



Joint Conference of the IEEE International Frequency Control Symposium  
& IEEE International Symposium on Applications of Ferroelectrics

# 2020 SYMPOSIUM PROGRAM

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IEEE ULTRASONICS, FERROELECTRICS,  
AND FREQUENCY CONTROL SOCIETY



# IFCS-ISAF 2020: SCHEDULE OVERVIEW

## July 12-31<sup>st</sup>

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Tutorial & Plenary Presentations available On-Demand

## July 19-31<sup>st</sup>

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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 19<sup>th</sup>

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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

## Monday, July 20<sup>th</sup>

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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 Verotte
	Tutorial Q&A: Tara Fortier

## Tuesday, July 21<sup>st</sup>

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6:00 – 7:00 MDT	Tutorial Q&A: Tony Schenk
	Tutorial Q&A: Claudio Calosso
	Tutorial Q&A: Firooz Aflatouni
7:00 – 8:00 MDT	Live Panel Q&A on Emerging Integrated Ferroelectrics: (Al,Sc)N and HfO <sub>2</sub>
8:00 – 9:00 MDT	WIE: Jody Julien
9:00 – 10:00 MDT	Patron Session: TOPTICA Photonics, Inc.
15:00 – 16:00 MDT	Tutorial Q&A: Robert Lutwak
	Tutorial Q&A: Attila Kanali

## Wednesday, July 22<sup>nd</sup>

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6:00 – 7:00 MDT	Patron Session: aixACCT Systems
7:00 – 7:30 MDT	ISAF and Student Awards Ceremony
7:30 – 8:00 MDT	Plenary Q&A: Andrea Alu
8:00 – 9:00 MDT	Student Event #2
9:00 – 10:00 MDT	Patron Session: SpectraDynamics, Inc.
15:00 – 15:30 MDT	Plenary Q&A: Clive Randall
15:30 – 16:30 MDT	Pub Quiz Social Event Honoring the 100th Anniversary of the Discovery of Ferroelectricity

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## 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 HfO<sub>2</sub>.

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 100<sup>th</sup> 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 Brenneka, Colorado School of Mines

**IFCS Program Chair**

Matteo Rinaldi, Northeastern University

**ISAF Program Chair**

Brady Gibbons, Oregon State University

# PRACTICAL INFORMATION

## **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](mailto:eventconduct@ieee.org).

## IFCS-ISAF 2020: ORGANIZING COMMITTEE

<b>General Co-Chair</b> Dana Weinstein <i>Purdue University</i>		<b>General Co-Chair</b> Geoff Brenneka <i>Colorado School of Mines</i>	
<b>Technical Co-Chair</b> Matteo Rinaldi <i>Northeastern University</i>		<b>Technical Co-Chair</b> Brady Gibbons <i>Oregon State University</i>	

### Finance Co-Chair

Debra Coler  
*OEwaves*

### Finance Co-Chair

Michelle Dolgos  
*University of Calgary*

### PFM Co-Chair

Seungbum Hong  
*Korea Advanced Institute of Science and Technology (KAIST)*

### PFM Co-Chair

Olga Ovchinnikova  
*Oak Ridge National Lab*

### Women In Engineering Chair

Laura Popa  
*Analog Devices*

### Diversity and Inclusion Chair

Julia Glaum  
*Norwegian University of Science and Technology*

### Tutorial Co-Chair

Troy Olsson  
*University of Pennsylvania*

### Tutorial Co-Chair

Eric Patterson  
*Naval Research Lab*

### Publication Co-Chair

Greg Weaver  
*Johns Hopkins APL*

### Publication Co-Chair

Brendan Hanrahan  
*Army Research Lab*

### Exhibit Co-Chair

Craig Nelson  
*NIST*

### Exhibit Co-Chair

Brendan Hanrahan  
*Army Research Lab*



**Award Co-Chair**

James Camparo  
*The Aerospace Corporation*

**Student Representative**

Sarah Shahraini  
*University of Central Florida*

**Social Chair**

Lauren Garten  
*Naval Research Lab*

**Academic Chair**

Azadeh Ansari  
*Georgia Institute of Technology*

**Award Co-Chair**

Ed Gorzkowski  
*US Naval Research Laboratory*

**Student Representative**

Lukas Riemer  
*Ecole Polytechnique Federale de Lausanne*

**Recording Chair**

Kyle Webber  
*Friedrich-Alexander Universitat*

**Conference Management**

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# IFCS 2020 TECHNICAL PROGRAM COMMITTEE

## **Group 1: Materials, Resonators & Resonator Circuits**

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Alexander Reinhardt, CEA-LETI, France  
Amelie Hagelauer, Friedrich-Alexander University, Germany  
Azadeh Ansari, Georgia Institute of Technology, USA  
Bernd W. Neubig, Advanced Crystal Products, USA  
Cristian Cassella, Northeastern University, USA  
Dan Stevens, Consultant, USA  
Dr. Tory Olsson, University of Pennsylvania, USA  
Jeffrey Pulskamp, US Army Research Labs, USA  
Max Zeng-Hui Wang, University of Electronic Science and Technology of China, China  
Randy Kubena, HRL Laboratories, USA  
Reza Abdolvand, University of Central Florida, USA  
Shuji Tanaka, Tohoku University, Japan  
Songbin Gong, University of Illinois, USA  
Tabrizian Roozbeh, University of Florida, USA  
Tanay Gosavi, Intel, USA  
Wei-Chang Li, National Taiwan University, Taiwan  
Yoonkee Kim, US Army CERDEC, USA  
Yook-Kong Yong, Rutgers University, USA

## **Group 2: Oscillators, Synthesizers, Noise, and Circuit Techniques**

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Archita Hati, National Institute of Standards and Technology, USA  
Bichoy Bahr, Kilby Labs, Texas Instruments, USA  
Claudio Calosso, INRiM, Italy  
Craig Nelson, National Institute of Standards and Technology, USA  
Enrico Rubiola, Franche-Comté Electronics Mechanics Thermal Science and Optics – Sciences and Technologies, France  
Jeremy Everard, University of York, England  
Magnus Danielsson, Net Insight, Sweden  
Markus Lutz, Si Time, USA  
Michael Driscoll, Consultant, USA  
Michael Tobar, University of Western Australia, Australia  
Michael Underhill, Underhill Research Limited, UK  
Olivier Llopis, Laboratoire d'Analyse et d'Architecture des Systèmes, France  
Paul P. Sotiriadis, University of Athens, Greece  
Sarah Bedair, US Army Research Labs, USA  
Serge Galliou, Franche-Comté Electronics Mechanics Thermal Science and Optics – Sciences and Technologies, France  
Wan-Thai Hsu, TXC Corporation, Taiwan

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### **Group 3: Microwave Frequency Standards**

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Bruno Pelle, Muquans, France  
David Howe, National Institute of Standards and Technology, USA  
Eric Burt, NASA Jet Propulsion Laboratory, USA  
Fang Fang, Norfolk Iron & Metal Co., USA  
Francois-Xavier, EsnaultCNES, USA  
Gaetano Mileti, Université de Neuchâtel, Switzerland  
John Kitching, National Institute of Standards and Technology, USA  
Liang Liu, Shanghai Institute of Optics and Fine Mechanics, China  
Peter Schwindt, Sandia National Laboratories, USA  
Qinghua Wang, Spectratime, France  
Robert Lutwak, The Defense Advanced Research Projects Agency, USA  
Robert Tjoelker, NASA Jet Propulsion Laboratory, USA  
Salvatore Micalizio, INRiM, Italy  
Scott Crane, U.S. Naval Research Laboratory, USA  
Tom Heavener, National Institute of Standards and Technology, USA  
Tom McClelland, Frequency Electronics Inc., USA  
Tom Swanson, United States Naval Observatory, USA

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### **Group 4: Resonant Sensors and Transducers**

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Ashwin Seshia, University of Cambridge, UK  
Bob Tingley, Draper, USA  
Fabien Josse, Marquette University, US  
Greg Weaver, Johns Hopkins University Applied Physics Laboratory, USA  
Guillermo Villanueva, Ecole Polytechnique Federal de Lausanne, Switzerland  
Hanna Cho, Ohio State University, USA  
Harris Hall, Air Force Research Laboratory, USA  
Laura Popa, Analog Devices, USA  
Laurent Durauffourg, CEA-Leti: Laboratoire d'électronique des technologies de l'information, France  
Leonhard Reindl, Uni Freiburg, Germany  
Mauricio Pereira da Cunha, University of Maine, USA  
Nithin Raghunathan, Purdue University, USA  
Philip Feng, Case Western Reserve University, USA  
Ralf Lucklum, Universität Magdeburg, Germany  
Ruonan Liu, Broadcom Inc., USA  
Sid Ghosh, Massachusetts Institute of Technology Lincoln Laboratories, USA  
Sid Talluri, IT Mumbai, India  
Sunil Bhawe, Purdue University, USA  
Xiyuan Lu, National Institute of Standards and Technology, USA  
Zhenyun Qian, Northeastern University, USA

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### **Group 5: Timekeeping, Time and Frequency Transfer, GNSS and Applications**

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Clivati Cecilia, INRiM, Italy  
Davide Calonico, INRiM, Italy  
Daniele Rovera, OBSPM, France  
Fujieda Miho, National Institute of Information and Communications Technology, Japan  
Gesine Grosche, Physikalisch-Technische Bundesanstalt, Germany  
Guilherme de Andrade Garcia, National Institute of Metrology Standardization and Industrial Quality, Brazil  
Jay Hanssen, United States Naval Observatory, USA  
Marina Gertszvol, National Research Council, Canada  
Pierre Ulrich, OBSPM, France  
Prof. Dr. Daniel Varela Magalhães, University of São Paulo, Brazil  
Shinn-Yan Lin (Calvin), TW, Taiwan  
Stefania Romisch, National Institute of Standards and Technology, USA  
Wolfgang Schaefer, Timetech, Germany

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### **Group 6: Optical Frequency Standards and Applications**

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Dave Leibrandt, National Institute of Standards and Technology, USA  
Marty Boyd, Vector Atomic, USA  
Pierre Dubé, National Research Council Canada, Canada  
Tara Fortier, National Institute of Standards and Technology, USA  
Hua Guan, Wuhan Institute of Physics and Mathematics, China  
David Hume, National Institute of Standards and Technology, USA  
Tetsuya Ido, National Institute of Information and Communications Technology, Japan  
Rodolphe Le Targat, SYRTE, France  
Andrew Ludlow, National Institute of Standards and Technology, USA  
Long-Sheng Ma, East China Normal University, China  
John McFerran, University of West Australia, Australia  
Franklyn Quinlan, National Institute of Standards and Technology, USA  
Masami Yasuda, National Metrology Institute of Japan, Japan  
Lin Yi, NASA Jet Propulsion Laboratory, USA  
Nan Yu, NASA Jet Propulsion Laboratory, USA

# ISAF 2020 TECHNICAL PROGRAM COMMITTEE

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## Group I: Fundamentals of Ferroelectrics and Related Materials

**Chair:** Xiaoli Tan- Iowa State University, USA

**Members:**

Fei Li- Xi'an Jiaotong University, China  
JP Maria- Penn State University, USA  
Hajima Nagata- Tokyo University of Science, Japan  
Takaaki Tsurumi- Tokyo Tech, Japan  
Nagarajan Valanoor- University of New South Wales, Australia  
Zuo-Guang Ye- Simon Fraser University, Canada

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## Group II: Processing of Ferroelectric Crystals, Ceramics, Thick and Thin Films

**Chair:** Alp Sehirlioglu- Case Western University, USA

**Members:**

Michelle Dolgos- University of Calgary, Canada  
Jon Ihlefeld- University of Virginia, USA  
Kazumi Kato- AIST, Japan  
Barbara Malic- Institut Jožef Stefan, Slovenia  
Ahmad Safari- Rutgers University, USA  
Shujun Zhang- University of Wollongong, Australia

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## Group III: Characterization & Properties of Ferroelectrics

**Chair:** John Daniels- University of New South Wales, Australia

**Members:**

Nazanin Bassiri-Gharb- Georgia Tech, USA  
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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## Group IV: Applications of Ferroelectrics, Piezoelectric and Related Materials

**Chair:** Qifa Zhou- University of Southern California, USA

**Members:**

Akira Ando- Murata Corporation, Japan  
Sandy Cochran- University of Glasgow, UK  
Junling Wang- Nanyang Technological University, Singapore  
Do-Kyun Kwon- Korea Aerospace University, South Korea  
Ron Polcawich- DARPA, USA  
Vladimir Shur- Ural Federal University, Russia  
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

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## GOLD PATRONS

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## IFCS 2020 AWARDS

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### **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.*

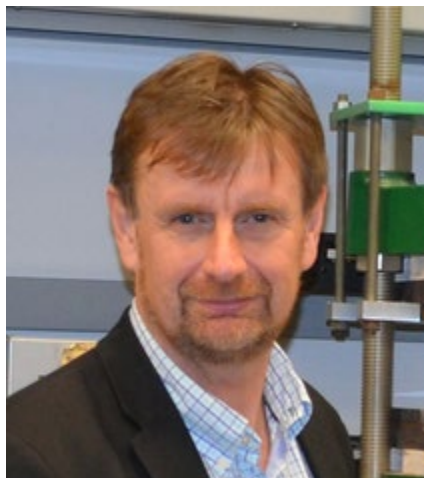
### **IFCS-EFTF 2021 Award Nominations**

Nominations are now open for the 2021 IFCS Awards. Nominations should be sent to the IFCS Awards Chairs at [james.c.camparo@aero.org](mailto:james.c.camparo@aero.org).



## PLENARY SPEAKER

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**Clive A. Randall**

**Professor of Materials Science and Engineering and Director of the Materials Research Institute at The Pennsylvania State University**

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)NbO<sub>3</sub>, BaTiO<sub>3</sub>, and Pb(Zr,Ti)O<sub>3</sub> 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.

## PLENARY SPEAKER

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**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.

## PLENARY SPEAKER

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**Lindy Blackburn**

**Center for Astrophysics | Harvard & Smithsonian**

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 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.

# IEEE WOMEN IN ENGINEERING

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## DESIGNING YOUR PURPOSE DRIVEN CAREER

### PURPOSE DRIVEN CAREER CHOICES – WHAT REALLY MATTERS TO YOU?

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.*

## TUTORIAL SPEAKERS

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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

**HfO<sub>2</sub>-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

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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 Uršič, 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  
Jācīme 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 Trolrier-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

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## **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

Date	Description
July 12-31 <sup>st</sup>	Tutorial & Plenary Presentations available On-Demand
July 19-31 <sup>st</sup>	All presentations available On-Demand

### 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.*

	July 19 <sup>th</sup>		
15:00 – 16:00 MDT	<b>Tutorial Q&amp;A:</b> David Leibrandt	<b>Tutorial Q&amp;A:</b> Amir Safavi-Naeini	<b>Tutorial Q&amp;A:</b> Sergei Kalinin

	July 20 <sup>th</sup>		
6:00 – 7:00 MDT	<b>Tutorial Q&amp;A:</b> Michael Hoffman	<b>Tutorial Q&amp;A:</b> John Domann	
7:00 – 7:30 MDT	<b>Welcome Ceremony and IFCS Awards</b>		
7:30 – 8:00 MDT	<b>Plenary Q&amp;A:</b> Lindy Blackburn		
8:00 – 9:00 MDT	<b>Student Pitch Competition</b>		
15:00 – 16:00 MDT	<b>Tutorial Q&amp;A:</b> Carol Thompson	<b>Tutorial Q&amp;A:</b> Francois Vernotte	<b>Tutorial Q&amp;A:</b> Tara Fortier

	July 21 <sup>st</sup>		
<b>6:00 – 7:00 MDT</b>	<b>Tutorial Q&amp;A:</b> Tony Schenk	<b>Tutorial Q&amp;A:</b> Claudio Calosso	<b>Tutorial Q&amp;A:</b> Firooz Aflatouni
<b>7:00 – 7:30 MDT</b>	<b>Live Panel Q&amp;A on Emerging Integrated Ferroelectrics: (Al,Sc)N and HfO<sub>2</sub></b>		
<b>7:30 – 8:00 MDT</b>			
<b>8:00 – 9:00 MDT</b>	<b>WIE:</b> Jody Julien		
<b>9:00 – 10:00 MDT</b>	<b>Patron Session:</b> TOPTICA Photonics, Inc.		
<b>15:00 – 16:00 MDT</b>		<b>Tutorial Q&amp;A:</b> Robert Lutwak	<b>Tutorial Q&amp;A:</b> Attila Kanali

	July 22 <sup>nd</sup>		
<b>6:00 – 7:00 MDT</b>	<b>Patron Session:</b> aixACCT Systems		
<b>7:00 – 7:30 MDT</b>	<b>ISAF and Student Awards Ceremony</b>		
<b>7:30 – 8:00 MDT</b>	<b>Plenary Q&amp;A:</b> Andrea Alu		
<b>8:00 – 9:00 MDT</b>	<b>Student Event #2</b>		
<b>9:00 – 10:00 MDT</b>	<b>Patron Session:</b> SpectraDynamics, Inc.		
<b>15:00 – 15:30 MDT</b>	<b>Plenary Q&amp;A:</b> Clive A. Randall		
<b>15:30 – 16:30 MDT</b>	<b>Pub Quiz Social Event Honoring the 100th Anniversary of the Discovery of Ferroelectricity</b>		

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.

## TECHNICAL PROGRAM – Monday, July 20<sup>th</sup>

Monday, July 20, 2020

9:30 – 11:30

### Keynote 1

#### **Ferroelectricity in AlScN**

Simon Fichtner<sup>{3}</sup>, Fabian Lofink<sup>{1}</sup>, Bernhard Wagner<sup>{3}</sup>, Tom-Niklas Kreutzer<sup>{2}</sup>  
<sup>{1}</sup>Fraunhofer ISIT, Germany; <sup>{2}</sup>Kiel University, Germany; <sup>{3}</sup>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<sup>{1}</sup>, Guofeng Chen<sup>{2}</sup>, Giuseppe Michetti<sup>{1}</sup>, Michele Pirro<sup>{1}</sup>, Luca Colombo<sup>{1}</sup>, Matteo Rinaldi<sup>{1}</sup>  
<sup>{1}</sup>Northeastern University, United States; <sup>{2}</sup>Skyworks Solutions, Inc., United States

#### **A High- $K_t^2$ Switchable Ferroelectric Al<sub>0.7</sub>Sc<sub>0.3</sub>N Film Bulk Acoustic Resonator**

Jialin Wang<sup>{1}</sup>, Mingyo Park<sup>{1}</sup>, Stefan Mertin<sup>{2}</sup>, Tuomas Pensala<sup>{2}</sup>, Farrokh Ayazi<sup>{1}</sup>, Azadeh Ansari<sup>{1}</sup>  
<sup>{1}</sup>Georgia Institute of Technology, United States; <sup>{2}</sup>VTT Technical Research Centre of Finland, Finland

#### **Al<sub>0.7</sub>Sc<sub>0.3</sub>N 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<sup>{1}</sup>, Ruochen Lu<sup>{1}</sup>, Shibin Zhang<sup>{1}</sup>, Songbin Gong<sup>{1}</sup>, Steven Bowers<sup>{2}</sup>  
<sup>{1}</sup>University of Illinois at Urbana-Champaign, United States; <sup>{2}</sup>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**

Jeffrey Zheng<sup>{3}</sup>, Zichen Tang<sup>{3}</sup>, Michael D'Agati<sup>{3}</sup>, Eric Stach<sup>{3}</sup>, Roy Olsson III<sup>{3}</sup>, Volker Roebisch<sup>{2}</sup>, Martin Kratzer<sup>{2}</sup>, Bernd Heinz<sup>{2}</sup>, Myung-Geun Han<sup>{1}</sup>, Kim Kisslinger<sup>{1}</sup>  
<sup>{1}</sup>Brookhaven National Laboratory, United States; <sup>{2}</sup>Evatec, Switzerland; <sup>{3}</sup>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 BiFeO<sub>3</sub> Nano and Microparticles**

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

## **Development of Instrumented Piezoelectric Meter for Polymer Sheet**

Markys Cain<sup>{2}</sup>, Thorsten Schmitz-Kempen<sup>{1}</sup>, Roland Kessels<sup>{1}</sup>, Jack Barraclough<sup>{3}</sup>, Alex Ward<sup>{3}</sup>  
<sup>{1}</sup>aixACCT Systems GmbH, Germany; <sup>{2}</sup>Electrosciences Ltd, United Kingdom; <sup>{3}</sup>Razorbill Instruments, United Kingdom

## **Influence of Oxygen Content on Structure and Performance of Ferroelectric HfxZr<sub>1-x</sub>O<sub>2</sub> Layers**

Monica Materano<sup>{1}</sup>, Terence Mittmann<sup>{1}</sup>, Patrick Lomenzo<sup>{1}</sup>, Thomas Mikolajick<sup>{2}</sup>, Uwe Schroeder<sup>{1}</sup>  
<sup>{1}</sup>NaMLab gGmbH, Germany; <sup>{2}</sup>NaMLab gGmbH, TU Dresden, Germany

## **Strengthened Relaxor Behavior in (1-x)Pb(Fe<sub>0.5</sub>Nb<sub>0.5</sub>)O<sub>3</sub>-xBiFeO<sub>3</sub> Solid Solutions**

Uroš Prah<sup>{2}</sup>, Mirela Dragomir<sup>{2}</sup>, Tadej Rojac<sup>{2}</sup>, Andreja Benčan<sup>{2}</sup>, Hana Uršič<sup>{2}</sup>, Rachel Broughton<sup>{3}</sup>, Jacob Jones<sup>{3}</sup>, Ching-Chang Chung<sup>{3}</sup>, Rachel Sherbondy<sup>{1}</sup>, Geoff Brennecke<sup>{1}</sup>  
<sup>{1}</sup>Colorado School of Mines, United States; <sup>{2}</sup>Jozef Stefan Institute, Slovenia; <sup>{3}</sup>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

Monday, July 20, 2020

13:00 – 15:00

## **Fundamentals of Ferroelectrics I**

*Session Chair: Brahim Dkhil, CentraleSupélec*

### **In-Situ TEM Observation on the Motion of Phase Boundaries During Antiferroelectric ↔ Ferroelectric Transition**

Binzhi Liu<sup>{2}</sup>, Xiaoli Tan<sup>{2}</sup>, Lin Zhou<sup>{1}</sup>

<sup>{1}</sup>Ames Laboratory, U.S. Department of Energy, United States; <sup>{2}</sup>Iowa State University, United States

### **Orientation Effects in Antiferroelectric Switching of PbZrO<sub>3</sub> Polycrystalline Films**

Cosme Milesi-Brault<sup>{1}</sup>, Stéphanie Girod<sup>{1}</sup>, Sebastjan Glinšek<sup>{1}</sup>, Emmanuel Defay<sup>{1}</sup>, Mael Guennou<sup>{2}</sup>

<sup>{1}</sup>Luxembourg Institute of Science and Technology, Luxembourg; <sup>{2}</sup>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<sup>{3}</sup>, Yuri Genenko<sup>{3}</sup>, Anna Morozovska<sup>{2}</sup>, Eugene Eliseev<sup>{1}</sup>

<sup>{1}</sup>Institute for Problems of Materials Science NAS of Ukraine, Ukraine; <sup>{2}</sup>Institute of Physics NAS of Ukraine, Ukraine; <sup>{3}</sup>Technische Universität Darmstadt, Germany

Monday, July 20, 2020

13:00 – 15:00

## **Hafnium Oxide Based Materials**

*Session Chair: Jon Ihlefeld, University of Virginia*

### **Stabilization of Ferroelectric Phase in Epitaxial HfO<sub>2</sub> Based Films**

Takanori Mimura<sup>{4}</sup>, Yu-Ki Tashiro<sup>{4}</sup>, Hiroshi Funakubo<sup>{4}</sup>, Takao Shimizu<sup>{1}</sup>, Hiroshi Uchida<sup>{2}</sup>, Yoshio Katsuya<sup>{3}</sup>, Osami Sakata<sup>{3}</sup>

<sup>{1}</sup>NIMS, Japan; <sup>{2}</sup>Sophia University, Japan; <sup>{3}</sup>Synchrotron X-ray Station at SPring-8, Japan;

<sup>{4}</sup>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<sub>2</sub> 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 Hf<sub>0.5</sub>Zr<sub>0.5</sub>O<sub>2</sub>**

Younghwan Lee, Hanan Alex Hsain, Gregory Parsons, Jacob Jones  
North Carolina State University, United States

### **Formation Process of Metastable Phases of Al-Doped HfO<sub>2</sub> 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<sup>{1}</sup>, Hayden McGuinness<sup>{1}</sup>, Daniel Soh<sup>{1}</sup>, Justin Christensen<sup>{1}</sup>, Roger Ding<sup>{1}</sup>, Patrick S. Finnegan<sup>{1}</sup>, Gregory Hoth<sup>{1}</sup>, William Kindel<sup>{1}</sup>, Bethany Little<sup>{1}</sup>, Randy Rosenthal<sup>{1}</sup>, Joel R. Wendt<sup>{1}</sup>, Anthony Lentine<sup>{1}</sup>, Matt Eichenfield<sup>{1}</sup>, Michae<sup>{1}</sup>  
<sup>{1}</sup>Sandia National Laboratories, United States; <sup>{2}</sup>University of Oklahoma, United States

### **A Microfabricated Rb Magnetometer for Resource Constrained Environments**

Fathima Niyaz<sup>{3}</sup>, Tom Heavner<sup>{2}</sup>, B. Bryce<sup>{1}</sup>, C. Gardner<sup>{1}</sup>, H. Korth<sup>{1}</sup>, John Kitching<sup>{2}</sup>  
<sup>{1}</sup>Johns Hopkins University Applied Physics Laboratory, United States; <sup>{2}</sup>National Institute of Standards and Technology, United States; <sup>{3}</sup>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**

Michael Hahn, Susan Trolrier-McKinstry, Richard Meyer Jr.  
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<sup>{1}</sup>, William Bowden<sup>{2}</sup>, Richard Hobson<sup>{2}</sup>, Ian Hill<sup>{2}</sup>, Marco Schioppo<sup>{2}</sup>, Alissa Silva<sup>{2}</sup>, Jake Paterson<sup>{2}</sup>, Helen Margolis<sup>{2}</sup>, Ben Sauer<sup>{1}</sup>, Patrick Gill<sup>{2}</sup>  
<sup>{1}</sup>Imperial College London, United Kingdom; <sup>{2}</sup>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 Bhawe{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 BaTiO<sub>3</sub> 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 Khachatryan{2}, Anna Grünebohm{2}, Jan Schultheiß{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 BaTiO<sub>3</sub> Crystals**

Eric Patterson{3}, Peter Finkel{3}, Margo Staruch{3}, Chris Lucas{2}, Paul Thompson{2}, Markys Cain{1}

{1}Electrosiences 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

Monday, July 20, 2020

15:30 – 17:30

### **Thin Films**

*Session Chair: Jon Paul Maria, Penn State*

#### **Domain Structure Change by Applying Electric Field in Dominantly In-Plane-Polarized (100)/(001)-Oriented Tetragonal Pb(Zr,Ti)O<sub>3</sub> Thin Film**

Hiroshi Funakubo<sup>{4}</sup>, Daichi Ichinose<sup>{4}</sup>, Tomoya Sato<sup>{4}</sup>, Takao Shimizu<sup>{3}</sup>, Yoshitaka Ehara<sup>{2}</sup>, Osami Sakata<sup>{3}</sup>, Tomoaki Yamada<sup>{1}</sup>

<sup>{1}</sup>Nagoya University, Japan; <sup>{2}</sup>National Defense Academy, Japan; <sup>{3}</sup>National Institute for Materials Science (NIMS), Japan; <sup>{4}</sup>Tokyo Institute of Technology, Japan

#### **The Role of Interfaces in DC Resistance Degradation and Electrical Breakdown of PZT Films**

Betul Akkopru-Akgun<sup>{1}</sup>, Thorsten J.M. Bayer<sup>{2}</sup>, Kosuke Tsuji<sup>{1}</sup>, Wanlin Zhu<sup>{1}</sup>, Clive A. Randall<sup>{1}</sup>, Michael T. Lanagan<sup>{1}</sup>, Susan Trolier-McKinstry<sup>{1}</sup>

<sup>{1}</sup>Penn State University, United States; <sup>{2}</sup>TDK Electronics GmbH & Co OG, Austria

#### **Compositional Design of ABO<sub>3</sub> 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

#### **Zn<sub>1-x</sub>Mg<sub>x</sub>O and the Concept of Ferroelectrics Everywhere**

Kevin Ferri, John Hayden, Susan Trolier-McKinstry, Venkatraman Gopalan, Jon-Paul Maria

The Pennsylvania State University, United States

Monday, July 20, 2020

15:30 – 17:30

### **Time and Frequency Transfer**

*Session Chair: Sebastian Koke, PTB*

#### **Impact of Multi-Path Interference on Optical Two-Way Time-Frequency Transfer**

William Swann<sup>{1}</sup>, Martha Bodine<sup>{1}</sup>, Jennifer Ellis<sup>{1}</sup>, Emily Hannah<sup>{1}</sup>, Laura Sinclair<sup>{1}</sup>, Nathan Newbury<sup>{1}</sup>, Jean-Daniel Deschênes<sup>{2}</sup>

<sup>{1}</sup>National Institute of Standards and Technology, United States; <sup>{2}</sup>Octosig Consulting, Canada

#### **Point-to-Point Stabilised Optical Frequency Transfer with Active Optics**

Benjamin Dix-Matthews<sup>{3}</sup>, Sascha Schediwy<sup>{3}</sup>, David Gozzard<sup>{3}</sup>, Charles Gravestock<sup>{3}</sup>, Darlene D'mello<sup>{3}</sup>, Skevos Karpathakis<sup>{3}</sup>, Francois-Xavier Esnault<sup>{1}</sup>, Thomas Leveque<sup>{1}</sup>, Peter Wolf<sup>{2}</sup>, Etienne Savalle<sup>{2}</sup>

<sup>{1}</sup>CNES, France; <sup>{2}</sup>Observatoire de Paris, France; <sup>{3}</sup>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**

Alecsander Imhof, John Domann  
Virginia Tech, United States

## **Grain Size Impact on Electric Polarization Responses of BaTiO<sub>3</sub> 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<sup>{2}</sup>, Ryan Knight<sup>{2}</sup>, Jeffrey Pulskamp<sup>{2}</sup>, Jonathan Puder<sup>{1}</sup>  
<sup>{1}</sup>General Technical Services, United States; <sup>{2}</sup>US Army Research Laboratory, United States

### **A Cascadable Reconfigurable Micro-Electromechanical Resonator Logic Gate**

Sally Ahmed, Xuecui Zou, Hossein Fariborzi  
KAUST, Saudi Arabia

### **Sputtered AIN 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<sup>{1}</sup>, Jeffry S. Pulskamp<sup>{2}</sup>  
<sup>{1}</sup>Adelphi, United States; <sup>{2}</sup>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 $^{113}\text{Cd}^+$ by Laser-Cooled $^{40}\text{Ca}^+$ 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<sup>{3}</sup>, Kaitlin Moore<sup>{1}</sup>, James McGilligan<sup>{3}</sup>, Rodolphe Boudot<sup>{2}</sup>, John Kitching<sup>{1}</sup>  
<sup>{1}</sup>National Institute of Standards and Technology, United States; <sup>{2}</sup>National Institute of Standards and Technology/FEMTO-ST, CNRS, United States; <sup>{3}</sup>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 Ido{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 Service 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



Monday, July 20, 2020

17:30 – 19:00

### **Processing of Ferroelectric Materials**

*Session Chair: Eric Patterson, NRL*

#### **Influence of Sonochemical Activation on the Formation of BaTiO<sub>3</sub> by Solid-State Reaction Between BaCO<sub>3</sub> and TiO<sub>2</sub>**

Seung Hyun Jin<sup>{2}</sup>, Hae Won Lee<sup>{2}</sup>, Na Won Kim<sup>{2}</sup>, Gil-Geun Lee<sup>{2}</sup>, Young Soo Lim<sup>{2}</sup>, Woo Hyun Nam<sup>{1}</sup>

<sup>{1}</sup>Korea Institute of Ceramic Engineering and Technology, Korea; <sup>{2}</sup>Pukyong National University, Korea

#### **Sputter Deposition and Microstructure of Lead-Free Piezoelectric (K,Na)NbO<sub>3</sub> Thin Films**

Moaz Waqar<sup>{2}</sup>, Stephen Pennycook<sup>{2}</sup>, John Wang<sup>{2}</sup>, Kui Yao<sup>{1}</sup>

<sup>{1}</sup>A STAR (Agency for Science, Technology and Research), Singapore; <sup>{2}</sup>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<sup>{2}</sup>, Brendan Hanrahan<sup>{3}</sup>, Jacob Jones<sup>{2}</sup>, Nicholas Strnad<sup>{1}</sup>, Ryan Rudy<sup>{3}</sup>, Asher Leff<sup>{3}</sup>

<sup>{1}</sup>General Technical Services, United States; <sup>{2}</sup>North Carolina State University, United States; <sup>{3}</sup>US Army Research Lab, United States

#### **Optimizing Antiferroelectric-Like Al-HfO<sub>2</sub> for Energy Storage**

Alexis Payne<sup>{2}</sup>, Owen Brewer<sup>{3}</sup>, Nicholas Strnad<sup>{1}</sup>, Brendan Hanrahan<sup>{4}</sup>, Jacob Jones<sup>{2}</sup>

<sup>{1}</sup>General Technical Services, United States; <sup>{2}</sup>North Carolina State University, United States; <sup>{3}</sup>Rochester Institute of Technology, United States; <sup>{4}</sup>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

Monday, July 20, 2020

19:00 – 20:00

### **Applications**

*Session Chair: Gunnar Picht, Bosch*

#### **Intrinsic Nonlinear Permittivity Enhancement Through Curie-Point Control Aiming 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<sup>{1}</sup>, Zhenghua Qian<sup>{1}</sup>, Yook-Kong Yong<sup>{2}</sup>

<sup>{1}</sup>Nanjing University of Aeronautics and Astronautics, China; <sup>{2}</sup>Rutgers University, United States

**Attenuation of Lamb Modes and SH Waves Near Cut-Off Frequencies**

Victor Plessky<sup>{3}</sup>, Julius Koskela<sup>{2}</sup>, Soumya Yandrapalli<sup>{1}</sup>

<sup>{1}</sup>EPFL, Switzerland; <sup>{2}</sup>GVR Trade SA, Switzerland; <sup>{3}</sup>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 K<sub>0.5</sub>Bi<sub>0.5</sub>TiO<sub>3</sub> 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 Na<sub>0.5</sub>Bi<sub>0.5</sub>TiO<sub>3</sub>-BaTiO<sub>3</sub> Piezoelectrics**

Ryan McQuade<sup>{1}</sup>, Alicia Manjon-Sanz<sup>{1}</sup>, Thomas Rowe<sup>{2}</sup>, Lilibel de la Puente<sup>{1}</sup>, Sadie Smith<sup>{1}</sup>, Michelle Dolgos<sup>{2}</sup>

<sup>{1}</sup>Oregon State University, United States; <sup>{2}</sup>University of Calgary, Canada

**Effect of Hf:Zr Ratio on Crystallization Temperatures and Phases of Polymorphic (Hf<sub>x</sub>Zr<sub>1-x</sub>O<sub>2</sub>) 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<sup>{2}</sup>, Anton Burovihin<sup>{2}</sup>, Alexander Semenov<sup>{2}</sup>, Antonina Dedyk<sup>{2}</sup>, Yulia Pavlova<sup>{2}</sup>, Andrei Kholkin<sup>{3}</sup>, Oleg Pakhomov<sup>{1}</sup>, Alexander Anokhin<sup>{1}</sup>  
<sup>{1}</sup>ITMO University, Russia; <sup>{2}</sup>Saint Petersburg State Electrotechnical University, Russia;  
<sup>{3}</sup>University of Aveiro, Portugal

### **Empirical Interface Energies in Mixed-Phase BiFeO<sub>3</sub>**

Stuart Burns<sup>{2}</sup>, Daniel Sando<sup>{4}</sup>, Ralph Bulanadi<sup>{3}</sup>, Oliver Paull<sup>{4}</sup>, Christie Lau<sup>{4}</sup>, Valanoor Nagarajan<sup>{4}</sup>, Marty Gregg<sup>{1}</sup>  
<sup>{1}</sup>Queen's University Belfast, United Kingdom; <sup>{2}</sup>University of Calgary, Canada; <sup>{3}</sup>University of Geneva, Switzerland; <sup>{4}</sup>UNSW Sydney, Australia

### **Ferroelectric Properties of Ba and Mn Doped Bismuth Ferrite Bulk and Nanoparticles**

Astita Dubey<sup>{1}</sup>, Marianela C. Escobar<sup>{1}</sup>, Vladimir V. Shvartsman<sup>{1}</sup>, Uroš Prah<sup>{2}</sup>, Matej Šadl<sup>{2}</sup>, Hana Uršič<sup>{2}</sup>, Tadej Rojac<sup>{2}</sup>, Doru C. Lupascu<sup>{1}</sup>  
<sup>{1}</sup>Institute of Materials Science, University Duisburg Essen, Germany; <sup>{2}</sup>Jožef Stefan Institute, Slovenia

### **Peculiarities of Dipolar Ordering in Mixed Cation Halide Perovskites**

Mantas Simenas<sup>{3}</sup>, Sergejus Balciunas<sup>{3}</sup>, Sarunas Svirskas<sup>{3}</sup>, Martynas Kinka<sup>{3}</sup>, Vytautas Samulionis<sup>{3}</sup>, Robertas Grigalaitis<sup>{3}</sup>, Juras Banyys<sup>{3}</sup>, Andrius Garbaras<sup>{1}</sup>, Anna Gagor<sup>{2}</sup>, Mirosław Maczka<sup>{2}</sup>, Adam Sieradzki<sup>{4}</sup>  
<sup>{1}</sup>Center for Physical Sciences and Technology, Lithuania; <sup>{2}</sup>Institute of Low Temperature and Structure Research, Poland; <sup>{3}</sup>Vilnius University, Lithuania; <sup>{4}</sup>Wrocław University of Science and Technology, Poland

### **High-Temperature Raman Spectroscopy Study of (Bi<sub>0.5</sub>Na<sub>0.5-x</sub>K<sub>x</sub>)TiO<sub>3</sub> 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<sup>{1}</sup>, Disha Talreja<sup>{1}</sup>, Venkatraman Gopalan<sup>{1}</sup>, Brian Foley<sup>{1}</sup>, Zerui Liu<sup>{2}</sup>, Luke Mawst<sup>{2}</sup>  
<sup>{1}</sup>Pennsylvania State University, United States; <sup>{2}</sup>University of Wisconsin-Madison, United States

### **Ultra-Large Electric-Field-Induced Strain in Potassium Sodium Niobate Crystals**

Chengpeng Hu<sup>{2}</sup>, Xiangda Meng<sup>{2}</sup>, Mao-Hua Zhang<sup>{4}</sup>, Hao Tian<sup>{2}</sup>, John Daniels<sup>{5}</sup>, Peng Tan<sup>{2}</sup>, Fei Huang<sup>{2}</sup>, Li Li<sup>{1}</sup>, Ke Wang<sup>{4}</sup>, Jing-Feng Li<sup>{4}</sup>, Qieni Lu<sup>{3}</sup>, Wenwu Cao<sup>{2}</sup>, Zhongxiang Zhou<sup>{2}</sup>  
<sup>{1}</sup>Harbin Engineering University, China; <sup>{2}</sup>Harbin Institute of Technology, China; <sup>{3}</sup>Tianjin University, China; <sup>{4}</sup>Tsinghua University, China; <sup>{5}</sup>University of New South Wales, Australia

Monday, July 20, 2020

19:00 – 20:00

**PFM-3**

*Session Chair: Andrei Kholkin, University of Aviero*

**Mechanical Switching of Ferroelectric Domains in PbZr<sub>0.2</sub>Ti<sub>0.8</sub>O<sub>3</sub> Thin Films**

Sergio González-Casal<sup>{1}</sup>, Xiaofei Bai<sup>{1}</sup>, David Albertini<sup>{1}</sup>, Nicolas Baboux<sup>{1}</sup>, Bertrand Vilquin<sup>{1}</sup>, Pedro Rojo-Romeo<sup>{1}</sup>, Solène Brottet<sup>{1}</sup>, Ingrid Canero Infante<sup>{1}</sup>, Brice Gautier<sup>{1}</sup>, Matthieu Bugnet<sup>{2}</sup>

<sup>{1}</sup>Institut des Nanotechnologies de Lyon, France; <sup>{2}</sup>Mateis, France

**Nanoscale Domain Transitions in Ultrathin Lead Zirconate Titanate Heterostructures**

Vivasha Govinden<sup>{2}</sup>, Qi Zhang<sup>{2}</sup>, Nagarajan Valanoor<sup>{2}</sup>, Sergei Prokhorenko<sup>{1}</sup>, Yousra Nahas<sup>{1}</sup>, Laurent Bellaiche<sup>{1}</sup>

<sup>{1}</sup>University of Arkansas, United States; <sup>{2}</sup>University of New South Wales, Australia

Monday, July 20, 2020

19:00 – 20:00

**Timekeeping, Time & Frequency Transfer I**

*Session Chair: Thanh Tung Thai, INRIM*

**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 21<sup>st</sup>

Tuesday, July 21, 2020

9:30 – 11:30

### Keynote 2

#### **Resonant MEMS for Gas Detection Based on the Measurements of Physical Properties of Gas Mixtures**

Isabelle Dufour<sup>{2}</sup>, Luis Iglesias Hernandez<sup>{2}</sup>, Priyadarshini Shanmugam<sup>{3}</sup>, Jean-François Michaud<sup>{3}</sup>, Daniel Alquier<sup>{3}</sup>, Dominique Certon<sup>{3}</sup>, Maria-Dolores Manrique-Juarez<sup>{1}</sup>, Thierry Leïchlé<sup>{1}</sup>, Fabrice Mathieu<sup>{1}</sup>, Laurent Mazenq<sup>{1}</sup>, Liviu Nicu<sup>{1}</sup>  
<sup>{1}</sup>CNRS-LAAS, France; <sup>{2}</sup>Université de Bordeaux, France; <sup>{3}</sup>Université de Tours, France

#### **IDT-Based Acoustic Wave Devices Using Ultrathin Lithium Niobate and Lithium Tantalate**

Shuji Tanaka, Michio Kadota  
Tohoku University, Japan

#### **Piezoelectric MEMS as a Micro-Power Source**

Isaku Kanno  
Kobe University, Japan

Tuesday, July 21, 2020

13:00 – 14:20

### **Characterization and Properties of Ferroelectrics III**

*Session Chair: Michelle Dolgos, University of Calgary*

#### **Thermal Devices: a New Frontier in Thermal Science**

Brian Foley  
The Pennsylvania State University, United States

#### **Acoustic Studies of Phase Transition in Lithium Tantalate Crystals**

Akhmedzhanov Farkhad<sup>{2}</sup>, Kurbanov Jakhongir<sup>{1}</sup>, Nazarov Jamoliddin<sup>{3}</sup>  
<sup>{1}</sup>Institute of Ion-plasma and Laser Technologies, Uzbekistan; <sup>{2}</sup>Institute of Ion-Plasma and Laser Technologies, Academy of Sciences of Uzbekistan, Uzbekistan; <sup>{3}</sup>Navoi state mining institute, Uzbekistan

#### **Porous Piezoelectric Ceramics for Bone Implant Applications**

Julia Glaum, Mikalai Zhuk, Freya Andersen, Magnus Rotan, Mari-Ann Einarsrud  
NTNU, Norway

#### **Analysis of Polycrystalline (1-x)[Pb(Mg<sup>1/3</sup>Nb<sup>2/3</sup>)O<sub>3</sub>]-xPbTiO<sub>3</sub> Domain Wall Scattering in Synchrotron Powder X-Ray Diffraction**

Alexandra Henriques<sup>{2}</sup>, Mojca Otoničar<sup>{1}</sup>, Jacob Jones<sup>{2}</sup>  
<sup>{1}</sup>Jožef Stefan Institute, United States; <sup>{2}</sup>North Carolina State University, Slovenia; <sup>{2}</sup>North Carolina State University, United States

#### **BNT and Mn:PIN-PMN-PT Single-Sample Characterisation at Operational Temperature Range for High-Power Ultrasonic Applications**

Nicola Giuseppe Fenu, Nathan Giles-Donovan, Sandy Cochran  
University of Glasgow, United Kingdom

### **'Designer Defects' Facilitate Superior Polarization Retention in BiFeO<sub>3</sub> Epitaxial Films**

Daniel Sando<sup>{2}</sup>, Dawei Zhang<sup>{2}</sup>, Oliver Paull<sup>{2}</sup>, Xuan Cheng<sup>{1}</sup>, Ralph Bulanadi<sup>{2}</sup>, Pankaj Sharma<sup>{2}</sup>, Fan Ji<sup>{2}</sup>, Vivasha Govinden<sup>{2}</sup>, Matthew Weyland<sup>{1}</sup>, Jan Seidel<sup>{2}</sup>, Valanoor Nagarajan<sup>{2}</sup>

<sup>{1}</sup>Monash University, Australia; <sup>{2}</sup>UNSW Sydney, Australia

Tuesday, July 21, 2020

13:00 – 14:20

#### **Ferroelectric Materials - Processing**

*Session Chair: Geoffrey Brennecke, Colorado School of Mines*

### **Pb(Mg<sub>1/3</sub>Nb<sub>2/3</sub>)O<sub>3</sub>–PbTiO<sub>3</sub> Thick Films Prepared by Aerosol Deposition Onto Metal and Polymer Substrates**

Hana Uršič<sup>{2}</sup>, Matej Šadl<sup>{2}</sup>, Uros Prah<sup>{2}</sup>, Barbara Malič<sup>{2}</sup>, Udo Eckstein<sup>{1}</sup>, Neamul Khansur<sup>{1}</sup>, Kyle Webber<sup>{1}</sup>

<sup>{1}</sup>Friedrich-Alexander-Universität Erlangen-Nürnberg, Germany; <sup>{2}</sup>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<sup>{1}</sup>, Alp Sehirlioglu<sup>{1}</sup>, Benjamin Kowalski<sup>{2}</sup>

<sup>{1}</sup>Case Western Reserve University, United States; <sup>{2}</sup>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<sup>{2}</sup>, Thomas Schibli<sup>{2}</sup>, Wataru Kokuyama<sup>{1}</sup>, Mamoru Endo<sup>{3}</sup>

<sup>{1}</sup>National Metrology Institute of Japan (NMIJ), Japan; <sup>{2}</sup>University of Colorado at Boulder, United States; <sup>{3}</sup>University of Tokyo, Japan

### **Low-Phase Noise Microwave Generation Using Self-Stabilized fceo-Free Comb**

James Cahill<sup>{4}</sup>, Tanvir Mahmood<sup>{4}</sup>, Patrick Sykes<sup>{4}</sup>, Weimin Zhou<sup>{4}</sup>, Rafal Wilk<sup>{1}</sup>, Sebastian Mueller<sup>{1}</sup>, Felix Rohde<sup>{1}</sup>, Matthew Cich<sup>{2}</sup>, Curtis Menyuk<sup>{3}</sup>

<sup>{1}</sup>Toptica Photonics, AG, Germany; <sup>{2}</sup>Toptica Photonics, Inc., United States; <sup>{3}</sup>University of Maryland Baltimore County, United States; <sup>{4}</sup>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 Geiselmann{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

Tuesday, July 21, 2020

13:00 – 14:20

### **Frequency Synthesis and Stability of Micromechanical Oscillators**

*Session Chair: Randal Kubena, HRL*

### **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 Smeys  
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

Tuesday, July 21, 2020

13:00 – 14:20

### **Fundamentals of Ferroelectrics III**

*Session Chair: Barbara Malic, Josef Stefan Institute*

### **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 $\text{Pb}_{0.99}[(\text{Zr}_{0.52}\text{Ti}_{0.48})_{0.98}\text{Nb}_{0.02}]\text{O}_3$ 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 $\text{PbFe}_{1/2}\text{Ni}_{1/2}\text{O}_3$ 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 $\text{Pb}(\text{Mg}_{1/3}\text{Nb}_{2/3})\text{O}_3$ - $\text{PbTiO}_3$ 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

Tuesday, July 21, 2020

13:00 – 14:20

**Time Scales & Science**

*Session Chair: Scott Crane, NRL*

### **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 $10^{-9}$ $\text{Rad.S}^{-1}$ Accuracy Level**

Romain Gautier, Matteo Altorio, Leonid Sidorenkov, Arnaud Landragin, Remi Geiger

Systèmes de Référence Temps-Espace (SYRTE), France



Tuesday, July 21, 2020

15:00 – 16:20

## **Applications of Ferroelectrics, Piezoelectrics & Related Materials I**

*Session Chair: Marco Deluca, Materials Center Leoben*

### **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 PbHfO<sub>3</sub>**

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

Tuesday, July 21, 2020

15:00 – 16:20

## **Characterization and Properties of Ferroelectrics IV**

*Session Chair: Iaroslav Gaponenko, University of Geneva*

### **Heavy Ion Irradiation Effects on Structural and Ferroelectric Properties of HfO<sub>2</sub> 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

### **Phase Exchange Driven Wake-Up and Fatigue in Ferroelectric Hafnium Zirconium Oxide Films**

Shelby Fields{3}, Samantha Jaszewski{3}, Ian Brummel{3}, Alejandro Salanova{3}, Jon Ihlefeld{3},  
Sean Smith{2}, Giovanni Esteves{2}, Steve Wolfley{2}, Michael Henry{2}, Paul Davids{2}, Philip  
Ryan{1}  
{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(Zr<sub>0.35</sub>Ti<sub>0.65</sub>)O<sub>3</sub> 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

Tuesday, July 21, 2020

15:00 – 16:20

### **Optical & Microwave Oscillators and Phase noise**

*Session Chair: Magnus Danielson, Net Insight*

## **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

Tuesday, July 21, 2020

15:00 – 16:40

### **Optical Frequency Measurements**

*Session Chair: Nils Huntemann, PTB*

## **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 Leibbrandt{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**

Manuel Andia<sup>{2}</sup>, Changlei Guo<sup>{2}</sup>, V. Cambier<sup>{2}</sup>, J. Calvert<sup>{2}</sup>, L. de Sarlo<sup>{2}</sup>, Sébastien Bize<sup>{2}</sup>, E. Cantin<sup>{2}</sup>, D. Xu<sup>{2}</sup>, M. Tonnes<sup>{2}</sup>, H. A. Martínez<sup>{2}</sup>, C. Ø. Bærentsen<sup>{2}</sup>, Rodolphe Le Targat<sup>{2}</sup>, J. Lodewyck<sup>{2}</sup>, Paul-Eric Pottie<sup>{2}</sup>, Nicolas Quintin<sup>{4}</sup>,  
<sup>{1}</sup>Laboratoire de Physique des Lasers, France; <sup>{2}</sup>LNE-SYRTE, Observatoire de Paris, France;  
<sup>{3}</sup>Physikalisch-Technische Bundesanstalt, Germany; <sup>{4}</sup>RENATER, France; <sup>{5}</sup>Université Paris 13, France

## **Nearly Continuous Operation of an Yb Optical Lattice Clock Towards Contribution to the International Atomic Time**

Takumi Kobayashi<sup>{1}</sup>, Daisuke Akamatsu<sup>{1}</sup>, Kazumoto Hosaka<sup>{1}</sup>, Yusuke Hisai<sup>{2}</sup>, Hajime Inaba<sup>{1}</sup>, Tomonari Suzuyama<sup>{1}</sup>, Feng-Lei Hong<sup>{2}</sup>, Masami Yasuda<sup>{1}</sup>  
<sup>{1}</sup>National Metrology Institute of Japan, Japan; <sup>{2}</sup>Yokohama National University, Japan

Tuesday, July 21, 2020

15:00 – 16:40

**PFM-1**

*Session Chair: Nagarajan Valanoor, UNSW*

## **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<sup>{1}</sup>, Matthias Roeper<sup>{1}</sup>, Zeeshan Amber<sup>{1}</sup>, Benjamin Kirbus<sup>{1}</sup>, Lukas Eng<sup>{1}</sup>, Jie Zhao<sup>{2}</sup>, Shayan Mookherjee<sup>{2}</sup>

<sup>{1}</sup>TU Dresden, Germany; <sup>{2}</sup>University of California, San Diego, United States

## **Selective Measurement of Electrical Behavior of Hydroxyapatite via Piezoresponse Force Microscopy**

Youngjoon Han<sup>{2}</sup>, Jeonjae Ryu<sup>{2}</sup>, Chungik Oh<sup>{2}</sup>, Seungbum Hong<sup>{2}</sup>, Andreas Schiffer<sup>{1}</sup>

<sup>{1}</sup>Khalifa University (KU), U.A.E.; <sup>{2}</sup>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

Tuesday, July 21, 2020

15:00 – 16:20

### **Space and Compact Clocks**

*Session Chair: Francois-Xavier ESNAULT, CNES*

#### **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<sup>{1}</sup>, Salvatore Micalizio<sup>{1}</sup>, Claudio Eligio Calosso<sup>{1}</sup>, Filippo Levi<sup>{1}</sup>, Aldo Godone<sup>{1}</sup>, Haixiao Lin<sup>{2}</sup>  
<sup>{1}</sup>INRIM, Italy; <sup>{2}</sup>Shanghai Institute of Optics and Fine Mechanics, China

Tuesday, July 21, 2020

15:00 – 16:20

### **Timescales and Synchronization**

*Session Chair: Tetsuya Ido, NICT*

#### **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<sup>{1}</sup>, Kai Heine<sup>{1}</sup>, Rainer Bermbach<sup>{1}</sup>, Dieter Sibold<sup>{2}</sup>  
<sup>{1}</sup>Ostfalia University of Applied Sciences, Germany; <sup>{2}</sup>Physikalisch-Technische Bundesanstalt, Germany

#### **Characterizing GPS Disciplined Oscillators for Distributed Vehicle-to-X Measurement Applications**

Julia Bauer<sup>{1}</sup>, Carsten Andrich<sup>{2}</sup>, Alexander Ihlow<sup>{2}</sup>, Niklas Beuster<sup>{2}</sup>, Giovanni Del Galdo<sup>{1}</sup>  
<sup>{1}</sup>Fraunhofer Institute for Integrated Circuits IIS, Germany; <sup>{2}</sup>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<sup>{3}</sup>, Stefan Gewies<sup>{2}</sup>, Lars Grundhöfer<sup>{2}</sup>, Michael Hoppe<sup>{1}</sup>  
<sup>{1}</sup>Federal Waterways and Shipping Administration WSV, Germany; <sup>{2}</sup>German Aerospace Center DLR, Germany; <sup>{3}</sup>RISE Research Institutes of Sweden, Sweden

Tuesday, July 21, 2020

16:30 – 18:00

## **Optical Frequency Standards & Applications**

*Session Chair: James Chou, NIST*

### **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, Haifeng Jiang

National Time Service Center, China

### **Multi-Branch Fiber Frequency Comb for Precision Frequency Measurement of Molecular Transitions**

Mingkun Li<sup>{2}</sup>, Kai Ning<sup>{3}</sup>, Lei Hou<sup>{1}</sup>, Songtao Fan<sup>{2}</sup>, Lulu Yan<sup>{2}</sup>, Yanyan Zhang<sup>{2}</sup>, Bingjie Rao<sup>{2}</sup>, Pan Zhang<sup>{2}</sup>, Haifeng Jiang<sup>{2}</sup>

<sup>{1}</sup>Institute of Photonics and Photon-technology, Northwest University, China; <sup>{2}</sup>National Time Service Center, Chinese Academy of Sciences, China; <sup>{3}</sup>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<sup>{1}</sup>, Zachary Newman<sup>{1}</sup>, John Kitching<sup>{1}</sup>, Matthew Hummon<sup>{1}</sup>, Valera Yudin<sup>{2}</sup>

<sup>{1}</sup>National Institute of Standards and Technology, United States; <sup>{2}</sup>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 <sup>3</sup>D<sub>1</sub> with Cold <sup>88</sup>Sr 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 Sutyurin, Sergey Slyusarev  
FSUE VNIIFTRI, Russia

## **Time-Scale Generation Methods Based on an Optical Clock**

Artem Gribov, Oleg Berdasov, Denis Sutyurin, 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 Llopiès{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, Séverine 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**

Louis Lecordier{2}, Elias Moufaret{2}, Olga Kozlova{1}, Anne Cournol{2}, Mathieu Manceau{2}, Dang Bao An Tran{2}, Nicolas Cahuzac{2}, Olivier Lopez{2}, Etienne Cantin{3}, Michel Abgrall{3}, Rodolphe Le Targat{3}, Paul-Eric Pottie{3}, Catherine Martin{1},  
{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<sup>{1}</sup>, Kivanç Azgın<sup>{2}</sup>  
<sup>{1}</sup>METU MEMS Center, Turkey; <sup>{2}</sup>Middle East Technical University, Turkey

### **Hanle Effect in the Metastable State of <sup>4</sup>He 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<sup>{3}</sup>, Gennady Kvashnin<sup>{3}</sup>, Nikita Asafiev<sup>{2}</sup>, Konstantin Kravchuk<sup>{3}</sup>, Nikolay Luparev<sup>{3}</sup>, Andrey Sotnikov<sup>{1}</sup>  
<sup>{1}</sup>Leibniz Institute for Solid State and Materials Research, Germany; <sup>{2}</sup>Moscow Institute of Physics and Technology, Russia; <sup>{3}</sup>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<sup>{1}</sup>, Shujin Zhou<sup>{1}</sup>, Zhuoze Zhao<sup>{1}</sup>, Hao Gao<sup>{1}</sup>, Jinting Cong<sup>{1}</sup>, Jianming Shang<sup>{1}</sup>, Xing Chen<sup>{1}</sup>, Bin Luo<sup>{1}</sup>, Song Yu<sup>{1}</sup>, Hong Guo<sup>{2}</sup>  
<sup>{1}</sup>Beijing University of Posts and Telecommunications, China; <sup>{2}</sup>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<sup>{2}</sup>, Anders Wallin<sup>{2}</sup>, Kalle Hanhijärvi<sup>{2}</sup>, Joona Eskelinen<sup>{1}</sup>, Jyri Näränen<sup>{1}</sup>  
<sup>{1}</sup>Metsähovi Geodetic Research Station, National Land Survey, Finland; <sup>{2}</sup>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 Institute 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 Pottier{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 Vojtěch

CESNET, Czech Rep.

## TECHNICAL PROGRAM – Wednesday, July 22<sup>nd</sup>

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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**

Etienne Cantin<sup>{3}</sup>, Mads Tonnes<sup>{3}</sup>, Dan Xu<sup>{3}</sup>, Hector Alvarez-Martinez<sup>{3}</sup>, Rodolphe Le Targat<sup>{3}</sup>, Michel Abgrall<sup>{3}</sup>, Paul-Eric Pottie<sup>{3}</sup>, Fabiola Guillou-Camargo<sup>{4}</sup>, Vincent Ménéret<sup>{4}</sup>, Bruno Desruelle<sup>{4}</sup>, Nicolas Quintin<sup>{5}</sup>, Emilie Camisard<sup>{5}</sup>, Olivier Lo  
<sup>{1}</sup>Laboratoire de Physique des Lasers, France; <sup>{2}</sup>Laboratoire de Physique des Lasers / Université Paris 13 - CNRS, France; <sup>{3}</sup>LNE-SYRTE, France; <sup>{4}</sup>MuQuans, France; <sup>{5}</sup>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<sup>{2}</sup>, Brian Downey<sup>{2}</sup>, Neeraj Nepal<sup>{2}</sup>, Scott Katzer<sup>{2}</sup>, David Meyer<sup>{2}</sup>, Eric Jin<sup>{1}</sup>, Vikrant Gokhale<sup>{1}</sup>  
<sup>{1}</sup>NRC Postdoctoral Fellow residing at the US Naval Research Laboratory, United States; <sup>{2}</sup>US Naval Research Laboratory, United States

#### **Epitaxial Al<sub>0.77</sub>Sc<sub>0.23</sub>N SAW and Lamb Wave Resonators**

Mingyo Park, Azadeh Ansari  
Georgia Institute of Technology, United States

#### **High Coupling Coefficient Resonance Mode in Al<sub>0.68</sub>Sc<sub>0.32</sub>N 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 Trolier-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}Electrosiences Ltd, United Kingdom; {3}Kiel University, Germany

## **AFE-Like Hysteresis Loops for Doped HfO<sub>2</sub>: 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)MnO<sub>3</sub> / (Ba,Sr)TiO<sub>3</sub> 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 BaTiO<sub>3</sub> Ceramics**

Gyunghyun Ryu, Elizabeth Dickey  
NC State University, United States

### **Giant Microwave Conductivity in Nominally Insulating Domain Walls in LiNbO<sub>3</sub>**

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

Wednesday, July 22, 2020

13:00 – 15:00

### **Laser Frequency Stabilization**

*Session Chair: David Hume, NIST*

#### **Cryogenic Photonic Resonator with 10-17/s Drift**

Wei Zhang<sup>{2}</sup>, Scott Papp<sup>{2}</sup>, William Milner<sup>{1}</sup>, Jun Ye<sup>{1}</sup>

<sup>{1}</sup>JILA University of Colorado at Boulder, United States; <sup>{2}</sup>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 $1 \times 10^{-16}$ Fractional Frequency Instability via a 2215 km Long European Optical Fibre Link Network**

Marco Schioppo<sup>{3}</sup>, Jochen Kronjäger<sup>{3}</sup>, Alissa Silva<sup>{3}</sup>, Riley Ilieva<sup>{3}</sup>, Jake Paterson<sup>{3}</sup>, Charles Baynham<sup>{3}</sup>, William Bowden<sup>{3}</sup>, Ian Hill<sup>{3}</sup>, Richard Hobson<sup>{3}</sup>, Alvise Vianello<sup>{3}</sup>, Rachel Godun<sup>{3}</sup>, Helen Margolis<sup>{3}</sup>, Anne Amy-Klein<sup>{1}</sup>, Olivier Lopez<sup>{1}</sup>,

<sup>{1}</sup>Laboratoire de Physique des Lasers (LPL), Université Paris 13, CNRS, France; <sup>{2}</sup>LNE-SYRTE, Observatoire de Paris, Université PSL, CNRS, Sorbonne Université, France; <sup>{3}</sup>National Physical Laboratory (NPL), United Kingdom; <sup>{4}</sup>Physikalisch-Technische Bundesanstalt

#### **Spectral Hole Burning for Ultra-Stable Lasers**

Shuo Zhang<sup>{1}</sup>, Nicolas Galland<sup>{2}</sup>, Nemanja Lucic<sup>{1}</sup>, Bess Fang<sup>{1}</sup>, Signe Seidelin<sup>{3}</sup>, Yann Le Coq<sup>{1}</sup>

<sup>{1}</sup>LNE-SYRTE, Observatoire de Paris, Université PSL, CNRS, Sorbonne Université, France; <sup>{2}</sup>LNE-SYRTE, Observatoire de Paris, Université Grenoble Alpes and CNRS, Institut Néel, France; <sup>{3}</sup>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

Wednesday, July 22, 2020

13:00 – 15:00

### **MEMS/NEMS for Sensing**

*Session Chairs: Hanna Cho, Ohio State University & Siddhartha Ghosh, MIT Lincoln Labs*

#### **Precision Residual Strain Sensor Employing Gap-Dependent Frequency Shift**

Alper Ozgurluk, 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 Caliskan, Antea Risso, Zhenyun Qian, Matteo Rinaldi

Northeastern University, United States

### **In-Situ Proton Radiation Sensing Using Comb-Drive MEMS Resonators**

Jaesung Lee<sup>{2}</sup>, Yong Xie<sup>{1}</sup>, Michael McCurdy<sup>{3}</sup>, Michael Alles<sup>{3}</sup>, Philip Feng<sup>{2}</sup>  
<sup>{1}</sup>Case Western Reserve University, United States; <sup>{2}</sup>University of Florida, United States;  
<sup>{3}</sup>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 ( $\beta$ -Ga<sub>2</sub>O<sub>3</sub>) Transducer**

Xu-Qian Zheng<sup>{2}</sup>, Yong Xie<sup>{1}</sup>, Jaesung Lee<sup>{2}</sup>, Philip Feng<sup>{2}</sup>  
<sup>{1}</sup>Case Western Reserve University, United States; <sup>{2}</sup>University of Florida, United States

Wednesday, July 22, 2020

15:30 – 17:30

### **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:HfO<sub>2</sub> 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<sup>{1}</sup>, Bo Wang<sup>{2}</sup>, Alexander Haußmann<sup>{3}</sup>, Long-Qing Chen<sup>{2}</sup>, Lukas M. Eng<sup>{3}</sup>  
<sup>{1}</sup>Fraunhofer IPMS, Germany; <sup>{2}</sup>Penn State University, United States; <sup>{3}</sup>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 Hf<sub>0.5</sub>Zr<sub>0.5</sub>O<sub>2</sub> Tunnel Barriers**

Yingfen Wei<sup>{2}</sup>, Cynthia Quinteros<sup>{2}</sup>, Pavan Nukala<sup>{2}</sup>, Mart Salverda<sup>{2}</sup>, Beatriz Noheda<sup>{2}</sup>, Sylvia Matzen<sup>{1}</sup>, Thomas Maroutian<sup>{1}</sup>, Guillaume Agnus<sup>{1}</sup>, Philippe Lecoeur<sup>{1}</sup>  
<sup>{1}</sup>Universit e Paris-Saclay, France; <sup>{2}</sup>University of Groningen, Netherlands

Wednesday, July 22, 2020

15:30 – 17:30

### **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 (K<sub>0.5</sub>Na<sub>0.5</sub>)NbO<sub>3</sub> Single Crystal by Solid-State Crystal Growth Method**

Ichiro Fujii, Shintaro Ueno, Satoshi Wada

University of Yamanashi, Japan

### **Piezoelectric Thin Films from a Lead-Free (K,Na)NbO<sub>3</sub>-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)O<sub>3</sub> Thin Films**

Runar Dahl-Hansen, Marit Stange, Henrik Ræder, Per Martin Rørvik

SINTEF, Norway



## **Interfacial Strain Gradients Control Nanoscale Domain Morphology in Epitaxial BiFeO<sub>3</sub> Multiferroic Films**

Daniel Sando{6}, Oliver Paul{6}, Mengjiao Han{2}, Vivasha Govinden{6}, Florian Appert{3}, Cécile Carrétéro{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, Thales, France; {6}UNSW, Australia

Wednesday, July 22, 2020

15:30 – 17:30

### **Lithium Niobate and 2D Material Based Devices**

*Session Chairs: Cristian Cassella, Northeastern University & Alexandre Reinhardt, CEA LETI*

## **X-Cut LiNbO<sub>3</sub> 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 LiNbO<sub>3</sub> 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 $\beta$ -Ga<sub>2</sub>O<sub>3</sub> Nanoelectromechanical Resonators**

Xu-Qian Zheng, Jaesung Lee, Philip Feng  
University of Florida, United States

Wednesday, July 22, 2020

15:30 – 17:30

### **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<sup>+</sup>**

Florin Lucian Constantin

Laboratoire PhLAM, CNRS UMR 8523, France

## **Hyperfine-Structure Measurement of the 7P<sub>1/2</sub> State in <sup>133</sup>Cs 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 <sup>127</sup>I<sub>2</sub>**

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

## **Wireless Passive Time-of-Flight Respiratory MEMS Flow Sensor**

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<sup>{2}</sup>, Florian Bender<sup>{2}</sup>, Fabien Josse<sup>{2}</sup>, Arnold K. Mensah-Brown<sup>{1}</sup>, R. Dyche Anderson<sup>{1}</sup>, Donnell Washington<sup>{1}</sup>

<sup>{1}</sup>Ford Motor Co., United States; <sup>{2}</sup>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 Azgın

Middle East Technical University, Turkey

## TECHNICAL PROGRAM – Thursday, July 23<sup>rd</sup>

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Thursday, July 23, 2020

8:00 – 9:20

### **AlN Based Materials**

*Session Chair: Geoffrey Brennecke, Colorado School of Mines*

#### **Nitride Perovskites – a New Frontier for Functional Materials**

Kevin Talley<sup>{2}</sup>, Rachel Sherbondy<sup>{2}</sup>, Geoff Brennecke<sup>{1}</sup>, Andriy Zakutayev<sup>{2}</sup>  
<sup>{1}</sup>Colorado School of Mines, United States; <sup>{2}</sup>National Renewable Energy Laboratory, United States

#### **Physical Properties of Epitaxial ScAlN**

Joseph Casamento, Huili Grace Xing, Debdeep Jena  
Cornell University, United States

#### **Growth Trends in Ferroelectric Al<sub>1-x</sub>Sc<sub>x</sub>N Thin Films**

John Hayden, Kevin Ferri, Susan Trolier-McKinstry, Jon-Paul Maria  
Pennsylvania State University, United States

#### **Monolithic Piezoelectric Control of Soliton Microcombs**

Junqiu Liu<sup>{1}</sup>, Erwan Lucas<sup>{1}</sup>, Arslan Raja<sup>{1}</sup>, Grigory Lihachev<sup>{1}</sup>, Rui Wang<sup>{1}</sup>, J. He<sup>{1}</sup>, T. Liu<sup>{1}</sup>,  
M. H. Anderson<sup>{1}</sup>, Tobias Kippenberg<sup>{1}</sup>, Hao Tian<sup>{2}</sup>, Sunil Bhawe<sup>{2}</sup>  
<sup>{1}</sup>École Polytechnique Fédérale de Lausanne, Switzerland; <sup>{2}</sup>Purdue University, United States

#### **Stress-Mediated Sc-Doped AlN Transducer with Tunable Ferroelectric Characteristics**

Roohbeh Tabrizian  
University of Florida, United States

#### **Characterization of AlScN on CMOS Wafer**

Yutong Liu<sup>{2}</sup>, Justin Kuo<sup>{2}</sup>, Benyamin Davaji<sup>{2}</sup>, Ved Gund<sup>{2}</sup>, Amit Lal<sup>{2}</sup>, Jaibir Sharma<sup>{1}</sup>, Navab  
Singh<sup>{1}</sup>  
<sup>{1}</sup>ASTAR, Singapore; <sup>{2}</sup>Cornell University, United States

Thursday, July 23, 2020

8:00 – 9:20

### **Chip Scale References & Techniques**

*Session Chair: Francois-Xavier ESNAULT, CNES & Fang Fang, National Institute of Metrology*

#### **Multiplexed Alkali Metal Deposition: Wafer-Level Fabrication of Microfabricated Alkali Vapor Cells**

Douglas Bopp, Vincent Maurice, John Kitching  
NIST, United States

#### **Toward an on-Chip 1560 nm Wavelength Reference**

Matthew Hummon<sup>{1}</sup>, Douglas Bopp<sup>{1}</sup>, Zachary Newman<sup>{1}</sup>, John Kitching<sup>{1}</sup>, Alexander Yulaev<sup>{1}</sup>,  
Daron Westly<sup>{1}</sup>, Kartik Srinivasan<sup>{1}</sup>, Vladimir Aksyuk<sup>{1}</sup>, Joshua Surya<sup>{2}</sup>, Hong Tang<sup>{2}</sup>  
<sup>{1}</sup>National Institute of Standards and Technology, United States; <sup>{2}</sup>Yale University, United States

### **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}, J  r  my Bon{3}, Val  rie Soumann{1}, R  mo Giust{1}, Philippe Abb  {1}, Nicolas Passilly{1}, Pierre-Fran  ois Cohadon{2}, Serge Galliou{1}  
{1}FEMTO-ST, France; {2}LKB, UPMC-Sorbonne Universit  s, 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<sup>{2}</sup>, Charlotte Cochard<sup>{2}</sup>, Ray McQuaid<sup>{2}</sup>, Amit Kumar<sup>{2}</sup>, Marty Gregg<sup>{2}</sup>, Roger Whatmore<sup>{1}</sup>

<sup>{1}</sup>Imperial College London, United Kingdom; <sup>{2}</sup>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<sup>{2}</sup>, Michael Schmidt<sup>{2}</sup>, Louise Colfer<sup>{2}</sup>, Zineb Saghi<sup>{1}</sup>

<sup>{1}</sup>CEA-Leti, France; <sup>{2}</sup>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, Shuting Chen, Chin Yaw Tan

Institute of Materials Research & Engineering, ASTAR, Singapore

Thursday, July 23, 2020

10:00 – 11:20

## **Characterization and Properties of Ferroelectrics VII**

*Session Chair: Julia Glaum, Norwegian University of Science and Technology*

### **$\mu$ -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 Radan{1}, Uroš Prah{1}, Oana A. Condurache{1}, Mirela Dragomir{1}, Barbara Malič{1}, Vignaswaran K. Veerapandiyan{2}, Theresa Gindel{2}, Marco Deluca{2}

{1}Jozef Stefan Institute, Austria; {1}Jozef Stefan Institute, Slovenia; {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 Bi<sub>2</sub>SiO<sub>5</sub> 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}, Lewys Jones{3}, 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**

Nils Nemitz{6}, Mamoru Sekido{6}, Kazuhiro Takefuji{7}, Hideki Ujihara{6}, Masanori Tsusumi{6}, Tetsuro Kondo{6}, Eiji Kawai{6}, Kunitaka Namba{6}, Yoshihiro Okamoto{6}, Rumi Takahashi{6}, Junichi Komuro{6}, Ryuichi Ichikawa{6}, Hidekazu Hachisu{6}, Hiros

{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 Pottier{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  $\mu\text{m}$  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