

Closing Editorial

WELCOME to our last issue in Volume 5 of IEEE TRANSACTIONS ON TERAHERTZ SCIENCE AND TECHNOLOGY. There is a lot to relay this month, including some results from our THz Origins contest, upcoming special issues in 2016, the end of our regular *THz Pioneer* series, and the introduction of a new Editor-in-Chief for these Transactions. In addition, we have a very full regular paper queue for November, as well as a Special Mini-Issue containing translated and updated papers from the Japanese *Journal of the IEICE* (Institute of Electronics, Information and Communication Engineers).

THz Origins

As far as this Editor-in-Chief is aware of, the first use of the term “THz” in an MTT Society journal publication appeared in an article by J. W. Fleming entitled, “High resolution submillimeter-wave Fourier-transform spectroscopy of gases,” *IEEE Trans. Microw. Theory Techn.*, vol. MTT-22, no. 12, pp. 1023–1025, Dec. 1974. Appropriately, the article title refers to the frequency regime that we now prefer to designate as “THz”, using the more historically popular designation “submillimeter-wave.” The rise of the now prolific term “THz” in association with the rise in popularity of the field in general, is rather intriguing. As such, I was interested to find out if other researchers had references to even earlier uses of the term “THz” in the literature, either in English or its equivalent term in other languages.

Several people responded to our “Request for Information” with some interesting historic references. The date to beat for an English language book publication (rather than a journal article) is now 1964. The EiC thanks Professor Derek Abbott of University of Adelaide, Australia, for this citation. The book is a compilation of papers from a proceedings edited by none other than Charles Hard Townes and Perry Ambrose Miles, “Quantum electronics and coherent light,” *Proc. Int. School of Physics*, Enrico Fermi course XXXI, Varenna on Lake Como, August 19–31, 1963. Within the text there is a prominent chapter by Z. Bay and H. S. Boyne titled, “The use of Terahertz Photobeats for Precise Velocity-of-Light Measurements.” There are several other uses of the term terahertz in other parts of the proceedings.

The term “teracycles” is officially defined, along with the convention of replacing “cycles” by “hertz,” maybe for the first time, in an IRE reference from 1959 by William Watkins of the U.S. Federal Communications Commission (FCC) where he states on page 6 of the article (the EiC again thanks Derek Abbott for this reference):

“Another change in terminology is adoption of “gigacycles” to mean one billion cycles and “teracycles” to mean one trillion cycles. For example, henceforth any frequency higher than 3000 Mc/s should be expressed in gigacycles.

Thus, 3000 Mc/s becomes 3 Gc/s. Still another change in terminology is the use of the word “Hertz” as a substitute for cycles per second (c/s). In most parts of the world where English is not the principal language, the use of Hertz and its multiples, “kHz”, “MHz”, and “GHz”, becomes standard, based on the French text.” (Ref.: W. H. Watkins, “Report on World Radio Conference, Geneva, Switzerland, 1959,” *IRE Trans. Broadcasting*, vol. 2, no. 1, pp. 3–7, 1960.)

Perhaps referring back to the French convention, the definition of the term “terahertz” appears (in French) in the introduction to a compilation of molecular spectroscopy journal issues, “Spectroscopia Molecular, volumes 5–10,” by Forest Fenton Cleveland, Editor, in 1956—a reference also submitted by Derek Abbott.

A couple of additional references came in from Dr. Jean-François Lampin, of the Chargé de Recherche CNRS, Villeneuve d'Ascq, France, citing a 1967 Masters thesis from University of British Columbia, Canada, by Vishnu Sahay defining the submillimeter as 0.3–3 THz, and the conversion of 8000 GHz to 8 THz in a French paper on Josephson junctions in *Revue de Physique Appliquée*, vol. 6, no. 4, pp. 535–542, by T. Pech in 1971. Interestingly, in Japan, where THz is a very popular research topic today, a program led by Jun-ichi Nishizawa¹ had the English title “Nishizawa Terahertz” under the ERATO (Exploratory Research for Advanced Technology) project in 1987, perhaps the earliest official government use of the term in that country (the EiC thanks Professor Koji Mizuno of Tohoku University for this reference).

If anyone would like to challenge, or add to our current list with an earlier reference to “THz” or “terahertz”, or the use of this terminology in other languages, please send me a note (psh@caltech.edu)!

November Issue Papers

Moving on to our current issue, we have 25 regular contributed papers covering topics from broad band infrared detectors to graphene-based waveguides to THz biomedical effects and much more. Rather than list these papers individually, the reader is referred to the lengthy Table of Contents this month. Note that this will be our largest single issue release since the journal began in September 2011! We also have 2 shorter papers in our *THz Letters* section to look over. Our THz Pioneer article this month—the last of the official series—is on atmospheric scientist Joe W. Waters, whose contributions involving high-frequency narrow-band spectral line measurements in the stratosphere and upper troposphere are the very definition of a “killer” application for this frequency regime. I am fairly certain this 26th article in our series will leave you with a strong

¹See P. H. Siegel, “THz Pioneer: Jun-Ichi Nishizawa—THz Shogun,” *IEEE Trans. THz Sci. Technol.*, vol. 5, no. 2, pp. 161–169, 2015. (ERATO reference on page 165).

positive feeling about the value of THz science for questions of global concern. The article is appropriately titled “*THz Meets Gaia*”.

Special Issue Papers

Trailing our regular contributions, we are following through on a project we have contemplated since almost the start of this journal—publishing articles that have appeared exclusively in another language, but that would benefit the THz community if they were to be presented in English. Last November, the Institute of Electronics, Information and Communication Engineers (IEICE) of Japan released a special issue of the *Journal of IEICE*² that focused on Terahertz Applications. After early discussions with two of the authors involved in the IEICE special issue articles, Dr. Naoya Kukutsu and Dr. Tadao Nagatsuma, we decided to try and put together an English language version of the IEICE release. The project turned out to be much more complicated than was originally envisioned by this EIC, but nevertheless we have prevailed. This Special Mini-Issue includes 11 of the original 14 articles, with translations and amendments that are targeted specifically for the audience that regularly reads this THz TRANSACTIONS. You will find these articles, and a special introduction, immediately after the last of our *THz Letters* in a separate section we have titled: “Special Mini-Issue on THz Applications: Translated and Updated Papers from the Institute of Electronics, Information and Communication Engineers (IEICE).”

Coming up in January 2016 is our Special Mini-Issue covering expanded papers from the 25th *International Symposium on Space Terahertz Technology (ISSTT)* that took place last spring at Harvard University, Boston, MA, USA. We also have a special issue in the works on *Terahertz Nanomaterials and Applications* scheduled for late spring–early summer (see the Call for Papers on page 288 of our March 2015 issue).

New EiC

Beginning in January 2016, this Transactions will have a new Editor-in-Chief, who is tasked with guiding the journal through the next three years. I would like to welcome Professor Jan Stake, of Chalmers University, Gothenburg, Sweden, to this role, and offer my personal thanks and my own best wishes for a very successful term. Professor Stake’s biography is contained within our Topical Editors (TE) biographies following this Editorial.

EIC Reminiscences

As this will be my last Editorial, and my last communications as Editor-in-Chief, I would like to spend a moment to look back over the last few years and highlight a few of the events that have brought us to this point.

The journal started with only a name and approval of the topic area by the IEEE and the MTT Society AdCom, in the summer of 2010, when the EiC was brought on. The scope, logo, slogan,

cover appearance, editorial structure, paper policies and procedures, web site and preferred article focus were all developed from scratch within the first month. Despite the backing from a mostly engineering society, the EiC pledged to expand the outreach and content to fields outside traditional microwave circuits and systems, and to encompass physics, optics, chemistry, biology and any other research areas that involved THz science or technology. In the fall of 2010, the EiC brought on board 13 internationally recognized “Topic Editors” who spanned a wide range of disciplines and geographic areas, and who volunteered to help realize these broad reaching goals.

Our paper submission site went live in October 2010, and we released our very well received Inaugural issue (September 2011) less than one year later. We started with an email paper handling process, but were fully converted over to an all-electronic-input paper handling system by May 2011, well before the release of our opening issue. By the end of year one, we were able to put in place an annual review process, and to announce a “THz Best Paper” award and—a first for MTT Society at least—a “THz Best Reviewer” award. We began our first paid subscriptions in 2013—the same year we finally began to be indexed on Reuters’ *Web of Science*. Before this point, authors could only find their published papers through IEEE Xplore. We were rewarded in July of 2013 with the highest Impact Factor ever achieved by an MTT Society publication—4.34, and were even more excited to learn that the journal was ranked in the top 5% of all journals in Electrical Engineering (12th out of 247), the top 12% of all *Applied Physics* journals (17th out of 136), and the top 6% of all journals in *Optics* (5th out of 82). As a result, we were also the first IEEE journal to officially implement a formal prescreening process for submitted manuscripts!

In order to serve the widest possible THz community, we have employed several unusual strategies, including the introduction of the *THz Pioneers* series to help bridge the historic background gap between THz electronics and THz photonics professionals, and to stimulate the interests of incoming and younger members of our THz family. We experimented with special “Mini-issues”—selected focused topics within the regular print issue—to add some current content from conferences or special topics considered particularly relevant to the THz community. We started a short paper section—*THz Letters*—at the beginning of 2014 in response to requests from our authors to have an outlet for less lengthy articles. We have built up a large cadre of THz reviewers—young and old—through events and outreach, and we have tried to treat our authors as our valued customers—giving them as much respect and personal attention as we can muster. You deserve no less.

Thank You

For all of this, I would like to express my most sincere thanks to those who have contributed to the establishment, growth and success of these transactions—all of whom are volunteers. I especially appreciate the time and devotion of our numerous and dedicated Reviewers, and most of all, our Topic Editors, many of whom have been with the journal from the very beginning: *Stefano Alberti, Rene Beigang, Alexander Giles Davies, Jack East, Gian Piero Gallerano, Erich Grossman, Haewook Han, Peter Uhd Jepsen, Kodo Kawase, Martin Koch, Nuria*

²This issue of the *IEICE Transactions on Electronics* appeared in November 2014 as vol. 97, no. 11, under the special issue title, “Special Issue on Advanced Terahertz Technologies and Efforts toward Practical Applications.” A link to the contents (in English) can be found at: <http://www.journal.ieice.org/archive.php?vol=97&num=11&year=2014&lang=E>

Llombart-Juan, Victor Lubecke, Imran Mehdi, Gun-Sik Park, Alex Shkurinov, Jan Stake, Chris Walker, and Vince Wallace. Also a special thank you to *Dylan Williams*, our founding Executive Editor; *Sharri Shaw*, our constant Administrative Editor; Frank Maiwald, our publicity chair; and *Mona Mittra*, our valued IEEE Publications Editor.

I also very much appreciate and wholeheartedly thank all of you who have contributed articles, even before we were widely indexed, and before we had an Impact Factor, and those of you who helped us with special issues and special invited papers. This first-of-its-kind exclusively “THz” transactions owes its existence and its success totally to your support as readers and

citers of its content, and to your continued loyalty as authors and contributors of significant research results. I hope you all find your future interactions with the editors and staff supporting the journal highly satisfactory, and I sincerely wish all of you success with your THz research and with your own careers.

It has been my greatest pleasure to serve the THz community these last five years, and I am grateful to all of you who have made my time as Editor-in-Chief both challenging and enjoyable. Thank you, I will remain forever grateful.

Now turn the page to start Volume 5, Issue 6 of IEEE TRANSACTIONS ON TERAHERTZ SCIENCE AND TECHNOLOGY.

PETER H. SIEGEL, *Editor-in-Chief*
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Peter H. Siegel (S’75–M’83–SM’98–F’01) received the B.A. degree from Colgate University, Hamilton, NY, in 1976, and the Ph.D. degree from Columbia University, New York, NY, USA, in 1983.

He held appointments as Faculty Associate in Electrical Engineering and Senior Scientist in Biology at Caltech, Pasadena, CA, USA, and Senior Research Scientist and Technical Group Supervisor for Submillimeter Wave Advanced Technology (SWAT) at the Jet Propulsion Laboratory (JPL) in Pasadena, CA, USA, for more than 25 years. He

retired from these positions in September 2013 in order to focus on a small R&D company he started, THz Global. He is also continuing his affiliation at Caltech as a Visiting Faculty member in the Electrical Engineering Department.

Dr. Siegel has PI’d or co-I’d more than 75 R&D programs and been involved in four major space flight instruments. He has published more than 300 articles in the THz field, and has given more than 200 invited talks in the U.S. and abroad on this subject. At JPL, he led a group of 25+ research scientists and engineers developing THz technology for NASA’s near and long term space missions as well as for several Department of Defense (DoD) applications. At Caltech, he has been involved in new biological and medical applications of THz. His current interests are focused on THz applications in medicine and biology. He has been extremely pleased, and very excited to be a part of the formation and growth of the IEEE TRANSACTIONS ON TERAHERTZ SCIENCE AND TECHNOLOGY.

Among many other duties, Dr. Siegel serves as elected General Secretary of the International Society for Infrared, Millimeter, and Terahertz Waves (IRMMW-THz), the oldest and largest venue devoted to the field of far IR techniques, science and applications, and he served as conference organizer and chair for IRMMW-THz 2008 in Pasadena and IRMMW-THz 2014 in

Tucson, AZ. He also founded, incorporated and served as first President of the International Society of Infrared, Millimeter, and Terahertz Waves. Dr. Siegel has served as an IEEE Distinguished Microwave Lecturer, co-Chair and Chair of MTT Committee 4—THz Technology, a TPC and Speaker’s bureau member, and as organizer and chair of seven special sessions at the IEEE International Microwave Symposia. For the past 5 years, Dr. Siegel has had the great privilege to serve as an Ad-hoc member of the MTT AdCom where he has learned from, and grown to admire the many professional volunteers that play such an enormous role in guiding this unique IEEE society and in particular, these THz TRANSACTIONS.

ADMINISTRATIVE EDITOR



Sharri Shaw was born in Michigan, and currently resides in Boulder, CO. She received the B.A. degree in English with a minor in psychology from Saginaw Valley State University in 1994. She continued her studies in 2001 in the Master in Education with Initial Certification (M.Ed.) program at Aquinas College, where she received her Secondary Level Teacher Certification.

From 2002 to 2005, she was a teacher in Michigan. From 2006 to 2010, she was the Assistant Editor of the IEEE TRANSACTIONS ON MICROWAVE THEORY AND TECHNIQUES. She currently holds the same position with *IEEE Microwave Magazine*, and also serves as the Publications Administrator for the IEEE TRANSACTIONS ON TERAHERTZ SCIENCE AND TECHNOLOGY.

TOPIC EDITORS



René Beigang received the Diploma and Ph.D. degrees from the University of Hannover, Hannover, Germany.

He spent three years as a post-doctorate and visiting scientist at the IBM T. J. Watson Research Center, Yorktown Heights, NY. He was Associate Professor at the Free University of Berlin and the University of Kaiserslautern. He is now a full professor at the Department of Physics of the University of Kaiserslautern. Since 2005, he is also Head of the Department on Terahertz Measurement and

Systems of the Fraunhofer Institute for Physical Measurement Techniques. His current research interests include nonlinear optics, generation and application of THz radiation, THz spectroscopy, applications of THz radiation in science and technology, realization and investigation of THz meta materials. (His homepage: <http://www.physik.uni-kl.de/beigang>).



A. Giles Davies received the B.Sc. degree in chemical physics from the University of Bristol, Bristol, U.K., in 1987, and the Ph.D. degree in semiconductor physics from the University of Cambridge, Cambridge, U.K., in 1991.

He is currently Professor of Electronic and Photonic Engineering at the University of Leeds, Leeds, U.K. His research interests concentrate on the electrical and optical properties of low-dimensional and nanostructured electronic systems, and multilayered semiconductor devices, with particular recent focus

on the development of terahertz frequency systems and the exploitation of biological processes for nanoscale assembly.



Gian Piero Gallerano received the Laurea degree (Ph.D.) in physics from the University of Rome, Italy, in 1980 with a thesis on the realization of a tunable color center laser in the near infrared.

In 1981, he was a Visiting Fellow at the Technical University Hannover, Germany. In 1983 he joined the High Power Laser Laboratory at ENEA Research Center, Frascati to work on the development of infrared free electron lasers (FEL). In 1991, he was a Visiting Scholar at the Ginzton Laboratory, EE Department, Stanford University. His work on FELs

lead to the realization of the ENEA Compact FEL (90–150 GHz) and of the Compact Advanced THz Source, FEL-CATS (0.4–0.7 THz). From 2001 to 2004, he has been the Coordinator of the European project THz-BRIDGE involving ten research institutes in the study the interaction of THz radiation with biological systems. From 2005 to 2007, he was in charge of the ENEA participation in the European project EUROFEL. He is currently the Head of the Radiation Sources Laboratory at ENEA Frascati. His areas of interest include generation of THz radiation and its application in the biological, biomedical, environmental and art conservation fields, THz imaging techniques, coherent emission from RF modulated electron beams, free electron lasers, optical design and diagnostics in the infrared.

Dr. Gallerano organized the “35th International Conference on Infrared, Millimeter and THz Waves” IRMMW-THz 2010 held in Rome, Italy, September 5–10, 2010, and currently chairs the International Society of Infrared, Millimeter and Terahertz Waves, the oldest and largest forum devoted to scientific and technological developments in the wide spectral range extending from the infrared to the millimeter wave region. He has been a member of the Italian Physical Society since 1981, and is a member of the Bioelectromagnetics Society.



Erich N. Grossman received the A.B. degree in physics from Harvard College, Cambridge, MA, in 1980, and a Ph.D. degree, also in physics, from the California Institute of Technology, Pasadena, in 1987. His thesis work involved development of an ultra-low noise, heterodyne receiver for 2 THz astronomy.

From 1988 to 1989, he was a post-doctoral fellow at the University of Texas at Austin, TX, USA, and in 1989, he joined the National Institute of Standards and Technology, Boulder, CO, USA, where he is now

a physicist in the Optoelectronics Division. His work at NIST focuses on infrared and submillimeter system development.

Dr. Grossman’s notable accomplishments include the development and demonstration of the world’s highest frequency, high efficiency lithographic antennas, the world’s highest frequency Josephson junctions, (awarded a Department of Commerce Gold Medal in 1993), and early conception and development of the SQUID multiplexer, first enabling large monolithic arrays of superconducting detectors. More recently, he has developed several 0.1–1 THz cameras for security applications. He is also chair of the Metrology Working Group for the DARPA Terahertz Electronics program.



Haewook Han (M’12) received the B.S. and M.S. degrees in electrical engineering from Seoul National University, Seoul, Korea, in 1986 and 1988, respectively, and the Ph.D. degree in electrical engineering from the University of Illinois at Urbana-Champaign, Urbana, IL, USA, in 1995.

He studied low-threshold strained quantum-well heterostructure lasers and two-dimensional photonic crystal semiconductor lasers. At Bell Laboratories, Murray Hill, NJ, USA, from 1995 to 1997, he contributed to the development of 980-nm high-power

semiconductor lasers. He is currently Associate Professor of the Department of Electrical and Computer Engineering at the Pohang University of Science and Technology (POSTECH). He co-founded the Korea THz Forum, and served as the Director of the Center for THz Photonics (1998–2000) and the National Laboratory for Nano-THz Photonics (2005–2009). He invented THz plastic photonic crystal fibers for single-mode THz pulse transmission in 2001. His current research interests include THz hydration dynamics of biomolecules, THz quantum interactions, and THz near-field microscopy and spectroscopy.



Peter Uhd Jepsen (M’10) received the M.Sc. degree in physics and chemistry from Odense University, Denmark, in 1994, and the Ph.D. degree in natural sciences from Århus University, Denmark in 1996.

He was at the University of Freiburg, Germany from 1996 to 2004, working with terahertz time-domain spectroscopy. From 2005, he was Associate Professor at the Technical University of Denmark (DTU), and since 2008, Professor and Head of the Terahertz Technologies and Biophotonics group at DTU. In 2008/2009, he was Visiting Professor at

Osaka University. His research areas include photonics-based THz technology, broadband THz spectroscopy for chemical sensing, imaging, chemistry, and water dynamics in the THz range, and time-resolved THz spectroscopy of ultrafast phenomena in the THz range.



Kodo Kawase received the B.S. degree in electronic engineering from Kyoto University in 1989, Japan, and the Ph.D. degree in electronic engineering from Tohoku University, Japan, in 1996.

He became an Initiative Researcher at RIKEN in 2001 and a Professor in the Graduate School of Engineering, Nagoya University, Japan, in 2005. He has been conducting research activities in several directions within the THz field. Professor Kawase developed several types of widely tunable THz sources using nonlinear optical effects, and implemented them for a wide range of real-life applications. He has published more than 130 articles in the THz field and has given more than 160 invited talks on this subject.

Dr. Kawase received the 1997 Young Scientist Award from the JSAP, the 1998 Excellent Presentation Award, the 2000 and 2006 Prize of Laser Engineering from the Laser Society of Japan, the 2002 Marubun research and encouragement award and the 2006 Marubun Special Research Award from the Marubun Research Promotion Foundation (MRPF), and the 2005 Young Scientists’ Prize by the Commendation for Science and Technology of the Minister of Education, Culture, Science and Technology (MEXT).



Nuria Llombart received the Electrical Engineering degree and Ph.D. degree from the Polytechnic University of Valencia, Spain, in 2002 and 2006, respectively.

During her Masters’ degree studies she spent one year at the Friedrich-Alexander University of Erlangen-Nuremberg, Germany, and worked at the Fraunhofer Institute for Integrated Circuits, Erlangen, Germany. From 2002 until 2007, she was with the Antenna Group at the TNO Defence, Security and Safety Institute, The Hague, The

Netherlands, working as a Ph.D. student and afterwards as a researcher. From 2007 until 2010, she was a Post-Doctoral Fellow at the California Institute of Technology, working for the Sub millimeter Wave Advance Technology group of the Jet Propulsion Laboratory (JPL), Pasadena, CA, USA. From 2010 to 2012, she held a “Ramón y Cajal” fellowship at the Optics Department of the Complutense University of Madrid, Spain. She recently relocated to Technical University of Delft, Netherlands, where she is a professor in the Electrical Engineering department, and she continues to be an affiliate at JPL, Pasadena. Her research interests include the analysis and design of planar antennas, periodic structures, reflector antennas, lens antennas, waveguide structures, with emphasis in the THz range.

Dr. Llombart was co-recipient of the H. A. Wheeler Award for the Best Applications Paper of 2008 in the IEEE TRANSACTIONS ON ANTENNAS AND PROPAGATION. She was also a co-recipient of an Honorable Mention at the 2010 European Conference of Antennas.



Victor M. Lubecke received the B.S.E.E. degree from the California State Polytechnic Institute, Pomona, CA, USA, in 1986, and the M.S. and Ph.D. degrees in electrical engineering from the California Institute of Technology, Pasadena, CA, USA, in 1990 and 1995, respectively.

He is currently a professor of Electrical Engineering at the University of Hawaii, Manoa, HI, USA. From 1998 to 2003, Dr. Lubecke was with Bell Laboratories, Lucent Technologies, where his research focused on remote sensing technologies for biomedical and industrial applications, and on microelectromechanical systems (MEMS) and 3-D wafer-scale integration technologies for wireless and optical communications. From 1987 through 1996, he was with the NASA Jet Propulsion Laboratory (JPL), and from 1996 to 1998, he was with the Institute for Physical and Chemical Research (RIKEN), Sendai, Japan, where his research involved terahertz and MEMS technologies for space remote sensing and communications applications. He holds six U.S. patents with several pending, and has published over 150 peer-reviewed research articles.

Prof. Lubecke is an emeritus Distinguished Microwave Lecturer (2006–2008) of the IEEE Microwave Theory and Techniques Society, and was a co-recipient of the Emerging Technology Award at TechConnect 2007. He co-founded and served as CTO for a start-up company that is now Kai Medical, Honolulu, HI. His current research interests include remote sensing technologies, biomedical sensors, MEMS, heterogeneous integration, and microwave/terahertz radio.



Imran Mehdi (S'83–M'90–SM'09–F'10) received the B.S.E.E. degree in 1985, the M.S.E.E. degree in 1986, and the Ph.D. degree in 1990, all from the University of Michigan.

He is currently Principal Member of Engineering staff at the Jet Propulsion Laboratory, California Institute of Technology, Pasadena, CA, USA, and Supervisor of the JPL Submillimeter-Wave advanced Technology (SWAT) team. His responsibilities include developing THz components and subsystems for current and future NASA missions.

He joined JPL in 1990 where his first task included the design and fabrication of low-parasitic planar Schottky diodes for submillimeter-wave applications. These devices were implemented on the ozone monitoring Microwave Limb Sounder instrument launched in 2004, as well as the MIRO instrument which represents the first submillimeter-wave receiver that will rendezvous with a comet in 2014. From 1999, he led the effort of developing broadband solid-state sources from 200 to 2500 GHz for the Heterodyne Instrument for Far Infrared (HIFI) on the Herschel Space Observatory, a cornerstone European Space Agency mission currently in space. This effort led to realization of wide-band solid-state sources in the THz range enabling ground-breaking astrophysics observations in space as well as at many ground-based observatories. His current interests include both mm and sub-mm wave devices, semiconductor fabrication technology, high-frequency instrumentation, and heterodyne receivers for miniature systems.



Alexander Shkurinov graduated in 1985 with honors from the Department of Physics of M.V. Lomonosov Moscow State University (MSU), and received the Ph.D. degree in physics from MSU in 1988.

In 1989, he became Research Scientist at the R.V. Khokhlov Laboratory of Non-Linear Optics at MSU. His research interests are centered on the development and application of femtosecond laser techniques, time-resolved spectroscopy of molecules in the liquid phase, nonlinear optics and terahertz

techniques and spectroscopy.

Dr. Shkurinov has participated in a wide range of scientific advisory boards and sat on the organizing and program committees of numerous international conferences. He was awarded the Rozhdstvensky Medal from the Russian Optical Society for his contribution into the development of optical science and technology in 2008.



Jan Stake (M'95) received the M.Sc. degree in electrical engineering and the Ph.D. degree in microwave electronics from Chalmers University of Technology, Göteborg, Sweden, in 1994 and 1999, respectively.

In 1997, he was a Research Assistant at the University of Virginia, Charlottesville, VA, USA. From 1999 to 2001, he was a Research Fellow in the millimeter wave group at the Rutherford Appleton Laboratory, U.K. He then joined Saab Combitech Systems AB as a Senior RF/microwave Engineer until 2003. From 2000 to 2006, he held different academic positions at Chalmers and was also Head of the Nanofabrication Laboratory at MC2 between 2003 and 2006. During 2007, he was a Visiting Professor in the Submillimeter Wave Advanced Technology (SWAT) group at Caltech/JPL, exploring THz applications in biology and medicine. He is currently Professor and Head of the Terahertz and Millimetre Wave Laboratory, Chalmers, Sweden. His research involves terahertz sources, detectors and mixers, high frequency semiconductor devices, graphene electronics, terahertz measurement techniques and applications. Prof. Stake takes over as Editor-in-Chief of the IEEE TRANSACTIONS ON TERAHERTZ SCIENCE AND TECHNOLOGY starting January 1, 2016.



Christopher Walker has over 25 years experience designing, building, and using state-of-the-art receiver systems for THz astronomy. He is a Professor of Astronomy and an Associate Professor of Optical Sciences and Electrical Engineering at the University of Arizona (U of A). He has worked in industry (TRW Aerospace and JPL) as well as academia. As a Millikan Fellow in Physics at Caltech, he worked on the development of low-noise, SIS waveguide receivers above 400 GHz and explored techniques for etching waveguide out of silicon. On joining the

U of A faculty in 1991 he began the Steward Observatory Radio Astronomy Lab (SORAL), which has become a world leader in developing THz receiver systems for astronomy and other remote sensing applications. These instruments are multi-institutional efforts, with key components coming from JPL, several universities, and a number of industrial partners. He manages and coordinates these efforts. Instruments developed by Prof. Walker's team have served as primary facility instruments at the Heinrich Hertz Telescope on Mt. Graham, AZ, USA, and the AST/RO telescope at the South Pole. He is leading the effort to design and build the world's largest (64 pixels) submillimeter-wave heterodyne array receiver (SuperCam). He is also PI of the NASA funded long duration balloon project "The Stratospheric THz Observatory (STO)". He has published numerous papers on star formation and protostellar evolution. He has served as dissertation director for nine Ph.D. students.



Vincent Wallace received the Ph.D. degree in medical physics from the University of London, London, U.K., in 1997.

He has nearly 20 years of experience in Biophotonics. After four years as a post doctorate at the Beckman Laser Institute and Medical Clinic, University of California, Irvine, CA, USA, he joined Toshiba Research in Cambridge, U.K., to look at potential applications of terahertz radiation. The terahertz group was spun-out of Toshiba Labs in April 2001 and became TeraView Ltd, also based in Cambridge. At TeraView, he led a group investigation the biomedical applications of terahertz technology. In 2007, he moved to the University of Western Australia to take up a full time academic role where he continues to apply terahertz and other optical techniques to biomedical and clinical problems and the understanding of the interaction of electromagnetic radiation with tissues.