### Experimental Investigation of Population Inversion Formation Process in 10ps KrF Laser Produced Recombining Plasmas

Eisuke MIURA, Toshihisa TOMIE, Isao OKUDA  
and Yoshiro OWADANO

*Advances in Laser Interaction with Matter and Inertial Fusion* (1998) 519-522

Irradiation conditions required for achieving population inversion in 10ps KrF laser produced recombining plasmas were experimentally investigated. To realize higher ionization state, suppressing an ASE (amplified spontaneous emission) prepulse accompanying a 10ps pulse was effective. Small spot size irradiation gave rapid expansion of the plasma, when the ASE prepulse was suppressed.

### High-Power Self-Starting Femtosecond Cr:Forsterite Laser

V. PETROV<sup>1</sup>, V. SHCHESLAVSKIY<sup>1</sup>  
T. MIRTCHEV<sup>1</sup>, F. NOACK<sup>1</sup>, Taro ITATANI  
Tadashi NAKAGAWA, Takeyoshi SUGAYA

<sup>1</sup>*Max-Born-Institut*

*Electronics Letters* **34** (1998) 559

We have achieved a self-modelocked Cr:forsterite laser generating sub-100fs transform limited pulses near 1260 nm with output energies as high as 10 nJ, and report 30% conversion efficiency in extracavity frequency doubling.

### Optical Deflection of Molecules

Hirofumi SAKAI, A. TARASEVITCH<sup>1</sup>, J. DANILOV<sup>1</sup>  
H. STAPELFELDT<sup>1</sup>, R. W. YIP<sup>1</sup>, C. ELLERT<sup>1</sup>  
E. CONSTANT<sup>1</sup>, P. B. Corkum<sup>1</sup>

<sup>1</sup> *National Research Council of Canada*  
*Physical Review A* **57** (1998) 2794-2801

When intense light interacts with a molecule it induces a force proportional to the gradient of the Stark shift. We use this nonresonant force to deflect I<sub>2</sub> and CS<sub>2</sub> molecules. We

trace the direction of molecules in a molecular beam, showing that the molecules that pass near the center of a 1.06- $\mu\text{m}$  or 10.6- $\mu\text{m}$  laser beam will focus. We predict that Stark shifts on the order of 50 meV can be obtained for all small molecules and atoms while maintaining ionization rates below 10<sup>6</sup> s<sup>-1</sup>. Among the devices that can be based on the nonresonant Stark shift are molecular accelerators and molecular quantum wires.

## MEASUREMENT AND STANDARD

### Results of Bilateral Comparisons: Capabilities and Problems of Spinning Rotor Gauges

M. HIRATA, M. BERGOGLIO<sup>1</sup>, A. CALCATELLI<sup>1</sup>  
G. RUMIANO<sup>1</sup>

<sup>1</sup>*10135 Torino, Italia, Istituto di Metrologia*

*"G. Colonnetti" (IMGC)*

*Vacuum* **48** 7/9 (1997) 719

Several rotors were calibrated at ETL and IMGC in the pressure range from 10<sup>-4</sup> Pa to 100 Pa for argon by using a static multi-stage system at the ETL and dynamic and static apparatus at IMGC. With stable rotors, the comparison showed that the two laboratories agree within 1%. Two rotors were calibrated also at higher pressures with the aim of increasing the operation range for pressure up to 10 Pa. The results of ETL and IMGC are also in good agreement.

### Results of Bilateral Pressure Comparisons in the Vacuum Region Between the ETL and the IMGC

M. HIRATA, M. BERGOGLIO<sup>1</sup>, A. CALCATELLI<sup>1</sup>  
G. RUMIANO<sup>1</sup>

<sup>1</sup>*10135 Torino, Italia, Istituto di Metrologia*

*"G. Colonnetti"*

*(IMGC)*

*Metrologia* **34** (1997) 421

Primary vacuum systems of the Electrotechnical Laboratory (ETL) and the Istituto di Metrologia "G. Colonnetti" (IMGC) were compared in the pressure range 10<sup>-4</sup>Pa to 10Pa by using spinning rotors as transfer gauges. Several rotors were calibrated at both laboratories in an argon atmosphere. The results obtained are in good agreement and are within the uncertainty value of both the laboratories.

**Discussion of the Stable Thermal Equilibrium Current of a Superconductor During Tests of High-Speed Rotor Windings**

Katsuyuki KAIHO ,Haruhiko NOMURA , Itaru ISHII,  
Shuichiro FUCHINO, Noboru HIGUCHI  
Naotake NATORI, Seiji SEKINE , Kazuaki ARAI  
Hiroshi YAMAGUCHI, Noriharu TAMADA  
Hiroshi TATEISHI

*IEEE Trans.Appl.Supercon.* 7 2 (1997) 223-226

Research and development of superconducting generation equipment has been conducted. As a part of the design research for the superconducting generator, the stability of superconducting field winding is being studied. The goal of this study is to formulate a design philosophy for a stable superconducting field winding in the presence of large disturbances. In the present paper, we describe the stable thermal equilibrium current of the superconductor, which is measured during the stability test. Modifying the equal area criterion presented by Maddock et. al., a simple graphical scheme has been presented and the minimum stable thermal equilibrium current was calculated.

**Study on Performance Evaluation of Thermoelectric Materials**

Atsushi YAMAMOTO, Toshitaka OHTA  
Tadayoshi TANAKA

*T.IEE Japan* 118-A 4 (1998) 420-425

We have measured the variability of thermoelectric performance for p-type Bi-Sb-Te thermoelements, synthesized via the PIES (Pulverized and Intermixed Elements Sintering) method. We observed variations both between samples and between slices taken from individual samples. Within each sample, resistivity and thermal conductivities were found to vary by 3 to 4% along the sample length, with minimum in the center; while the Seebeck coefficient varied by 1% randomly. Variability in thermoelectric performance was larger between samples, due to variances in carrier concentration (not measured). The observed thermoelectric figure-of-merit had a mean value across all samples of

$0.00315 \pm 0.00022 \pm 0.00019 K^{-1}$ ; where the first error is due to variance between samples, and the second error is the variance within each sample. This yields a TOTAL VARIABILITY of 10%. Thus, the PIES method is an excellent choice for high quality mass production of p-type Bi-Sb-Te.

**Superconducting Properties and Uniaxial Strain Characteristics of Nb<sub>3</sub>Sn Fiber-Reinforced Superconductors with Tantalum Reinforcement Fibers**

Kazuaki ARAI, Masaichi UMEDA, Koh AGATSUMA  
and Hiroshi TATEISHI

*Transactions of the Institute of Electrical Engineers of Japan* 118-A 5 (1998) 447-452

We have been developing fiber-reinforced superconductors (FRS) for high-field and large-scale magnets. Tungsten fibers have been selected as the reinforcement fiber for FRS so far because tungsten has the highest elastic modulus of approximately 400 GPa which can minimize the strain from electromagnetic force. The preparation process of FRS consists of sputtering deposition and heat treatment because it may be difficult to apply drawing methods to materials of high-elastic modulus such as tungsten. Tantalum has high elastic modulus of 178 GPa and its thermal expansion coefficient that is closer to that of Nb<sub>3</sub>Sn than tungsten's, which means prestrain in Nb<sub>3</sub>Sn in FRS is reduced by adopting tantalum fibers. Tantalum has been used as barriers between bronze and copper in conventional Nb<sub>3</sub>Sn superconductors which are usually prepared with drawing process despite of the tantalum's high elastic modulus. That implies drawing process may be applied to prepare FRS with tantalum reinforcement fibers. In this paper, FRS using tantalum fibers prepared with sputtering process are described with making comparison with FRS of tungsten to clarify the basic properties of FRS using tantalum fibers. Depth profiles in Nb<sub>3</sub>Sn layer in FRS were measured to examine reaction between superconducting layers and reinforcement fibers. Superconducting properties including strain and stress characteristics were shown. Those data will contribute to design of FRS using tantalum reinforcement fibers which adopts the drawing processes.

### YBaCuO Trilayer Junctions with PrBaCuO Barrier

Hiroshi AKOH, Hiroshi SATO

*Advances in Superconductivity IX*

2 (1997) 1135-1140

We have investigated YBaCuO trilayer junctions with PrBaCuO barriers to improve the distribution of junction parameters. For the improvement of junction parameters, we have carefully fabricated trilayer films, using a backing plate of Al/Cu/Al stacked foils between substrate and sample holder to ensure uniform substrate temperature during deposition of trilayer films, and by controlling film composition precisely to reduce the precipitated particles on the film surface. By introducing these techniques, the 88 junctions with the 35-nm PrBaCuO barrier and dimensions of  $\leq 10 \times 10 \mu\text{m}^2$  on a  $15 \times 15 \text{mm}^2$  substrate showed the  $1-\sigma$  spreads of  $J_c$  and  $R_n A$  with 34% and 25%, respectively.

### Defects in the Ti/GaAs System Probed by Monoenergetic Positron Beams

Akira UEDONO<sup>1</sup>, Satoshi FUJII<sup>2</sup>, Takeshi MORITA<sup>1</sup>

Takao KAWANO<sup>1</sup>, Shoichiro TANIGAWA<sup>1</sup>

Ryoichi SUZUKI, Toshiyuki OHDAIRA

and Tomohisa MIKADO

<sup>1</sup>University of Tsukuba

<sup>2</sup>Sumitomo Electric Industries Limited

*J. Phys. Condens. Matter* **9** (1997) 6827-6835

Defects in a Ti/GaAs specimen were probed by monoenergetic positron beams. From measurements of Doppler broadening profiles of the annihilation radiation and lifetime spectra of positrons, vacancy-type defects were found to be present in both the Ti layer and the GaAs substrate. In the GaAs substrate, a damaged region was present below the Ti/GaAs interface, and its width was about 100 nm. The lifetime of the positrons (336 ps) trapped by the vacancy-type defects in this region was close to that of divacancies,  $V_2$ , while the characteristic value of the lineshape parameter  $S$  for such defects was smaller than that for  $V_2$ . From these

results, the major species of the defects in the region below the Ti/GaAs interface was identified as being divacancy-impurity complexes.

### Larmor Precession of $\text{Mn}^{2+}$ Moments Initiated by Exchange Field of Photo-Injected Carriers in $\text{CdTe}/\text{Cd}_{1-x}\text{Mn}_x\text{Te}$

Ryoichi AKIMOTO, Koji ANDO, Fumio SASAKI,

Shunsuke KOBAYASHI, Toshiro TANI

*Physical Review B* **57** (1998) 7208-7213

We observed dynamical processes of the magnetic moments of photo-injected carriers and resultant perturbed magnetic moment of  $\text{Mn}^{2+}$  ions in  $\text{CdTe}/\text{Cd}_{1-x}\text{Mn}_x\text{Te}$  quantum wells by means of the femtosecond time-resolved magneto-optical Kerr rotation measurement in transverse magnetic fields. The time-resolved Kerr rotation signal shows that the Larmor precession of  $\text{Mn}^{2+}$  moment is initiated by the photo-injected carriers. Especially, we observed a time delay in terms of phase and an amplitude of  $\text{Mn}^{2+}$  beats as a function of external field to confirm the mechanism of perturbing  $\text{Mn}^{2+}$  moment, i.e., a transient  $p-d$  exchange field, proposed in earlier studies. The motion of  $\text{Mn}^{2+}$  moment is also simulated by the Bloch model including the impulsive transverse exchange fields produced by the conduction electron and heavy-hole spins. From this, it is found that the exchange field of the heavy-hole spin contributes dominantly to tipping the  $\text{Mn}^{2+}$  moment away from the external field axis. The exchange field estimated by the Bloch model so as to fit experimental data is in reasonable agreement with the exchange field estimated from  $p-d$  exchange interaction, which also supports the above mechanism.

### Field Trials of the CIE Chromatic-Adaptation Transform

Hiroaki SOBAGAKI, Yoshinobu NAYATANI<sup>1</sup>

<sup>1</sup>Osaka Electro-Communication University

*Color Res. & Appl.* **23** 2 (1998) 78-91

Field trials of the chromatic-adaptation transform provided by CIE Technical Report No.109(1994) was conducted on the basis of the CSAJ, the Breneman, and the McCann experiments. In the study, a concept of common normalized

illuminant and illuminance, independent of various illuminants and illuminances used in the actual experiments, is newly introduced in the predictions. This concept made it possible to compare the various experimental results done under different illuminations at the common normalized condition. The function of the CIE chromatic-adaptation transform using this concept of normalization becomes very similar to that of the nonlinear color-appearance model. In addition, the effective adaptation coefficient  $\alpha_{\min}$  already proposed by the authors is confirmed as effective in the case of the CIE chromatic-adaptation transform. The transform predicts the above three kinds of experiments nicely.