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ifcs-isaf2020.org
# IFCS-ISAF 2020: SCHEDULE OVERVIEW

**July 12-31st**
Tutorial & Plenary Presentations available On-Demand

**July 19-31st**
All presentations available On-Demand

### Live Sessions
The following live events complement the large amount of On-Demand content. Please note that the live Q&A sessions will assume that the audience has already viewed the associated On-Demand presentation.

**Sunday, July 19th**

<table>
<thead>
<tr>
<th>Time</th>
<th>Event</th>
</tr>
</thead>
<tbody>
<tr>
<td>15:00 – 16:00 MDT</td>
<td>Tutorial Q&amp;A: David Leibrandt</td>
</tr>
<tr>
<td></td>
<td>Tutorial Q&amp;A: Amir Safavi-Naeini</td>
</tr>
<tr>
<td></td>
<td>Tutorial Q&amp;A: Sergei Kalinin</td>
</tr>
</tbody>
</table>

**Monday, July 20th**

<table>
<thead>
<tr>
<th>Time</th>
<th>Event</th>
</tr>
</thead>
<tbody>
<tr>
<td>6:00 – 7:00 MDT</td>
<td>Tutorial Q&amp;A: Michael Hoffman</td>
</tr>
<tr>
<td></td>
<td>Tutorial Q&amp;A: John Domann</td>
</tr>
<tr>
<td>7:00 – 7:30 MDT</td>
<td>Welcome Ceremony and IFCS Awards</td>
</tr>
<tr>
<td>7:30 – 8:00 MDT</td>
<td>Plenary Q&amp;A: Lindy Blackburn</td>
</tr>
<tr>
<td>8:00 – 9:00 MDT</td>
<td>Student Pitch Competition</td>
</tr>
<tr>
<td>15:00 -16:00 MDT</td>
<td>Tutorial Q&amp;A: Carol Thompson</td>
</tr>
<tr>
<td></td>
<td>Tutorial Q&amp;A: Francois Vernotte</td>
</tr>
<tr>
<td></td>
<td>Tutorial Q&amp;A: Tara Fortier</td>
</tr>
</tbody>
</table>

**Tuesday, July 21st**

<table>
<thead>
<tr>
<th>Time</th>
<th>Event</th>
</tr>
</thead>
<tbody>
<tr>
<td>6:00 – 7:00 MDT</td>
<td>Tutorial Q&amp;A: Tony Schenk</td>
</tr>
<tr>
<td></td>
<td>Tutorial Q&amp;A: Claudio Calosso</td>
</tr>
<tr>
<td></td>
<td>Tutorial Q&amp;A: Firooz Aflatouni</td>
</tr>
<tr>
<td>7:00 – 8:00 MDT</td>
<td>Live Panel Q&amp;A on Emerging Integrated Ferroelectrics: (Al,Sc)N and HfO2</td>
</tr>
<tr>
<td>8:00 – 9:00 MDT</td>
<td>WIE: Jody Julien</td>
</tr>
<tr>
<td>9:00 – 10:00 MDT</td>
<td>Patron Session: TOPTICA Photonics, Inc.</td>
</tr>
<tr>
<td>15:00 – 16:00 MDT</td>
<td>Tutorial Q&amp;A: Robert Lutwak</td>
</tr>
<tr>
<td></td>
<td>Tutorial Q&amp;A: Attila Kanali</td>
</tr>
</tbody>
</table>

**Wednesday, July 22nd**

<table>
<thead>
<tr>
<th>Time</th>
<th>Event</th>
</tr>
</thead>
<tbody>
<tr>
<td>6:00 – 7:00 MDT</td>
<td>Patron Session: aixACCT Systems</td>
</tr>
<tr>
<td>7:00 – 7:30 MDT</td>
<td>ISAF and Student Awards Ceremony</td>
</tr>
<tr>
<td>7:30 – 8:00 MDT</td>
<td>Plenary Q&amp;A: Andrea Alu</td>
</tr>
<tr>
<td>8:00 – 9:00 MDT</td>
<td>Student Event #2</td>
</tr>
<tr>
<td>9:00 – 10:00 MDT</td>
<td>Patron Session: SpectraDynamics, Inc.</td>
</tr>
<tr>
<td>15:00 – 15:30 MDT</td>
<td>Plenary Q&amp;A: Clive Randell</td>
</tr>
<tr>
<td>15:30 – 16:30 MDT</td>
<td>Pub Quiz Social Event Honoring the 100th Anniversary of the Discovery of Ferroelectricity</td>
</tr>
</tbody>
</table>
# TABLE OF CONTENTS

<table>
<thead>
<tr>
<th>Section</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>WELCOME FROM THE COMMITTEE CHAIRS</td>
<td>4</td>
</tr>
<tr>
<td>PRACTICAL INFORMATION</td>
<td>6</td>
</tr>
<tr>
<td>IFCS-ISAF 2020: ORGANIZING COMMITTEE</td>
<td>7</td>
</tr>
<tr>
<td>IFCS 2020 TECHNICAL PROGRAM COMMITTEE</td>
<td>9</td>
</tr>
<tr>
<td>ISAF 2020 TECHNICAL PROGRAM COMMITTEE</td>
<td>12</td>
</tr>
<tr>
<td>SPECIAL THANKS</td>
<td>13</td>
</tr>
<tr>
<td>SPONSORS</td>
<td>13</td>
</tr>
<tr>
<td>PLATINUM PATRONS</td>
<td>13</td>
</tr>
<tr>
<td>GOLD PATRONS</td>
<td>14</td>
</tr>
<tr>
<td>WEBSITE PATRONS</td>
<td>14</td>
</tr>
<tr>
<td>IFCS 2020 AWARDS</td>
<td>15</td>
</tr>
<tr>
<td>PLENARY SPEAKERS</td>
<td>16</td>
</tr>
<tr>
<td>IEEE WOMEN IN ENGINEERING</td>
<td>19</td>
</tr>
<tr>
<td>TUTORIAL SPEAKERS</td>
<td>20</td>
</tr>
<tr>
<td>INVITED SPEAKERS</td>
<td>21</td>
</tr>
<tr>
<td>VIRTUAL NETWORKING OPPORTUNITES</td>
<td>23</td>
</tr>
<tr>
<td>PROGRAM GRID</td>
<td>24</td>
</tr>
<tr>
<td>TECHNICAL PROGRAM – Monday, July 20^{th}</td>
<td>26</td>
</tr>
<tr>
<td>TECHNICAL PROGRAM – Tuesday, July 21^{st}</td>
<td>41</td>
</tr>
<tr>
<td>TECHNICAL PROGRAM – Wednesday, July 22^{nd}</td>
<td>55</td>
</tr>
<tr>
<td>TECHNICAL PROGRAM – Thursday, July 23^{rd}</td>
<td>63</td>
</tr>
</tbody>
</table>
WELCOME FROM THE COMMITTEE CHAIRS

We welcome all participants to the joint meeting of the IEEE International Frequency Control Symposium (IFCS) and International Symposium on Applications of Ferroelectrics (ISAF), in conjunction with both the workshop on Piezoresponse Force Microscopy (PFM) and European Frequency and Time Forum (EFTF). This year’s meeting is a first in many ways, some planned, and others as a response to a global pandemic.

First, we are all disappointed that we weren’t able to gather in mountains of Keystone, Colorado, USA for this meeting, but a fully-online approach is clearly the only approach that makes sense. As this is the first online IFCS or ISAF meeting, we kindly request both your patience and your feedback. This mode of operation clearly brings challenges: for example, presenters had to pre-record their talks far in advance of when they would usually be completed, and there is simply no substitute for a face-to-face conversation over coffee or some other beverage of choice among colleagues. However, there are advantages to a remote model above and beyond the health benefits and reduced time and cost for each participant: with the talks, posters, and tutorials all being delivered asynchronously, that pesky limitation of not being able to be in multiple parallel sessions at the same time disappears and far more content is directly available to each participant—and we hope that you are all able to take advantage of every minute of content possible! Please engage with the speakers and one another via the asynchronous Q&A for the keynote, invited, and contributed talks and posters in addition to both the asynchronous and live Q&A for the tutorials and plenaries.

Speaking of plenaries, we are thrilled to have an outstanding trio of plenary speakers that truly represent the broad impact of IFCS-ISAF topics: Dr. Lindy Blackburn will be speaking on Black Hole Imaging with the Event Horizon Telescope, Prof. Andrea Alù will present on Tim-Variations and Gain for the Next Generation of Metamaterials, and Prof. Clive Randall will lead a Discussion of Defects, Crystal Chemistry, Thermochemistry, Non-equilibrium Processing, and the Impact on Properties of Ferroelectric Materials. We are of course disappointed that Dr. Sylvia Gebhardt and Prof. Nava Setter are unable to deliver their plenaries this year but look forward to hearing from them at future meetings. Be sure to also catch the live panel discussion and Q&A on Emerging Integrated Ferroelectrics: (Al,Sc)N and HfO₂.

In addition to the tremendous technical program, the conference also includes a number of live social and professional development activities that we hope will help to bring us all together despite being located in many different time zones. For example, Women in Engineering (WIE) invites everyone to participate in a workshop run by Jody Julien on Designing Your Purpose Driven Career. The IEEE-UFFC student representatives have organized a multi-themed networking event in addition to a student pitch competition. We will also announce Ferroelectrics and Frequency Control committee awards in addition to student awards as part of the meeting. And finally, the grand finale of the conference will be a pub-quiz style celebration of the 100th anniversary of the discovery of the phenomenon of ferroelectricity by Joseph Valasek at the University of Minnesota.

As with every such endeavor, there are a small number of people who get to sign such a welcome letter but a large number of people who put in innumerable hours of help to make the event a reality. We especially want to thank the Technical Program Committees and all of the other organizers. Without their tireless efforts and flexibility—this year in particular—this meeting simply could not have happened.

On behalf of the entire community, we also want to thank all of the sponsors and patrons! Not only do these corporate partners support events such as this meeting, they are the inspiration, customers, suppliers, and colleagues that keep our community running.
Despite the fact that the Morse code message in the meeting logo no longer applies, we hope that this conference will still serve as a vehicle for learning, collaborating, and enhancing the personal and professional friendships that are even more important as we deal with a powerful reminder that we all share one planet. Please take advantage of this opportunity to strengthen the science and the community as we all look forward to a future in which we’re able to see each other in person again.

We wish you an exciting, fruitful, and successful conference.

IFCS General Chair
Dana Weinstein, Purdue University

ISAF General Chair
Geoff Brennecke, Colorado School of Mines

IFCS Program Chair
Matteo Rinaldi, Northeastern University

ISAF Program Chair
Brady Gibbons, Oregon State University
Virtual Platform:
IFCS-ISAF will be using the Virtual Platform CONFLUX to host the 2020 symposium. Registered attendees will receive an email 24 hours prior to the start of the conference with access information.

No Recording or Job Postings
Please note that it is Symposium policy that there is to be NO unauthorized digital imaging or recording in any of the Tutorial or Symposium sessions. It is also IEEE policy that there be no job posting, of any kind, at the Symposium or at the Tutorials. Your cooperation is appreciated.

Symposium Proceedings
The Symposium Proceedings will be distributed via email to registered attendees after the Symposium.

Event Conduct and Safety Statement
IEEE believes that science, technology, and engineering are fundamental human activities, for which openness, international collaboration, and the free flow of talent and ideas are essential. Its meetings, conferences, and other events seek to enable engaging, thought-provoking conversations that support IEEE’s core mission of advancing technology for humanity. Accordingly, IEEE is committed to providing a safe, productive, and welcoming environment to all participants, including staff and vendors, at IEEE-related events.

IEEE has no tolerance for discrimination, harassment, or bullying in any form at IEEE-related events. All participants have the right to pursue shared interests without harassment or discrimination in an environment that supports diversity and inclusion. Participants are expected to adhere to these principles and respect the rights of others.

IEEE seeks to provide a secure environment at its events. Participants should report any behavior inconsistent with the principles outlined here, to on site staff, security or venue personnel, or to eventconduct@ieee.org.
<table>
<thead>
<tr>
<th>Role</th>
<th>Name</th>
<th>Institution</th>
</tr>
</thead>
<tbody>
<tr>
<td>General Co-Chair</td>
<td>Dana Weinstein</td>
<td>Purdue University</td>
</tr>
<tr>
<td>General Co-Chair</td>
<td>Geoff Brennecka</td>
<td>Colorado School of Mines</td>
</tr>
<tr>
<td>Technical Co-Chair</td>
<td>Matteo Rinaldi</td>
<td>Northeastern University</td>
</tr>
<tr>
<td>Technical Co-Chair</td>
<td>Brady Gibbons</td>
<td>Oregon State University</td>
</tr>
<tr>
<td>Finance Co-Chair</td>
<td>Debra Coler</td>
<td>OEwaves</td>
</tr>
<tr>
<td>Finance Co-Chair</td>
<td>Michelle Dolgos</td>
<td>University of Calgary</td>
</tr>
<tr>
<td>PFM Co-Chair</td>
<td>Seungbum Hong</td>
<td>Korea Advanced Institute of Science and Technology (KAIST)</td>
</tr>
<tr>
<td>PFM Co-Chair</td>
<td>Olga Ovchinnikova</td>
<td>Oak Ridge National Lab</td>
</tr>
<tr>
<td>Women In Engineering Chair</td>
<td>Laura Popa</td>
<td>Analog Devices</td>
</tr>
<tr>
<td>Diversity and Inclusion Chair</td>
<td>Julia Glaum</td>
<td>Norwegian University of Science and Technology</td>
</tr>
<tr>
<td>Tutorial Co-Chair</td>
<td>Troy Olsson</td>
<td>University of Pennsylvania</td>
</tr>
<tr>
<td>Tutorial Co-Chair</td>
<td>Eric Patterson</td>
<td>Naval Research Lab</td>
</tr>
<tr>
<td>Publication Co-Chair</td>
<td>Greg Weaver</td>
<td>Johns Hopkins APL</td>
</tr>
<tr>
<td>Publication Co-Chair</td>
<td>Brendan Hanrahan</td>
<td>Army Research Lab</td>
</tr>
<tr>
<td>Exhibit Co-Chair</td>
<td>Craig Nelson</td>
<td>NIST</td>
</tr>
<tr>
<td>Exhibit Co-Chair</td>
<td>Brendan Hanrahan</td>
<td>Army Research Lab</td>
</tr>
</tbody>
</table>
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The Aerospace Corporation

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Sarah Shahraini
University of Central Florida

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Kazumi Kato- AIST, Japan
Barbara Malic- Institut Jožef Stefan, Slovenia
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Shujun Zhang- University of Wollongong, Australia

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Marco Deluca- Materials Center Leoben, Austria
Marty Gregg- Queen's University Belfast, UK
Satoshi Wada- University of Yamanashi, Japan
Kyle Webber- Friedrich-Alexander Universität, Germany

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Roger Whatmore- Imperial College London, UK
SPECIAL THANKS

The joint conference of the IEEE International Frequency Control Symposium and IEEE International Symposium on Applications and Ferroelectrics is possible with support from:

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PLATINUM PATRONS
The 2020 W. G. Cady Award
Craig Nelson

For leadership in the design and development of state-of-the-art low noise oscillators and phase noise measurement systems

The 2020 I. I. Rabi Award
Robert Lutwak

For pioneering technical contributions and engineering management leading to the development of the first commercial “chip-scale” atomic clock.

The 2020 C. B. Sawyer Memorial Award
Victor Plessky

For pioneering contributions to the development of SAW and micro-acoustic devices, including the prediction of Surface Transverse Waves (STM), the theory of the “leaky” SAW in periodic structures (i.e., the “Plessky equation”), and the invention of XBARs.

IFCS-EFTF 2021 Award Nominations
Nominations are now open for the 2021 IFCS Awards. Nominations should be sent to the IFCS Awards Chairs at james.c.camparo@aero.org.
Clive A. Randall is a Professor of Materials Science and Engineering and Director of the Materials Research Institute at The Pennsylvania State University. He received a B.Sc. with Honors in Physics in 1983 from the University of East Anglia (UK), and a Ph.D. in Experimental Physics from the University of Essex (UK) in 1987. He was Director for the Center for Dielectric Studies 1997-2013, and Co-Director of the Center for Dielectrics and Piezoelectrics 2013-2015, still serving as Technical Advisor. He has authored/co-authored over 450 technical papers (20,000 citations H-index 76) and holds 15 patents (with 1 pending) in the field of electroceramics. His research interests are in the area of discovery, processing, material physics, and compositional design of functional materials; with different processing and characterization methods. Prof. Randall has received a number of awards from various societies, including the American Ceramic Society Fulrath Award, Fellow of the American Ceramic Society, Academician of the World Academy of Ceramics; Spriggs Phase Equilibria Award; Friedberg Lecture at the American Ceramic Society; Edward C. Henry Best Paper of the Year from the American Ceramics Society Electronics Division (2012 and 2017), IEEE UFFC-S Ferroelectrics Recognition Award (2014), Robertson Breakthrough of the Year Award (College of Earth and Mineral Sciences, Penn State University, 2017).

A Discussion of Defects, Crystal Chemistry, Thermochemistry, Non-equilibrium Processing and the Impact on Properties of Ferroelectric Materials

Ferroelectric and related materials are very sensitive to compositional design. Perovskite structured ferroelectrics can be compositionally guided through understanding the inter-relationship between crystal chemistry and phase transition behavior. Several demonstrations of this design approach through the Goldschmidt tolerance factor will be given including high temperature morphotropic phase boundaries, high temperature relaxor ferroelectrics, and developing antiferroelectrics solid solutions.

A subtler perturbation to ferroelectric phase transitions and properties is understanding of non-stoichiometric partial Schottky reactions, the associated defect and defect clusters that can control Curie points, the electronic conduction, and associated degradation mechanisms. Co-doping strategies utilizing rare earth ion dopants that are amphoteric in nature (occupying A and B-sites of the perovskite structure) can help the stabilization of the mobile oxygen vacancy defects. Comprehension of these defects and quantification of their dynamics can be used to mediate internal bias. The details of these charge distributions need to be considered at a defect complex within the lattice and/or macroscopically across a grain or series of grain boundaries. Experimental insights into this behavior can be determined through careful electron paramagnetic resonance (EPR) and thermally stimulated depolarization current (TSDC) measurements. Data from these observations can be modeled with a phenomenological theory, that points to local electrostatic potentials modifying the probability of ionic hopping. Understanding the science and engineering of these defect dynamics is critical, particularly as applications push to higher temperatures and higher electric field operation.

Many of the above concepts are applicable to solid state processing methods that involve high temperature sintering. However, there is a possibility that we may have to reexamine the defect and dopant strategies if we continue to make advances with low temperature synthesis of bulk and multilayer devices. With the introduction of cold sintering, a process that limits the temperatures to below 300°C, there are many new concepts that will impact the future designs of ferroelectrics and related materials. Recently, we have densified ferroelectrics such as (Na,K)NbO3, BaTiO3, and Pb(Zr,Ti)O3 under these cold sintering conditions. The properties and future trends of these materials for capacitors, piezoelectrics and other applications will be discussed, together with co-sintering with polymers and hybrid organic/inorganic perovskites.
Andrea Alù
Photonics Initiative, Advanced Science Research Center, City University of New York

Andrea Alù is the Founding Director and Einstein Professor at the Photonics Initiative, CUNY Advanced Science Research Center. He received his Laurea (2001) and PhD (2007) from the University of Roma Tre, Italy, and, after a postdoc at the University of Pennsylvania, he joined the faculty of the University of Texas at Austin in 2009, where he was the Temple Foundation Endowed Professor until Jan. 2018. Dr. Alù is a Fellow of AAAS, IEEE, OSA, SPIE and APS, a Simons Investigator, a Highly Cited Researcher, a DoD Vannevar Bush Faculty Fellow, and has received several scientific awards, including the IEEE Kiyo Tomiyasu Award (2019), the ICO Prize in Optics (2016), the NSF Alan T. Waterman award (2015), the OSA Adolph Lomb Medal (2013), and the URSI Issac Koga Gold Medal (2011).

Time-Variations and Gain for the Next Generation of Metamaterials

Metamaterials are artificial materials with properties well beyond what offered by nature, providing unprecedented opportunities to tailor and enhance the control of waves. In this talk, I discuss our recent activity in electromagnetics and acoustics, showing how suitably tailored meta-atoms and their arrangements open exciting venues for new technology. I focus in particular on the opportunities offered by time modulation and switching, as well as gain, in new metamaterials, which offer an interesting platform for enhanced sensing, one-way signal transport and nonlinear phenomena. These concepts are ideally suited for the new technological opportunities offered by piezo-electric, opto-mechanical and electro-mechanical phenomena. Physical insights into the underlying phenomena, and new devices based on these concepts will be presented.
Dr. Lindy Blackburn is a Radio Astronomer and EHT Data Scientist at the Center for Astrophysics | Harvard & Smithsonian. He leads calibration and data reduction efforts for the Event Horizon Telescope Collaboration, toward the goal of obtaining high resolution images of supermassive black holes. Blackburn obtained a PhD in physics from MIT while working on the LIGO experiment and was a NASA Postdoctoral Program fellow at Goddard Space Flight Center prior to joining the Center for Astrophysics in 2014. His work focuses on the study of black holes, experimental general relativity, and the application of statistical methods and modeling for precision measurement in astronomy.

Black Hole Imaging with the Event Horizon Telescope

The Event Horizon Telescope (EHT) has captured the first image of the shadow of a black hole, a result of the processing and interpretation of petabytes of signal data recorded simultaneously at several locations spanning the globe using the technique of very long baseline interferometry. The radio image, taken at a wavelength of 1.3 mm, matches that of lensed photons from relativistic magnetized plasma surrounding a 6.5 billion solar mass black hole at the center of nearby galaxy M87. I will introduce the EHT instrument and first results, highlighting the challenges in maintaining a phase stable synthetic aperture the size of the Earth at these high radio frequencies. Moving to even higher observing frequencies and and utilizing longer baselines to space places even stronger requirements on timing and calibration, but the additional coverage and resolution provided will enable an entirely new way to study black hole dynamics and populations through direct imaging and movie making.
When it comes to making career choices, the more we are aligned with what most motivates and drives us, the more we will find purpose and satisfaction in whatever we do.

Together we will discover a framework by which you may gain additional insight and awareness about what makes you unique, what motivates you and what to take into account in order to make career decisions that resonate with what you believe to be really important. Finding purpose in each of the professional choices you make throughout your career will mean the difference between average satisfaction in what you do to being able to continuously thrive!

PURPOSE DRIVEN CAREER CHOICES COMBINES PASSIONS + TALENTS + VALUES

While you dive deeper into discovering more about your purpose-driven career choices, you will also have the opportunity to enhance your professional community! There will be networking and exchanging on these themes with fellow WIE members in a fun and relaxed way. Each participant will have the opportunity to do their own self-assessment and start to redefine their own SUCCESS STORY!

Jody Julien
Professional & Life Coach
Founder, J2 COACHING & CONSULTING

Born in the USA, holds degrees from universities in Michigan and New York in the areas of International Business and Strategic Human Resources. Trained and certified in both Professional and Life Coaching. Held worldwide leadership positions for over 20 years, has lived in North America, South America, and Europe, and is currently based in Paris, France. The founder of J2 Coaching & Consulting since 2011, a global firm specializing in professional development and international organizational effectiveness.

Conference attendees and especially women active in the technical areas of the IEEE IFCS-ISAF-EFTF symposium are encouraged to attend this special networking event organized by the women of the UFFC Society.
Amir Safavi-Naeini
Scaling up Microwave Quantum Machines: Acoustic and Electro-Optic Technologies

Attila Kinali
Designing Low-noise Analog Electronics for Time and Frequency Metrology

Carol Thompson
X ray scattering techniques, familiar friends and strangers

Claudio E. Calosso
Low-noise digital electronics for time and frequency metrology

David Leibrandt
Optical atomic clocks and their applications

Francois Vernotte
Frequency Stability Estimation: Allan Variance and Friends

John Domann
Coupling Maxwell with Mechanics: Modeling Multiferroics from Nano to Macro and DC to RF

Michael Hoffmann
Negative Capacitance in Ferroelectrics

Robert Lutwak
Microwave Atomic Clocks

Tara Fortier
Optical frequency combs for atomic clock comparisons and ultra-low-noise microwave generation.

Tony Schenk
HfO2-based Ferroelectrics: Where do we stand?

Sergei Kalinin
Machine Learning Mesoscopic Phenomena in Ferroelectrics

Firooz Aflatouni
Realizing Tunable Optical sources from Optical Frequency Combs
INVITED SPEAKERS

Aaron Partridge, SiTime Corporation
Albina Borisevic, Oak Ridge National Lab
Alexei Gruverman, University of Nebraska
Alp Sehirlioglu, Case Western Reserve University
Anton Ievlev, ORNL
Anne Amy Klein, LPL
Barbara Malic, Jozef Stefan Institute
Benyamin Davaji, Cornell University
Brian Foley, Penn State University
Chengpeng Hu, Harbin Institute of Technology
Clive Randall, The Pennsylvania State University
David Ginger, University of Washington
David Hume, NIST
Dixiong Wang, University of Pennsylvania
Ernest Yen, Texas Instruments
Etienne Cantin, LNE-SYRTE
Florian Hausen, FZ Julich
Giuseppe Michetti, Northeastern University
Hana Ursič, Jozef Stefan Institute
Hana Ursic, Jozef Stefan Institute
Hiroshi Funakubo, Tokyo Institute of Technology
Holger Röhm, KIT
Hong Wang, Xi’an Jiaotong University
Ingrid Canero-Infante, University of Lyon
Ingrid Infante, INL
Isabelle Dufour, Université de Bordeaux
Isaku Kanno, Kobe University
Jérôme Lodewyck, LNE-SYRTE
Jan Seidel, UNSW
Jérôme Lodewyck, LNE-SYRTE
Jiangyu Li, Chinese Academy of Science
Jonathan M. Puder, Adelphi
Joseph Guy, Queens University Belfast
Julian Walker, NTNU
Ke Wang, Tsinghua Univ.
Kevin Talley, National Renewable Energy Laboratory
Kohei Yamasue, Tohoku University
Laiming Jiang, University of Southern California
Lawrence Robins, NIST
Lin Zhou, Ames Lab
Luca Lorini, LNE-SYRTE
Manoj Kalubovilage, University of Colorado at Boulder
Marty Gregg, Queen’s University of Belfast
Max Kessel, Fraunhofer
Michael Hoffmann, NaMLab
Murray Barrett, NUS Singapore
Neus Domingo, ICN2
Nils Nemitz, National Institute of Information and Communications Technology
Prasanna Balachandran, Univ. of Virginia
Rattakorn Kaewuam, Center for Quantum Technologies
Robert Tjoelker, JPL/CIT
Roozbeh Tabrizian, University of Florida
Sabine Neumayer, Oak Ridge National Laboratory
Sakyo Hirose, Murata Manufacturing
Sanghun Jeon, KAIST
Shinnosuke Yasuoka, Tokyo Institute of Technology
Shuji Tanaka, Tohoku University
Simon Fichtner, Kiel University
Sohini Kar-Narayan, Cambridge University
Susan Trolie-McKinstry, Penn State University
Takanori Mimura, Tokyo Institute of Technology
Takuma Nakamura, National Institute of Standards and Technology
William Swann, National Institute of Standards and Technology
Xuefan Zhou, Central South University
Yao Zhu, Institute of Microelectronics (IME)
Yasuo Cho, Tohoku University
Yunfei Chang, Harbin Institute
Yunseok Kim, Sungkyunkwan Univ
Yutong Liu, Cornell University
Zhu Yao, IME, ASTAR
VIRTUAL NETWORKING OPPORTUNITIES

Networking1: "Get Connected: All Stage Networking"
On Monday, July 20th from 8:00 am to 9:00 am MDT (UTC-6), three simultaneously held Zoom networking events provide an opportunity for everyone to have a friendly chat with their peers. Participation in one or more of the meetings possible via individual Zoom links!

Zoom Chat Roulette
This event is designed to fuel connections between attendees and create future friends. It will start with a short introduction followed by a chat Roulette. Attendees will be randomly assigned to smaller four-person breakout rooms for short time intervals. No registration required!

Student Professor Meet and Greet
This meeting is designated for students who are seeking an opportunity to network with the UFFC Society’s academic leaders. The idea is to establish conversations that will include topics such as career challenges in academia, postdoctoral positions, and advice related to specific research fields. The meeting will start with a short introduction by academia members and will be followed by assigning attendees to smaller break out groups based on their technical field and/or topic of interest.

Student-Industry Networking Event
The objective of this networking event is to encourage and facilitate contact between graduate student finishing their Ph.D. programs and industry members looking for Ph.D. graduate positions. Job opportunities in the field of frequency control and ferroelectrics are varied and are often unknown to students. This event is a good opportunity to fill this gap. The meeting will start with a short introduction by industry members and will be followed by assigning attendees to smaller break out groups based on their field of interest.

Networking2: “IEEE UFFC-S Student Pitch”
The IEEE UFFC-S Student Pitch, on Wednesday, July 22nd from 8:00 am to 9:00 am MDT (UTC-6), will be an opportunity for students to present themselves to future employers and the research community. Search for a graduate position or your newest team member, and expand your professional network! Two individual juries of either leading academic or industry representatives will select their winner. Bring a single slide and show everyone your most interesting results in 60 seconds!

Participants will be judged on their single presentation slide, their clarity of speech and time management, their clarity of results/research, and the overall impression they would give if this pitch was in a job interview scenario. There will be three cash prizes awarded, and each winner will receive an IEEE UFFC-S certificate!

The first 30 minutes of this networking event will be composed of student live pitches of 60 seconds in length (maximum of 20 student participants) followed by 30 minutes of Zoom Chat Roulette.
# PROGRAM GRID

<table>
<thead>
<tr>
<th>Date</th>
<th>Description</th>
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</thead>
<tbody>
<tr>
<td>July 12-31&lt;sup&gt;st&lt;/sup&gt;</td>
<td>Tutorial &amp; Plenary Presentations available On-Demand</td>
</tr>
<tr>
<td>July 19-31&lt;sup&gt;st&lt;/sup&gt;</td>
<td>All presentations available On-Demand</td>
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**Live Session Program Grid:**

*The following live events complement the large amount of On-Demand content. Please note that the live Q&A sessions will assume that the audience has already viewed the associated On-Demand presentation.*

<table>
<thead>
<tr>
<th>Time</th>
<th>Event</th>
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| 15:00 – 16:00 MDT | **Tutorial Q&A:** David Leibrandt  
                        **Tutorial Q&A:** Amir Safavi-Naeini  
                        **Tutorial Q&A:** Sergei Kalinin |
| 6:00 – 7:00 MDT | **Tutorial Q&A:** Michael Hoffman  
                        **Tutorial Q&A:** John Domann |
| 7:00 – 7:30 MDT | **Welcome Ceremony and IFCS Awards**                                    |
| 7:30 – 8:00 MDT | **Plenary Q&A:** Lindy Blackburn                                          |
| 8:00 – 9:00 MDT | **Student Pitch Competition**                                            |
| 15:00 – 16:00 MDT | **Tutorial Q&A:** Carol Thompson  
                        **Tutorial Q&A:** Francois Vernotte  
                        **Tutorial Q&A:** Tara Fortier |
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<th>Time</th>
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<tbody>
<tr>
<td>6:00 – 7:00 MDT</td>
<td>Tutorial Q&amp;A: Tony Schenk, Tutorial Q&amp;A: Claudio Calosso, Tutorial Q&amp;A: Firooz Aflatouni</td>
</tr>
<tr>
<td>7:00 – 7:30 MDT</td>
<td>Live Panel Q&amp;A on Emerging Integrated Ferroelectrics: (Al,Sc)N and HfO2</td>
</tr>
<tr>
<td>7:30 – 8:00 MDT</td>
<td>WIE: Jody Julien</td>
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<tr>
<td>8:00 – 9:00 MDT</td>
<td>Patron Session: TOPTICA Photonics, Inc.</td>
</tr>
<tr>
<td>9:00 – 10:00 MDT</td>
<td>Tutorial Q&amp;A: Robert Lutwak, Tutorial Q&amp;A: Attila Kanali</td>
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<tr>
<th>Time</th>
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<tbody>
<tr>
<td>6:00 – 7:00 MDT</td>
<td>Patron Session: aixACCT Systems</td>
</tr>
<tr>
<td>7:00 – 7:30 MDT</td>
<td>ISAF and Student Awards Ceremony</td>
</tr>
<tr>
<td>7:30 – 8:00 MDT</td>
<td>Plenary Q&amp;A: Andrea Alu</td>
</tr>
<tr>
<td>8:00 – 9:00 MDT</td>
<td>Student Event #2</td>
</tr>
<tr>
<td>9:00 – 10:00 MDT</td>
<td>Patron Session: SpectraDynamics, Inc.</td>
</tr>
<tr>
<td>15:00 – 15:30 MDT</td>
<td>Plenary Q&amp;A: Clive A. Randall</td>
</tr>
<tr>
<td>15:30 – 16:30 MDT</td>
<td>Pub Quiz Social Event Honoring the 100th Anniversary of the Discovery of Ferroelectricity</td>
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</tbody>
</table>

Please note that the Dates/Times for asynchronous sessions are just for organizational purposes. These presentations will be on-demand and can be accessed 24/7 and at your convenience. Authors and attendees are not required to be online at any specific time for these sessions.

There are a few select presentations that are synchronous such as Tutorials, Plenary, Networking, etc. Please see the Live Session Program Grid below for more information.
Monday, July 20, 2020
9:30 – 11:30
**Keynote 1**

**Ferroelectricity in AlScN**
Simon Fichtner{3}, Fabian Lofink{1}, Bernhard Wagner{3}, Tom-Niklas Kreutzer{2}
{1}Fraunhofer ISIT, Germany; {2}Kiel University, Germany; {3}Kiel University, Fraunhofer ISIT, Germany

**High-Frequency Reference System Implementations Utilizing Mirror-Encapsulated BAW Resonators**
Ernest Yen, Benyong Zhang, Danielle Griffith, Keegan Martin, Mahmud Chowdhury, Jeronimo Segovia-Fernandez, Trevor Tarsi, Brian Goodlin, Benjamin Cook, Ricky Jackson
Texas Instruments, United States

**Piezoelectric Micromachined Ultrasound Transducers**
Christopher Cheng, Tianning Liu, Ajay Dangi, Sri-Rajasekhar Kothapalli, Thomas Jackson, Susan Trolier-Mckinstry
Pennsylvania State University, United States

Monday, July 20, 2020
13:00 – 15:00
**Aluminum Nitride and Aluminum Scandium Nitride Devices**
*Session Chairs: Troy Olsson, University of Pennsylvania & Tanay Gosavi, Intel*

**A Review of the Approaches to Improve Effective Coupling Coefficient of AlN Based RF MEMS Resonators**
Yao Zhu, Nan Wang, Chen Liu, Ying Zhang
Institute of Microelectronics (IME), ASTAR, Singapore

**11 GHz Lateral-Field-Excited Aluminum Nitride Cross-Sectional Lamé Mode Resonator**
Meruyert Assylbekova{1}, Guofeng Chen{2}, Giuseppe Michetti{1}, Michele Pirro{1}, Luca Colombo{1}, Matteo Rinaldi{1}
{1}Northeastern University, United States; {2}Skyworks Solutions, Inc., United States

**A High-$K_e^2$ Switchable Ferroelectric Al0.7Sc0.3N Film Bulk Acoustic Resonator**
Jialin Wang{1}, Mingyo Park{1}, Stefan Mertin{2}, Tuomas Pensala{2}, Farrokh Ayazi{1}, Azadeh Ansari{1}
{1}Georgia Institute of Technology, United States; {2}VTT Technical Research Centre of Finland, Finland

**Al0.7Sc0.3N Acoustically Coupled Filters with Large Bandwidth and Frequency Tunability**
Sushant Rassay, Faysal Hakim, Roozbeh Tabrizian
University of Florida, United States
Enabling Channelizing Filters for High Impedance Nodes with Temperature Compensated Lamb-Wave Resonators
Steffen Link{1}, Ruochen Lu{1}, Shibin Zhang{1}, Songbin Gong{1}, Steven Bowers{2}
{1}University of Illinois at Urbana-Champaign, United States; {2}University of Virginia, United States

Introducing Ferroelectric Integrated and Reconfigurable ScAlN Technologies (FIRST) as a Next Generation Thin-Film Platform
Giuseppe Michetti, Luca Colombo, Michele Pirro, Sungho Kang, Zhenyun Qian, Cristian Cassella, Matteo Rinaldi
Northeastern University, United States

C-Axis Textured Aluminum Scandium Nitride Thin Films with Sub-100 nm Thicknesses
{1}Brookhaven National Laboratory, United States; {2}Evatec, Switzerland; {3}University of Pennsylvania, United States

Monday, July 20, 2020
13:00 – 15:00
Characterization and Properties of Ferroelectrics I
Session Chair: John Daniels, University of New South Wales

Crystallization Mechanisms and Optical Properties of BiFeO3 Nano and Microparticles
Xiaofei Bai{1}, Ingrid Infante{1}, Pascale Gemeiner{5}, Brahim Dkhil{5}, Jerome Guillot{3}, Damien Lenoble{3}, Carlos Frontera{2}, Jie Wei{6}, Matthieu Bugnet{4}
{1}INL, Univ Lyon, INSA-Lyon, UMR CNRS 5270 ECL UCBL CPE, France; {2}Institut de Ciència de Materials de Barcelona, CSIC, Spain; {3}Luxembourg Institute of Science and Technology, Luxembourg; {4}MATEIS, Univ Lyon, INSA-Lyon, UMR CNRS 5510 UCBL, France; {5}

Development of Instrumented Piezoelectric Meter for Polymer Sheet
Markys Cain{2}, Thorsten Schmitz-Kempen{1}, Roland Kessels{1}, Jack Barraclough{3}, Alex Ward{3}
{1}aixACCT Systems GmbH, Germany; {2}Electrosciences Ltd, United Kingdom; {3}Razorbill Instruments, United Kingdom

Influence of Oxygen Content on Structure and Performance of Ferroelectric HfxZr1-xO2 Layers
Monica Materano{1}, Terence Mittmann{1}, Patrick Lomenzo{1}, Thomas Mikolajick{2}, Uwe Schroeder{1}
{1}NaMLab gGmbH, Germany; {2}NaMLab gGmbH, TU Dresden, Germany

Strengthened Relaxor Behavior in (1–x)Pb(Fe0.5Nb0.5)O3–xBiFeO3 Solid Solutions
Uroš Prah{2}, Mirela Dragomir{2}, Tadej Rojac{2}, Andreja Benčan{2}, Hana Uršič{2}, Rachel Broughton{3}, Jacob Jones{3}, Ching-Chang Chung{3}, Rachel Sherbondy{1}, Geoff Brennecka{1}
{1}Colorado School of Mines, United States; {2}Jožef Stefan Institute, Slovenia; {3}North Carolina State University, United States

Textured PIN-PSN-PT Ceramics with Ultrahigh Piezoelectric Properties and Enhanced Temperature Stability
Shuai Yang, Jinglei Li, Mingwen Wang, Zhuo Xu, Fei Li
Xi’an Jiaotong University, China
<table>
<thead>
<tr>
<th>Time</th>
<th>Session</th>
<th>Chair(s)</th>
<th>Presentations</th>
</tr>
</thead>
</table>
| 13:00 – 15:00     | **Fundamentals of Ferroelectrics I**         | **Brahim Dkhil, CentraleSupélec** | In-Situ TEM Observation on the Motion of Phase Boundaries During Antiferroelectric ↔ Ferroelectric Transition  
Binzhi Liu\(^2\), Xiaoli Tan\(^2\), Lin Zhou\(^1\)  
\(^1\)Ames Laboratory, U.S. Department of Energy, United States; \(^2\)Iowa State University, United States  
Orientation Effects in Antiferroelectric Switching of PbZrO\(_3\) Polycrystalline Films  
Cosme Milesi-Brault\(^1\), Stéphanie Girod\(^1\), Sebastjan Glinšek\(^1\), Emmanuel Defaÿ\(^1\), Mael Guennou\(^2\)  
\(^1\)Luxembourg Institute of Science and Technology, Luxembourg; \(^2\)University of Luxembourg, Luxembourg  
Ferroic Domain Continuity Over Grain Boundaries in Polycrystalline Microstructures  
Sukriti Mantri, John Daniels  
UNSW Sydney, Australia  
Interface and Surface Stabilization of the Polarization in Ferroelectric Thin Films  
Chiara Gattinoni, Nives Strkalj, Manfred Fiebig, Morgan Trassin, Nicola Spaldin  
ETH Zurich, Switzerland  
Manipulation of Domain States in Rhombohedral Ferroelectrics with Misfit Strain  
Ivan Vorotiahin\(^3\), Yuri Genenko\(^3\), Anna Morozovska\(^2\), Eugene Eliseev\(^1\)  
\(^1\)Institute for Problems of Materials Science NAS of Ukraine, Ukraine; \(^2\)Institute of Physics NAS of Ukraine, Ukraine; \(^3\)Technische Universität Darmstadt, Germany |
| Monday, July 20, 2020 | **Hafnium Oxide Based Materials**         | **Jon Ihlefeld, University of Virginia** | Stabilization of Ferroelectric Phase in Epitaxial HfO\(_2\) Based Films  
Takanori Mimura\(^4\), Yu-Ki Tashiro\(^4\), Hiroshi Funakubo\(^4\), Takao Shimizu\(^1\), Hiroshi Uchida\(^2\), Yoshio Katsuya\(^3\), Osami Sakata\(^3\)  
\(^1\)NIMS, Japan; \(^2\)Sophia University, Japan; \(^3\)Synchrotron X-ray Station at SPring-8, Japan; \(^4\)Tokyo Institute of Technology, Japan  
HZO-Films for the Integration of Ferroelectric Functionalities Into the BEoL  
David Lehninger, Tarek Ali, Ricardo Olivo, Maximilian Lederer, Thomas Kämpfe, Konstantin Mertens, Konrad Seidel  
Fraunhofer IPMS, Germany  
Fabrication of Ferroelectric Gd:HfO\(_2\) by Pulsed Laser Deposition in a CMOS Compatible Process  
Matteo Cavalieri, Éamon O'Connor, Carlotta Gastaldi, Igor Stolichnov, Adrian Ionescu  
NANOLAB, EPFL, Switzerland |
The Role of Textured Tin on Ferroelectric Hf0.5Zr0.5O2
Younghwan Lee, Hanan Alex Hsain, Gregory Parsons, Jacob Jones
North Carolina State University, United States

Formation Process of Metastable Phases of Al-Doped HfO2 Films Directly on Si by Atomic Layer Deposition
Shuya Takarae, Kenshi Takada, Yuki Saho, Takeshi Yoshimura, Norifumi Fujimura
Osaka Prefecture University, Japan

XRR for Advanced Microstructure Exploration of Solution-Deposited Piezoelectric Thin Films
Tony Schenk, Emmanuel Defay, Sebastjan Glinsek
Luxembourg Institute of Science and Technology (LIST), Luxembourg

Monday, July 20, 2020
13:00 – 15:00
Novel Sensors for Positioning, Navigation & Timing (PNT)
Session Chair: Greg Weaver, Johns Hopkins University Applied Physics Laboratory

A Cold Atom Interferometry Sensor Platform Based on Diffractive Optics and Integrated Photonics
Jongmin Lee{1}, Hayden McGuinness{1}, Daniel Soh{1}, Justin Christensen{1}, Roger Ding{1}, Patrick S. Finnegan{1}, Gregory Hoth{1}, William Kindel{1}, Bethany Little{1}, Randy Rosenthal{1}, Joel R. Wendt{1}, Anthony Lentine{1}, Matt Eichenfield{1}, Michael{1}
{1}Sandia National Laboratories, United States; {2}University of Oklahoma, United States

A Microfabricated Rb Magnetometer for Resource Constrained Environments
Fathima Niyaz{3}, Tom Heavner{2}, B. Bryce{1}, C. Gardner{1}, H. Korth{1}, John Kitching{2}
{1}Johns Hopkins University Applied Physics Laboratory, United States; {2}National Institute of Standards and Technology, United States; {3}National Institute of Standards and Technology / University of Colorado Boulder, United States

Quantization Requirements for FM Gyroscopes: an Update on the Nonlinear FM Gyroscope
Andrew Sabater, Eric Bozeman, Omar Horta, Kari Moran, Kevin Stanzione
Naval Information Warfare Center Pacific, United States

Electrostatic Frequency Tuning of Bulk Acoustic Wave Disk Gyroscopes
Madan Parajuli, Guillermo Sobreviela, Ashwin A. Seshia
University of Cambridge, United Kingdom

Flexoelectricity in Barium Strontium Titanate (BST) Ceramics for Hydrophones
Pennsylvania State University, United States
Monday, July 20, 2020
13:00 – 15:00

**Optical Frequency Standards**
*Session Chair: Andrew Ludlow, NIST*

**A Mercury Optical Lattice Clock with Improved Stability and Accuracy**
Changlei Guo, Valentin Cambier, Manuel Andia, Bruno Ximenez Rodrigues Alves, Yannick Foucault, Héctor Álvarez-Martínez, William Moreno, Jammes Calvert, Luigi De Sarlo, Rodolphe Le Targat, Jérôme Lodewyck, Sébastien Bize
SYRTE - Observatoire de Paris, France

**Background-Gas Collisions in Sr Optical Lattice Clocks**
William Moreno, Bruno Ximenez Rodrigues Alves, Yannick Foucault, Rodolphe Le Targat, Jérôme Lodewyck
Observatoire de Paris, Syrte, France

**Quantum Non-Destructive Detection in an Optical Lattice Clock**
Alvise Vianello{1}, William Bowden{2}, Richard Hobson{2}, Ian Hill{2}, Marco Schioppo{2}, Alissa Silva{2}, Jake Paterson{2}, Helen Margolis{2}, Ben Sauer{1}, Patrick Gill{2}
{1}Imperial College London, United Kingdom; {2}National Physical Laboratory, United Kingdom

Monday, July 20, 2020
15:30 – 17:30

**Acoustoelectric, Magnetostatic, Nonreciprocal, and Phononic Devices**
*Session Chair: Reza Abdolvand, University of Central Florida*

**Large Terminal Gain, Ultra-Compact Acoustoelectric Amplifier in Epitaxial Indium Gallium Arsenide on 41° YX Lithium Niobate Heterostructure**
Lisa Hackett, Michael Miller, Felicia Brimigion, Daniel Dominguez, Greg Peake, Anna Tauke-Pedretti, Shawn Arterburn, Tom Friedmann, Matt Eichenfield
Sandia National Laboratories, United States

**Demonstration of an Acoustoelectric Surface Acoustic Wave Circulator**
Lisa Hackett, Michael Miller, Felicia Brimigion, Daniel Dominguez, Greg Peake, Anna Tauke-Pedretti, Shawn Arterburn, Tom Friedmann, Matt Eichenfield
Sandia National Laboratories, United States

**Trapped Charge Effect on Composite Lithium Niobate-Silicon Acoustoelectric Delay Lines**
Hakhamanesh Mansoorzare, Reza Abdolvand
University of Central Florida, United States

**A 3-Port Circulator Based on Non-Reciprocal Acoustoelectric Delay Lines**
Siddhartha Ghosh, Matthew Ricci
MIT Lincoln Laboratory, United States

**Reconfigurable Gyration and Isolation Through Nonreciprocal Coupling to Resonators with Tunable Q-Factor**
Christopher Peterson, Mengze Sha, Gaurav Bahl
University of Illinois at Urbana-Champaign, United States
Micromachined YIG Resonators
Sen Dai{2}, Sunil Bhave{2}, Renyuan Wang{1}
{1}BAE Systems, United States; {2}Purdue University, United States

Localized Modes in Asymmetric Phononic Crystals
Yanbo He, Dana Weinstein
Purdue University, United States

Monday, July 20, 2020
15:30 – 17:30
Characterization and Properties of Ferroelectrics II
Session Chair: Andrew Bell, University of Leeds

Switching Dynamics and Functional Properties in Plastic Crystal Ferroelectrics
Julian Walker{2}, Simon Scherrer{2}, Nora Løndal{2}, Rany Miranti{2}, Tor Grande{2}, Mari-Ann Einarsrud{2}, Tadej Rojac{1}
{1}Jozef Stefan Institute, Slovenia; {2}Norwegian University of Science and Technology, Norway

Improved Long-Term Reliability of Nb-Doped Lead Zirconate Titanate Films with Graded Doping
Wanlin Zhu{1}, Jung In Yang{1}, Betul Akkopru-Akgun{1}, Ke Wang{1}, Susan Trolier-McKinstry{1}, Charalampos Fragkiadakis{2}, Song Won Ko{2}, Peter Mardilovich{2}
{1}The Pennsylvania State University, United States; {2}Xaar plc, United Kingdom

New Insight Into Defects and Degradation Kinetics in Lead Zirconate Titanate
Daniel Monteiro Diniz Reis{2}, Sven Rzepka{1}
{1}Fraunhofer ENAS, Germany; {2}Robert Bosch GmbH, Germany

Linear and Nonlinear Optical Properties of Hafnium Zirconium Oxide Films
Jon Ihlefeld{3}, Samantha Jaszewski{3}, Shelby Fields{3}, Ting Luk{2}, Sean Smith{2}, Michael Henry{2}, Paul Davids{2}, Costel Constantin{1}
{1}James Madison University, United States; {2}Sandia National Laboratories, United States; {3}University of Virginia, United States

Electromechanical Domain-Assisted 'Roller Coaster' in BaTiO3 Membranes: Domain-Assisted Superelastic Piezoelectricity
Hemaprabha Elangovan{1}, Maya Barzilay{1}, Sahar Seremi{2}, Noy Cohen{1}, Yizhe Jiang{2}, Lane W Martin{2}, Yachin Ivry{1}
{1}Technion Israel Institute of Technology, Israel; {2}University of California, Berkeley, United States

Monday, July 20, 2020
15:30 – 17:30
Fundamentals of Ferroelectrics II
Session Chair: Jing-Feng Li, Tsinghua University

Stress-Induced Metastable Phases and Ferroelastic Switching Mechanisms
Keisuke Yazawa, Edwin García, John Blendell
Purdue University, United States
Unravel the Mystery of A.C. Poling on Relaxor-PT Crystals
Fei Li{3}, Chaorui Qiu{3}, Bo Wang{1}, Nan Zhang{3}, Shujun Zhang{2}, Jinfeng Liu{3}, Tom Shrout{1}, Long-Qing Chen{1}, Zhuo Xu{3}
{1}The Pennsylvania State University, United States; {2}University of Wollongong, Australia; {3}Xi'an Jiaotong University, China

Multi-Step Stochastic Mechanism Model of Field-Driven Polarization Reversal in Rhombohedral Ferroelectrics/Ferroelastics
Yuri Genenko{3}, Ivan Vorotiahin{3}, Jurij Koruza{3}, Ruben Khachaturyany{2}, Anna Grünebohm{2}, Jan Schultheis{1}, John Daniels{4}
{1}Norwegian University of Science and Technology, Norway; {2}Ruhr-Universität Bochum, Germany; {3}TU Darmstadt, Germany; {4}UNSW, Australia

Strain Degradation with Cycling in Fe-Doped BaTiO3 Crystals
Eric Patterson{3}, Peter Finkel{3}, Margo Staruch{3}, Chris Lucas{2}, Paul Thompson{2}, Markys Cain{1}
{1}Electrosciences Ltd., United Kingdom; {2}European Synchrotron Radiation Facility, France; {3}U.S. Naval Research Laboratory, United States

A Hopeless Mess No More: Connecting Structure and Chemistry in Relaxor Ferroelectrics
Abinash Kumar{1}, Jonathon Baker{2}, Preston Bowes{2}, Matthew Cabral{3}, Shujun Zhang{4}, Elizabeth Dickey{2}, Douglas Irving{2}, James Lebeau{1}
{1}Massachusetts Institute of Technology, United States; {2}North Carolina State University, United States; {3}University of Sydney, Australia; {4}University of Wollongong, Australia

Monday, July 20, 2020
15:30 – 17:30
MEMS Oscillators
Session Chair: Jeronimo Segovia-Fernandez, Texas Instruments

An X-Band Oscillator Utilizing Overtone Lithium Niobate MEMS Resonator and 65-nm CMOS
Ali Kourani, Yansong Yang, Songbin Gong
University of Illinois at Urbana-Champaign, United States

Effects of Resonator Volume on the Oscillator Near-Carrier Phase Noise
Parvin Akhkandi, Sina Moradian, Hakhamanesh Mansoorzare, Reza Abdolvand
University of Central Florida, United States

199-MHz Polysilicon Micromechanical Disk Array-Composite Oscillator
Qianyi Xie, Sherwin Afshar, Alper Ozgurluk, Clark Nguyen
UC Berkeley, United States

True Series Resonance Oscillator Using Active Shunt Capacitance Cancellation
Darren Branch, Kurt Wessendorf
Sandia National Laboratories, United States

Noise Evasion Properties of Electrostatic Gap-Closing MEMS Resonators with Pulsed Excitation Waveforms
Jérôme Juillard{1}, Antonio Somma{1}, Alexis Brenes{2}
{1}GEEPS / CentraleSupélec, France; {2}ISEP / LISITE, France
Domain Structure Change by Applying Electric Field in Dominantly In-Plane-Polarized (100)/(001)-Oriented Tetragonal Pb(Zr,Ti)O3 Thin Film
Hiroshi Funakubo{4}, Daichi Ichinose{4}, Tomoya Sato{4}, Takao Shimizu{3}, Yoshitaka Ehara{2}, Osami Sakata{3}, Tomoaki Yamada{1}
{1}Nagoya University, Japan; {2}National Defense Academy, Japan; {3}National Institute for Materials Science (NIMS), Japan; {4}Tokyo Institute of Technology, Japan

The Role of Interfaces in DC Resistance Degradation and Electrical Breakdown of PZT Films
Betul Akkopru-Akgun{1}, Thorsten J.M. Bayer{2}, Kosuke Tsuji{1}, Wanlin Zhu{1}, Clive A. Randall{1}, Michael T. Lanagan{1}, Susan Trolier-McKinstry{1}
{1}Penn State University, United States; {2}TDK Electronics GmbH & Co OG, Austria

Compositional Design of ABO3 Entropy-Stabilized Oxide Thin Films
George Kotsonis, Rui Zu, Venkatraman Gopalan, Jon-Paul Maria
Pennsylvania State University, United States

Investigation of the Growth Mechanism of PZT Films Using Combinatorial Sputtering Method
Mikio Murase, Takeshi Yoshimura, Norifumi Fujimura
Osaka Prefecture University, Japan

Zn1-xMgxO and the Concept of Ferroelectrics Everywhere
Kevin Ferri, John Hayden, Susan Trolier-McKinstry, Venkatraman Gopalan, Jon-Paul Maria
The Pennsylvania State University, United States

Impact of Multi-Path Interference on Optical Two-Way Time-Frequency Transfer
William Swann{1}, Martha Bodine{1}, Jennifer Ellis{1}, Emily Hannah{1}, Laura Sinclair{1}, Nathan Newbury{1}, Jean-Daniel Deschênes{2}
{1}National Institute of Standards and Technology, United States; {2}Octosig Consulting, Canada

Point-to-Point Stabilised Optical Frequency Transfer with Active Optics
Benjamin Dix-Matthews{3}, Sascha Schediwy{3}, David Gozzard{3}, Charles Gravestock{3}, Darlene D’mello{3}, Skevos Karpathakis{3}, Francois-Xavier Esnault{1}, Thomas Leveque{1}, Peter Wolf{2}, Etienne Savalle{2}
{1}CNES, France; {2}Observatoire de Paris, France; {3}University of Western Australia, Australia

Real-Time Free-Running Time Scale Using Remote Master Clock on Fiber-Based Frequency Network
Fangmin Wang, Bo Wang, Hongwei Si, Yufeng Chen, Lijun Wang
Tsinghua University, China
Performance Evaluation on C-Band TWSTFT Network of National Time Service Center
Shuo Ding, Wei Wang, Xuhai Yang, Weichao Li
National Time Service Center, China

A TWSTFT Transmitter Prototype Compatible with SDR Receivers and SATRE Modems
Marco Siccardi{3}, Tung Thanh Thai{1}, Giovanni Daniele Rovera{2}, Ilaria Sesia{1}
{1}Istituto Nazionale di Ricerca Metrologica, Italy; {2}LNE-SYRTE, Observatoire de Paris, France; {3}SKK Electronics, Italy

Monday, July 20, 2020
17:30 – 19:00
Fundamentals
Session Chair: Kyle Webber, FAU

Analysis of Magnetostrictive Constitutive Models
Alescsander Imhof, John Domann
Virginia Tech, United States

Grain Size Impact on Electric Polarization Responses of BaTiO3 Polycrystalline Ceramics
Maryam Taheri, Bryan Zanca, Michelle Dolgos, Steven Bryant, Simon Trudel
University of Calgary, Canada

Thermal Rectification in Thin Film Meta-Lattice Structures: a Computational Study
Devon Eichfeld, Brian Foley, Weinan Chen, Ismaila Dabo
Pennsylvania State University, United States

Thickness Scaling of the Ferroelectric Photovoltaic Effect: the Interface PV vs. the Bulk Mechanism
Amr Abdelsamie, Lu You, Junling Wang
Nanyang Technological University, Singapore

Monday, July 20, 2020
17:30 – 19:00
Materials, Resonators, & Resonator Circuits
Session Chair: Wei-Chang Li, National Taiwan University

Nonlinearity Driven Higher Order Harmonics in CMOS-MEMS Resonators
Kalyani Bhosale, Gayathri Pillai, Sheng-Shian Li
National Tsing Hua University, Taiwan

A Quartz Crystal Plate of Novel Cut with High Thermal Stability at a Lower Turnover Temperature
Qi Huang{1}, Shaoyun Wang{1}, Tingfeng Ma{1}, Ji Wang{1}, Julian Shen{2}, Shi-Yung Pao{2}, Min-Chiang Chao{2}
{1}Ningbo University, China; {2}TXC (Ningbo) Corporation, China

Investigation of Lamb Wave Excitation in Diamond-Based Piezoelectric Layered Structure
Gennady Kvashnin{1}, Boris Sorokin{3}, Sergey Burkov{2}
{1}Technological Institute for Superhard and Novel Carbon Materials, Russia; {2}Siberian Federal University, Russia; {3}Technological Institute for Superhard and Novel Carbon Materials, Russia
Tunable Quality Factor Resonators for Inertial Sensors
Ryan Rudy{2}, Ryan Knight{2}, Jeffrey Pulskamp{2}, Jonathan Puder{1}
{1}General Technical Services, United States; {2}US Army Research Laboratory, United States

A Cascadable Reconfigurable Micro-Electromechanical Resonator Logic Gate
Sally Ahmed, Xuecui Zou, Hossein Fariborzi
KAUST, Saudi Arabia

Sputtered AlN Lateral Bimorph: Process Integration Challenges and Opportunities
Benyamin Davaji, Mamouh Abdelmajeed, Amit Lal, Thomas Pennell, Vince Genova
Cornell University, United States

Motion Enabled Reconfigurable Circuits for Radio Front Ends
Jonathan M. Puder{1}, Jeffry S. Pulskamp{2}
{1}Adelphi, United States; {2}US Army Research Laboratory, United States

Monday, July 20, 2020
17:30 – 19:00
Microwave Frequency Standards & Applications
Session Chair: Francois-Xavier ESNAULT, CNES

Optically Pumped Cold Cesium Beam Atomic Clock Based on Two-Dimensional Magneto-Optical Trap
Weibin Xie, Qing Wang, Xuan He, Xianghui Qi, Xuzong Chen
Peking University, China

Atomic Clock Research for the Space Environment
Zachary Warren, James Camparo, Travis Driskell, Michael Huang, Andrew Hudson, Daniele Monahan, He Wang
The Aerospace Corporation, United States

Progress on Sympathetic Cooling of 113Cd+ by Laser-Cooled 40Ca+ for High-Accuracy Cadmium Ion Frequency Standard
Jize Han, Haoran Qin, Liming Guo, Nongchao Xin, Huaxing Hu, Jianwei Zhang, Lijun Wang
Tsinghua University, China

Measuring Residual Magnetic Field in the Magnetic Shield with Magnetic Resonance Signal Width
Yucheng Yang, Jingbiao Chen, Xiang Peng, Teng Wu, Hong Guo
State Key Laboratory of Advanced Optical Communication Systems and Networks, Department of Electron, China

Progress Toward a Fully MEMS Magneto-Optical Trap
Gabriela Martinez{3}, Kaitlin Moore{1}, James McGilligan{3}, Rodolphe Boudot{2}, John Kitching{1}
{1}National Institute of Standards and Technology, United States; {2}National Institute of Standards and Technology/FEMTO-ST, CNRS, United States; {3}National Institute of Standards and Technology/University of Colorado, Boulder, United States
Computer Simulation of Commercial Optically-Pumped Cesium Beam Tubes Parameters
Weibin Xie, Qing Wang, Xuan He, Nan Chen, Zezheng Xiong, Shengwei Fang, Xianghui Qi, Xuzong Chen
Peking University, China

Research on Utilization Rate of Cesium Atoms in Optically Pumped Cesium Beam Tube
Weibin Xie, Qing Wang, Xuan He, Xianghui Qi, Xuzong Chen
Peking University, China

Advances of Chip-Scale Atomic Clock in Peking University in 2019
Jianye Zhao{1}, Ping Guo{1}, Hongling Meng{2}
{1}Peking University, China; {2}zhongkeqidi Optoelectronic Technology (Guangzhou) Co., Ltd., China

Towards a Raman-Ramsey Clock Based on a Cold Cesium Beam
Chenfei Wu{2}, Xueshu Yan{1}, Jianwei Zhang{2}, Lijun Wang{2}
{1}Beihang University, China; {2}Tsinghua University, China

Micro-Device-Technologies Toward Chip Level Integration of Microwave Atomic Clock System
Yuichiro Yano{1}, Motoaki Hara{1}, Masatoshi Kajita{1}, Shinsuke Hara{1}, Akifumi Kasamatsu{1}, Tetsuya Ito{1}, Hiroyuki Ito{3}, Masaya Toda{2}, Takahito Ono{2}
{1}National Institute of Information and Communications Technology, Japan; {2}Tohoku University, Japan; {3}Tokyo Institute of Technology, Japan

Optical Pumped Cesium Atomic Clock with Multi-Pole Magnet
Tianyu Liu, Duo Pan, Jingbiao Chen
Peking University, China

Comparison with Tai of NTSC-F1
Dandan Liu, Jun Ruan, Sichen Fan, Hui Zhang, Xinliang Wang, Junru Shi, Fan Yang, Yang Bai, Shougang Zhang
National Time Serice Center, China

A High Performance and Miniature Optically Pumped Cesium Beam Frequency Standard
Xuan He, Qing Wang, Weibin Xie, Nan Chen, Zezheng Xiong, Xianghui Qi, Xuzong Chen
Peking University, China

The High Frequency Electrodeless Mercury Isotope Lamp
Xing Chen, Honglei Yang, Peng Fei, Yuan Jiang, Xiaobo Xue, Shengkang Zhang
Beijing Institute of Radio metrology and measurement, China

Investigations in Compact Microwave Atomic Clock Technologies for GNSS-Free Timing Applications
Guilong Huang, Hugh Klein, Martin Knapp, Conor Robinson, Dimitrios Zaouris, Pravin Patel, Laurence Nicholls, Jean Morris, Julian Robinson-Tait, Folly Ayi-Yovo, Soliman Edris, Mohsin Haji, Patrick Gill
Search Results Web Result with Site Links National Physical Laboratory, United Kingdom
**Processing of Ferroelectric Materials**

*Session Chair: Eric Patterson, NRL*

**Influence of Sonochemical Activation on the Formation of BaTiO3 by Solid-State Reaction Between BaCO3 and TiO2**
Seung Hyun Jin{2}, Hae Won Lee{2}, Na Won Kim{2}, Gil-Geun Lee{2}, Young Soo Lim{2}, Woo Hyun Nam{1}
{1}Korea Institute of Ceramic Engineering and Technology, Korea; {2}Pukyong National University, Korea

**Sputter Deposition and Microstructure of Lead-Free Piezoelectric (K,Na)NbO3 Thin Films**
Moaz Waqar{2}, Stephen Pennycook{2}, John Wang{2}, Kui Yao{1}
{1}A STAR (Agency for Science, Technology and Research), Singapore; {2}National University of Singapore, Singapore

**Application of Uniaxial Hot Press for Solid State Crystal Growth of Lead Based Ceramics**
Ashleigh Buck, Andrew Bell
University of Leeds, United Kingdom

**Impact of Sputter Ion Energy on Crystallization and Ferroelectric Behavior of Hafnium Zirconium Oxide Thin Films Deposited by Pulsed DC Sputtering**
Samantha Jaszewski, Shelby Fields, Alejandro Salanova, Jon Ihlefeld
University of Virginia, United States

**3D Substrate for Benchmarking ALD-Deposited Ferroelectric Thin Films**
Alexis Payne{2}, Brendan Hanrahan{3}, Jacob Jones{2}, Nicholas Strnad{1}, Ryan Rudy{3}, Asher Leff{3}
{1}General Technical Services, United States; {2}North Carolina State University, United States; {3}US Army Research Lab, United States

**Optimizing Antiferroelectric-Like Al-HfO2 for Energy Storage**
Alexis Payne{2}, Owen Brewer{3}, Nicholas Strnad{1}, Brendan Hanrahan{4}, Jacob Jones{2}
{1}General Technical Services, United States; {2}North Carolina State University, United States; {3}Rochester Institute of Technology, United States; {4}US Army Research Lab, United States

**Lead-Free Antiferroelectric Materials for Energy Storage**
Jack Leber, Jake Dechiara, Ahmad Safari
Rutgers, The State University of New Jersey, United States

**Intirinsic Nonlinear Permittivity Enhancement Through Curie-Point Control Aimimg at Improving Readout Speed in Ferroelectric Probe Data Storage**
Yoshiomi Hiranaga, Yasuo Cho
Yohoku University, Japan
Dispersion Curves, Mode Couplings and Mode Shapes for Lamb Wave in Piezomagnetic/Piezoelectric Layered Plates
Zinan Zhao{1}, Zhenghua Qian{1}, Yook-Kong Yong{2}
{1}Nanjing University of Aeronautics and Astronautics, China; {2}Rutgers University, United States

Attenuation of Lamb Modes and SH Waves Near Cut-Off Frequencies
Victor Plessky{3}, Julius Koskela{2}, Soumya Yandrapalli{1}
{1}EPFL, Switzerland; {2}GVR Trade SA, Switzerland; {3}GVR Trade SA, Resonant Inc., Switzerland

Temperature Change Due to Deformation of PZT Composite or PVDF Thin Film: Elastocaloric Effect or Secondary Electrocaloric Effect or a Combination of These Factors
Hiroshi Maiwa
Shonan Institute of Technology, Japan

The Thermal Stability of Recoverable Energy Storage Density in Novel Eu-Substituted Lead Free K0.5Bi0.5TiO3 Relaxor Ferroelectric
Krishnarjun Banerjee, Saket Asthana
Indian Institute of Technology Hyderabad, India

Band Gap Tuning by Intercalation of Dipolar Molecules
Noki Lee, Jaichan Lee
sungkyunkwan university, Korea

Surface Molecular Functionalization for on-Demand Ferroelectric Polarization Screening and Stabilization
Irena Spasojevic, Haibing Xie, José Manuel Caicedo, José Santiso, Gustau Catalan, Mónica Lira, Neus Domingo
Catalan Institute of Nanoscience and Nanotechnology (ICN2), Spain

Ferroelectric Capacitor Based Adaptive Differential Equalizer
Dubari Borah, Aarushi Gupta, Thottam Kalkur
University of Colorado Colorado Springs, United States

Induced Ice Nucleation by Polar Materials: the Role of Pyroelectricity and Ions in the Water
David Ehre, Sofia Curland, Leah Javitt, Meir Lahav, Igor Lubomirsky
Weizmann Institute of Science, Israel

Monday, July 20, 2020
19:00 – 20:00
Characterization & Properties
Session Chair: Shujun Zhang, University of Wollongong

Structure-Property Relationships in Modified Na0.5Bi0.5TiO3-BaTiO3 Piezoelectrics
Ryan McQuade{1}, Alicia Manjon-Sanz{1}, Thomas Rowe{2}, Lilibel de la Puente{1}, Sadie Smith{1}, Michelle Dolgos{2}
{1}Oregon State University, United States; {2}University of Calgary, Canada

Effect of Hf:Zr Ratio on Crystallization Temperatures and Phases of Polymorphic (HfxZr1-xO2) Thin Films
Hanan Alexandra Hsain, Younghwan Lee, Gregory Parsons, Jacob Jones
NC State University, United States
Temperature-Dependent Non-Linear Characteristics of Ferroelectric Ceramics for Multicaloric Applications
Ivan Mylnikov{2}, Anton Burovihin{2}, Alexander Semenov{2}, Antonina Dedyk{2}, Yulia Pavlova{2}, Andrei Kholkin{3}, Oleg Pakhomov{1}, Alexander Anokhin{1}
{1}ITMO University, Russia; {2}Saint Petersburg State Electrotechnical University, Russia; {3}University of Aveiro, Portugal

Empirical Interface Energies in Mixed-Phase BiFeO3
Stuart Burns{2}, Daniel Sando{4}, Ralph Bulanadi{3}, Oliver Paull{4}, Christie Lau{4}, Valanoor Nagarajan{4}, Marty Gregg{1}
{1}Queen's University Belfast, United Kingdom; {2}University of Calgary, Canada; {3}University of Geneva, Switzerland; {4}UNSW Sydney, Australia

Ferroelectric Properties of Ba and Mn Doped Bismuth Ferrite Bulk and Nanoparticles
Astita Dubey{1}, Marianela C. Escobar{1}, Vladimir V. Shvartsman{1}, Uroš Prah{2}, Matej Šadl{2}, Hana Uršič{2}, Tadej Rojac{2}, Doru C. Lupascu{1}
{1}Institute of Materials Science, University Duisburg Essen, Germany; {2}Jožef Stefan Institute, Slovenia

Peculiarities of Dipolar Ordering in Mixed Cation Halide Perovskites
Mantas Simenas{3}, Sergejus Balciunas{3}, Sarunas Svirkas{3}, Martynas Kinka{3}, Vytautas Samulionis{3}, Robertas Grigalaitis{3}, Juras Banys{3}, Andrius Garbaras{1}, Anna Gagor{2}, Miroslaw Maczka{2}, Adam Sieradzki{4}
{1}Center for Physical Sciences and Technology, Lithuania; {2}Institute of Low Temperature and Structure Research, Poland; {3}Vilnius University, Lithuania; {4}Wroclaw University of Science and Technology, Poland

High-Temperature Raman Spectroscopy Study of (Bi0.5Na0.5-xKx)TiO3 Ceramics with K Ion Substitution
Sam Yeon Cho, Eun-Young Kim, Sang-Don Bu
Jeonbuk National University, Korea

Polarisation Profiles in VDF-TrFE Copolymer Bilayers and Multilayers: Development During Thermal Depolarization
David Smykalla, Bernd Ploss
University of Applied Sciences Jena, Germany

Impact of Dopants and Film Thickness on the Thermal Conductivity of Indium Phosphide
Carlos Perez{1}, Disha Talreja{1}, Venkatraman Gopalan{1}, Brian Foley{1}, Zerui Liu{2}, Luke Mawst{2}
{1}Pennsylvania State University, United States; {2}University of Wisconsin-Madison, United States

Ultra-Large Electric-Field-Induced Strain in Potassium Sodium Niobate Crystals
Chengpeng Hu{2}, Xiangda Meng{2}, Mao-Hua Zhang{4}, Hao Tian{2}, John Daniels{5}, Peng Tan{2}, Fei Huang{2}, Li Li{1}, Ke Wang{4}, Jing-Feng Li{4}, Qieni Lu{3}, Wenwu Cao{2}, Zhongxiang Zhou{2}
{1}Harbin Engineering University, China; {2}Harbin Institute of Technology, China; {3}Tianjin University, China; {4}Tsinghua University, China; {5}University of New South Wales, Australia
Mechanical Switching of Ferroelectric Domains in PbZr0.2Ti0.8O3 Thin Films
Sergio González-Casal{1}, Xiaofei Bai{1}, David Albertini{1}, Nicolas Baboux{1}, Bertrand Vilquin{1}, Pedro Rojo-Romeo{1}, Solène Brottet{1}, Ingrid Canero Infante{1}, Brice Gautier{1}, Matthieu Bugnet{2}
{1}Institut des Nanotechnologies de Lyon, France; {2}Mateis, France

Nanoscale Domain Transitions in Ultrathin Lead Zirconate Titanate Heterostructures
Vivasha Govinden{2}, Qi Zhang{2}, Nagarajan Valanoor{2}, Sergei Prokhorenko{1}, Yousra Nahas{1}, Laurent Bellaiche{1}
{1}University of Arkansas, United States; {2}University of New South Wales, Australia

An Approach for Mitigating PPP Day-Boundary with Clock Stochastic Model
Weijin Qin, Yulong Ge, Pei Wei, Xuhai Yang
National Service Center, CAS, China

Remote Calibration of Time Scale Difference by Moving a Portable Cesium Clock
Wen-Hung Tseng, Shinn-Yan Lin
Telecommunication Laboratories, Taiwan

Ultrastable Long-Haul Fibre-Optic Radio Frequency Transfer Based on PLL Frequency Mixing
Chenxia Liu, Shujin Zhou, Zhuoze Zhao, Hao Gao, Jianming Shang, Xing Chen, Bin Luo, Song Yu
Beijing University of Posts and Telecommunications, China

Multi-Source Maximum Likelihood Modified Allan Deviation Estimation
James Schatzman
Augustus Aerospace Co, United States

Application of TWSTFT: the Technology of Satellite Orbit Determination by Two-Way Tracking (ODTT)
Xuhai Yang, Shuo Ding, Xuan Cheng, Liang Chen, Wei Wang, Hui Lei, Fen Cao, Weichao Li, Zhigang Li
national time service center, chinese academy of sciences, China
### TECHNICAL PROGRAM – Tuesday, July 21st

<table>
<thead>
<tr>
<th>Time</th>
<th>Event</th>
</tr>
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<tbody>
<tr>
<td>Tuesday, July 21, 2020 9:30 – 11:30</td>
<td><strong>Keynote 2</strong>&lt;br&gt;<strong>Resonant MEMS for Gas Detection Based on the Measurements of Physical Properties of Gas Mixtures</strong>&lt;br&gt;Isabelle Dufour{2}, Luis Iglesias Hernandez{2}, Priyadarshini Shanmugam{3}, Jean-François Michaud{3}, Daniel Alquier{3}, Dominique Cer ton{3}, Maria-Dolores Manrique-Juarez{1}, Thierry Leïchlé{1}, Fabrice Mathieu{1}, Laurent Mazenq{1}, Liviu Nicu{1}&lt;br&gt;{1}CNRS-LAAS, France; {2}Université de Bordeaux, France; {3}Université de Tours, France</td>
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<td><strong>IDT-Based Acoustic Wave Devices Using Ultrathin Lithium Niobate and Lithium Tantalate</strong>&lt;br&gt;Shuji Tanaka, Michio Kadota&lt;br&gt;Tohoku University, Japan</td>
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<td><strong>Piezoelectric MEMS as a Micro-Power Source</strong>&lt;br&gt;Isaku Kanno&lt;br&gt;Kobe University, Japan</td>
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<tr>
<td>Tuesday, July 21, 2020 13:00 – 14:20</td>
<td><strong>Characterization and Properties of Ferroelectrics III</strong>&lt;br&gt;<em>Session Chair: Michelle Dolgos, University of Calgary</em></td>
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<td><strong>Thermal Devices: a New Frontier in Thermal Science</strong>&lt;br&gt;Brian Foley&lt;br&gt;The Pennsylvania State University, United States</td>
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<td><strong>Acoustic Studies of Phase Transition in Lithium Tantalate Crystals</strong>&lt;br&gt;Akhmedzhanov Farkhad{2}, Kurbanov Jakhongir{1}, Nazarov Jamoliddin{3}&lt;br&gt;{1}Institute of Ion-plasma and Laser Technologies, Uzbekistan; {2}Institute of Ion-Plasma and Laser Technologies, Academy of Sciences of Uzbekistan, Uzbekistan; {3}Navoi state mining institute, Uzbekistan</td>
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<td><strong>Porous Piezoelectric Ceramics for Bone Implant Applications</strong>&lt;br&gt;Julia Glaum, Mikalai Zhuk, Freya Andersen, Magnus Rotan, Mari-Ann Einarsrud&lt;br&gt;NTNU, Norway</td>
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<td><strong>Analysis of Polycrystalline (1-x)[Pb(Mg1/3Nb2/3)O3]-xPbTiO3 Domain Wall Scattering in Synchrotron Powder X-Ray Diffraction</strong>&lt;br&gt;Alexandra Henriques{2}, Mojca Otoničar{1}, Jacob Jones{2}&lt;br&gt;{1}Jožef Stefan Institute, United States; {2}North Carolina State University, Slovenia; {2}North Carolina State University, United States</td>
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<td><strong>BNT and Mn:PIN-PMN-PT Single-Sample Characterisation at Operational Temperature Range for High-Power Ultrasonic Applications</strong>&lt;br&gt;Nicola Giuseppe Fenu, Nathan Giles-Donovan, Sandy Cochran&lt;br&gt;University of Glasgow, United Kingdom</td>
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'Designer Defects' Facilitate Superior Polarization Retention in BiFeO₃ Epitaxial Films
{1}Monash University, Australia; {2}UNSW Sydney, Australia

Tuesday, July 21, 2020
13:00 – 14:20
Ferroelectric Materials - Processing
Session Chair: Geoffrey Brennecka, Colorado School of Mines

Pb(Mg1/3Nb2/3)O3–PbTiO3 Thick Films Prepared by Aerosol Deposition Onto Metal and Polymer Substrates
Hana Uršič{2}, Matej Šadl{2}, Uros Prah{2}, Barbara Malič{2}, Udo Eckstein{1}, Neamul Khansur{1}, Kyle Webber{1}
{1}Friedrich-Alexander-Universität Erlangen-Nürnberg, Germany; {2}Jozef Stefan Institute, Slovenia

Guiding the Search for High-Temperature Ferroelectric Perovskites: from Intuition Driven Approaches to Applied Data Sciences
Alp Sehirlioglu
Case Western Reserve University, United States

High Temperature Ferroelectrics Using Ternary Components with Cobalt: Stoichiometry Control
Benjamin Hirt{1}, Alp Sehirlioglu{1}, Benjamin Kowalski{2}
{1}Case Western Reserve University, United States; {2}NASA Glenn Research Center, United States

Tuesday, July 21, 2020
13:00 – 14:20
Frequency Combs
Session Chair: Takuma Nakamura, NIST

Free Running Mode Locked Monolithic Laser Based 8 GHz Ultra Low Noise Microwave Generation Below −180 dBc/Hz Phase Noise
Manoj Kalubovilage{2}, Thomas Schibli{2}, Wataru Kokuyama{1}, Mamoru Endo{3}
{1}National Metrology Institute of Japan (NMIJ), Japan; {2}University of Colorado at Boulder, United States; {3}University of Tokyo, Japan

Low-Phase Noise Microwave Generation Using Self-Stabilized fceo-Free Comb
James Cahill{4}, Tanvir Mahmood{4}, Patrick Sykes{4}, Weimin Zhou{4}, Rafal Wilk{1}, Sebastian Mueller{1}, Felix Rohde{1}, Matthew Cich{2}, Curtis Menyuk{3}
{1}Toptica Photonics, AG, Germany; {2}Toptica Photonics, Inc., United States; {3}University of Maryland Baltimore County, United States; {4}US Army CCDC ARL, United States

An Optical Frequency Synthesizer Referenced to a Yb Optical Clock
Yanyi Jiang, Yuan Yao, Guang Yang, Bo Li, Xiaotong Chen, Yaqin Hao, Yuxin Sun, Hongfu Yu, Longsheng Ma
East China Normal University, China
Microwave Frequencies with $1 \times 10^{-18}$ Instability
Takuma Nakamura{1}, Josue Davila-Rodriguez{1}, Holly Leopardi{1}, Jeff Sherman{1}, Tara Fortier{1}, Xiaojun Xie{2}, Joe Campbell{2}, William McGrew{1}, Xiaogang Zhang{1}, Youssef Hassan{1}, Daniele Nicolodi{1}, Kyle Beloy{1}, Andrew Ludlow{1}, Scott Didda
{1}National Institute of Standards and Technology, United States; {2}University of Virginia, United States

Visible Blue-to-Red 10 GHz Frequency Comb via on-Chip Triple-Sum-Frequency Generation
Ewelina Obrzud{3}, Victor Brasch{3}, Thibault Voumard{1}, Anton Stroganov{2}, Michael Geisselmann{2}, François Wildi{4}, Francesco Pepe{4}, Steve Lecomte{3}, Tobias Herr{1}
{1}Center for Free-Electron Laser Science, Deutsches Elektronen-Synchrotron, Germany; {2}LIGENTEC SA, Switzerland; {3}Swiss Center for Electronics and Microtechnology (CSEM), Switzerland; {4}University of Geneva, Department of Astronomy, Switzerland

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Tuesday, July 21, 2020
13:00 – 14:20

**Frequency Synthesis and Stability of Micromechanical Oscillators**
*Session Chair: Randal Kubena, HRL*

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Low Phase Noise Wine-Glass Oscillator Realized Using Enhanced Support Transducer Design
Hsin-Tung Jen{1}, Gayathri Pillai{3}, Shen-Luan Liu{1}, Sheng-Shian Li{2}
{1}Graduate Institute of Electronics Engineering, National Taiwan University, Taiwan; {2}Inst. of NanoEngineering and MicroSystem, National Tsing Hua Univ., Taiwan; {3}Inst. of NanoEngineering and MicroSystems, National Tsing Hua Univ., Taiwan

Experimental Study on Frequency Stability of Micromechanical Resonators Operating in the Nonlinear Tapping Mode
Chun-Pu Tsai, Jia-Ren Liu, Wei-Chang Li
National Taiwan University, Taiwan

An Analytical Model to Predict Extrinsic Aging in BAW Resonators
Jeronimo Segovia-Fernandez, Ernest Ting-Ta Yen, Javier Rojas, Thu Tran, Mahmud Chowdhury, Peter Smeyts
Texas Instruments Inc., United States

Nonlinear Analysis of Phononic Comb Generation in High-Q Quartz Resonators
Randall Kubena, Walter Wall, Joseph Koehl, Richard Joyce
HRL Laboratories, United States

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Tuesday, July 21, 2020
13:00 – 14:20

**Fundamentals of Ferroelectrics III**
*Session Chair: Barbara Malic, Josef Stefan Institute*

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Experimental Ferroelectric Energy Landscapes: Insights Into the Origin of Negative Capacitance
Michael Hoffmann{1}, Mengcheng Gui{1}, Stefan Slesazeck{1}, Thomas Mikolajick{2}
{1}NaMLab gGmbH, Germany; {2}NaMLab gGmbH/TU Dresden, Germany
Lattice Distortions in Heterovalent-Substituted Lead-Free Relaxors
Marco Deluca{2}, Vignaswaran Veerapandiyan{2}, Jorge Sanz Mateo{2}, Florian Mayer{2}, Maxim Popov{2}, Jürgen Spitaler{2}, Julian Rosalie{3}, Daniel Kiener{3}, Pedro Groszewicz{4}, Giovanna Canu{1}, Vincenzo Buscaglia{1}
{1}CNR-ICMATE, Italy; {2}Materials Center Leoben Forschung GmbH, Austria; {3}Montanuniversitaet Leoben, Austria; {4}University of Cambridge, United Kingdom

Domain Switching in Pb0.99[(Zr0.52Ti0.48)0.98Nb0.02]O3 Thin Films on Various Substrates from 10 K to 296 K
Kathleen Coleman{2}, Smitha Shetty{2}, Wanlin Zhu{2}, Susan Trolier-McKinstry{2}, Brendan Hanrahan{1}
{1}Army Research Laboratory, United States; {2}Pennsylvania State University, United States

Compositional Heterogeneity and its Links to Magnetic Order in the Near-Surface Region of PbFe1/2N1/2O3 Probed with Muons
Nathan Giles-Donovan{4}, Sandy Cochran{4}, Xiaobing Li{2}, Haosu Luo{2}, Adrian Hillier{1}, Adam Berlie{1}, Chris Stock{3}
{1}ISIS Neutron and Muon Source, United Kingdom; {2}Shanghai Institute of Ceramics, Chinese Academy of Sciences, China; {3}University of Edinburgh, United Kingdom; {4}University of Glasgow, United Kingdom

Research on Dielectric and Piezoelectric Properties of Rare Earth Element Doped Pb(Mg1/3Nb2/3)O3-PbTiO3 Ceramics
Yang Li, Marcell Borbely, Andrew Bell
University of Leeds, United Kingdom

Deposition-Induced Tailoring of Ferroelectric Phase Transition Temperature During Aerosol Deposition
Neamul Hayet Khansur, Udo Eckstein, Kyle Webber
Friedrich-Alexander Universität Erlangen-Nürnberg, Germany

Simultaneous Multi-Axis Inertial Sensing with Compact Point Source Atom Interferometry
Azure Hansen{1}, Yun-Jhih Chen{2}, Elizabeth A. Donley{1}, John E. Kitching{1}
{1}National Institute of Standards and Technology, United States; {2}National Institute of Standards and Technology and University of Colorado Boulder, United States

Precision Experiments with Photons, Phonons and Spins and Application to Tests of Fundamental Physics
Catriona Thomson, Graeme Flower, Ben McAllister, Maxim Goryachev, Eugene Ivanov, Michael Tobar
University of Western Australia, Australia

Absolute Rotation Rate Measurement with a Cold Atom Gyroscope at the 10⁻⁹ Rad.S⁻¹ Accuracy Level
Romain Gautier, Matteo Altorio, Leonid Sidorenkov, Arnaud Landragin, Remi Geiger
Systèmes de Référence Temps-Espace (SYRTE), France
### Applications of Ferroelectrics, Piezoelectrics & Related Materials I

**Session Chair:** Marco DeLuca, Materials Center Leoben

<table>
<thead>
<tr>
<th>Title</th>
<th>Authors</th>
</tr>
</thead>
</table>
| Commercial Production of Epitaxial PZT for Piezoelectric MEMS Applications | Ryoma Miyake{2}, Mario Kiuchi{2}, Shinya Yoshida{3}, Shuji Tanaka{3}, Glen Fox{1}  
{1}Fox Materials Consulting, LLC, United States; {2}Sumitomo Precision Products Co., Ltd., Japan;  
{3}Tohoku University, Japan                                                                 |
| Integrated Stress Control in Piezoelectric Adjustable X-Ray Optics   | Nathan Bishop{2}, Susan Trolier-McKinstry{2}, Vladimir Kradinov{1}, Paul Reid{1}  
{1}Harvard-Smithsonian CFA, United States; {2}Penn State University, United States                                                                 |
| Electromechanical Properties of MEMS Piezoelectric Vibration Energy Harvester for Impulse Vibration | Sengsavang Aphayvong{1}, Takeshi Yoshimura{1}, Norifumi Fujimura{1}, Shuichi Murakami{2}, Kensuke Kanda{3}  
{1}Osaka Prefecture University, Japan; {2}Osaka Research Institute of Industrial Science and Technology, Japan; {3}University of Hyogo, Japan |
| Improving Performance of Thin Film PZT-Based PMUT Arrays for Imaging  | Christopher Cheng, Susan Trolier-McKinstry, Ajay Dangi, Sumit Agrawal, Sri-Rajasekhar Kothapalli  
Pennsylvania State University, United States                                                                                      |
| Putting the Pb Back In: Performance of Antiferroelectric, Atomic Layer-Deposited PbHfO3 | Brendan Hanrahan{2}, Alexis Payne{2}, Asher Leff{1}, Nick Strnad{1}  
{1}General Technical Services, United States; {2}U.S. Army Research Laboratory, United States                                                                 |

### Characterization and Properties of Ferroelectrics IV

**Session Chair:** Iaroslav Gaponenko, University of Geneva

<table>
<thead>
<tr>
<th>Title</th>
<th>Authors</th>
</tr>
</thead>
</table>
| Heavy Ion Irradiation Effects on Structural and Ferroelectric Properties of HfO2 Films | Thomas Kämpfe{1}, Tobias Vogel{3}, Ricardo Olivo{1}, Maximilian Lederer{1}, Nico Kaiser{3}, Stefan Petzold{3}, Tarek Ali{1}, David Lehninger{1}, Christina Trautmann{2}, Lambert Alff{3}, Konrad Seidel{1}  
{1}Fraunhofer IPMS, Germany; {2}GSI Darmstadt, Germany; {3}TU Darmstadt, Germany                                                                 |
{1}Argonne National Laboratory, United States; {2}Sandia National Laboratory, United States;  
{3}University of Virginia, United States                                                                                      |
| Study on Polarization Behavior of Multilayer Ceramics Using Various Ferroelectric Materials | Hiroshi Kishi{2}, Takaaki Tsurumi{2}, Takayuki Gotoh{1}, Koichiro Morita{1}, Yoshiki Iwazaki{1}  
{1}Taiyo Yuden, Japan; {2}Tokyo Institute of Technology, Japan                                                                 |
### Piezoelectric Response Driven by Imperfect Charge Screening in Polarization-Inclined Pb(Zr0.35Ti0.65)O3 Nanorods

Tomoaki Yamada\(^1\), Kazuki Okamoto\(^1\), Masahito Yoshino\(^1\), Takanori Nagasaki\(^1\), Osami Sakata\(^2\)

\(^1\)Nagoya University, Japan; \(^2\)National Institute for Materials Science, Japan

### Control of Switching Behavior in the (110) Orientated BFO Film

Yangyang Zhang\(^4\), Yimei Zhu\(^1\), Myung-Geun Han\(^1\), Daniel Sando\(^3\), Nagarajan Valanoor\(^3\), Yueze Tan\(^2\), Long-Qing Chen\(^2\)

\(^1\)Brookhaven National Laboratory, United States; \(^2\)Penn State University, United States; \(^3\)University of New South Wales, Australia; \(^4\)University of New South Wales / Brookhaven National Laboratory, Australia

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<table>
<thead>
<tr>
<th>Date</th>
<th>Time</th>
<th>Session</th>
<th>Chair</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tuesday, July 21, 2020</td>
<td>15:00 – 16:20</td>
<td><strong>Optical &amp; Microwave Oscillators and Phase noise</strong>&lt;br&gt;Session Chair: Magnus Danielson, Net Insight</td>
<td></td>
</tr>
<tr>
<td>Tuesday, July 21, 2020</td>
<td>15:00 – 16:40</td>
<td><strong>Optical Frequency Measurements</strong>&lt;br&gt;Session Chair: Nils Huntemann, PTB</td>
<td></td>
</tr>
</tbody>
</table>

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### Reduced Noise Oscillator

Eugene Ivanov, Michael Tobar
The University of Western Australia, Australia

### Generation of High-Stability Timing Signals from Optical References via Transfer Oscillator Technique

Archita Hati, Marco Pomponio, Nick Nardelli, Esther Baumann, Tara Fortier, Craig Nelson
NIST, United States

### Cross-Spectrum Versus Spectrum Average

Francois Vernotte, Antoine Baudiquez, Enrico Rubiola, Eric Lantz
FEMTO-ST, France

### Nonlinear Filtering of an Optical Pulse Train Using Dissipative Kerr Solitons

Victor Brasch\(^1\), Ewelina Obrzud\(^1\), Steve Lecomte\(^1\), Tobias Herr\(^2\)
\(^1\)CSEM, Switzerland; \(^2\)DESY, Germany

### Effects of Polarization Mode Dispersion on an All Polarization Maintaining Fibers Based Coupled Optoelectronic Oscillator

Alexis Bougaud\(^1\), Aliou Ly\(^2\), Arnaud Fernandez\(^1\), Olivier Llopis\(^1\)
\(^1\)LAAS, France; \(^2\)LaserQuantum, United Kingdom

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### Probing Beyond the Laser Coherence Time in Optical Clock Comparisons

David Hume\(^2\), Ethan Clements\(^2\), May Kim\(^2\), Samuel Brewer\(^1\), Kaifeng Cui\(^2\), William McGrew\(^2\), Yousseff Hassan\(^2\), Daniele Nicolodi\(^2\), Xiaogang Zhang\(^2\), Nicholas Nardelli\(^2\), Tara Fortier\(^2\), Scott Diddams\(^2\), Andrew Ludlow\(^2\), David Leibrandt\(^2\)
\(^1\)Colorado State University, United States; \(^2\)NIST, United States
A Definition the SI Second Based on a Set of Optical Clock Transitions
Jérôme Lodewyck
LNE-SYRTE, Observatoire de Paris, France

Optical Frequency Comparisons Using a Mercury Clock Improved with a 2D Magneto-Optical Trap
{1}Laboratoire de Physique des Lasers, France; {2}LNE-SYRTE, Observatoire de Paris, France; {3}Physikalisch-Technische Budesanstalt, Germany; {4}RENA TER, France; {5}Université Paris 13, France

Nearly Continuous Operation of an Yb Optical Lattice Clock Towards Contribution to the International Atomic Time
Takumi Kobayashi{1}, Daisuke Akamatsu{1}, Kazumoto Hosaka{1}, Yusuke Hisai{2}, Hajime Inaba{1}, Tomonari Suzuyama{1}, Feng-Lei Hong{2}, Masami Yasuda{1}
{1}National Metrology Institute of Japan, Japan; {2}Yokohama National University, Japan

Reversible and Irreversible Electrochemically-Mediated PFM Hysteresis Loop
Yunseok Kim
Sungkyunkwan University (SKKU), Korea

Quadruple Well Ferroelectric Van der Waals Crystals - Ionic Effects and Polarization Switching
Sabine Neumayer
Oak Ridge National Laboratory, United States

Periodic Poling of X-Cut Thin-Film Lithium Niobate: the Route to Submicrometer Periods
Michael Rüsing{1}, Matthias Roeper{1}, Zeeshan Amber{1}, Benjamin Kirbus{1}, Lukas Eng{1}, Jie Zhao{2}, Shayan Mookherjea{2}
{1}TU Dresden, Germany; {2}University of California, San Diego, United States

Selective Measurement of Electrical Behavior of Hydroxyapatite via Piezoresponse Force Microscopy
Youngjoon Han{2}, Jeonjae Ryu{2}, Chungik Oh{2}, Seungbum Hong{2}, Andreas Schiffer{1}
{1}Khalifa University (KU), U.A.E.; {2}Korea Advanced Institute of Science and Technology (KAIST), Korea

Quantification of Nanoscale Electromechanical Responses: Converse Flexoelectricity and the Effect of Schottky Barriers
Neus Domingo
Institut Català de Nanociència i Nanotecnologia, Spain
Stability Demonstration of Micro Mercury Trapped Ion Clock
Thai Hoang, Sang Chung, Thanh Le, John Prestage, Lin Yi, Robert Tjoelker, Nan Yu
Jet Propulsion Laboratory, United States

171Yb+ Microwave Clock for Military and Commercial Applications
Hyunwook Park, Jonathan Tallant, Xianli Zhang, Jay Noble, David Guan, Nakri Dao, Richard Overstreet
Microchip Technology Inc., United States

The Mini-Pop Rb Clock
Michele Gozzelino{1}, Salvatore Micalizio{1}, Claudio Eligio Calosso{1}, Filippo Levi{1}, Aldo Godone{1}, Haixiao Lin{2}
{1}INRIM, Italy; {2}Shanghai Institute of Optics and Fine Mechanics, China

Remote Calibration of Time with NRC-TimeLink™
Marina Gertsvolf, Andre Charbonneau, Rob Douglas
NRC, Canada

Analysis and Compensation of Latencies in NTS-Secured NTP Time Synchronization
Martin Langer{1}, Kai Heine{1}, Rainer Bermbach{1}, Dieter Sibold{2}
{1}Ostfalia University of Applied Sciences, Germany; {2}Physikalisch-Technische Bundesanstalt, Germany

Characterizing GPS Disciplined Oscillators for Distributed Vehicle-to-X Measurement Applications
Julia Bauer{1}, Carsten Andrich{2}, Alexander Ihlow{2}, Niklas Beuster{2}, Giovanni Del Galdo{1}
{1}Fraunhofer Institute for Integrated Circuits IIS, Germany; {2}Institute for Information Technology, Technische Universität Ilmenau, Germany

A Distributed National Time Scale for the UK
Peter Whibberley, John Davis, Krzysztof Szymaniec, Simon Ashford, Kathryn Burrows, Hannah Collingwood, Belinda Eglin, Rob Foot, Richard Hendricks, Elizabeth Laier English, Conway Langham, Setnam Shemar, Leon Lobo, Helen Margolis
NPL, United Kingdom

Synchronization of R-Mode Base Stations
Carsten Rieck{3}, Stefan Gewies{2}, Lars Grundhöfer{2}, Michael Hoppe{1}
{1}Federal Waterways and Shipping Administration WSV, Germany; {2}German Aerospace Center DLR, Germany; {3}RISE Research Institutes of Sweden, Sweden
Modulation Transfer Spectroscopy on Cs D2 Line Exposed to a Dual-Frequency Laser Field
Pengyuan Chang, Duo Pan, Haosen Shang, Tiantian Shi, Jingbiao Chen
Peking University, China

An Er:fiber Femtosecond Optical Frequency Comb for Measurement of the Lithium Transition Frequency
Bingjie Rao, Yanyan Zhang, Lulu Yan, Pan Zhang, Songtao Fan, Wenge Guo, Xiaofei Zhang, Shougang Zhang Zhang, Haifeng Jiang
National Time Service Center, China

Multi-Branch Fiber Frequency Comb for Precision Frequency Measurement of Molecular Transitions
Mingkun Li{2}, Kai Ning{3}, Lei Hou{1}, Songtao Fan{2}, Lulu Yan{2}, Yanyan Zhang{2}, Bingjie Rao{2}, Pan Zhang{2}, Haifeng Jiang{2}
{1}Institute of Photonics and Photon-technology, Northwest University, China; {2}National Time Service Center, Chinese Academy of Sciences, China; {3}School of Astronomy and Space Sciences, University of Chinese Academy of Sciences, China

Optimization of Pumping Light for Cs Four-Level Active Optical Clock
Tiantian Shi, Jianxiang Miao, Duo Pan, Jingbiao Chen
Peking University, China

Novel Technological Approaches for Hollow-Core Photonic Crystal Fibers Based Optical Frequency References
Jan Hrabina, Michal Jelínek, Radim Skoupý, Miroslava Holá, Bretislav Mikel, Martin Čížek, Ondrej Číp, Josef Lazar
Institute of Scientific Instruments, Czech Academy of Sciences, Czech Rep.

Towards Suppression of Light Shifts in Two-Photon Rb Optical Frequency Standard
Joseph Christesen{1}, Zachary Newman{1}, John Kitching{1}, Matthew Hummon{1}, Valera Yudin{2}
{1}National Institute of Standards and Technology, United States; {2}Novosibirsk State University, Russia

Preliminary Stability Budget for Thermal Calcium Beam Clock
Bryan Hemingway, Thomas Akin, Jennifer Taylor, Thomas Swanson, Steven Peil
United States Naval Observatory, United States

The Suppressed Cavity-Pulling Effect in Dual-Wavelength Active Optical Clock Based on Twice Cavity-Locking Technique
Tiantian Shi, Duo Pan, Jingbiao Chen
Peking University, China

The Measurement of Landé G Factor of 3D1 with Cold 88Sr Atoms
Shengnan Zhang, Preetam Ramchurn, Kai Bongs, Yeshpal Singh
University of Birmingham, United Kingdom
A Frequency Comb Perspective on Real-Time Monitoring and Validation of Frequency Comparison Data for Steering Local Time Scales
Jake Paterson, Alissa Silva, Marco Schioppo, Helen Margolis
National Physical Laboratory, United Kingdom

Optical Frequency Standard Based on Ultracold Magnesium Atoms: Current Status and Future Prospects
Maksim Tropnikov{1}, Anatoliy Bonert{1}, Andrey Goncharov{2}, Sergey Kuznetsov{1}, Vladimir Baraulya{1}, Denis Brazhnikov{2}, Oleg Prudnikov{2}, Alexey Taichenachev{2}, Sergey Bagayev{2}
{1}Institute of Laser Physics SB RAS, Russia; {2}Institute of Laser Physics SB RAS, Novosibirsk State University, Russia

Narrowing Laser Linewidth Using Modulation Transfer Spectroscopy
Haosen Shang, Jingbiao Chen
Peking University, China

Widely Tunable Stabilized Quantum Cascade Laser with Traceability to Primary Standards
Dang Bao An Tran{2}, Olivier Lopez{2}, Rosa Santagata{2}, Mathieu Manceau{2}, Anne Cournol{2}, Michel Abgrall{1}, Rodolphe Le Targat{1}, Yann Le Coq{1}, Hector Alvarez-Martinez{1}, Etienne Cantin{1}, Dan Xu{1}, Paul-Eric Pottie{1}, Anne Amy-Klein{2}, Beno
{1}LNE-SYRTE, Observatoire de Paris, Université PSL, CNRS, Sorbonne Université, France; {2}Université Paris 13, France

Development of Transportable and Portable Optical Lattice Clocks on Ytterbium Atoms
Gleb Belotelov, Denis Sutyrin, Sergey Slyusarev
FSUE VNIIFTRI, Russia

Time-Scale Generation Methods Based on an Optical Clock
Artem Gribov, Oleg Berdasov, Denis Sutyrin, Sergey Antropov, Gleb Belotelov, Evgeniya Stelmashenko, Aleksei Kostin, Mikhail Gurov, Anastasia Semenko, Alexander Malimon, Daria Fedorova, Roman Balaev, Sergey Slyusarev
FSUE VNIIFTRI, Russia

Experimental Investigations on Lasers FM and AM Noise
Olivier Llopis{1}, Gilles Bailly{1}, Alexis Bougaud{1}, Arnaud Fernandez{2}
{1}LAAS-CNRS, France; {2}LAAS-CNRS and UPS, France

Digital Control of Residual Amplitude Modulation for Ultra-Stable Optical Cavity
Santerelli Falzon Tetsing Talla, Jacques Millo, Sèverine Denis, Clément Lacroûte, Gwenhael Goavec-Merou, Enrico Rubiola, Yann Kersalé
FEMTO-ST Institute, Université Bourgogne Franche-Comté, CNRS, France

Mise En Pratique of the New Kelvin Using Doppler Broadening Thermometry with a Direct Link to the Primary Frequency Standards
{1}Laboratoire Commun de Métrologie LNE-CNAM, F-93210, La Plaine Saint-Denis, France; {2}Laboratoire de Physique des Lasers, Université Paris 13, CNRS, Villetaneuse, France; {3}LNE-SYRTE, Observatoire de Paris, Université PSL, CNRS, Sorbonne Université, P
A Versatile Optical Atomic Clock Testbed System for the EU Quantum Flagship iqClock Project
Jonathan Jones{2}, Markus Gellesch{2}, Kai Bongs{2}, Yeshpal Singh{2}, Iqclock Consortium{1}
{1}IqClock Consortium, Denmark; {2}University of Birmingham, United Kingdom

Tuesday, July 21, 2020
16:30 – 18:00
Phase Noise, Oscillators, Synthesis and Statistics
Session Chair: Craig Nelson, NIST

Low Phase Noise Frequency Division Using PLL
Andrey Pluteshko
Advantex LLC, Russia

Multipath Parameter Extraction and Correction from Frequency Dependent Amplitude Fading
Archita Hati, Craig Nelson
NIST, United States

FPGA-Based Low-Latency Digital Servo for Optical Physics Experiments
Marco Pomponio, Archita Hati, Craig Nelson
NIST, United States

2.4 GHz Narrow-Band Photodetector for Optical Fiber Radio Frequency Transmission System
Junjie Shi, Yaojun Qiao, Chenxia Liu, Zhuoze Zhao, Shujin Zhou, Jinting Cong, Jianming Shang, Xing Chen, Bin Luo, Song Yu
Beijing University of Posts and Telecommunications, China

Low Phase Noise and Highly Stable Optoelectronic Oscillator by Using Frequency-Multiplying Charge Pump Phase Locked Loop
Huanfa Peng{2}, Naijing Liu{2}, Yankun Li{1}, Xiaopeng Xie{1}, Zhangyuan Chen{1}
{1}Peking University, China; {2}Qian xuesen Laboratory of Space Technology, China

Laser Phase Noise Measurement by Using Offset Optical Phase Locked Loop
Huanfa Peng{2}, Naijing Liu{2}, Qijun Liang{2}, Guangyu Gao{2}, Yankun Li{1}, Xiaopeng Xie{1}, Zhangyuan Chen{1}
{1}Peking University, China; {2}Qian xuesen Laboratory of Space Technology, China

The Cool Oscillator Model with Predicted Performance in Practical Systems with Explanations of Oscillator-Spurs and Injection-Locking Processes
Michael Underhill
Underhill Research Ltd, United Kingdom

Resonator Screening for Low Noise Applications Using a Compact Temperature Controlled Apparatus
Mike Wacker
Microchip Technology, Inc., United States
High Stability Ultra-Miniature Size OCXO Operating Within Wide Temperature Range Using ASIC with Built-in Oven for OCXO
Kenji Irie, Masato Ogawa, Jun-Ichi Arai, Manabu Ito, Toshiyuki Shinotsuka, Manabu Ishikawa, Shun-Ichi Wakamatsu
NIHON DEMPA KOGYO CO., LTD., Japan

Fully Digital QCM Using Twin Quartz Sensor
Takeshi Imaike, Akito Shirai
Nihon University, Japan

A Dual-Ring Breath-Mode MEMS-Based 10.00 MHz GPS-Disciplined Reference Oscillator
Mohammad Islam{1}, Soumyajit Mandal{1}, George Xereas{2}, Vamsy Chodavarapu{3}
{1}Case Western Reserve University, United States; {2}NXTSENS Microsystems Inc., Canada; {3}University of Dayton, United States

Use of Artificial Intelligence in Classification and Monitoring of VHF Signals in a Software Based Instrumentation System
Razvan Ciocan
The Charles Stark Draper Laboratory, Inc, United States

Stochastic Modeling of Short and Long Term Clock Skew
Carsten Andrich, Maximilian Engelhardt, Alexander Ihlow, Giovanni Del Galdo
Technische Universität Ilmenau, Germany

Statistics of Cross-Spectrum Measurements
Antoine Baudiquez, Eric Lantz, Enrico Rubiola, François Vernotte
Femto-ST, France

Tuesday, July 21, 2020
16:30 – 18:00

Sensors & Transducers Posters
Session Chairs: Harris Hall, Air Force Research Lab & Philip Feng, University of Florida

A High-Frequency Thin-Film Piezoelectric-on-Silicon MEMS Oscillator for Mass Sensing Applications
Chien-Hao Weng, Gayathri Pillai, Sheng-Shian Li
National Tsing Hua University, India; National Tsing Hua University, Taiwan

Pyroelectric CMOS Compatible Sensor Element Based on Hafnium Oxide Thin Films
Clemens Mart{1}, Alison Viegas{1}, Wenke Weinreich{1}, Doris Mutschall{2}, Alena Kaiser{2}, Norbert Neumann{2}, Toni Großmann{3}, Karla Hiller{3}, Lukas Eng{4}
{1}Fraunhofer IPMS CNT, Germany; {2}InfraTec GmbH, Germany; {3}Technische Universität Chemnitz, Germany; {4}Technische Universität Dresden, Germany

The Improvement of Spin Self-Sustaining Atomic Magnetometer
Qin Zhao, Boling Fan, Shiguang Wang, Lijun Wang
Tsinghua University, China

Implementation of QCM with Uniform Mass Sensitivity Distribution
Qiao Chen, Xianhe Huang, Wei Pan, Wei Fu
School of Automation Engineering University of Electronic Science and Technology of China, China
Scalar Magnetometer with Large Magnetic Field Dynamic Range
Yudong Ding, Rui Zhang, Yucheng Yang, Zhaoyu Zheng, Teng Wu, Jingbiao Chen, Xiang Peng, Hong Guo
Peking University, China

Improved Electromechanical Transduction for PiezoMUMPS HBAR Impedance Sensors
Jesus Yanez, Eyglis Ledesma, Arantxa Uranga, Nuria Barniol
Universitat Autònoma de Barcelona, Spain

MEMS Resonant Temperature Sensing with Variable Coupling Stiffness and Improved Sensitivity
Ertuğ Şimşek{1}, Kıvanç Azgın{2}
{1}METU MEMS Center, Turkey; {2}Middle East Technical University, Turkey

Hanle Effect in the Metastable State of ⁴He Atoms with Arbitrarily Polarized Light
He Wang, Teng Wu, Wei Xiao, Haidong Wang, Yucheng Yang, Xiang Peng, Hong Guo
Peking University, China

Thin and UltraThin Film Deposition Sensor Developed on Diamond-Based HBAR
Boris Sorokin{3}, Gennady Kvashnin{3}, Nikita Asafiev{2}, Konstantin Kravchuk{3}, Nikolay Luparev{3}, Andrey Sotnikov{1}
{1}Leibniz Institute for Solid State and Materials Research, Germany; {2}Moscow Institute of Physics and Technology, Russia; {3}Technological Institute for Superhard and Novel Carbon Materials, Russia

Tuesday, July 21, 2020
16:30 – 18:00
Timekeeping, Time & Frequency Transfer II
Session Chair: Laura Sinclair, NIST

Field Trial of Stable Radio Frequency Transfer System in 100 km Metropolitan Optical Fiber Link
Chenxia Liu{1}, Shujin Zhou{1}, Zhuoze Zhao{1}, Hao Gao{1}, Jinting Cong{1}, Jianming Shang{1}, Xing Chen{1}, Bin Luo{1}, Song Yu{1}, Hong Guo{2}
{1}Beijing University of Posts and Telecommunications, China; {2}Peking University, China

Measurement of Drift and Jitter of Network Synchronized Distributed Clocks
Carsten Andrich, Maximilian Engelhardt, Alexander Ihlow, Giovanni Del Galdo
Technische Universität Ilmenau, Germany

A 50-km RF-Over-Fiber Link for Very-Long Baseline Interferometry
Thomas Fordell{2}, Anders Wallin{2}, Kalle Hanshjärvi{2}, Joona Eskelinen{1}, Jyri Näränen{1}
{1}Metsähovi Geodetic Research Station, National Land Survey, Finland; {2}National Metrology Institute MIKES, VTT, Finland

Monolithic Interferometer for Accurate Optical Frequency Dissemination
Thomas Jürß, Sebastian Koke, Gesine Grosche
Physikalisch-Technische Bundesanstalt, Germany
On Using UTC/UTCr for GNSS-GNSS Time Offset Monitoring
Petr Bogdanov{2}, Andrei Druzhin{1}, Tatiana Primakina{1}
{1} Russian Institute of Radionavigation and Time, Russia; {2} Russian Unstitute of Radionavigation and Time, Russia

Characterization of GPS Disciplined Oscillators Using a Laboratory GNSS Simulation Testbed
Julia Bauer{1}, Carsten Andrich{2}, Alexander Ihlow{2}, Niklas Beuster{2}, Giovanni Del Galdo{1}
{1} Fraunhofer Institute for Integrated Circuits IIS, Germany; {2} Institute for Information Technology, Technische Universität Ilmenau, Germany

Scientific Data Processing of a Fiber Network for Optical Frequency Transfer: Methods and Studies
Mads Tønnes{2}, Etienne Cantin{2}, Dan Xu{2}, Florian Frank{2}, Olivier Lopez{1}, Anne Amy-Klein{1}, Paul-Éric Pottie{2}
{1} Laboratoire de Physique des Lasers, Université Paris 13, CNRS, France; {2} Observatoire de Paris - Université PSL - CNRS - Sorbonne Université, France

Precise Time and Data Transfer Test Facility Using Optical Fiber Links in S-Band and C-Band
Sarbojeet Bhowmick, Josef Vojtech, Vladimir Smotlacha, Radek Velc, Lada Altmannova, Martin Slapak
CESNET, Czech Rep.

White Rabbit Single Fibre Bidirectional Transmission of Precise Time Transmission Using Unconventional Wave-Lengths
Josef Vojtech, Ondrej Havlis, Sarbojeet Bhowmick, Martin Slapak, Vladimir Smotlacha, Petr Munster, Tomas Horvath, Radek Velc, Jan Kundrat, Lada Altmannova, Rudolf Vohnout, Pavel Skoda
CESNET, Czech Rep.

White Rabbit in the Czech Time and Frequency Transfer Infrastructure
Vladimir Smotlacha, Josef Vojtêch
CESNET, Czech Rep.
Wednesday, July 22, 2020
9:30 – 11:30

Keynote 3

Mercury Ion Frequency Standards and the DSAC Technology Demonstration Mission
Robert Tjoelker, Eric Burt, John Prestage, Angela Dorsey, Todd Ely, Daphna Enzer, Da Kuang, David Murphy, David Robison, Jill Seubert, Rabi Wang
JPL/CIT, United States

Refimeve+ Optical Fiber Network Dissemination on the Academic Network to Around 20 Physics Labs
{1}Laboratoire de Physique des Lasers, France; {2}Laboratoire de Physique des Lasers / Université Paris 13 - CNRS, France; {3}LNE-SYRTE, France; {4}MuQuans, France; {5}RENATER, France

Wednesday, July 22, 2020
13:00 – 15:00

Advanced Material Synthesis & Electromechanical Devices
Session Chairs: Azadeh Ansari, Georgia Institute of Technology & Ryan Rudy, Army Research Labs

Tracing Chemical Heterogeneity Across Scales in Alkali Niobate Based Lead-Free Piezoelectric Ceramics and its Influence on Functional Properties
Barbara Malič, Kristian Radan, Oana Condurache, Andreja Benčan
Jožef Stefan Institute, Slovenia

Epitaxial Growth of ScAlN for Ferroelectric Applications Using Molecular Beam Epitaxy
Matthew Hardy{2}, Brian Downey{2}, Neeraj Nepal{2}, Scott Katzer{2}, David Meyer{2}, Eric Jin{1}, Vikrant Gokhale{1}
{1}NRC Postdoctoral Fellow residing at the US Naval Research Laboratory, United States; {2}US Naval Research Laboratory, United States

Epitaxial Al0.77Sc0.23N SAW and Lamb Wave Resonators
Mingyo Park, Azadeh Ansari
Georgia Institute of Technology, United States

High Coupling Coefficient Resonance Mode in Al0.68Sc0.32N Surface Acoustic Wave Resonator with AlN Buffer Layer on a Silicon Substrate
Zichen Tang, Michael D'Agati, Roy Olsson III
University of Pennsylvania, United States

A 255MHz Intrinsically Switchable Bulk Acoustic Resonator Based on 10nm-Thick Ferroelectric Hafnium Zirconium Oxide
Faysal Hakim, Mayur Ghatge, Glen Walters, Toshikazu Nishida, Roozbeh Tabrizian
University of Florida, United States
A Study of Quality Factor in SAW Resonators for SAW Gyroscope Applications
Ashraf Mahmoud, Tamal Mukherjee, Gianluca Piazza
Carnegie Mellon University, United States

Wednesday, July 22, 2020
13:00 – 15:00
Applications of Ferroelectrics, Piezoelectrics & Related Materials II
Session Chair: Hong Wang, Southern University of Science and Technology

Pyro-Electro-Catalytic Disinfection Using the Pyroelectric Effect in Low Curie Temperature, Lead-Free Ferroelectric Ceramics
Eleanor Roake, Margaret Hopkins, Bethany L. Patenall, Chris Bowen
University of Bath, United Kingdom

Physical Chemistry of Ferroelectric Surfaces: Pyrocatalysis and Ferrocatalysis
Irena Spasojevic{3}, Elzbietha Pach{2}, Kumara Cordero-Edwards{5}, Virginia Pérez-Dieste{1}, Carlos Escudero{1}, Albert Verdaguer{2}, Marivi Fernandez-Serra{4}, Neus Domingo{3}
{1}ALBA Synchrotron Light Source, Spain; {2}ICMAB, Spain; {3}ICN2, Spain; {4}Stony Brook University, United States; {5}Universite de Geneve, Switzerland

Progress and Challenges in the Development of Rohs Compliant Lead-Free Materials: Perspectives of a Company
Franz Schubert, Antje Kynast, Michael Töpfer
PI Ceramic GmbH, Germany

Evidence of Multifunctionality in Novel Gd-Substituted Lead-Free Ferroelectric for Energy Storage Density and Electrocaloric Applications
Goutham Cilaveni, Saket Asthana
Indian Institute of Technology Hyderabad, India

Cold Sintering of PZT Composites for Medical Ultrasound Transducers
Shruti Gupta, Dixiong Wang, Clive Randall, Susan Trollier-McKinstry
Pennsylvania State University, United States

Wednesday, July 22, 2020
13:00 – 15:00
Characterization and Properties of Ferroelectrics V
Session Chair: Roger Whatmore, Imperial College - London

LiMm Analysis of Novel Lead-Free Pyroelectric Materials for IR Array Detectors
Thorsten Schmitz-Kempen{1}, Stefan Tappertzhofen{1}, Sebastian Bette{1}, Stephan Tiedke{1}, Simon Fichtner{3}, Sebastian Bröker{3}, Bernhard Wagner{3}, Markys Cain{2}
{1}aixACCT Systems GmbH, Germany; {2}Electrosciences Ltd, United Kingdom; {3}Kiel University, Germany

AFE-Like Hysteresis Loops for Doped HfO2: Field Induced Phase Change vs. Depolarization Fields
David Spirito{4}, Semen Gorfman{4}, Tony Schenk{1}, Patrick D. Lomenzo{2}, Thomas Mikolajick{3}, Uwe Schroeder{2}
{1}Luxembourg Institute of Science and Technology, Luxembourg; {2}Namlab, Germany; {3}Namlab/TU Dresden, Germany; {4}Tel Aviv University, Israel
Local Structure Quantification of Relaxor Ferroelectrics with Tetragonal Tungsten Bronze Structures
Nicole Creange{1}, Matthew Cabral{1}, Stephen Funni{1}, Elizabeth Dickey{1}, Zijin Yang{2}, Xiao Li Zhu{2}, Ziang Ming Chen{2}
{1}North Carolina State University, United States; {2}Zhejiang University, China

Direct Measurement of the Intrinsic and Extrinsic Contributions to the Dynamic Piezoelectric Response in Ferroelectrics Under High-Power Drive
Mihail Slabki{2}, Kodumudi Venkatarama Lalitha{2}, Stefano Checchia{1}, John Daniels{3}, Jurij Koruza{2}
{1}Lund University, Sweden; {2}Technical University of Darmstadt, Germany; {3}UNSW Sydney, Australia

Local and Average Structure of Barium Zirconate Titanate with Up to 60% Sn(II) Studied with Bayesian Refinements
Rachel Broughton, Shaun O'Donnell, Ching-Chang Chung, Paul Maggard, Jacob Jones
North Carolina State University, United States

Inhomogeneous Ferroelectric Domain Switching and Phase Transitions Near Electrodes and in Dead Zones of Multi-Layer Ceramic Actuators
Jacob Jones{1}, Jianwei Zhao{1}, Stephen Funni{1}, Elizabeth Dickey{1}, Eberhard Hennig{2}, Michael Toepfer{2}, Antje Kynast{2}, Franz Schubert{2}
{1}North Carolina State University, United States; {2}PI Ceramic GmbH, Germany

Wednesday, July 22, 2020
13:00 – 15:00
Fundamentals of Ferroelectrics IV
Session Chair: Zuo-Guang Ye, Simon Fraser University

Band Tuning Using Chemical Modulation at (La,Sr)MnO3 / (Ba,Sr)TiO3 Interface
Antoine Ruyter{1}, Jérôme Wolfman{2}, Béatrice Negulescu{2}, Pascal Andreazza{3}, Cécile Autret{2}, Xavier Wallart{4}
{1}CRISMAT, UMR6508 CNRS ENSI, 6 Boulevard du Maréchal Juin, F-14050 CAEN cedex 4, France; {2}GREMAN, UMR7347 CNRS, Univ. de Tours, Parc de Grandmont, F-37200 Tours, France; {3}ICMN, UMR 7374 CNRS, Univ. d’Orléans, 1b rue de la Férollerie, F-45071 Orléans

Co-Doping Strategies for Controlling Electrical Conductivity of BaTiO3 Ceramics
Gyunghyun Ryu, Elizabeth Dickey
NC State University, United States

Giant Microwave Conductivity in Nominally Insulating Domain Walls in LiNbO3
Thomas Kämpfe{1}, Alexander Haußmann{2}, Lukas M. Eng{2}
{1}Fraunhofer IPMS, Germany; {2}TU Dresden, Germany

Metamaterial-Inspired Design to Broaden the Possibility of Piezoelectric Devices
Jikun Yang, Shuxiang Dong
Peking University, China
Cryogenic Photonic Resonator with 10-17/s Drift
Wei Zhang{2}, Scott Papp{2}, William Milner{1}, Jun Ye{1}
{1}JILA University of Colorado at Boulder, United States; {2}National Institute of Standards and Technology, United States

Frequency Pulling in a Cold Strontium Based Laser with an Unconfined Ensemble Spectral Characteristics in the Superradiant Crossover Regime
Stefan Schäffer, Mikkel Tang, Martin Henriksen, Jan Thomsen
University of Copenhagen, Denmark

Comparing Ultrastable Lasers Below 1×10-16 Fractional Frequency Instability via a 2215 km Long European Optical Fibre Link Network
Marco Schioppo{3}, Jochen Kronjäger{3}, Alissa Silva{3}, Riley Ilieva{3}, Jake Paterson{3}, Charles Baynham{3}, William Bowden{3}, Ian Hill{3}, Richard Hobson{3}, Alvise Vianello{3}, Rachel Godun{3}, Helen Margolis{3}, Anne Amy-Klein{1}, Olivier Lopez{1},
{1}Laboratoire de Physique des Lasers (LPL), Université Paris 13, CNRS, France; {2}LNE-SYRTE, Observatoire de Paris, Université PSL, CNRS, Sorbonne Université, France; {3}National Physical Laboratory (NPL), United Kingdom; {4}Physikalisch-Technische Bunde

Spectral Hole Burning for Ultra-Stable Lasers
Shuo Zhang{1}, Nicolas Galland{2}, Nemanja Lucic{1}, Bess Fang{1}, Signe Seidelin{3}, Yann Le Coq{1}
{1}LNE-SYRTE, Observatoire de Paris, Université PSL, CNRS, Sorbonne Université, France; {2}LNE-SYRTE, Observatoire de Paris, Université Grenoble Alpes and CNRS, Institut Néel, France; {3}Université Grenoble Alpes and CNRS, Institut Néel, Institut Universit

Ultra-Low Noise Lasers for Rb D2 Line Interrogation
Yu-Hung Lai, Anatoliy Savchenkov, Danny Eliyahu, Setareh Ganji, Robert Moss, Skip Williams, Andrey Matsko
OEwaves Inc., United States

MEMS/NEMS for Sensing
Session Chairs: Hanna Cho, Ohio State University & Siddartha Ghosh, MIT Lincoln Labs

Precision Residual Strain Sensor Employing Gap-Dependent Frequency Shift
Alper Oezgur, Clark T.-C. Nguyen
University of California, Berkeley, United States

A Zero Standby Power MEMS Switch-Based Infrared Sensor with Frequency Output
Vageeswar Rajaram, Sungho Kang, Sila Calisgan, Antea Risso, Zhenyun Qian, Matteo Rinaldi
Northeastern University, United States
In-Situ Proton Radiation Sensing Using Comb-Drive MEMS Resonators
Jaesung Lee{2}, Yong Xie{1}, Michael McCurdy{3}, Michael Alles{3}, Philip Feng{2}
{1}Case Western Reserve University, United States; {2}University of Florida, United States; {3}Vanderbilt University, United States

Material Properties Influence on the Nonlinear Tapping Behavior of MEMS Resoswitches
Hsuan-Wei Wang, Chun-Pu Tsai, Wei-Chang Li
National Taiwan University, Taiwan

Photothermal Frequency Response Characterization of Large Deformation Multi-Layer Thin Film Structures
Harris Hall, Sean McDaniel, David Torres, Lavern Starman
Air Force Research Laboratory, United States

Dual-Modality Solar Blind Ultraviolet Detection Using a Beta Gallium Oxide (β-Ga2O3) Transducer
Xu-Qian Zheng{2}, Yong Xie{1}, Jaesung Lee{2}, Philip Feng{2}
{1}Case Western Reserve University, United States; {2}University of Florida, United States

Applications of Ferroelectrics, Piezoelectrics & Related Materials III
Session Chair: Kui Yao, IMRE, A-Star

What Is 5G and How Can Materials Help?
Nathan Orloff
NIST, United States

Antiferroelectric Si:HfO2 for High Energy Storage Using 3D Mim Capacitors
Alison Viegas, Clemens Mart, Malte Czernohorsky
Fraunhofer IPMS, Germany

Tuning Domain Wall Conductance in Lithium Niobate Thin-Films
Thomas Kämpfe{1}, Bo Wang{2}, Alexander Hausmann{3}, Long-Qing Chen{2}, Lukas M. Eng{3}
{1}Fraunhofer IPMS, Germany; {2}Penn State University, United States; {3}TU Dresden, Germany

Lead-Free Piezo-Composite for Ultrasound-Induced Wireless Energy Harvesting on Biomedical Application
Laiming Jiang, Yizhe Sun, Mark S. Humayun, K. Kirk Shung, Qifa Zhou
University of Southern California, United States

Multiferroic Tunnel Junctions Based on Hf0.5Zr0.5O2 Tunnel Barriers
Yingfen Wei{2}, Cynthia Quinteros{2}, Pavan Nukala{2}, Mart Salverda{2}, Beatriz Noheda{2}, Sylvia Matzen{1}, Thomas Maroutian{1}, Guillaume Agnus{1}, Philippe Lecoeur{1}
{1}Université Paris-Saclay, France; {2}University of Groningen, Netherlands

Characterization and Properties of Ferroelectrics VI
Session Chair: Glen Fox, Fox Consulting
Freestanding Complex Oxide Ferroelectrics: Synthesis, Properties and Applications
Saidur Bakaul\(^1\), Liliana Stan\(^1\), Claudy Serrao\(^2\), Sayeef Salahuddin\(^2\)
\(^1\)Argonne National Laboratory, United States; \(^2\)University of California Berkeley, United States

Influence of Oxygen on the Ferroelectric Properties of Sputtered Hafnium Oxide
Fenja Berg, Ulrich Boettger
IWE2, RWTH Aachen University, Germany

Recent Results Regarding the Fundamental Properties of Epitaxial PZT Ferroelectrics
Lucian Pintilie, Georgia Andra Boni, Lucian Dragos Filip, Cristina Chirila, Luminita Hrib, Raluca Negrea, Cosmin Istrate, Lucian Trupina, Iuliana Pasuk, Ioana Pintilie
NIMP, Romania

Surface Pyroelectricity as a New Tool for Characterization Molecular Nanostructures and Surface Reconstruction
David Ehre, Elena Meirzadeh, Meir Lahav, Igor Lubomirsky
Weizmann Institute of Science, Israel

Fatigue Characteristics of Sol-Gel Derived PZT Thin Films on Glass and Silicon Substrates
Naveen Aruchamy, Torsten Granzow, Sebastjan Glinsek, Stephanie Girod
Luxembourg Institute of Science and Technology, Luxembourg

Wednesday, July 22, 2020
15:30 – 17:30
Lead Free Ferroelectrics I
Session Chair: Dou Zhang, Central South University

Influence of Different Niobium Pentoxide Precursors on the Formation of KNN-Based Piezoelectric Ceramics
Hao-Cheng Thong\(^2\), Alexis Payne\(^1\), Jing-Feng Li\(^2\), Jacob Jones\(^1\), Ke Wang\(^2\)
\(^1\)North Carolina State University, United States; \(^2\)Tsinghua University, China

Fabrication of <111>c-oriented (K0.5Na0.5)NbO3 Single Crystal by Solid-State Cryrstal Growth Method
Ichiro Fujii, Shintaro Ueno, Satoshi Wada
University of Yamanashi, Japan

Piezoelectric Thin Films from a Lead-Free (K,Na)NbO3-Based Composite via Pulsed Laser Deposition
Jack Leber\(^2\), Ahmad Safari\(^2\), Takayuki Matsuoka\(^1\), Masato Yamazaki\(^1\)
\(^1\)NGK SPARK PLUG Co., Ltd., Japan; \(^2\)Rutgers, The State University of New Jersey, United States

Thermal-Stable and High-Performance BNT-Based Ferroelectric Ceramics for Capacitor Applications
Xuefan Zhou, Hang Luo, Dou Zhang
Central South University, China

Stress and Dielectric Properties of Lead-Free (Ba,Ca)(Zr,Ti)O3 Thin Films
Runar Dahl-Hansen, Marit Stange, Henrik Ræder, Per Martin Rørvik
SINTEF, Norway
Interfacial Strain Gradients Control Nanoscale Domain Morphology in Epitaxial BiFeO3 Multiferroic Films
Daniel Sando[6], Oliver Paull[6], Mengjiao Han[2], Vivasha Govinden[6], Florian Appert[3], Cécile Carrétero[4], Johanna Fischer[4], Agnès Barthélémy[5], Manuel Bibes[4], Vincent Garcia[4], Stéphane Fusil[4], Brahim Dkhil[1], Jean Juraszek[3], Yinlian Zhu
{1}CentraleSupélec, France; {2}Chinese Academy of Sciences, China; {3}CNRS, GPM, France; {4}CNRS, Thales, France; {5}CNRS, Thals, France; {6}UNSW, Australia

Lithium Niobate and 2D Material Based Devices
Session Chairs: Cristian Cassella, Northeastern University & Alexandre Reinhardt, CEA LETI

X-Cut LiNbO3 Coupled Resonators for Narrow-Band Filtering Applications
Michele Pirro[2], Luca Colombo[2], Giuseppe Michetti[2], Gianluca Piazza[1], Matteo Rinaldi[2]
{1}Carnegie Mellon University, United States; {2}Northeastern University, United States

Zero Power X-Cut LiNbO3 MEMS-Based Radio Frequency Rectifier
Luca Colombo[2], Giuseppe Michetti[2], Michele Pirro[2], Cristian Cassella[2], Gianluca Piazza[1], Matteo Rinaldi[2]
{1}Carnegie Mellon University, United States; {2}Northeastern University, United States

Optimization of a Series-Parallel MEMS Resonators Configuration for Passive Voltage Amplification in Wake-Up Radios
Luca Colombo[2], Giuseppe Michetti[2], Michele Pirro[2], Cristian Cassella[2], Gianluca Piazza[1], Matteo Rinaldi[2]
{1}Carnegie Mellon University, United States; {2}Northeastern University, United States

Frequency and Coupling Factor Scaling of Shear Horizontal SAW Resonators in LNOI Platform
Kuan-Ju Tseng, Ming-Huang Li
National Tsing Hua University, Taiwan

Lithium Niobate Optomechanical Disk Resonators
Renyuan Wang[1], Sunil Bhave[2]
{1}Cornell University, United States; {2}Purdue University, United States

Toward Enhanced Electrical Readout of β-Ga2O3 Nanoelectromechanical Resonators
Xu-Qian Zheng, Jaesung Lee, Philip Feng
University of Florida, United States

Optical Spectroscopy & Applications
Session Chair: Tara Fortier, NIST

Observation of the 1S-3S Two-Photon Transition of Atomic Hydrogen Cooled to 7.8K
Hao Xu[1], Haoyuan Lu[1], Dawei Li[1], Zhong Wang[2], Jianye Zhao[1]
{1}Peking University, China; {2}Peking University/Zhongkeqidi Optoelectronic Technology (Guangzhou) Co., Ltd, China
Characterization of a Static Magnetic Field with Two-Photon Rotational Spectroscopy of Cold Trapped HD⁺
Florin Lucian Constantin
Laboratoire PhLAM, CNRS UMR 8523, France

Hyperfine-Structure Measurement of the 7P1/2 State in 133Cs Based on the Active Optical Clock
Tiantian Shi, Jianxiang Miao, Duo Pan, Jingbiao Chen
Peking University, China

Towards Probing a Variation of Fundamental Constants with Optical Clock Transitions of 127I₂
Florin Lucian Constantin
Laboratoire PhLAM, CNRS UMR 8523, France

Wednesday, July 22, 2020
15:30 – 17:30
Sensor Systems & New Applications
Session Chairs: Laura Popa, Analog Devices & Zhenyun Qian, Northeastern University

Dual Range and High Data-Rate Intrabody Communication Transceiver Based on Piezoelectric Micromachined Ultrasonic Transducers
Flavius Pop, Bernard Herrera, Matteo Rinaldi
Northeastern University, United States

Sina Moradian, Parvin Akhkandi, Hedy Fatemi, Reza Abdolvand
University of central florida, United States

Micromagnetic Sensor Utilizing Single SAW IDT Shunt-Loaded with GMI Wire
Akila Khatun{2}, Florian Bender{2}, Fabien Josse{2}, Arnold K. Mensah-Brown{1}, R. Dyche Anderson{1}, Donnell Washington{1}
{1}Ford Motor Co., United States; {2}Marquette University, United States

Liquid-Phase Contour-Mode Piezo-Silicon Micro-Disc Oscillators for Pico-Scale Gravimetry
Hakhamanesh Mansoorzare, Sarah Shahraini, Reza Abdolvand
University of Central Florida, United States

Sensitivity Enhancement in Resonant Microbolometers with Dual Mode Operation
Onurcan Kaya, Kivanç Azgin
Middle East Technical University, Turkey
### TECHNICAL PROGRAM – Thursday, July 23rd

#### Thursday, July 23, 2020  
8:00 – 9:20

**AlN Based Materials**  
*Session Chair: Geoffrey Brennecka, Colorado School of Mines*

<table>
<thead>
<tr>
<th>Title</th>
<th>Authors</th>
<th>Institutions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nitride Perovskites – a New Frontier for Functional Materials</td>
<td>Kevin Talley{2}, Rachel Sherbondy{2}, Geoff Brennecka{1}, Andriy Zakutayev{2}</td>
<td>{1}Colorado School of Mines, United States; {2}National Renewable Energy Labratory, United States</td>
</tr>
<tr>
<td>Physical Properties of Epitaxial ScAlN</td>
<td>Joseph Casamento, Huili Grace Xing, Debdeep Jena</td>
<td>Cornell University, United States</td>
</tr>
<tr>
<td>Growth Trends in Ferroelectric Al1-xScxN Thin Films</td>
<td>John Hayden, Kevin Ferri, Susan Trolier-McKinstry, Jon-Paul Maria</td>
<td>Pensylvannia State University, United States</td>
</tr>
<tr>
<td>Monolithic Piezoelectric Control of Soliton Microcombs</td>
<td>Junqiu Liu{1}, Erwan Lucas{1}, Arslan Raja{1}, Grigory Lihachev{1}, Rui Wang{1}, J. He{1}, T. Liu{1}, M. H. Anderson{1}, Tobias Kippenberg{1}, Hao Tian{2}, Sunil Bhave{2}</td>
<td>{1}École Polytechnique Fédérale de Lausanne, Switzerland; {2}Purdue University, United States</td>
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<tr>
<td>Stress-Mediated Sc-Doped AlN Transducer with Tunable Ferroelectric Characteristics</td>
<td>Roozbeh Tabrizian</td>
<td>University of Florida, United States</td>
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</table>

#### Thursday, July 23, 2020  
8:00 – 9:20

**Chip Scale References & Techniques**  
*Session Chair: Francois-Xavier ESNault, CNES & Fang Fang, National Institute of Metrology*

<table>
<thead>
<tr>
<th>Title</th>
<th>Authors</th>
<th>Institutions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Multiplexed Alkali Metal Deposition: Wafer-Level Fabrication of Microfabricated Alkali Vapor Cells</td>
<td>Douglas Bopp, Vincent Maurice, John Kitching</td>
<td>NIST, United States</td>
</tr>
<tr>
<td>Toward an on-Chip 1560 nm Wavelength Reference</td>
<td>Matthew Hummon{1}, Douglas Bopp{1}, Zachary Newman{1}, John Kitching{1}, Alexander Yulaev{1}, Daron Westly{1}, Kartik Srinivasan{1}, Vladimir Aksyuk{1}, Joshua Surya{2}, Hong Tang{2}</td>
<td>{1}National Institute of Standards and Technology, United States; {2}Yale University, United States</td>
</tr>
</tbody>
</table>
Chip-Scale Active Optical Clock Scheme
Haosen Shang, Duo Pan, Xiaopeng Xie, Tiantian Shi, Jingbiao Chen
Peking University, China

Microchip Chip Scale Atomic Clock (CSAC) Technical Status, Applications, and Future Plans
Peter Cash, Jonathan Francis, Lichung Ha, Igor Kosvin, Will Krzewick, Paul Machado, Mike Silveira, Matthew Stanczyk, Jon Wright
Microchip Technology Inc., United States

Progress Towards a Compact and Low-Power Miniaturized Rubidium Oscillator (mRO™)
Joseph Gouloumet, Bernard Leuenberger, Christian Schori, Serge Grop, Pascal Rochat
Orolia Switzerland, Switzerland

Thursday, July 23, 2020
8:00 – 9:20
OCXOs
Session Chair: Mike Driscoll, Retired

Effects of Helium Exposure on the Frequency Output of a Space System OCXO
Andrew Hudson{2}, Gebriel Iyanu{2}, He Wang{2}, Martin Bloch{1}, Thomas McClelland{1}
{1}Frequency Electronics, Inc, United States; {2}The Aerospace Corporation, United States

Ultralow Phase Noise 5MHz Crystal Oscillators
St.John Gilbert{2}, Jeremy Everard{2}, Timothy Nankervis{1}
{1}Rolls Royce, United Kingdom; {2}University of York, United Kingdom

A Novel Miniature OCXO Using Hermetically Sealed Ceramic Package
Wan-Lin Hsieh, Erh-Shuo Hsu, Yu-Shun Yen, Sheng-Hsiang Kao, Ying-Che Huang, Min-Ho Wang
TXC Corporation, Taiwan

Design Optimization for High-Volume, Low-Cost 9x7 OCXO
Hoklay Pak, Adam Jarrett
Microchip Technology Inc., United States

Secondary Frequency Versus Temperature Compensation of an OCXO Using a Segmented Polynomial Array
John Esterline{2}, Dewain Stange{1}
{1}Connor Winfield, United States; {2}Esterline Research and Design, United States

Effect of Optical Radiation Pressure in a Quartz Crystal Resonator
Kevin Rosenziveig{1}, Jérémy Bon{3}, Valérie Soumann{1}, Rémo Giust{1}, Philippe Abbé{1}, Nicolas Passilly{1}, Pierre-François Cohadon{2}, Serge Galliou{1}
{1}FEMTO-ST, France; {2}LKB, UPMC-Sorbonne Universités, France; {3}Univ. Paris Diderot, France
Thursday, July 23, 2020
8:00 – 9:20
PFM-2
Session Chair: Nazanin Bassiri-Gharb, Georgia Institute of Technology

Probing Negative Capacitance Using Charge Gradient Microscopy
Joseph Guy{2}, Charlotte Cochard{2}, Ray McQuaid{2}, Amit Kumar{2}, Marty Gregg{2}, Roger Whatmore{1}
{1}Imperial College London, United Kingdom; {2}Queens University Belfast, United Kingdom

Atomic Resolution Studies on Surface Dipoles by Noncontact Scanning Nonlinear Dielectric Microscopy and Potentiometry
Kohei Yamasue, Yasuo Cho
Tohoku University, Japan

Insight Into Ferroelectric Domain Wall Properties via Scanning Probe Microscopy
Jan Seidel
University of New South Wales, Australia

Persistence of Ferroelectricity Close to Unit-Cell Thickness in Structurally Disordered Aurivillius Phases
Lynette Keeney{2}, Michael Schmidt{2}, Louise Colfer{2}, Zineb Saghi{1}
{1}CEA-Leti, France; {2}Tyndall National Institute, University College Cork, Ireland

Compact Transducer for GHz Phononic Circuit on Thin-Film Lithium Niobate on Sapphire
Felix Mayor, Wentao Jiang, Christopher Sarabalis, Timothy McKenna, Jason Herrmann, Jeremy Witmer, Amir Safavi-Naeini
Stanford University, United States

Thursday, July 23, 2020
10:00 – 11:20
Acoustic Transducers & Ultrasonic Sensors
Session Chairs: Harris Hall, Air Force Research Lab & Philip Feng, University of Florida

A Sub-mW/Pixel Zero-Bias CMUT-in-CMOS Receiver Front-End with Tin Electrode
Tzu-Hsuan Hsu, Ming-Huang Li, Anurag A. Zope, Sheng-Shian Li
National Tsing Hua University, Taiwan

Frequency and Acoustic Performance Tunability for a SiN-AlScN Based PMUT Device
Shomnath Bhowmick, Eloi Marigó, Mohanraj Soundara-Pandian
Silterra Malaysia Sdn. Bhd., Malaysia

Piezoelectric Polymer Multilayers from Electrophoretic Deposition for Ultrasonic Transducers
Kui Yao, Weng Heng Liew, Qingqing Ke, Shutong Chen, Chin Yaw Tan
Institute of Materials Research & Engineering, A*STAR, Singapore
µ-Raman Investigations of Periodically-Poled X-Cut Thin-Film Lithium Niobate for Integrated Optics
Sven Reitzig{1}, Michael Rüsing{1}, Benjamin Kirbus{1}, Joshua Gössel{1}, Ekta Singh{1}, Lukas Eng{1}, Jie Zhao{2}, Shayan Mookherjea{2}
{1}Technische Universität Dresden, Germany; {2}University of California, San Diego, United States

Structure and Temperature Induced Phase Transitions in Lead-Free Li- and Ta- Modified Alkaline Niobate Based Piezoceramics Probed by Raman Spectroscopy
Kristian Rada{1}, Uroš Prah{1}, Oana A. Condurache{1}, Mirela Dragan{1}, Barbara Malič{1}, Vignaswaran K. Veerapandiyan{2}, Theresa Gindel{2}, Marco Deluca{2}
{1}Jozef Stefan Institute, Austria; {2}Materials Center Leoben, Austria

Observation of Domain Structure of P(VDF-TrFE) Films Using Direct Piezoelectric Response Microscopy
Takeshi Yoshimura, Izuru Kanagawa, Yuji Matusita, Norifumi Fujimura
Osaka Prefecture University, Japan

Crystal Growth and Ferroelectric Properties of Monoclinic Bi2SiO5 Thin Films
Masanori Kodera{2}, Hiroshi Funakubo{2}, Takao Shimizu{1}
{1}National Institute for Materials Science, Japan; {2}Tokyo Institute of Technology, Japan

Probing the Dynamics of Charged Ferroelectric Domain Walls with the Electron Beam at the Atomic Scale
Michele Conroy{4}, Kalani Moore{4}, Eoghan O’Connell{4}, Clive Downing{3}, Eileen Courtney{4}, Roger Whatmore{1}, Alexei Gruverman{5}, Marty Gregg{2}, Ursel Bangert{4}
{1}Imperial College London, United Kingdom; {2}Queen’s University Belfast, United Kingdom; {3}Trinity College Dublin, Ireland; {4}University of Limerick, Ireland; {5}University of Nebraska Lincoln, United States

Bilateral Interface Control in Ultrathin Ferroelectrics
Nives Strkalj{2}, Chiara Gattinoni{2}, Alexander Vogel{1}, Marco Campanini{1}, Rea Haerdi{2}, Antonella Rossi{3}, Marta D. Rossell{1}, Nicola A. Spaldin{2}, Manfred Fiebig{2}, Morgan Trassin{2}
{1}Empa, Switzerland; {2}ETH Zurich, Switzerland; {3}ETH Zurich and University of Cagliari, Switzerland
Thursday, July 23, 2020
10:00 – 11:20
Optical Links and Clock Comparison
Session Chair: Davide Calonico, INRIM

Intercontinental Optical Clock Comparison by Broadband VLBI
{1}Bureau International des Poids et Mesures, France; {2}Istituto Nazionale di Astrofisica, Italy; {3}Istituto Nazionale di Astrofisica / Istituto Nazionale di Ricerca Metrologica, Italy; {4}Istituto Nazionale di Ricerca Metrologica, Italy; {5}Istituto Na

Repeatability of Fiber-Based Optical Frequency Dissemination Over 1400 km Combining Fiber Brillouin Amplification with a Repeater Laser Station
Sebastian Koke{2}, Alexander Kuhl{2}, Thomas Waterholter{2}, Sebastian M.F. Raupach{2}, Olivier Lopez{3}, Etienne Cantin{3}, Nicolas Quintin{3}, Anne Amy-Klein{3}, Paul-Eric Pottie{1}, Gesine Grosche{2}
{1}Observatoire de Paris, Université PSL, France; {2}Physikalisch-Technische Bundesanstalt, Germany; {3}Université Paris 13, France

Picosecond-Precision Optical Two-Way Time Transfer in Free Space Using Flexible Binary Offset Carrier Modulation
Honglei Yang, Haifeng Wang, Xueyun Wang, Hang Yi, Wenzhe Yang, Hongbo Wang, Shengkang Zhang
Beijing Institute of Radio Metrology and Measurement, China

Polarisation-Optimised Fibre Brillouin Amplifier Module for the Interferometric Fibre Link Between Braunschweig and Strasbourg
Alexander Kuhl, Thomas Waterholter, Sebastian Koke, Gesine Grosche
Physikalisch-Technische Bundesanstalt, Germany

Thursday, July 23, 2020
10:00 – 11:20
Portable Optical Clocks
Session Chair: Jerome Lodewyck, LNE–SYRTE

Updates on the NIST Portable Yb Optical Lattice Clock
Robert Fasano, Wesley Brand, Yun-Jhih Chen, William McGrew, Daniele Nicolodi, Xiaogang Zhang, Youssef Hassan, Kyle Beloy, Richard Fox, Andrew Ludlow
NIST, United States

Clockwork for Transportable Optical Clocks and Rack-Mounted Laser System for Sr Lattice Clocks
Michele Giunta{2}, Marc Fischer{2}, Nikolai Lilienfein{2}, Martin Wolferstetter{2}, Simon Holzberger{2}, Sarah Saint-Jalm{2}, Florian Skopnik{2}, Maurice Lessing{2}, Wolfgang Hänsel{2}, Ronald Holzwarth{1}
{1}Max-Planck-Institut für Quantenoptik, Germany; {2}Menlo Systems GmbH, Germany
An Optical Lattice Clock Testbed System for the iqClock Project Demonstrator
Markus Gellesch, Richard Barron, Jonathan Jones, Alok Singh, Qiushuo Sun, Kai Bongs, Yeshpal Singh
University of Birmingham, United Kingdom

Acetylene Frequency Reference: a 1.5 µm Laser with Hz-Level Frequency Stability
Martin Romme Henriksen, Asbjørn Arvad Jørgensen, Stefan Alaric Schäffer, Jan Westenkær Thomsen
Niels Bohr Institute, University of Copenhagen, Denmark