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14. ABSTRACT

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a. REPORT UU	b. ABSTRACT UU	c. THIS PAGE UU			19b. TELEPHONE NUMBER 585-275-0333

RPPR Final Report
as of 08-Nov-2018

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Proposal Number: 69588ELCF

Agreement Number: W911NF-16-1-0381

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EIN: 160743209

Report Date: 22-May-2017

Date Received: 07-Nov-2018

Final Report for Period Beginning 23-Jun-2016 and Ending 22-Feb-2017

Title: Travel Support to The International Conference on Infrared, Millimeter, and Terahertz Waves (IRMMW-THz) in Copenhagen, Denmark

Begin Performance Period: 23-Jun-2016

End Performance Period: 22-Feb-2017

Report Term: 0-Other

Submitted By: Xi-Cheng Zhang

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Distribution Statement: 1-Approved for public release; distribution is unlimited.

STEM Degrees:

STEM Participants:

Major Goals: New visions and directions for the MMW & THz regime addressed in this conference.

The International Conference on Infrared, Millimeter, and Terahertz Waves (IRMMW-THz), is the oldest and largest continuous forum devoted to the science and technology of long-wavelength radiation. The scope of the conference includes all scientific and technological activities from millimeter-waves to the THz regime and on to the far-infrared region of the electromagnetic spectrum. This covers a very wide range of disciplines, encompassing everything from micro- and nano-scale devices and structures to large-scale accelerators and tokamaks and their applications. Presentations at this conference address issues ranging from basic physics, chemistry, electrical engineering and materials science to problems in high frequency circuits and systems, communications, antennas and optics, imaging and spectroscopy, and much, much more.

The conference brings together scientists and technologists from more than 30 countries and typically hosts 600-700 participants. Contributed papers are archived on IEEEXplore, and IEEE is a long term technical co-sponsor of the conference series - currently celebrating 40 years since the first event was held in Atlanta, Georgia in 1974. We believe this is an excellent opportunity for researchers and academicians from around the world to come to Hong Kong to meet with the world leading researchers in related areas.

Accomplishments: Programme: This is a 6-day (Sep 25 Sunday – Sep 30 Friday) conference consisting of:

- 10 Plenary keynote speeches
- Peer-reviewed technical program with papers presentation
- Posters sessions, demo and exhibition sessions for idea exchange
- Social programs including welcome reception, award banquet and excursions
- Student workshop associated with the conference (Sep 24-Sep 25)

Plenary speaker(s):

Name Department / Institution / Country

Toshitaka Idehara, Fukui University, 2016 Button Prize, Japan

David Smith, Duke University, USA

Carlo Sirtori, Université Paris Diderot, France

Alfred Leitenstorfer, University of Konstanz, Germany

Søren Keiding, Aarhus University, Denmark

René Beigang, Technical University of Kaiserslautern, Germany

Franz X. Kärtner, DESY and University of Hamburg, Germany

RPPR Final Report

as of 08-Nov-2018

Villy Sundstrøm, Lund University
David Shoemaker, Kavli Institute, MIT, USA
Songlin Zhuang (Giving by Yiming Zhu), Chinese National Academy of Mechanical Engineering, China

Training Opportunities: Nothing to Report

Results Dissemination: The International Conference on Infrared, Millimeter, and Terahertz Waves (IRMMW-THz) continues to grow in scope and stature. The 41st International Conference on Infrared, Millimeter and Terahertz Waves is hosted by the Technical University of Denmark with Prof. Peter Uhd Jepsen, Department of Photonics Engineering. Conference Details: <http://terahertz.dk/irmmwthz2016/about/>

IRMMW-THz 2016 Conference Chair, Prof. Peter Jepsen, sent a list of seven US students participating the conference. These students received the support from AFOSR and ARO grants. The students are author or co-authors of the papers presented in IRMMW-THz conference.

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Honors and Awards: Nothing to Report

Protocol Activity Status:

Technology Transfer: Nothing to Report

PARTICIPANTS:

Participant Type: PD/PI

Participant: Xicheng Zhang

Person Months Worked: 1.00

Project Contribution:

International Collaboration:

International Travel:

National Academy Member: N

Other Collaborators:

Funding Support:

Support of The International Conference on Infrared, Millimeter, and Terahertz Waves (IRMMW-THz) in Copenhagen, Denmark

- **Location:** Copenhagen, Denmark

-

- **Dates:** September 25-30, 2016.

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- **Army Research Interests:**

- Terahertz wave is a part of electromagnetic wave, between the microwave and infrared frequency range. Terahertz (THz) science and technology that enables fundamental research directly impacts our lives, from industrial quality control, to national security and environmental studies, and to medical diagnostic and treatment as a long-term prospect. THz research and development relates to at least six of the 8 areas with "*" listed above.

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- Sandwiched between the optical on the short wavelength side and radio on the long wavelength extreme, the Terahertz or Far-Infrared has long been considered the last remaining scientific gap in the electromagnetic spectrum. Due to the historic role the IRMMW conference has played in bridging this gap by bringing together international researchers in many diverse fields - from space science to nuclear fusion - and recently chemistry and biology, the Principal Investigator and his students would again like to reach out to scientists in adjacent fields who can benefit from recent developments in the THz community.

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Summary of Objectives:

Support American students to attend "The International Conference on Infrared, Millimeter, and Terahertz Waves (IRMMW-THz) in Copenhagen, Denmark".

Location: Copenhagen, Denmark. Dates: September 25-30, 2016.

DoD Research Interests:

Terahertz wave is a part of electromagnetic wave, between the microwave and infrared frequency range. Terahertz (THz) science and technology that enables fundamental research directly impacts our lives, from industrial quality control, to national security and environmental studies, and to medical diagnostic and treatment as a long-term prospect. THz research and development relates to at least six of the 8 areas with "*" listed above.

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The International Conference on Infrared, Millimeter, and Terahertz Waves (IRMMW-THz), begun in 1974, is the oldest and largest continuous forum specifically devoted to the field of ultra high frequency electronics and applications. In 2004 the original conference series, International Conference on Infrared and Millimeter Waves (IRMMW), joined up with the International Conference on THz Electronics to form the Joint 29th International Conference on Infrared and Millimeter Waves and the 12th International Conference on Terahertz Electronics (IRMMW-THz 2004). In 2008 the conference name was shortened to the 33rd International Conference on Infrared, Millimeter, and Terahertz Waves, keeping the same general acronym: IRMMW-THz 20XX. In 2009 the conference series was formally incorporated into a permanent non-profit international society registered in the state of

California, USA. The International Society of Infrared, Millimeter, and Terahertz Waves (IRMMW-THz) has the mission statement: "Promoting the worldwide collection, dissemination and exchange of scientific and technical knowledge in the areas and disciplines involving infrared, millimeter, and terahertz waves."

The Society web is <http://irmmw-thz.org/index.html>

Conference history: In 2003 both the IRMMW and THz Electronics conferences were held sequentially in Japan. Total attendees for both events were 520 registrants from 18 countries with 340 submitted papers. After 2003 the two conferences joined and attendance in 2004 (Karlsruhe, Germany) exceeded 450 scientists from 28 countries with over 400 contributed papers. The 2005 conference in Williamsburg, Virginia, hosted 300 scientists from 23 countries with more than 375 contributed papers. In Shanghai, China in 2006 more than 550 papers were submitted representing 28 countries and regions, the largest venue in recent memory. The 2007 conference in Cardiff, Wales, UK ended with more than 430 participants from 18 countries and 550 submitted papers. The 2008 conference in Pasadena had over 460 papers from 32 countries. The 2009 venue in Busan, Korea had over 535 attendees from 43 countries. In 2010 the conference in Rome hosted the largest crowd to date, with 640 participants from around the world. This year, we have 752 submissions for IRMMW-THz conference in Hong Kong; this is a new record for the conference submissions.

In the last few years, interest in terahertz imaging and spectroscopy from the biology, security, ultra-fast chemistry and health science communities has grown exponentially as new instrumentation and techniques have begun to make their way into many laboratories world-wide. This is especially the case in Europe and Japan, both of which have thriving cross-disciplinary programs supporting new applications in this frequency domain.

Prof. Peter Uhd Jepsen is the Conference Program Chair. He is in charge of the conference technical program, including all the plenary, keynote, oral, and poster presentation. The conference has 10 plenary speakers, approximately 60 keynote speakers (35 confirmed), 300 oral presentations and 200 posters expected. The conference rejection rate in 2016 is expected to be about 20%.

Chairperson: Dr. Peter Uhd Jepsen, Professor, Department of Photonics Engineering, Technical University of Denmark

Dissemination of Meeting Results:

The conference brings together scientists and technologists from more than 30 countries and typically hosts 600-700 participants. Contributed papers are archived on IEEEXplore, and IEEE is a long term technical co-sponsor of the conference series - currently celebrating 41 years since the first event was held in Atlanta, Georgia in 1974. We believe this is an excellent opportunity for researchers and academicians from around the world to come to Copenhagen to meet with the world leading researchers in related areas.

CONFERENCE INFORMATION

New visions and directions for the MMW & THz regime addressed in this conference.

The International Conference on Infrared, Millimeter, and Terahertz Waves (IRMMW-THz), is the oldest and largest continuous forum devoted to the science and technology of long-wavelength radiation. The scope of the conference includes all scientific and technological activities from millimeter-waves to the THz regime and on to the far-infrared region of the electromagnetic spectrum. This covers a very wide range of disciplines, encompassing everything from micro- and nano-scale devices and structures to large-scale accelerators and tokamaks and their applications. Presentations at this conference address issues ranging from basic physics, chemistry, electrical engineering and materials science to problems

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The focus areas that were addressed in the conference:

01. Astronomy and Environmental Science
02. Applications in Biology and Medicine
03. Applications in Security and Defense
04. Applications in Industry
05. Spectroscopy and Material Properties
06. Protein Dynamics and Molecular Spectroscopy
07. Spectroscopy of Gases, Liquids, and Solids
08. Sources, Detectors, and Receivers
09. Imaging and Remote Sensing
10. Modeling and Analysis Techniques
11. Metamaterial Structures and Applications
12. Devices, Components, and Systems
13. R&D, Future Applications, and Market Directions
14. High-Field THz Wave Generation and Nonlinear THz Physics
15. Frequency and Time Domain Instruments
16. MMW systems, Transmission Lines and Antennas
17. MMW and Sub-millimeter Wave Radar and Communications
18. Ultra High Speed MMW Digital Devices
19. Laser Driven THz Sources
20. Quantum Cascade Lasers
21. Gyro-Oscillators and Amplifiers
22. Free Electron Lasers and Synchrotron Radiation
23. Planetary and Earth Science Applications
24. Applications in Art Conservation studies
25. Ultrafast Measurements
26. Plasma Diagnostics
27. Metrology

Programme: This is a 6-day (Sep 25 Sunday – Sep 30 Friday) conference consisting of:

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Søren Keiding, Aarhus University, Denmark
 René Beigang, Technical University of Kaiserslautern, Germany
 Franz X. Kärtner, DESY and University of Hamburg, Germany
 Villy Sundstrøm, Lund University
 David Shoemaker, Kavli Institute, MIT, USA
 Songlin Zhuang (Giving by Yiming Zhu), Chinese National Academy of Mechanical Engineering, China

DoD Interests:

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