Conclusion

I would like to express my deep thanks to Prof. T. Miyoshi for inviting me and undertaking all the organization of my visit. I am grateful to the President of Yamaguchi University and the Dean of the Faculty for accepting me at the Faculty and the Venture Business Laboratory. I hope the joint collaboration will continue in the future.

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(4) Visit of Yamaguchi University

Dr. Eugene O. Kamenetskii

Department of Electrical and Computer Engineering, Ben Gurion University of the Negev, Beer Sheva, 84105, Israel

世話教官：工学部・電気電子工学科教授　粟井　郁雄

Introduction

I visited Yamaguchi University on kind invitation of Prof. Ikuo Awai, Department of Electrical and Electronic Engineering, in the frame of the Venture Business Laboratory with financial support of the Japanese Ministry of Education. This is my second visit to Yamaguchi University. The aim of the present visit was to join experiences concerning the development of new artificial materials for microwave application, both in theoretical studies and experiments, guidance for graduate students and academic staffs, delivering seminars on physical foundation and application of microwave complex media, consideration of the main aspects for possible continuation of scientific collaboration. This was a great chance for me, for the second time, to learn more about Japanese education, culture, and get a better understanding of Japanese thinking and approach to problems. I hope also that I was able to say something interesting about my country to many people I met.

Research

Development and implementation of new microwave components is a very important subject for many applications. To realize a new generation of microwave components one should focus his efforts in search for novel microwave materials. Artificial microwave materials are a very attractive subject in this search. Novel electromagnetic properties of artificial materials arise from particles ("atoms") with new properties that compose the material structure. New-effect artificial atoms appeared recently on the agenda in modern electromagnetics. Some time ago, I put forth an idea that small ferromagnetic (quasi-magnetostatic) resonators with special-form surface metallizations can be considered in microwaves as point particles with properties of local internal magnetoelectric (ME) coupling. Such artificial ME particles (that one can consider as glued pairs of small electric and magnetic dipoles) do not exist in nature. Theoretical analysis of composite materials based on these ME particles (bianisotropic materials) showed new (unknown for natural condensed media) electromagnetic properties. Experimental investigations carried out recently by the research group of Prof. I. Awai's laboratory in Yamaguchi University, have verified that quasistatic microwave ME effect really exists in small ferromagnetic resonators with special-form surface metallizations, as theoretically predicted. The artificial atoms are characterized by rich spectrums of ME oscillations that can be excited by external RF electric and magnetic fields. This is a new effect in microwaves. New microwave artificial materials (bianisotropic materials) can be synthesized as a structural composition of ferrite ME particles. A well-developed modern technology for thin-film ferromagnetic resonators can be successfully implemented for manufacturing new microwave devices.

During two years, since the time of my last visit to Yamaguchi University, our scientific collabora-

tion with Prof. I. Awai and researches of his group, Mr. A.K. Saha and Dr. A. Sanada, was very intensive and very productive. The obtained results of new experiments and calculations laid down the basis for our common journal publications and presentations at International Conferences.

Recently, I have shown theoretically that properties of energy eigenstates and the spinning properties surprisingly describe the oscillating modes in a disk-form ferrite resonator. These facts reveal a fundamentally new physical nature of the "ME artificial atoms" and open a way to realize new artificial materials with unknown properties. Professor I. Awai is a well-known expert in the field of magnetostatic wave propagation in ferromagnetic films. He is also a well-known expert in the field of microwave solid-state resonators. At present, he carries out serious research in complex electromagnetic materials. I think that his great experience in these fields of research let him to understand all the potential significance of my recent theoretical models for development new artificial materials and gave me, as a result, an opportunity to advance my ideas in common investigations in his laboratory. Many productive discussions, both at scientific seminars and at personal talks with Professor I. Awai, were very useful in understanding fundamental problems and potential applications of new phenomena.

During this my stay at Yamaguchi University we were successful to obtain new very important experimental results. Together with Mr. A.K Saha, Ph. D. student of Prof. I. Awai's laboratory, we were able to show experimentally that (a) the ME effect can strongly be increased in particles with "terminated" surface electrodes and (b) because of a special character of a circulation, oscillations in disk-form ferrite resonators can be excited by a normal component of the RF electric field. This is very exciting for me since these experimental results verify my new theoretical proposition concerning the main role of "spinning properties" of magnetostatic oscillations in the observed ME effect. Now we plan to submit a series of papers in leading physical journals (such as, Physical Review Letters, Physical Review E, Journal of Applied Physics).

Teaching students, education

During my stay in Yamaguchi University I gave several seminars for academic staffs and students in Prof. I. Awai's laboratory on application of complex electromagnetic materials, special properties of bianisotropic media, and physical models of ferrite ME particles. I am very thankful to all the participants of these my seminars for their interest to my ideas and very productive discussions.

Future co-operation

At present, we are witnessing a great and continuous interest in the interaction of electromagnetic waves and artificial materials. Search of new artificial materials with new electromagnetic properties is a very topical subject. Based on a simple model of a medium as a composition of small structural elements, a large variety of different artificial electromagnetic materials have been suggested. New applications are supposed to be found for microwave devices based on such novel materials.

It becomes clear, however, that development and implementation of this new subject of research, is really worthwhile when novel properties can be expected. A vast range of problems in condensed medium electrodynamics is due to different properties of atoms and material structures in natural media (dielectrics, ferrites, semiconductors, etc.). Electromagnetic properties of known artificial electromagnetic materials (such, for example, as artificial dielectrics, microwave chiral composites) do not show new effects principally different from those of natural materials (natural dielectrics, natural optically active media). At the same time, it is highly desirable to have new materials that exhibit novel electromagnetic properties and, therefore, may give a basis for new, unexpected applications. Such novel electromagnetic properties should arise from new properties of particles (atoms) that compose a material structure.

Ferromagnetic resonators, being small multiresonance structures with very short-wavelength (in comparison with a wavelength in a host material) magnetostatic oscillations are characterized by intrinsic dynamical processes with energy eigenstates and, therefore, may be considered as structural elements of artificial electromagnetic materials similar to atoms and molecules which are struc-

tural elements of natural continuous media. Ferromagnetic resonators with special-form surface metallizations are characterized by oscillating processes of the RF magnetization and the RF surface electric current and may be considered as bianisotropic particles with "glued pairs" of two (electric and magnetic) mutually coupled dipoles. A composition of such bianisotropic particles gives an artificial material with new electromagnetic properties. Theoretical models published in my recent papers and our common experimental results obtained in Prof. I. Awai's laboratory, show that we can be rather optimistic in our estimations to use ferromagnetic resonators with a special-form surface electrodes as "bianisotropic atoms" for future microwave complex materials and new microwave devices. I got the feeling that Prof. I. Awai and his research group are very much interested in these topics as well and that our co-operation will be continued.

Summary

This stay, as the previous one, had a great impact on my understanding of Japanese university research and approach to basic and device related topics. Looking back I feel that this visit to Department of Electrical and Electronic Engineering, Yamaguchi University was very fruitful for me. I gained a lot from scientific discussions with Prof. I. Awai, Mr. A.K. Saha and Dr. A. Sanada. I was able to be in touch with students of Prof. Awai's laboratory. We successfully carried our joint experiment and obtained fundamentally new results. I would like to express my deep thanks to Prof. Ikuo Awai for inviting me and undertaking all the organization of my visit. I would like to thank Dr. A. Sanada and Mr. A.K. Saha for their general support and undertaking the organization of my visit.

I am thankful to students of Prof. I. Awai's laboratory for their interest to the subject of my research and their help in carrying out our experiments. I have to acknowledge the support of the Japanese Ministry of Education. I am grateful to the President of Yamaguchi University and the Dean of the Faculty for accepting me at the Faculty and the Venture Business Laboratory. I will always remember the warm welcome in Japan.

I hope that this my visit will turn out a milestone in continuation of our joint research in realization and application of fundamentally new microwave complex materials.

5) My Visit to Yamaguchi University Institute of Biological Sciences and Venture Business Laboratory; February 1- March 12, 2001

Dr. Reza Md. Shahjahan

Senior Scientific Officer, Institute of Food and Radiation Biology (IFRB), Atomic Energy Research Establishment (AERE), Savar Bangladesh Atomic Energy Commission, Dhaka

世話教官：理学部・自然情報科学科教授　遠藤　克彦

Introduction

I have the pleasure to gratefully acknowledge the untiring efforts of Professor Katsuhiko Endo, System Biologist, Faculty of Science, Yamaguchi University (YU) Institute of Biological Sciences for opening a gate of cooperation through bilateral agreement between IFRB and YU. And inviting me to visit his laboratory under a joint venture of the Venture Business Laboratory (VBL), Graduate School of the Faculty of technology Yamaguchi University, form the 1 February to 12-th. March 2001 as an Associate Professor. Since my graduation from the University of Manchester, UK, I have had always a desire to explore Science and Technology in the eastern hemisphere. Being driven by such an ambitious and noble desire and dream as an young graduate I was always kept a conscious out look on the research in biological science in this zone. The dream came partially true in January 1993, When I was given a chance to participate Japan Atomic Energy Research Institute (JAERI) training course entitled Molecular