



RIEC International Symposium

**5th Russia-Japan-USA-Europe Symposium on
Fundamental & Applied Problems of
Terahertz Devices & Technologies**

Advance Program

Oct. 31 – Nov. 4, 2016

**Sakura Hall, Katahira Campus
Tohoku University, Sendai, Japan**

Sponsored by

- RIEC: Research Institute Electrical Communication, Tohoku University, Japan
- Inoue Foundation for Science
- Intelligent Cosmos Scientific Foundation
- The Murata Science Foundation
- The Foundation for the Promotion of Electrical Communication Engineering



RJUSE TeraTech-2016 Timetable

31st, Oct. (Mon.)	1st, Nov. (Tue.)	2nd, Nov. (Wed.)	3rd, Nov. (Thu.)	4th, Nov. (Fri.)
	8:30-18:00 Registration	8:30-18:00 Registration	8:30-12:00 Registration	8:30-12:00 Registration
	9:00-9:15 Opening	9:00-10:55 Session We1: Graphene and Carbon Nanotubes for THz Devices J. Kono (Plenary) A. Belyanin (Invited) V. Enaldiev (Contributed) S. Kameo (Contributed)	9:00-10:35 Session Th1: Graphene Heterostructures for THz Devices V. I. Fal'ko (Plenary) V. V. Mitin (Invited) D. Yadav (Contributed)	9:00-10:45 Session Fr1: THz Microscopy & Nanoscopy S. Komiyama (Plenary) I. Kawayama (Contributed) Q. C. Weng (Contributed) K.-T. Lin (Contributed)
	9:15-11:00 Session Tu1: THz Electronic Devices M. Asada (Plenary) D. Jena (Invited) D. Coquillat (Invited)			
	11:00-11:20 Coffee Break	10:55-11:15 Coffee Break	10:35-10:55 Coffee Break	10:45-11:05 Coffee Break
	11:20-12:30 Session Tu2: THz Spectroscopy M. Tonouchi (Invited) K. I. Zytsev (Contributed) H. Suzuki (Contributed)	11:15-12:15 Session We2: THz Imaging K. Kawase (Invited) W. Knap (Invited)	10:55-12:15 Session Th2: THz Plasmonic Devices - II D. V. Fateev (Invited) Y. M. Meziani (Invited) F. Kasuya (Contributed)	11:05-12:45 Session Fr2: THz Photodetectors & Bolometers G. N. Goltsman (Invited) K. Hirakawa (Invited) S. Kim (Contributed) M. Patrashin (Contributed)
		12:15-12:30 Photo Session		
	12:30-14:00 Lunch	12:30-14:00 Lunch	12:15-19:00 Free Time	12:45-13:00 Award Ceremony & Closing
	14:00-15:40 Session Tu3: THz Plasmonic Devices - I S. Shapoval (Invited) H. G. Roskos (Invited) K. Wakita (Contributed) A. S. Petrov (Contributed)	14:00-15:40 Session We3: THz Photonics & Metamaterials S. O. Yurchenko (Invited) Y. Takida (Invited) S. Yudate (Contributed) Y. Kanamori (Contributed)		
	15:40-16:00 Coffee Break	15:40-16:00 Coffee Break		
	16:00-17:50 Session Tu4: THz Dynamics of Electrons/Phonons/ Plasmons and Their Interactions C. J. Stanton (Invited) M. Helm (Invited) D. Svintsov (Invited) T. Komatsu (Contributed)	16:00-18:00 Session We4: THz Lasers W. Terashima (Invited) J.-F. Lampin (Invited) S. V. Morozov (Invited) A. A. Dubinov (Invited)		
17:30-19:00 Registration				
19:00-21:00 Welcome Meeting	17:50-19:30 Poster Session	18:00-19:30 Poster Session	19:00-21:00 Banquet	

Welcome

Terahertz (THz) electromagnetic waves and phenomena in the THz range are explosively investigated yet not fully unveiled in broad areas of sciences & technologies ranging from fundamental physics to commercial applications.

The symposium aims to bring together researchers who tackle "Fundamental & Applied Problems in Terahertz Devices & Technologies", so as to stimulate discussions on their state-of-the-art results and promote their collaborations.

Based on the successful organizations of preceding symposiums in Japan, Russia, and USA, the 5th RJUSE will be back in RIEC, Tohoku University, Sendai, Japan, on Oct. 31-Nov. 4, 2016.

Organizers

Symposium Chair

Akira Satou (Tohoku U., Japan)

Organizing Committee

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Sponsors

We wish to thank the following sponsors for their contributions to the success of this symposium.

- RIEC: Research Inst. Electrical Communication, Tohoku University, Japan
- Inoue Foundation for Science
- Intelligent Cosmos Scientific Foundation
- The Murata Science Foundation
- The Foundation for the Promotion of Electrical Communication Engineering



Special Thanks

Students in Tohoku U.: Ms. D. Yadav, Mr. F. Kasuya, Mr. T. Komatsu, Ms. F. Hemmi, Mr. J. Mitsushio, Mr. T. Hosotani, Mr. Y. Watamura, Mr. Y. Ohmori, Mr. K. Sugawara, Mr. M. Suzuki, for all the effort they made to RJUSE TeraTech-2016.

Instructions for Speakers

- For Plenary/Invited/Contributed Speakers

Time for each oral presentation (in minutes) is as follows:

	Plenary	Invited	Contributed
Talk	40	25	15
Discussion	5	5	5

You may use your laptop PC (Windows, Mac, or Unix), or you may bring your USB memory and upload your presentation file to our laptop PC before the session starts. Our PC supports Microsoft PowerPoint 2013 and Adobe Acrobat Reader DC.

We will provide VGA (a.k.a RGB) and HDMI cables for connection to the projector. For other types, please bring your adaptor to VGA or HDMI connection. You are requested to check the connection to your laptop before the session starts. Laser pointers will be available.

- For Presenters of Poster Session

Poster sessions will be held during 17:50-19:30 on 1st, November and 18:00-19:30 on 2nd, November. Posters for both sessions are identical, so you are requested to display your poster for both sessions.

Please display your poster during 12:00-18:00 on the 1st. Poster boards will be available with identifying labels. The size of a board is 113 cm in width and 166 cm in height (suited for an A0-sized poster). Pushpins will be available.

Right after the session on the 2nd finishes, please remove your poster.

Venue

The symposium will be held at Sakura Hall, in Katahira Campus, Tohoku University, Sendai, which takes 20-min. walk from Sendai Station.

The address of the venue is:

2F, Sakura Hall, Katahira Campus, Tohoku University
2-1-1 Katahira, Aoba-ku, Sendai 980-8577, JAPAN

Welcome Meeting & Banquet

A welcome meeting will be held on the 1st floor of Sakura Hall, during 19:00-21:00 on 31st, October.

A symposium banquet will be held at MIYABI on the 25th floor of the Westin Sendai, during 19:00-21:00 on 3rd, November. Please show your banquet ticket at the entrance of the banquet hall.

Symposium Website

<http://www.otsuji.riec.tohoku.ac.jp/RJUSE-TeraTech-2016>

Secretaries

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RJUSE TeraTech-2016 Program

MONDAY, Oct. 31st, 2016

19:00 - 21:00 Welcome Meeting

TUESDAY, Nov. 1st, 2016

9:00 - 9:15 Opening

9:15 - 11:00	Session Tu1	Chair: Kazuhiko Hirakawa (<i>University of Tokyo, Japan</i>)	
	9:15 - 10:00	Terahertz Resonant Tunneling Diodes and Applications	2
	Tu1-1	Masahiro Asada	
	Plenary	<i>Institute of Innovative Research, Tokyo Institute of Technology, Japan</i>	
	10:00 - 10:30	Possible Paths for THz Electronics Using III-Nitrides and 2D Materials	6
	Tu1-2	Debdeep Jena	
	Invited	<i>ECE and MSE Departments, Cornell University, USA</i>	
	10:30 - 11:00	High-speed InP Double Heterojunction Bipolar Transistor as Room Temperature Terahertz Detector	8
	Tu1-3	Dominique Coquillat	
	Invited	<i>Laboratoire Charles Coulomb (L2C), UMR 5221 CNRS-Université Montpellier 2, France</i>	

11:00 - 11:20 Coffee Break

11:20 - 11:50	Session Tu2	Chair: Manfred Helm (<i>Helmholtz-Zentrum Dresden-Rossendorf, Germany</i>)	
	11:20 - 11:50	Parallel Plate Waveguide Terahertz Time Domain Spectroscopy	12
	Tu2-1	Masayoshi Tonouchi	
	Invited	<i>Institute of Laser Engineering, Osaka University, Japan</i>	
	11:50 - 12:10	Spectroscopic Methods for Skin Cancer Diagnosis using Terahertz Electromagnetic Waves	14
	Tu2-2	Kirill I. Zaytsev	
	Contributed	<i>Bauman Moscow State Technical University, Russia</i>	
	12:10 - 12:30	Rotational Dynamics of Li⁺ Ion Encapsulated in C₆₀ Cage at Low Temperature Investigated by Terahertz Spectroscopy	18
	Tu2-3	Hal Suzuki	
	Contributed	<i>Graduate School of Science, Osaka University, Japan</i>	

12:30 - 14:00 Lunch

14:00 - 15:40	Session Tu3	Chair: Wojciech Knap (<i>University of Montpellier and CNRS, France</i>)	
	14:00 - 14:30	Terahertz Response of Tightly Concatenated Two Dimensional InGaAs Field-Effect Transistors Integrated on a Single Chip	22
	Tu3-1		
	Invited		

TUESDAY, Nov. 1st, 2016

		Sergei Shapoval <i>Institute of Microelectronics Technology and High Purity Materials, Russian Academy of Sciences, Russia</i>	
	14:30 - 15:00	Optimization of the Design of THz Detectors Based on Si CMOS and AlGaIn/GaN Field-Effect Transistors	26
	Tu3-2		
	Invited	Hartmut G. Roskos <i>Physikalisches Institut, Goethe-Universität Frankfurt, Germany</i>	
	15:00 - 15:20	Design and Fabrication of Terahertz Detectors Based on 180-nm CMOS Process Technology	30
	Tu3-3		
	Contributed	Kosuke Wakita <i>Research Center for Integrated Quantum Electronics, Hokkaido University, Japan</i>	
	15:20 - 15:40	Plasma Instability of 2D Electrons in a Field Effect Transistor with a Partly Gated Channel	34
	Tu3-4		
	Contributed	Aleksander S. Petrov <i>Laboratory 2D Materials' Optoelectronics, Moscow Institute of Physics and Technology, Russia</i>	

15:40 - 16:00 Coffee Break

16:00 - 17:50	Session Tu4	Chair: Masayoshi Tonouchi (Osaka University, Japan)	
	16:00 - 16:30	Ultrafast Interactions of Nonequilibrium L and X Valley Plasmons with THz Coherent Phonons in Polar Semiconductor Nanostructures	38
	Tu4-1		
	Invited	Christopher J. Stanton <i>Department of Physics, University of Florida, USA</i>	
	16:30 - 17:00	Surprising Effects of Electron-Electron Scattering in Graphene	42
	Tu4-2		
	Invited	Manfred Helm <i>Helmholtz-Zentrum Dresden-Rossendorf, Germany</i>	
	17:00 - 17:30	Auger Recombination in Two-Dimensional Narrow-Gap Semiconductors	44
	Tu4-3		
	Invited	Dmitry Svintsov <i>Laboratory of 2d Materials' Optoelectronics, Moscow Institute of Physics and Technology, Russia</i>	
	17:30 - 17:50	A Numerical Model for Energy Dispersion Correction by Electron-Electron Interaction in Doped Graphene at Finite Temperature	48
	Tu4-4		
	Contributed	Tatsuhiro Komatsu <i>Research Institute of Electrical Communication, Tohoku University, Japan</i>	

17:50 - 19:30 Poster Session (see page x for the list of poster presentations)

WEDNESDAY, Nov. 2nd, 2016

9:00 - 10:55			
	Session We1	Chair: Christopher J. Stanton (<i>University of Florida, USA</i>)	
	9:00 - 9:45	Recent Progress in the Terahertz Studies of Graphene and Carbon Nanotubes	52
	We1-1		
	Plenary	Junichiro Kono <i>Department of Physics and Astronomy, Rice University, USA</i>	
	9:45 - 10:15	THz Nonlinear Optics of Massless Dirac Fermions	56
	We1-2		
	Invited	Alexey A. Belyanin <i>Department of Physics and Astronomy, Texas A&M University,</i>	
	10:15 - 10:35	Effect of Scattering Assisted Transitions on the Optical Conductivity of Pumped Graphene	58
	We1-3		
	Contributed	Vladimir Enaldiev <i>Laboratory 2D Materials' Optoelectronics, Moscow Institute of Physics and Technology, Russia</i>	
	10:35 - 10:55	Temperature Dependence of the Terahertz Conductivity of Graphene	62
	We1-4		
	Contributed	Shohei Kameo <i>Institute of Laser Engineering, Osaka University, Japan</i>	
10:55 - 11:15 Coffee Break			
11:15 - 12:15			
	Session We2	Chair: Vladimir Mitin (<i>University at Buffalo, SUNY, USA</i>)	
	11:15 - 11:45	THz Spectroscopic Imaging of Chemicals Using is-TPG	64
	We2-1		
	Invited	Kodo Kawase <i>Graduate School of Engineering, Nagoya University, Japan</i>	
	11:45 - 12:15	Plasma Field Effect Transistor Arrays for Imaging in Sub-THz Atmospheric Windows	68
	We2-2		
	Invited	Wojciech Knap <i>Laboratoire Charles Coulomb (L2C), UMR 5221 CNRS-Université Montpellier 2, France</i>	
	CANCELLED	Quality of THz Imaging System Operating in Presence of Scattering Materials	72
	We2-3		
		Valeriy E. Karasik <i>Bauman Moscow State Technical University, Russia</i>	
12:15 - 12:30 Photo Session			
12:30 - 14:00 Lunch			
14:00 - 15:40			
	Session We3	Chair: Junichiro Kono (<i>Rice University, USA</i>)	
	14:00 - 14:30	Light Interaction with Colloidal Photonic Crystals: Theoretical and Experimental Studies	74
	We3-1		
	Invited	Stanislav O. Yurchenko <i>Bauman Moscow State Technical University, Russia</i>	

WEDNESDAY, Nov. 2nd, 2016

	14:30 - 15:00	Nonlinear Photonics for Efficient Terahertz-Wave Technology	76
	We3-2		
	Invited	Yuma Takida <i>RIKEN Center for Advanced Photonics, RIKEN, Japan</i>	
	15:00 - 15:20	Laser Diode Excited Continuous-Wave Terahertz Light Source via Difference Frequency Generation and Its Spectroscopic Application	78
	We3-3		
	Contributed	Shintaro Yudate <i>Department of Materials Science, Tohoku University, Japan</i>	
	15:20 - 15:40	Fabrication of Electromagnetically Induced Transparency Like Metamaterials in THz Region	82
	We3-4		
	Contributed	Yoshiaki Kanamori <i>Department of Finemechanics, Tohoku University, Japan</i>	
15:40 - 16:00 Coffee Break			
16:00 - 18:00	Session We4	Chair: Masahiro Asada (<i>Tokyo Institute of Technology, Japan</i>)	
	16:00 - 16:30	Recent Progress of GaN-based Terahertz Quantum Cascade Lasers	84
	We4-1		
	Invited	Wataru Terashima <i>RIKEN Center for Advanced Photonics, RIKEN, Japan</i>	
	16:30 - 17:00	Continuous Wave THz Generation by a QCL-Pumped Molecular Laser	88
	We4-2		
	Invited	Jean-Francois Lampin <i>Institute of Electronics Microelectronics and Nanotechnology (IEMN) UMR CNRS 8520, Lille 1 University, France</i>	
	17:00 - 17:30	Experimental Observation of Long-Wavelength Stimulated Emission, Photoluminescence and Proposal of THz Lasers in HgCdTe Quantum Well Waveguide Heterostructures	92
	We4-3		
	Invited	Sergey V. Morozov <i>Institute for Physics of Microstructures of RAS, Russia</i>	
	17:30 - 18:00	Calculation of Modal Gain for Terahertz Lasers Based on HgCdTe Heterostructures with Quantum Wells	96
	We4-4		
	Invited	Alexander A. Dubinov <i>Institute for Physics of Microstructures of RAS, Russia</i>	
18:00 - 19:30 Poster Session (see page x for the list of poster presentations)			

THURSDAY, Nov. 3rd, 2016

9:00 - 10:35	Session Th1	Chair: Gregory Goltsman (Moscow State Pedagogical University, Russia)	
	9:00 - 9:45	Ballistic Regimes and Moiré Minibands in Graphene-hBN Heterostructures	100
	Th1-1		
	Plenary	Vladimir I. Fal'ko <i>National Graphene Institute, The University of Manchester, UK</i>	
	9:45 - 10:15	Plasmonic Enhancement of Terahertz Devices Efficiency	102
	Th1-2		
	Invited	Vladimir V. Mitin <i>Department of Electrical Engineering, University at Buffalo, USA</i>	
	10:15 - 10:35	Double Graphene Layer van der Waals Heterostructures for Terahertz Emission and Detection	106
	Th1-3		
	Contributed	Deepika Yadav <i>Research Institute of Electrical Communication, Tohoku University, Japan</i>	

10:35 - 10:55 Coffee Break

10:55 - 12:15	Session Th2	Chair: Sergei Yu. Shapoval (IMTHPM, Russia)	
	10:55 - 11:25	Plasmonic Terahertz Detection in a Dual-Grating-Gate Graphene Structure	110
	Th2-1		
	Invited	Denis V. Fateev <i>Kotelnikov Institute of Radio Engineering and Electronics of RAS (Saratov Branch), Russia</i>	
	11:25 - 11:55	Sub-Micron Gate Length Field Effect Transistors as a Broad Band Detectors of Terahertz Radiation	114
	Th2-2		
	Invited	Yahya M. Meziani <i>NanoLab, Salamanca University, Spain</i>	
	11:55 - 12:15	Array Configuration and Silicon-Lens Integration of Asymmetric Dual-Grating-Gate HEMT for Improvement of Light Coupling Efficiency	118
	Th2-3		
	Contributed	Fuzuki Kasuya <i>Research Institute of Electrical Communication, Tohoku University, Japan</i>	

12:15 - 19:00 Free Time

19:00 - 21:00 Banquet

FRIDAY, Nov.4th, 2016

9:00-10:45	Session Fr1	Chair: Alexey A. Belyanin (<i>Texas A&M University, USA</i>)	
	9:00 - 9:45	Scanning Noise Microscopy -A New Metrology of Matter-	122
	Fr1-1	Susumu Komiyama	
	Plenary	<i>Department of Basic Science, The University of Tokyo, Japan</i>	
	9:45 - 10:05	Detection of Non-Radiative Inversion Domain in GaN	126
	Fr1-2	with Terahertz Emission Microscopy	
	Contributed	Iwao Kawayama	
		<i>Institute of Laser Engineering, Osaka University, Japan</i>	
	10:05 - 10:25	Terahertz Near-Field Nanoscopy for Equilibrium and Non-	128
	Fr1-3	Equilibrium Dynamics	
	Contributed	Qianchun Weng	
		<i>Institute of Industrial Science, The University of Tokyo, Japan</i>	
	10:25 - 10:45	A Highly Sensitive Passive THz Near-Field Microscope	132
	Fr1-4	with a Cryogen-Free Cryostat	
	Contributed	Kuan-Ting Lin	
		<i>Institute of Industrial Science, The University of Tokyo, Japan</i>	

10:45 - 11:05 Coffee Break

11:05 - 11:35	Session Fr2	Chair: Valeriy E. Karasik (<i>Bauman Moscow State Technical U., Russia</i>)	
	11:05 - 11:35	Superconducting Thin Film Nanostructures as Terahertz	136
	Fr2-1	and Infrared Heterodyne and Direct Detectors	
	Invited	Gregory N. Gol'tsman	
		<i>Moscow State Pedagogical University, Russia</i>	
	11:35 - 12:05	Room Temperature, Very Sensitive Bolometer Using	138
	Fr2-2	Doubly Clamped Microelectromechanical Resonators	
	Invited	Kazuhiko Hirakawa	
		<i>Institute of Industrial Science, The University of Tokyo, Japan</i>	
	12:05 - 12:25	Improved Performance of Ultrahigh-Sensitive Charge-	140
	Fr2-3	Sensitive Infrared Phototransistors (CSIP)	
	Contributed	Sunmi Kim	
		<i>Institute of Industrial Science (IIS), the University of Tokyo, Japan</i>	
	12:25 - 12:45	THz Bandgap in Strained-Layer InAs/GaInSb	142
	Fr2-4	Superlattices	
	Contributed	Mikhail Patrashin	
		<i>National Institute of Information and Communications Technology, Japan</i>	

12:45 - 13:00 Award Ceremony & Closing

Poster Sessions: 17:50-19:30, TUE., Nov. 1st & 18:00-19:30, WED., Nov. 2nd

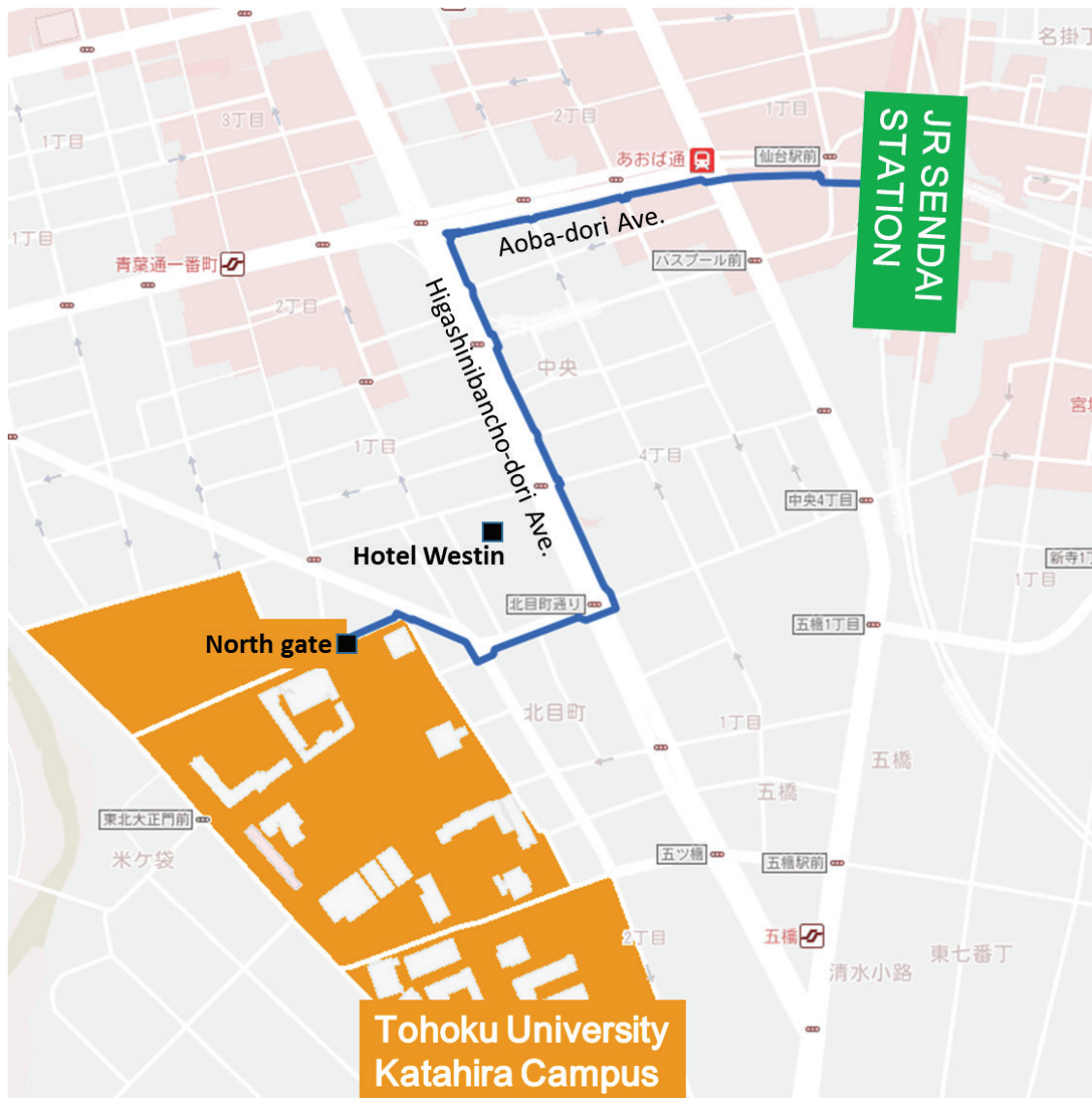
P-1	Terahertz Quantum-Cascade Laser Based on the Resonant-Phonon Depopulation Scheme	144
	Rustam A.Khabibullin (<i>Institute of Ultrahigh Frequency Semiconductor Electronics RAS, Moscow, Russia</i>)	
P-2	Terahertz Emission from $\text{In}_y\text{Ga}_{1-y}\text{As}$ Photoconductor Grown on Metamorphic Buffer Layer	148
	Dmitry S.Ponomarev (<i>Institute of Ultrahigh Frequency Semiconductor Electronics RAS, Moscow, Russia</i>)	
P-3	Enhancement of the THz Wave Generation from the Surface of Photoexcited GaAs	152
	Keita Miyagawa (<i>Graduate school of Engineering Science, Osaka University, Japan</i>)	
P-4	Liquid Phase Growth of High-Crystallinity GaSe and Its Characterization for THz Wave Generation	154
	Yohei Sato (<i>Department of Materials Science, Tohoku University, Japan</i>)	
P-5	Electrical and Ellipsometric Characterization of CVD-Grown MoS_2 Thin Films for Use in THz Applications	158
	Timothy Yore (<i>Department of Electrical Engineering, University at Buffalo, The State University of New York, USA</i>)	
P-6	Phase Contrast Computed Tomography Using Continuous THz Source	162
	Yoshiaki Sasaki (<i>RIKEN Sendai, Japan</i>)	
P-7	Basic Examination of the THz-Tomosynthesis Imaging with Heterodyne Detection Method	166
	Yoshiaki Sasaki (<i>RIKEN Sendai, Japan</i>)	
P-8	Novel Terahertz Diagnostics for the Non-Invasive Inspection of Blood Sugar Level	170
	Teruaki Torii (<i>Department of Materials science and engineering, Tohoku University, Japan</i>)	
P-9	Terahertz Wave-TDS Technique Combined Metamaterials for the Biomedical Application	174
	Narimasa Uematsu (<i>Department of Bioengineering, The University of Tokyo, Japan</i>)	
P-10	Qualitative and Quantitative Metal Corrosion Analysis On Hot-Dip Galvanized Steel Sheet By Using Terahertz Spectroscopy and Imaging	176
	Takashi Kimura (<i>Department of Materials Science, Tohoku University, Japan</i>)	
P-11	Application of Nondestructive Inspection Using Terahertz Wave for Electric Wires Covered with Invisible Insulator	178
	Kenta Kuroo (<i>Department of Materials Science, Tohoku University, Japan</i>)	
P-12	Frequency Stabilization of Resonant-Tunneling-Diode Terahertz Oscillator Using Phase Locked Loop Circuit	180
	Kota Ogino (<i>Department of Electrical and Electronic Engineering, Tokyo Institute of Technology, Japan</i>)	
P-13	InP HEMT and Graphene FET for Optical to Sub-THz Carrier Frequency Conversion	182
	Akira Satou (<i>Research Institute of Electrical Communication, Tohoku University, Japan</i>)	
P-14	Numerical Characterization of Dyakonov-Shur Instability in Gated Two-Dimensional Electron Systems	186
	Akira Satou (<i>Research Institute of Electrical Communication, Tohoku University, Japan</i>)	

Access Map (Sendai City)

By foot: About 15 minutes from the Sendai Station west exit.

By taxi: 5 minutes from Sendai Station. 40 minutes from Sendai Airport.

By bus: Catch a bus from platform 11 at the west entrance in front of Sendai Station bound for the "Miyagi University of Education/Aobadai" or "Dobutsukoen Circle via Aoba-dori" get off at "Aoba dori ichibancho 1-A" Approx. a 5 min ride, 10 min walk from the bus stop.



Access Map (Katahira Campus, Tohoku University)

Banquet Venue

The Westin Sendai

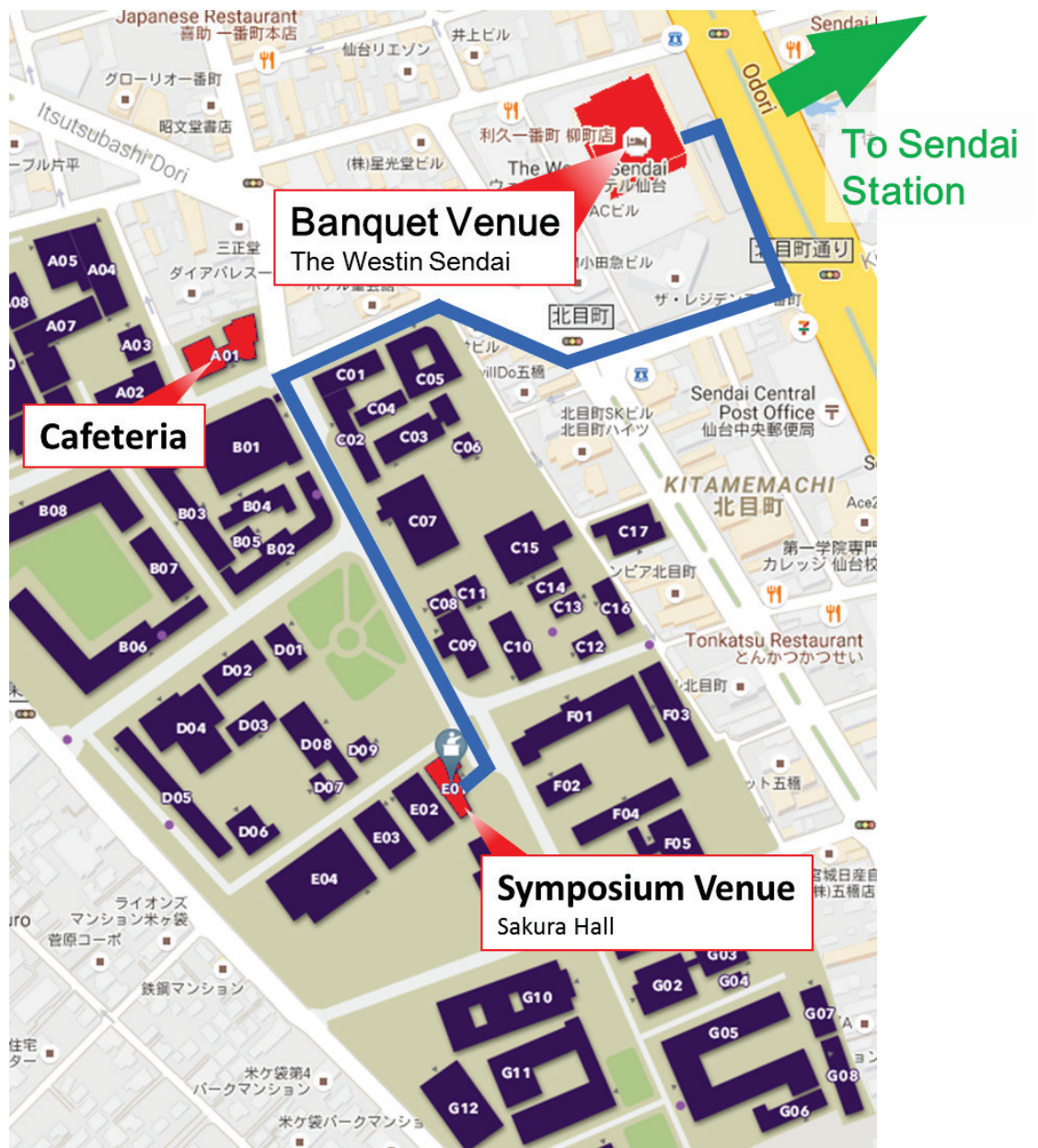
1-9-1 Ichiban-cho, Aoba-ku, Sendai, Miyagi 981-0811 Japan

Symposium Venue

Sakura Hall, Katahira Campus

Research Institute of Electrical Communication, Tohoku University

2-1-1 Katahira, Aoba-ku, Sendai 980-8577, Japan





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