



NEWSLETTER

of the International Consortium “Development of High-Power Terahertz Science & Technology”

October 2017

№ 7

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EDITORIAL: HOW TO CONTRIBUTE TO THE NEWSLETTER

Dear Reader,

We are inviting contributions to the following rubrics:

- Research highlights (annotations) presenting the projects pursued by the members of the Consortium.
- Short regular papers.
- Proposals for collaborative research work.
- News from the participating institutions.
- Information about conferences, symposia, workshops, seminars.
- Programs and frameworks for an exchange of visits and mobility of researchers. Job opportunities (especially for young researchers, e.g. postdoctoral positions, specializations, internships).
- Annotations of books, conference proceedings, software and internet resources. Additions to the list of the recent scientific publications and conference reports at the website of the Consortium (http://fir.ufukui.ac.jp/Website_Consortium/publist.html).
- Information and announcements about awards and nominations.
- Short presentations of laboratories and research groups belonging to the participating institutions.

Please submit your contributions to the Newsletter as well as requests for information to:

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INTERNATIONAL COLLABORATIVE RESEARCH PROGRAM



On 2 October 2017, the Research Center for Development of Far-Infrared Region, University of Fukui (FIR UF), announced a new International Collaborative Research Program. This program aims to support the development of the high-power Terahertz science and technology through international personnel exchange visits and studies, being performed at the FIR UF in a wide interdisciplinary field that includes the development of radiation sources (most notably gyrotrons and other gyro-devices) and their applications in physical experiments and advanced novel technologies.

More detailed information about the International Collaborative Research Program and the application form are available at the website of the International Consortium for Development of High-Power Terahertz Science and Technology (visit: http://fir.u-fukui.ac.jp/Website_Consortium/index.html). We are inviting proposals for collaborative research work advancing to this new International Collaborative Research Program.

PERSONALIA AND AWARDS

IRMMW-THz Society Exceptional Service Award

During the 42nd International Conference on Infrared, Millimeter, and Terahertz Waves held in Cancún, Mexico, at the end of August 2017, Prof. Dr. Dr.h.c. Manfred Thumm from the Institute for Pulsed Power and Microwave Technology at Karlsruhe Institute of Technology (IHM-KIT) received the "Exceptional Service Award (ESA)" from the International Society of Infrared, Millimeter, and Terahertz Waves (IRMMW-THz Society). Prof. Thumm received this award for his long-standing, dedicated and highly successful collaboration in the International Organization Committee (since 2004), the Kenneth John Button (KJB) Prize Committee (since 2001) and the Best Student Paper Prize Committee since 2011) of the conference series. In particular, he was honored to organize the first "Joint 29th International Conference on Infrared and Millimeter Waves and 12th International Conference on Terahertz Electronics" at the University of Karlsruhe in the autumn of 2004. The merger of the two conference series took place only 5 months before the start of the joint conference was adopted. Since 1983, he and his colleagues contributed over 330 contributions to the annual IRMMW-THz conferences. In 2000, he received the "KJB Prize" of the IOP London, which was connected to the conference series, for his contributions to the generation, transmission and application of high-power millimeter waves from gyrotron tubes.



Dr. Peter Siegel from the California Institute of Technology awards Prof. M. Thumm with the Exceptional Service Award

The recipient of this prize for 2018 is Dr. Gian Piero Gallerano, ENEA-Frascati, Rome, Italy.
Visit: <http://www.irmmw-thz.org/society-prizes>

PAST AND UPCOMING EVENTS

IRMMW-THz CONFERENCE: Cancún passed the baton to Nagoya

The 42nd Conference IRMMW-THz was held successfully from 27 August to 1 September 2017 in Cancún, Mexico (visit: <http://www.cio.mx/irmmw-thz2017>).



IRMMW-THz 2018 will take place in Nagoya, Japan between Sunday September 9 and Friday September 14, 2018. The Co-Chairs are: Professor Toshitaka Idehara and Professor Masahiko Tani from the University of Fukui, Fukui, Japan.



IRMMW-THz 2018

2018 43rd International Conference on Infrared,
Millimeter and Terahertz Waves

9 - 14 SEPTEMBER 2018

Nagoya Congress Center

Nagoya, Japan



Visit the website of IRMMW-THz 2017 at: <http://www.irmmw-thz2018.org/>

New horizons of the high-power THz science and technology have been reported at the 10th International Workshop “Strong Microwaves and Terahertz Waves: Sources and Applications”



The 10th International Workshop “Strong Microwaves and Terahertz Waves: Sources and Applications”, organized by the Institute of Applied Physics of the Russian Academy of Sciences (IAP-RAS) was held from 17 July to 22 July, 2017 on board of a river boat starting from Nizhny Novgorod, Russia.

The traditionally rich and diverse scientific program of the Workshop was organized in four strongly interrelated topical symposia:

- Symposium S: High-power microwave sources;
- Symposium H: Current drive and plasma heating by microwaves in nuclear fusion devices;
- Symposium T: Extreme and nonlinear terahertz science (metamaterials for strong THz generation and frequency conversion, nonlinear effects in THz frequencies, high power THz sources);
- Symposium A: High power microwave and terahertz applications (including accelerators, radars, gas discharges, materials processing, biomedical applications etc.)

During the Workshop, 153 participants from 15 countries presented 172 reports of which 23 plenary talks. The greatest number of reports was presented by the participants in the Symposium S: “High-power microwave sources”. Sources of high-power microwave radiation”. Most of the reports were devoted to the development of millimeter and submillimeter wave sources and associated components for many novel and emerging applications. Among them are powerful gyrotrons for controlled thermonuclear fusion, microwave processing of materials, plasma physics, and advanced spectroscopic techniques (most notably DNP-NMR spectroscopy).

The proceedings of the Workshop are available online on [EPJ Web of Conferences website](http://www.epj-conferences.org/) (Open Access): A.G. Litvak (Ed.), 10th International Workshop 2017 “Strong Microwaves and Terahertz Waves: Sources and Applications”, Nizhny Novgorod, Russia, July 17-22, 2017.



Visit the website of the Workshop (<http://www.smp.sci-nnov.ru/>) for links to more photos and videos.

PRESENTING OUR COLLABORATORS

Institute of Electronics of the Bulgarian Academy of Sciences



Laboratories:

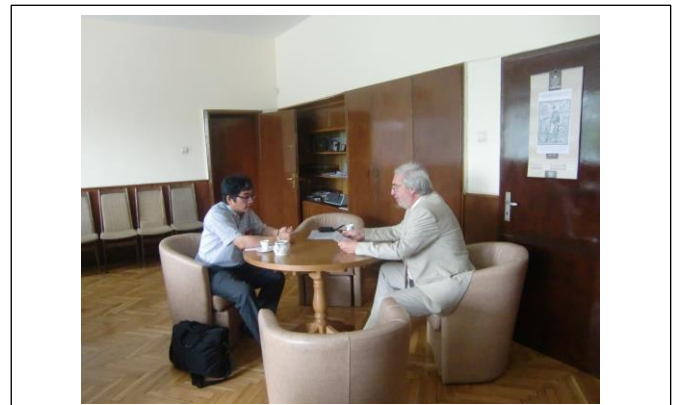
- LASER SYSTEMS
- MICRO AND NANO PHOTONICS
- BIOPHOTONICS
- LASER RADARS
- SUPERCONDUCTIVITY AND CRYOELECTRONICS
- MICROWAVE PHYSICS AND TECHNOLOGIES
- NON-LINEAR AND FIBER OPTICS
- PHYSICAL PROBLEMS OF ION TECHNOLOGIES
- PLASMA PHYSICS AND ENGINEERING
- MICROWAVE MAGNETICS
- PHYSICAL PROBLEMS OF ELECTRON-BEAM TECHNOLOGIES
- PHYSICAL TECHNOLOGIES - SLIVEN

The Institute of Electronics of the Bulgarian Academy of Sciences (IE-BAS) is a longstanding research partner of the Research Center for Development of Far-Infrared Region at the University of Fukui since 1999 and a member of the International Consortium for Development of High-Power Terahertz Science and Technology. IE-BAS was established in 1963 as a non-profit state organization conducting research, education, and dissemination of scientific knowledge in the fields of Physical Electronics, Radio Physics, Photonics and Quantum Electronics. In recent years, the Institute of Electronics evolved as a leading scientific institution in these areas of applied physics and engineering within the Bulgarian Academy of Sciences. Through the years, the Institute's research field and structure have developed dynamically in response to the changes taking place in the main trends in applied physics and technologies: plasma physics, materials science and technologies, physics of nano-sized objects and nanotechnologies, nanoelectronics, photonics, opto-electronics, quantum optics, environmental physics and monitoring, biomedical photonics and biomedical applications. The collaboration between IE-BAS and FIR UF is focused on the development, numerical studies, computer-aided design and applications of gyrotrons operating in the sub-THz to THz frequency range to novel scientific and technological fields.

From 15 to 18 July 2017 the Director of FIR UF Professor M. Tani visited IE-BAS. In his invited lecture to the seminar of IE-BAS he presented the research activities of FIR UF and the International Consortium. During his visit, Professor M. Tani discussed the bilateral collaboration between the institutions with the Director of IE-BAS Professor L. Avramov and Professor S. Sabchevski – Head of the Laboratory Plasma Physics and Engineering. Alongside with other frameworks and forms of collaborative research he introduced the cross-appointment scheme, which is being implemented in the University of Fukui.



Professor M. Tani at the seminar of IE-BAS



Professor M. Tani and Professor L. Avramov

LIST OF SELECTED RECENT PUBLICATIONS

Bibliography and links to selected recent publications on topics related to the research field of the International Consortium and published after June 2017, i.e. after issuing the previous Newsletter #6. These cumulative list are in chronological order as collected from various bibliographical and alert services

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NEWS FROM THE NET (OUR BROADER HORIZONTS)

Detecting Hazardous Radiation From Afar Now Possible

The concept of using THz radiation for detection of concealed sources of ionizing radiation has been proposed first in the [paper](#) by V.L. Granatstein and G.S. Nusinovich. It has been followed by a series of publications (see for example, [G.S. Nusinovich, et al.](#)) on the development of THz-range gyrotrons for the realization of this approach. Recently, researchers at Ulsan National Institute of Science and Technology (UNIST) in Ulsan, South Korea, have successfully demonstrated experimentally a real-time remote detection of substances that emit hazardous radiation. The researchers used a 95 GHz gyrotron with an output power of 32 kW. Their results were published [in](#) [K. Dongsung, et al., "Remote detection of radioactive material using high-power pulsed electromagnetic radiation," *Nature Communications*, vol. 8 (2017) 15394. DOI:10.1038/ncomms15394.]

For an interview with the leader of the team, Professor EunMi Choi given to *IEEE Spectrum* follow this [link](#).

Liquid water can generate THz waves!

"By illuminating a thin film of water with ultrashort laser pulses, physicists have demonstrated that liquid water can generate terahertz (THz) waves, which are currently being researched for applications such as wireless data transmission, industrial quality control, and high-resolution imaging with the capability for penetration. The researchers, led by Xi-Cheng Zhang, the M. Parker Givens Professor at the University of Rochester's Institute of Optics in New York, as well as at Capital Normal University in Beijing and ITMO University in Saint Petersburg, Russia, have published a paper on the generation of THz waves from water in a recent issue of *Applied Physics Letters*.

The result is surprising because bulk water is a strong absorber of light in the THz frequency range, and so for a long time it seemed very unlikely that liquid water could serve as a source of THz radiation. Researchers have previously shown, however, that water can emit light at other frequencies, including white light, and that water vapor can emit THz waves. The key to getting liquid water to generate THz waves, as the scientists show in the new study, is to use a very thin (less than 200 μm -thick) free-flowing film of water." Please visit the source of this information at: <https://phys.org/news/2017-08-thought-impossible-scientists-liquid-thz.html> and access the original paper [Qi Jin et al. "Observation of broadband terahertz wave generation from liquid water." *Applied Physics Letters*, vol. 111, n. 7(2017) 071103. DOI: 10.1063/1.4990824] from this [link](#).

Setting Up a THz-TDS Setup in Half a Day

A white paper of [TeTechs](#) gives helpful tips and tricks for setting up a THz-TDS system in half a day. It shows that with kits currently in research labs around the globe, an efficient THz-TDS setup can be achieved

quickly. Follow this [link](#) in order to obtain this useful white paper. TeTechs provides also a Measurement Kit for Research and Development at its [website](#).

Experimental demonstration of a 5th harmonic mm-wave frequency multiplying vacuum tube could lead to development of a novel terahertz radiation source

In their recent [paper](#), scientists from SLAC reported: “the experimental demonstration of a 5th harmonic mm-wave frequency multiplying vacuum electronic device, which uses an over-moded spherical sector output cavity. In this device, a pencil electron beam is helically deflected in a transverse deflecting cavity before entering the output cavity. No magnetic field is required to focus or guide the beam. We built and tested a proof-of-principle device with an output frequency of 57.12 GHz. The measured peak power was 52.67 W at the 5th harmonic of the drive frequency. Power at the 4th, 6th, and 7th harmonics was 33.28 dB lower than that at the 5th harmonic.”

For more comments on this invention visit the SLAC’s webpage at:

<https://www6.slac.stanford.edu/news/2017-10-04-slac-invention-could-lead-novel-terahertz-light-sources-help-us-see-world-different> and the NewsWise [site](#).

Links to useful internet websites (blogs, newsletters, etc.) containing news and resources about THz science and technology

DNP-NMR Literature Blog:

<http://blog.bridge12.com/>

Blogs about Terahertz Technology:

<https://terahertztechnology.blogspot.com/>

<https://plus.google.com/+RandyKnudson>

<https://plus.google.com/105902248514555979271>

<http://blog.tmcnet.com/terahertz/>

Resources about RF and Wireless devices:

<http://www.rfwireless-world.com/>

Terahertz Spectroscopy and Imaging:

<http://terahertzspectroscopyandimaging.blogspot.com>

AMPERE Newsletter on microwave technology:

<http://www.ampereurope.org/index-3.html>

News about THz devices and techniques:

<http://www.terahertz.co.uk/news>

Study on Electromagnetic Waves in the Terahertz Region Using COMSOL Multiphysics:

<https://www.comsol.ch/paper/study-on-electromagnetic-waves-in-the-terahertz-region-using-comsol-multiphysics-14666?setlang=1>

and the presentation of T. Nishida (In Japanese) available at this [link](#).

2017 Terahertz Science and Technology Roadmap is available at this [link](#) and [here](#).