

## TUTORIALS

On Monday, 19 May, there will be a series of tutorials covering a wide range of topics relevant to the frequency control community. The tutorials include both the fundamental topics of frequency and timing at a level suitable for practitioners new to the field, and more advanced and specialized topics related to specific areas. MEMS technology will be highlighted in the tutorial sessions this year with a special attention to its use for timing applications. The tutorials aim to provide useful knowledge to the beginners in the community, as well as those with extensive experience.

### TUTORIAL SCHEDULE

	<b>MEMS</b>	<b>Frequency &amp; Noise</b>	<b>Resonators</b>
	Room 101A	Room 101B	Room 101D
8:00 - 10:00	<b>Introduction to Timing Devices</b> Aaron Partridge	<b>Cross-correlation in Measurement</b> Enrico Rubiola	<b>Quartz Crystal Resonators and Oscillators</b> John Vig and Y-K Yong
10:00 - 10:20	Break – Outside Rooms 101A/B		
10:20 - 12:20	<b>Co-design of Resonators and Circuits in MEMS Oscillators</b> Ashwin Seshia	<b>Vibration-Induced Phase Noise</b> Michael M. Driscoll	<b>RF Acoustic Resonators</b> Ken-ya Hashimoto
12:20 - 13:20	Lunch – Hospitality Room		
13:20 - 15:20	<b>MEMS-Based Oscillators</b> Clark T.-C. Nguyen	<b>Atomic Clocks</b> Elizabeth Donley	<b>Piezoelectric MEMS for RF</b> Matteo Rinaldi
15:20 – 15:40	Break – Outside Rooms 101A/B		
15:40 - 17:40	<b>Piezoelectric Micromechanical Oscillators</b> Roy Olsson III	<b>Optical Oscillators</b> Lute Maleki <i>Presented by Andrey Matsko</i>	<b>CMOS-MEMS Technology</b> Sheng-Shian Li

## MANUFACTURERS' FORUM

On Wednesday, 21 May, 10:20 to 12:20, there will be a special session for manufacturers. A panel of frequency control device manufacturers has been invited to bring forward review topics or emerging processing technology in the following:

- Process control and/or quality metrics
- Manufacturing methods or technology approaches
- System engineering applied to customer needs
- Capacity planning for emerging device production

Six 10 minute talks have been organized by the IFCS 2014 Technical Program Committee based on relevance, novelty, and contribution to the community. 30 minutes will be reserved for open-mike participation for directed Q&A, follow-up or new topics.

The manufacturers scheduled to speak are:

- **CSAC Production Statistics**, Peter Cash, Microsemi
- **Application Challenges in Photonic Devices for THz Generation**, Wilhelm Kaenders, Topica
- **From Quartz Growing, Q-masa, to Timing Module – Advanced Quartz Photolithography Manufacturing**, Alex Yang, Taitien
- **MEMS Manufacturing for Timing Devices**, Wan-Thai Hsu, Micrel
- **Commercial Rb and Cs Clock Processing**, Yuanhong Cao, Chengdu Spaceon Electronics
- **Application Driven Atomic Clock Selection**, David Briggs, Precise Time and Frequency, Inc.

The motivation for these talks is to stimulate a collegial dialogue among the attendees about the role of manufacturing engineering, process control and the engagement of frequency control technologies into the application needs of our users.

The IFCS 2014 Technical Program Committee desires to extract a community consensus about the migration of research developments based on leading edge applied science into commercial-scale device production. Potentially, a few themes will emerge that the IFCS may advance into the 2015 technical program.

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## IEEE WOMEN IN ENGINEERING TAIPEI CHAPTER JOINT LUNCHEON WITH 2014 IEEE INTERNATIONAL FREQUENCY CONTROL SYMPOSIUM

3F Banquet Hall, Taipei International Convention Center  
12:20 - 13:20, Wednesday, 21 May 2014

**Lunch Speaker:** Dr. H.D. Lee, Pervasive Displays

**Topic:** What is Entrepreneurship? Take TFT- LCD industry for example

Entrepreneurship is a way of life. Despite the endless doubts of self and others. It's a powerful force deep down inside, driving you to achieve your dreams. In this talk, the speaker, a successful serial entrepreneur, will take his 15-year experience in Taiwan TFT-LCD industry for example, to provide the invaluable advices to you who want to have your own business and make your dream come true.

## **PLENARY SESSION SCHEDULE**

Welcome from the General Chair

Attendance Statistics

Sponsor Acknowledgement

Symposium Schedule Overview

Welcome from the Technical Program Chair

Technical Program Overview

2015 IEEE IFCS-EFTF Announcement

Welcome from the UFFC President

Acknowledgement of Recent IEEE Fellows & Distinguished Lecturers

Presentation of IEEE IFCS Awards

Plenary Speaker Introduction

Plenary Speaker: The Rise and Fall(out) of FBAR

Concluding Remarks

Adjourn

## PLENARY SESSION INVITED TALK



**“The Rise and Fall(out) of FBAR”**  
Rich Ruby, *Wireless Semiconductor Division*

### **Abstract:**

Although the first papers on Thin Film Bulk Acoustic Resonators (FBAR) were published in 1980; as a technology worthy of commercialization, FBAR was not immediately a prime candidate. This was due to the large technical obstacles that needed to be overcome (e.g. low Q, choice of materials, uncertain coupling coefficient). Also, there was no obvious path to manufacturability; lastly, the rapid success of SAW filters obviated the perceived need of FBAR. Interest in FBAR devices fell off dramatically by the early '90s. That said, perceptions changed with the introduction of the first FBAR duplexer in a cell phone for the PCS band (a North America CDMA band 1850-1910MHz Tx and 1930-1990 MHz Rx) in 2001. As it turns out, it was all about 'size and performance'.

This talk will start by covering those early days of FBAR leading up to the introduction of the HPMD 7901 (and 7904) duplexer in 2001 and the following duplexer families using an all-silicon, wafer-scale, chip scale package (the ACMD-7401) in 2003. I will give some anecdotes describing the highs and lows of those days: the challenges, the fear of failure and ultimately, the euphoria of seeing the first phone (with FBAR) in a stranger's hands. I will cover the rise of FBAR over the last 12 years, from when we made only 2 to 3 parts per day to well over ten million FBAR (and BAW) made per day. I will also discuss why FBAR grew so quickly, despite the relatively high price of the component.

So, FBAR is successful, perhaps 'wildly so'. But as FBAR technology begins to saturate the front-end filter needs for cell phones, there is a strong need to explore and expand into adjacent markets, or if no adjacent markets in the mobile space are available, then adjacent technologies that use the unique properties of FBAR resonators. One such field is Time and Frequency. The second half of this talk will explore a vision of how the unique properties of AlN combined with the ability to integrate circuitry to overcome 'imperfections in an FBAR resonator and to create a better 'resonator' that potentially could be disruptive.

### **Bio:**

Rich Ruby obtained his B.S., M.S., and PhD at the University of California, Berkeley in 1977, 1981, and 1984, respectively. His PhD work was in superconductivity. After his graduate work, he joined HP Labs (later to become Agilent Labs, and now Avago Technologies) working on superconductivity, E-beam lithography, X-Ray lithography and packaging. In 1993, he started a project on Free Standing Bulk Acoustic Wave Resonator devices (FBAR) and has stayed with that technology since. He has made many contributions to the development and innovations centered on the acoustic properties, manufacturability and the packaging of FBAR filters and duplexers. Rich was instrumental in commercializing the first FBAR duplexers HPMD7901 and the 7904 in 2001 to 2003. His innovations also led to the first all-silicon, chip-scale packaged FBAR duplexer (the ACMD 7401) introduced in 2004. Today roughly 1.5 to 2 billion FBAR and BAW filters are sold worldwide into the mobile market every year. He was made an Agilent Fellow in 2002 and holds that title as well as Director of Technology at Avago. Rich was also awarded the Barney Oliver Prize, the Bill Hewlett Award, and the CB Sawyer Award for his work on FBAR technology. Rich was made IEEE Fellow in 2010. Rich has over 80 patents and patents pending in the area of FBAR devices and has given numerous invited papers. FBAR has since won several industrial awards. Rich's new interests include making the 'perfect' resonator and finding new and emerging applications for these novel devices.

## TUESDAY ORAL SESSIONS

Tuesday 20 May		
Room 101A	Room 101B	Room 101CD
A1L-A: Time and Frequency Synchronization and Networking	A1L-B: Bio and Chemical Sensing	A1L-C: New Technologies
Shinn-Yan Lin, Chunghwa Telecom Co., Ltd.	Clemens Ruppel, EPCOS AG	Mike Underhill, Underhill Research Limited, United Kingdom
10:20		
<p style="text-align: center;"><b>Searching for Optimal Network Topology with Best Possible Synchronizability*</b></p> <p><i>Guanrong Chen</i> University of Hong Kong, Hong Kong</p>	<p style="text-align: center;"><b>Shear-Horizontal Surface Acoustic Wave Biosensors for POCT*</b></p> <p><i>Mikihiro Goto</i>{2}, <i>Hiromi Yatsuda</i>{1}, <i>Jun Kondoh</i>{3} {1}Japan Radio Co. Ltd. / OJ-Bio Ltd., Japan; {2}Japan Radio Co. Ltd. / Shizuoka University, Japan; {3}Shizuoka University, Japan</p>	<p style="text-align: center;"><b>LGT Alternative Quartz Materials for Ultra-Stable Oscillators*</b></p> <p><i>Joël Imbaud, Jean Jacques Boy, Fabrice Sthal</i> FEMTO-ST Institute, France</p>
11:00		
<p style="text-align: center;"><b>Precise Latency Measurement of Unidirectional-Data-Flow Network Equipment</b></p> <p><i>I-Chun Chao</i>{3}, <i>Shinn-Yan Lin</i>{1}, <i>Kang Lee</i>{2}, <i>Frederick Proctor</i>{2}, <i>Chien-Chung Shen</i>{4}, <i>Fan-Ren Chang</i>{3}</p> <p>{1}Chunghwa Telecom Co., Ltd., Taiwan; {2}National Institute of Standards and Technology, United States; {3}National Taiwan University, Taiwan; {4}University of Delaware, United States</p>	<p style="text-align: center;"><b>380MHz SH-SAW Biosensors</b></p> <p><i>Mikihiro Goto</i>{2}, <i>Hiromi Yatsuda</i>{1}, <i>Jun Kondoh</i>{3}</p> <p>{1}Japan Radio Co. Ltd. / OJ-Bio Ltd., Japan; {2}Japan Radio Co. Ltd. / Shizuoka University, Japan; {3}Shizuoka University, Japan</p>	<p style="text-align: center;"><b>High-Performance DSP-TCXO Using Twin-Crystal Oscillator</b></p> <p><i>Kaoru Kobayashi, Yoshiaki Mori, Tsukasa Kobata, Manabu Ito, Shigenori Watanabe, Shinichi Sato, Kazuo Akaike</i></p> <p><i>Nihon Dempa Kogyo Co., Ltd., Japan</i></p>

11:20

**Characterization of Coincident-Frequency Entangled Source in Quantum Synchronization Application**

*Ruifang Dong, Runai Quan, Feiyan Hou, Mengmeng Wang, Zhaoyang Tai, Tao Liu, Shougang Zhang*

*National Time Service Center / Chinese Academy of Sciences, China*

**Multi-Component Olfactory Display with a SAW Atomizer and Micropumps Controlled by a Tablet PC**

*Takamichi Nakamoto, Kazuki Hashimoto, Tomoyuki Aizawa, Yossiri Ariyakul*

*Tokyo Institute of Technology, Japan*

**Spintronic Nano-Oscillators: Towards Nanoscale and Tunable Frequency Devices**

*Eva Grimaldi{5}, R. Lebrun{5}, A. Jenkins{5}, A. Dussaux{2}, J. Grollier{5}, V. Cros{5}, A. Fert{5}, H. Kubota{3}, K. Yakushiji{3}, A. Fukushima{3}, R. Matsumoto{3}, S. Yuasa{3}, G. Cibiel{1}, P. Bortolotti{5}, G. Pillet{4}*

*{1}Centre National d'Études Spatiales, France; {2}ETH Zurich, Switzerland; {3}National Institute of Advanced Industrial Science and Technology, Japan; {4}Thales Research and Technology, France; {5}Unité Mixte de Physique CNRS/Thales and Université Paris Sud 11, France*

11:40

**Performance Evaluation of NMSL's Developed Calibration System for Timing Devices with Seven-Segment LCD**

*Ahmad Sahar Omar{1}, Mohd Nasir Zainal Abidin{1}, Mohd Fauzi Othman{2}, Erik Dierikx{3}, Roland van Bemmelen{3}, Peter van Otterloo{3}*  
*{1}SIRIM Berhad, Malaysia; {2}Universiti Teknologi Malaysia, Malaysia; {3}VSL Dutch Metrology Institute, Netherlands*

**High-Frequency SiC Microdisk Resonators Operating in Water with Responses to H2O2 and NH4OH**

*Hao Jia, Jaesung Lee, Zenghui Wang, Philip Feng*  
*Case Western Reserve University, United States*

**Bulk Acoustic Wave Resonator Thermal Noise Measurements**

*Maxim Goryachev{2}, Eugene Ivanov{2}, Stephen Parker{2}, John Winterflood{2}, Michael Tobar{2}, Serge Galliou{1}*  
*{1}FEMTO-ST Institute, France; {2}University of Western Australia, Australia*

12:00

**In-Situ Monitor Electrochemical Processes in Batteries Using Vibrating Microcantilevers**

*Jinho Yang, Jimmy Chen, Mark Ming-Cheng Cheng*  
*Wayne State University, United States*

**Tuesday 20 May**

Room 101A	Room 101B	Room 101CD
<b>A2L-A: Combs and Stable Oscillators</b>	<b>A2L-B: Time Scale and Satellite Time Transfer</b>	<b>A2L-C: Quartz Crystals</b>
Long-Sheng Ma, East China Normal University	Wen-Hun Tseng, Chunghwa Telecom Co., Ltd.	Yook-Kong Yong, Rutgers University
<b>13:20</b>		
<p align="center"><b>Novel Techniques for Low-Noise Microwave Generation and Transfer of Spectral Purity with Optical Frequency Combs*</b></p> <p><i>Yann Le Coq</i></p> <p><i>LNE-SYRTE, France</i></p>	<p align="center"><b>A New Method for Generating Japan Standard Time by Using Distributed Atomic Clocks Connected via Satellites*</b></p> <p><i>Yuko Hanado</i></p> <p><i>National Institute of Information and Communications Technology, Japan</i></p>	<p align="center"><b>A Perspective for the Quartz Crystal Devices Industry and Technologies in Taiwan and China*</b></p> <p><i>Min-Chiang Chao{2}, Paul Jin-Bao Lin{2}, Peter Wan-Shin Lin{2}, Levi Shan-Shin Chen{2}, Ren-Hung Larn{2}, Ji Wang{1}</i></p> <p><i>{1}NingBo University, China; {2}TXC Corporation, Taiwan</i></p>
<b>14:00</b>		
<p align="center"><b>Long-Term Stable Balanced Optical-Microwave Phase Detector with Sub-Femtosecond Residual Timing Jitter Capability for Optical-to-RF Extraction</b></p> <p><i>Michael Y. Peng, Franz Kärtner</i></p> <p><i>Massachusetts Institute of Technology, United States</i></p>	<p align="center"><b>Method of Precise Common-View Frequency Transfer Based on BeiDou GEO Satellite</b></p> <p><i>Yao Kong, Xuhai Yang, Hong Chang, Weijin Qin, Fen Cao, Zhigang Li, Baoqi Sun</i></p> <p><i>National Time Service Center / Chinese Academy of Sciences, China</i></p>	<p align="center"><b>Quartz-Based Vibrating MEMS Fabricated Using a Wafer-Bonding Process with Sealed Cavities</b></p> <p><i>Sebastien Grousset{1}, Pierre Lavenus{3}, Lamine Benaissa{1}, Rachid Taïbi{3}, Emmanuel Augendre{1}, Thomas Signamarcheix{1}, Olivier Le Traon{3}, Sylvain Ballandras{2}</i></p> <p><i>{1}CEA-Leti, France; {2}FreC'N'Sys SAS, France; {3}Office National d'Etudes et de Recherches Aérospatiales, France</i></p>

14:20

**All-Optical Micro-Clock**

*Wei Liang, Danny Eliyahu, Vladimir Ilchenko,  
Anatoliy Savchenkov, Andrey Matsko, Lute Maleki*

*OEwaves Inc., United States*

**Mitigation of the TWSTFT Diurnal Effect Using  
Software-Defined Receivers**

*Yi-Jiun Huang, Wen-Hung Tseng*

*Chunghwa Telecom Co., Ltd., Taiwan*

**Wafer-Level Quartz Dry Etching Technology**

*Atsushi Kamijo, Shigeharu Monoe, Norihiro  
Murayama, Takefumi Saito, Noritoshi Kimura*

*Nihon Dempa Kogyo Co., Ltd., Japan*

14:40

**Hollow-Core Fibre Frequency Standard**

*Chris Perrella{3}, James Anstie{3}, Philip Light{1},  
Fetah Benabid{2}, Andrew White{4}, Andre  
Luiten{3}*

*{1}Univeristy of Adelaide, Australia; {2}Université  
de Limoges, France; {3}University of Adelaide,  
Australia; {4}University of Queensland, Australia*

**A Study of Antenna Multipath Instabilities in  
Two-Way Satellite Time and Frequency Transfer**

*Fang-Dar Chu{1}, Wen-Hung Tseng{1}, Wei-Chih  
Hsu{2}, Pei-Yih Ting{3}*

*{1}Chunghwa Telecom Co., Ltd., Taiwan;  
{2}National Kaohsiung First University of Science  
and Technology, Taiwan; {3}National Taiwan  
Ocean University, Taiwan*

**A Miniature 12 MHz GT Cut Quartz Resonator  
Vibrating in a (m = 3, n = 1) Mode**

*Yusuke Yamagata, Katsuya Mizumoto*

*River Eletec Corporation, Japan*

15:00

**An Analysis of Frequency Temperature  
Characteristics of a Lamb Wave Type Quartz  
Acoustic Wave Device**

*Tasuku Kon, Katsuya Mizumoto, Yasutaka Saigusa*

*River Eletec Corporation, Japan*



## TUESDAY POSTER SESSIONS

15:40 – 17:40

*(prefix numbers register poster location in Poster Session A, Exhibit Hall)*

**Session:** A3P-D: Materials, Filters & Resonators I

**Room:** Poster Area

**Session Chair:** Ji Wang, Ningbo University

### **(1) Thickness-Shear Frequencies of an Infinite Quartz Plate with Material Property Variation Along the Thickness**

*Ji Wang, Ningbo University, China*

*Wenliang Zhang, Ningbo University, China*

*Dejin Huang, Ningbo University, China*

*Tingfeng Ma, Ningbo University, China*

*Jianke Du, Ningbo University, China*

### **(2) Long Term Stability and Quality Factors of Degenerately N-Type Doped Silicon Resonators**

*Antti Jaakkola, VTT Technical Research Centre of Finland, Finland*

*Sergey Gorelick, VTT Technical Research Centre of Finland, Finland*

*Mika Prunnila, VTT Technical Research Centre of Finland, Finland*

*James Dekker, VTT Technical Research Centre of Finland, Finland*

*Tuomas Pensala, VTT Technical Research Centre of Finland, Finland*

*Panu Pekko, VTT Technical Research Centre of Finland, Finland*

### **(3) Micro Rb Atomic Vapor Cells for the Chip-Scale Atomic Clock**

*Chang Zhang, Peking University, China*

*Shuangyou Zhang, Peking University, China*

*Dengzhu Guo, Peking University, China*

*Zhong Wang, Peking University, China*

*Jianye Zhao, Peking University, China*

### **(4) Piezoresistive Sensing in a Strongly-Coupled High Q Lamé Mode Silicon MEMS Resonator-Pair**

*Yuanjie Xu, City University of Hong Kong, Hong Kong*

*Haoshen Zhu, City University of Hong Kong, Hong Kong*

*Joshua Lee, City University of Hong Kong, Hong Kong*

### **(5) Measurement of Vibration Amplitude Distribution of Piezoelectric Devices by Speckle Interferometry with Pulsed Laser**

*Hajime Kobayashi, Nihon Dempa Kogyo Co., Ltd., Japan*

*Keita Mochizuki, Tokyo Metropolitan University, Japan*

*Yasuaki Watanabe, Tokyo Metropolitan University, Japan*

### **(6) Aluminum Nitride Lamb Wave Resonators with High Figure of Merit for Narrowband Filter Applications**

*Ji Liang, Tianjin University, China*

*Hongxiang Zhang, Tianjin University, China*

*Heng Xie, Tianjin University, China*

*Wei Pang, Tianjin University, China*

*Daihua Zhang, Tianjin University, China*

*Hao Zhang, Tianjin University, China*

### **(40) Second Harmonic Mode Polarization Inverted Resonator Consisting of PbTiO<sub>3</sub> Thin Film**

*Katsuyoshi Katada, Nagoya Institute of Technology, Japan*

*Takahiko Yanagitani, Nagoya Institute of Technology, Japan*

*Masashi Suzuki, Nagoya Institute of Technology, Japan*

*Kiyotaka Wasa, Kyoto University, Japan*

**(35) High Electromechanical Coupling in PZT Epitaxial Thick Film Resonators at 550 °C**

*Takahiko Yanagitani, Nagoya Institute of Technology, Japan*

*Katsuyoshi Katada, Nagoya Institute of Technology, Japan*

*Masashi Suzuki, Nagoya Institute of Technology, Japan*

*Kiyotaka Wasa, Kyoto University, Japan*

**(36) Length-Extension LGS Microresonators for FM-AFM: Microfabrication and Shear Effects Sensitivity**

*Therese Leblois, FEMTO-ST Institute, France*

*Etienne Herth, FEMTO-ST Institute, France*

*Fabien Henrot, FEMTO-ST Institute, France*

*Fabrice Sthal, FEMTO-ST Institute, France*

**(37) Magnetic Field Influence on the Spectra of BAW Resonator with Ferrite Layers**

*Natalia Polzikova, Kotel'nikov Institute of Radio Engineering and Electronics, Russian Academy of Sciences, Russia*

*Sergey Alekseev, Kotel'nikov Institute of Radio Engineering and Electronics, Russian Academy of Sciences, Russia*

*Iosif Kotelyanskii, Kotel'nikov Institute of Radio Engineering and Electronics, Russian Academy of Sciences, Russia*

*Alexander Raevskiy, Kotel'nikov Institute of Radio Engineering and Electronics, Russian Academy of Sciences, Russia*

**(38) Finite Element Analysis of Anchor Loss in AlN Lamb Wave Resonators**

*Yung-Yu Chen, Tatung University, Taiwan*

*Yen-Ting Lai, Tatung University, Taiwan*

*Chih-Ming Lin, University of California, Berkeley, United States*

**(39) Low-Power Ovenization of Fused Silica Resonators for Temperature-Stable Oscillators**

*Zhengzheng Wu, University of Michigan, United States*

*Adam Peczkalski, University of Michigan, United States*

*Mina Rais-Zadeh, University of Michigan, United States*

**Session:** A3P-E: Oscillators, Synthesizers, Noise & Circuit Techniques I

**Room:** Poster Area

**Session Chair:** Fabrice Sthal, FEMTO-ST

**(10) Robust Colpitts and Hartley Oscillator Design**

*Chingyei Chung, Ming Hsin University of Science and Technology, Taiwan*

*Sou-Yen Chao, Ming Hsin University of Science and Technology, Taiwan*

**(31) The High Stability of Device Resolution Based Precise Phase Difference Measurement**

*Wei Zhou, Xidian University, China*

*Lina Bai, Xidian University, China*

*Xin Su, Xidian University, China*

*Jianguo Yu, Xidian University, China*

*Jinglu Ma, Hebei Far-East Communication System Engineering Co. Ltd, China*

*Guangyun Yu, Hebei Far-East Communication System Engineering Co. Ltd, China*

**(32) Adaptive Self-Adjusted Temperature Compensated Oscillators Based on Fuzzy-Logic Algorithms**

*Anatoly Kosykh, Omsk State Technical University, Russia*

*Dmitry Titov, Omsk State Technical University, Russia*

**Session:** A3P-F: Microwave Standards I

**Room:** Poster Area

**Session Chair:** Elizabeth Donley, NIST

**(58) Atomic Beam Optical Slower Using Laser Chirping Method**

*Vadim Zholnerov, Russian Institute of Radionavigation and Time, Russia*

*Evgenia Ageichik, Russian Institute of Radionavigation and Time, Russia*

*Yury Rozhdestvenskiy, ITMO University, Russia*

*Anton Vershovskii, Physical-Technical Institute of the Russian Academy of Sciences, Russia*

**(59) Study on an Improved Magnetron Cavity for Vapor-Cell Rubidium Frequency Standards**

*Rongbo Chen, Lanzhou Institute of Physics, China*

*Jingzhong Cui, Lanzhou Institute of Physics, China*

*Jinhai Zhang, Lanzhou Institute of Physics, China*

*Yaoting Liang, Lanzhou Institute of Physics, China*

*Jianhui Tu, Lanzhou Institute of Physics, China*

**(60) Accuracy Evaluations of the Cs Fountain Primary Frequency Standard Nim5**

*Fang Fang, National Institute of Metrology, China*

*Weiliang Chen, National Institute of Metrology, China*

*Nianfeng Liu, National Institute of Metrology, China*

*Kun Liu, National Institute of Metrology, China*

*Rui Suo, National Institute of Metrology, China*

*Tianchu Li, National Institute of Metrology, China*

**(61) The 87Rb Pop Maser Atomic Clock**

*Wenyu Zhao, National Time Service Center / Chinese Academy of Sciences, China*

*Zhijing Du, National Time Service Center / Chinese Academy of Sciences, China*

*Wenxiang Xue, National Time Service Center / Chinese Academy of Sciences, China*

*Zhijian Yu, National Time Service Center / Chinese Academy of Sciences, China*

*Xin Wang, National Time Service Center / Chinese Academy of Sciences, China*

*Haifeng Jiang, National Time Service Center / Chinese Academy of Sciences, China*

*Shougang Zhang, National Time Service Center / Chinese Academy of Sciences, China*

**(62) Frequency Resolution Improvement of Microwave Measurement Using Down-Convert Technique**

*Po-Cheng Chang, Chunghwa Telecom Co., Ltd., Taiwan*

*Chia-Shu Liao, Chunghwa Telecom Co., Ltd., Taiwan*

**(63) The Optical System of the Fountain Clock**

*Xinliang Wang, National Time Service Center / Chinese Academy of Sciences, China*

*Jun Ruan, National Time Service Center / Chinese Academy of Sciences, China*

*Hui Zhang, National Time Service Center / Chinese Academy of Sciences, China*

*Rui Lin, National Time Service Center / Chinese Academy of Sciences/University of Chinese Academy of Science, China*

*Dandan Liu, National Time Service Center / Chinese Academy of Sciences, China*

*Jiang Chen, National Time Service Center / Chinese Academy of Sciences, China*

*Yong Guan, National Time Service Center / Chinese Academy of Sciences, China*

*Fengxiang Yu, National Time Service Center / Chinese Academy of Sciences/University of Chinese Academy of Science, China*

*Junru Shi, National Time Service Center / Chinese Academy of Sciences/University of Chinese Academy of Science, China*

*Shougang Zhang, National Time Service Center / Chinese Academy of Sciences, China*

**Session:** A3P-G: Sensors and Transducers

**Room:** Poster Area

**Session Chair:** Svenja Knappe, NIST  
Matteo Rinaldi, Northeastern University

**(7) Detecting of Small Change of Temperature Using SAW Resonators**

*Alexander Medved, Kotel'nikov Institute of Radio Engineering and Electronics, Russian Academy of Sciences, Russia*

*Raisa Kryshchal, Kotel'nikov Institute of Radio Engineering and Electronics, Russian Academy of Sciences, Russia*

**(8) A CMOS CO<sub>2</sub> Concentration to Frequency Converter with Calibration Circuits**

*Cheng-Ta Chiang, National Chia Yi University, Taiwan*

*Ming-Yi Huang, National Chia Yi University, Taiwan*

*Michelle Chung, National Chia Yi University, Taiwan*

**(9) Analysis of Impedance-Loaded Passive SAW Sensor**

*Takuma Genji, Shizuoka University, Japan*

*Jun Kondoh, Shizuoka University, Japan*

**(33) A Flexible Capacitive Pressure Sensor Array for Pulse Diagnosis**

*Jen-Yu Peng, National Tsing Hua University, Taiwan*

*Michael Lu, National Tsing Hua University, Taiwan*

**(34) Capacitive Driving and Sensing of a Bi-Axial Scanning Micromirror for Projection Display**

*Sheng-Gang Fu, National Tsing Hua University, Taiwan*

*David Lin, Opus Microsystems Corporation, Taiwan*

*Harrison Lai, Opus Microsystems Corporation, Taiwan*

*Andrew Hung, Opus Microsystems Corporation, Taiwan*

*Michael Lu, National Tsing Hua University, Taiwan*

**Session:** A3P-H: Time & Frequency I

**Room:** Poster Area

**(51) Application of Kalman Filter for Steering UTC(Lab) to UTC**

*Ye Ren, National Time Service Center / Chinese Academy of Sciences, China*

*Xiaohui Li, National Time Service Center / Chinese Academy of Sciences, China*

*Yanrong Xue, National Time Service Center / Chinese Academy of Sciences, China*

*Ruifang Dong, National Time Service Center / Chinese Academy of Sciences, China*

**(52) OFDM Technology Anti-Multipath Performance Analysis in China Mobile Multimedia Broadcasting (CMMB) System**

*Zhaopeng Hu, National Time Service Center / Chinese Academy of Sciences, China*

*Yu Hua, National Time Service Center / Chinese Academy of Sciences, China*

*Hong Chang, National Time Service Center / Chinese Academy of Sciences, China*

*Chaozhong Yang, National Time Service Center / Chinese Academy of Sciences, China*

*Jiangbin Yuan, National Time Service Center / Chinese Academy of Sciences, China*

**(53) NTP Network Timing Technique Research for Android and iOS Mobile Platform**

*Hong-Jiao Ma, National Time Service Center / Chinese Academy of Sciences, China*

*Meng Li, National Time Service Center / Chinese Academy of Sciences, China*

*Kang Wang, National Time Service Center / Chinese Academy of Sciences, China*

*Zhong Dou, National Time Service Center / Chinese Academy of Sciences, China*

*Haifeng Jiang, National Time Service Center / Chinese Academy of Sciences, China*

**(54) Research on a New Method of Time Delay Measurement in Telephone Time Service**

Xiaozhen Jin, National Time Service Center / Chinese Academy of Sciences, China  
Yu Hua, National Time Service Center / Chinese Academy of Sciences, China  
Yuanhong Cao, Sichuan Spaceon Time & Frequency Tech. Co., Ltd, China

**(55) Experimental Study on Optical Frequency Transfer via Communication Fibers**

Jie Liu, National Time Service Center / Chinese Academy of Sciences, China  
Jing Gao, National Time Service Center / Chinese Academy of Sciences, China  
Guanjun Xu, National Time Service Center / Chinese Academy of Sciences, China  
Dongdong Jiao, National Time Service Center / Chinese Academy of Sciences, China  
Long Chen, National Time Service Center / Chinese Academy of Sciences, China  
Linbo Zhang, National Time Service Center / Chinese Academy of Sciences, China  
Haifeng Jiang, National Time Service Center / Chinese Academy of Sciences, China  
Ruifang Dong, National Time Service Center / Chinese Academy of Sciences, China  
Tao Liu, National Time Service Center / Chinese Academy of Sciences, China  
Shougang Zhang, National Time Service Center / Chinese Academy of Sciences, China

**(67) New Timekeeping System and its Time Link Calibration at Nim**

Kun Liang, National Institute of Metrology, China  
Aimin Zhang, National Institute of Metrology, China  
Weibo Wang, National Institute of Metrology, China  
Dayu Ning, National Institute of Metrology, China  
Yuan Gao, National Institute of Metrology, China  
Zhiqiang Yang, National Institute of Metrology, China  
Kejia Zhao, National Institute of Metrology, China  
Yue Zhang, National Institute of Metrology, China  
Kun Liu, National Institute of Metrology, China  
Bo Long, Guizhou Institute of Metrology, China

**(68) A New Steering Strategy for UTC(NTSC)**

Shuhong Zhao, National Time Service Center / Chinese Academy of Sciences, China  
Dongshan Yin, National Time Service Center / Chinese Academy of Sciences, China  
Shaowu Dong, National Time Service Center / Chinese Academy of Sciences, China  
Haibo Yuan, National Time Service Center / Chinese Academy of Sciences, China  
Lili Qu, National Time Service Center / Chinese Academy of Sciences, China  
Jun Ruan, National Time Service Center / Chinese Academy of Sciences, China

**(69) Study of an Atomic Clock Steering Method Based on Least Square**

Yuwei Li, National Time Service Center / Chinese Academy of Sciences, China  
Wenli Wang, National Time Service Center / Chinese Academy of Sciences, China  
Liu Ya, National Time Service Center / Chinese Academy of Sciences, China  
Xiaohui Li, National Time Service Center / Chinese Academy of Sciences, China  
Ruifang Dong, National Time Service Center / Chinese Academy of Sciences, China  
Yinhua Liu, National Time Service Center / Chinese Academy of Sciences, China

**(70) Calibration of GNSS Receivers**

Kun Liang, National Institute of Metrology, China  
Aimin Zhang, National Institute of Metrology, China  
Weibo Wang, National Institute of Metrology, China

**Session:** A3P-J: Optical Frequency Standards I

**Room:** Poster Area

**(56) Sub-Doppler Cooling with the 1S0-1P1 Line in Ytterbium**

*Nikita Kostylev, University of Western Australia, Australia*

*Eugene Ivanov, University of Western Australia, Australia*

*Michael Tobar, University of Western Australia, Australia*

*John McFerran, University of Western Australia, Australia*

**(57) Population Inversion on 88Sr Atomic Beam for Active Optical Clock**

*Xiaobo Xue, Peking University, China*

*Duo Pan, Peking University, China*

*Xiaogang Zhang, Peking University, China*

*Wei Zhuang, Peking University, China*

*Jingbiao Chen, Peking University, China*

**(64) Piezoelectric Periodically Polled Resonators for Nonlinear-Optical Conversion of Laser Radiation**

*Oleg Ryabushkin, NTO IRE-Polus / Moscow Institute of Physics and Technology, Russia*

*Aleksey Konyashkin, NTO IRE-Polus / Moscow Institute of Physics and Technology, Russia*

**(65) Improved Uncertainty of 171Yb Optical Lattice Clock at KRISS**

*Chang-Yong Park, Korea Research Institute of Standards and Science, Korea, South*

*Dai-Hyuk Yu, Korea Research Institute of Standards and Science, Korea, South*

*Won-Kyu Lee, Korea Research Institute of Standards and Science, Korea, South*

*Sangkyung Lee, Korea Research Institute of Standards and Science, Korea, South*

*Sang Eon Park, Korea Research Institute of Standards and Science, Korea, South*

*Jongchul Mun, Korea Research Institute of Standards and Science, Korea, South*

*Sang-Bum Lee, Korea Research Institute of Standards and Science, Korea, South*

*Taeg Yong Kwon, Korea Research Institute of Standards and Science, Korea, South*

## WEDNESDAY ORAL SESSIONS

**Wednesday 21 May**

Room 101A	Room 101B	Room 101C
<b>B1L-A: Optical Lattice Clocks</b>	<b>B1L-B: MEMS Oscillators</b>	<b>B1L-C: Physical Sensors</b>
Yann Le Coq, SYRTE	Clark T.-C Nguyen, University of California at Berkeley	Matteo Rinaldi, Northeastern University Svenja Knappe, NIST
<b>8:00</b>		
<p><b>Frequency Comparison of Cryogenic Optical Lattice Clocks Between Riken and the University of Tokyo*</b></p> <p><i>Hidetoshi Katori{1}, Ichiro Ushijima{1}, Masao Takamoto{2}</i></p> <p><i>{1}University of Tokyo, Japan; {2}University of Tokyo / RIKEN, Japan</i></p>	<p><b>Wafer-Level Selective Transfer Method for FBAR-LSI Integration*</b></p> <p><i>Kousuke Hikichi{4}, Kazushi Seiyama{1}, Masanori Ueda{3}, Shinji Taniguchi{3}, Ken-Ya Hashimoto{2}, Masayoshi Esashi{4}, Shuji Tanaka{4}</i></p> <p><i>{1}Asahi Kasei Microdevices Corporation, Japan; {2}Chiba University, Japan; {3}Taiyo Yuden Co. Ltd., Japan; {4}Tohoku University, Japan</i></p>	<p><b>Magnetic Sensors Based on Micromechanical Oscillators*</b></p> <p><i>Mo Li, Vashwar Rouf, Soner Sonmezoglu, David Horsley</i></p> <p><i>University of California, Davis, United States</i></p>
<b>8:40</b>		
<p><b>Optical Atomic Clock Measurements at the mHz Level</b></p> <p><i>Nathan Hinkley, Kyle Beloy, Nate Phillips, Marco Schioppa, Jeffrey Sherman, Chris Oates, Andrew Ludlow</i></p> <p><i>National Institute of Standards and Technology, United States</i></p>	<p><b>Integrated MEMS Oscillator for Cellular Transceivers</b></p> <p><i>Greg Chance{2}, Thorsten Meyer{3}, Stephan Stoekli{3}, Burkhard Neurauder{1}, Giuseppe Patane{1}, Bernhard Neubauer{1}, Gerald Minichshofer{1}, Jan Kuypers{4}, Juergen Schoepf{4}, Reimund Rebel{4}, Darren Weninger{4}, Kim Chung{4}, Tung Shen Chew{4}, Oscar Mendoza{4}</i></p> <p><i>{1}Danube Mobile Communications Engineering, Austria; {2}Intel Mobile and Communications Group, Germany; {3}Intel Mobile Communications, Germany; {4}Sand 9, United States</i></p>	<p><b>Ultra-Sensitive Magnetic Field Sensor Based on a Low-Noise Magnetolectric MEMS-CMOS Oscillator</b></p> <p><i>Yu Hui, Tianxiang Nan, Nianxiang Sun, Matteo Rinaldi</i></p> <p><i>Northeastern University, United States</i></p>

9:00

**Direct Frequency Comparison of Intercontinentally Separated Sr Lattice Clocks Using Carrier-Phase Two-Way Satellite Frequency Transfer**

*Tetsuya Ido{1}, Miho Fujieda{1}, Hidekazu Hachisu{1}, Shigeo Nagano{1}, Tadahiro Gotoh{1}, Stephan Falke{2}, Nils Huntemann{2}, Christian Grebing{2}, Burghard Lipphardt{2}, Christian Lisdat{2}, Dirk Piester{2}*

*{1}National Institute of Information and Communications Technology, Japan; {2}Physikalisch-Technische Bundesanstalt, Germany*

**Low Noise Chip Scale Atomic Clock (LNCSAC)**

*Peter Cash, Dan Boschen, Ramesh Gandham, David Mailoux*

*Microsemi Corporation, United States*

**A Fully Integrated Wafer-Scale Sub-mm<sup>3</sup> FBAR-Based Wireless Mass Sensor**

*Manohar Nagaraju{3}, Jingren Gu{3}, Andrew Lingley{3}, Fan Zhang{2}, Martha Small{1}, Richard Ruby{1}, Brian Otis{3}*

*{1}Avago Technologies, United States; {2}Marvell Semiconductor, United States; {3}University of Washington, United States*

9:20

**Prospects for Frequency Stabilization Using Collective Effects of Strontium Atoms in an Optical Cavity**

*Bjarke Takashi Røjle Christensen{3}, Martin Romme Henriksen{3}, Philip Grabow Westergaard{1}, Jun Ye{2}, Jan Westenkær Thomsen{3}*

*{1}Danish Fundamental Metrology, Denmark; {2}University of Colorado Boulder, United States; {3}University of Copenhagen, Denmark*

**A UHF SiGe Push-Pull Quartz MEMS Oscillator**

*Harris Moyer{1}, Yeong Yoon{1}, Zhiwei Xu{1}, Robert Nagele{1}, Deborah Kirby{1}, Randall Kubena{1}, Richard Joyce{1}, R.L. Bowen{2}, David Chang{1}*

*{1}HRL Laboratories LLC, United States; {2}HRL Laboratories, LLC, United States*

**Response Signal Enhancement of Film Bulk Acoustic Resonator Mass Sensor with Bounded Hydrophobic Teflon Film**

*Menglun Zhang, Weiwei Cui, Daihua Zhang, Wei Pang, Hao Zhang*

*Tianjin University, China*

9:40

**Lasing of Cesium Active Optical Clock with 459 nm Laser Pumping**

*Duo Pan, Zhichao Xu, Xiaobo Xue, Wei Zhuang, Jingbiao Chen*

*Peking University, China*

**A Low Noise, Wide Variable Range and High Linearity VCXO-IC Using Linearity Designable on-Chip Varactor Arrays for Fundamental AT-Cut Crystal Resonators**

*Yutaka Takahashi, Toshiyuki Shinotsuka, Hiroyasu Kunitomo, Takayuki Akutsu, Chisato Ishimaru, Shigeyoshi Murase, Kazuo Akaike*  
*Nihon Dempa Kogyo Co., Ltd., Japan*

**An Analysis of Frequency Temperature Characteristics of a Lamb Wave Type Quartz Acoustic Wave DeviceAtomically-Thin MoS<sub>2</sub> Resonators for Pressure Sensing**

*Jaesung Lee, Phillip Feng*

*Case Western Reserve University, United States*



Wednesday 21 May		
Room 101A	Room 101B	Room 101CD
<b>B2L-A: Vapor Cell and CPT Clocks</b>	<b>B2L-B: Photonics and Microwave Oscillators</b>	<b>B2L-C: Imaging and CMOS-MEMS Resonators</b>
Francois-Xavier Esnault, CNES	Enrico Rubiola, FEMTO-ST	Gianluca Piazza, Carnegie Mellon University
<b>13:20</b>		
<p><b>High Performance Compact Atomic Clock Based on Coherent Population Trapping*</b></p> <p><i>Stephane Guerandel, Jean-Marie Danet, Peter Yun, Emeric de Clercq</i></p> <p><i>LNE-SYRTE, France</i></p>	<p><b>Current Limitations of Cryogenic Microwave Oscillator Frequency Stability*</b></p> <p><i>Stephen Parker{2}, Eugene Ivanov{2}, Michael Tobar{2}, John Hartnett{1}</i></p> <p><i>{1}University of Adelaide, Australia; {2}University of Western Australia, Australia</i></p>	<p><b>Near-Field Microscopy: Is There an Alternative to Micro and Nano Resonating Cantilevers?</b></p> <p><i>Lionel Buchaillot{2}, Estelle Mairiaux{2}, Benjamin Walter{2}, Zhuang Xiong{2}, Marc Faucher{2}, Bernard Legrand{2}, Didier Theron{2}, Emmanuelle Algré{1}</i></p> <p><i>{1}ESIEE ESYCOM, France; {2}Université de Lille 1 / L'Institut d'Electronique, de Microélectronique et de Nanotechnologie, France</i></p>
<b>13:40</b>		
		<p><b>Laser Probe System for 5 GHz SAW/BAW Devices</b></p> <p><i>Ken-Ya Hashimoto, Shuntaro Kawachi, Akira Takahashi, Shinya Sakamoto, Tatsuya Omori</i></p> <p><i>Chiba University, Japan</i></p>
<b>14:00</b>		
<p><b>Pulsed Optically Pumped Rubidium Clock with Ultrahigh Resonance Contrast*</b></p> <p><i>Jianliao Deng, Jinda Lin, Jun Qian, Gongxun Dong, Huijuan He, Yuzhu Wang</i></p> <p><i>Shanghai Institute of Optics and Fine Mechanics / Chinese Academy of Sciences, China</i></p>	<p><b>Metamaterial Möbius Strips (MMS): Application in Resonators for Oscillators and Synthesizers</b></p> <p><i>Ajay Poddar{1}, Ulrich Rohde{2}</i></p> <p><i>{1}Synergy Microwave Corporation, United States; {2}Synergy Microwave Corporation / Brandenburgische Technische Universität, Germany</i></p>	<p><b>A CMOS-MEMS Arrayed RGFET</b></p> <p><i>Chi-Hang Chin, Sheng-Shian Li</i></p> <p><i>National Tsing Hua University, Taiwan</i></p>

<p><i>continued from previous time slot</i></p>	<b>14:20</b>	
<p><b>Frequency Biases in a Cold-Atom Coherent Population Trapping Clock</b></p> <p><i>Elizabeth Donley{2}, Eric Blanshan{2}, Francois-Xavier Esnault{1}, John Kitching{2}</i></p> <p><i>{1}Centre National d'Etudes Spatiales, France; {2}National Institute of Standards and Technology, United States</i></p>	<p><b>Ultra-High Stability Cryocooled Sapphire Microwave Oscillators</b></p> <p><i>Ashby Hilton{2}, John Hartnett{1}, Eugene Ivanov{2}, Andre Luiten{1}</i></p> <p><i>{1}University of Adelaide, Australia; {2}University of Western Australia, Australia</i></p>	<p><b>An Experimental Investigation on the Q-Boosted CMOS-MEMS Flexural-Mode Resonator Circuits</b></p> <p><i>Ming-Huang Li, Chao-Yu Chen, Sheng-Shian Li</i></p> <p><i>National Tsing Hua University, Taiwan</i></p>
<b>14:40</b>		
<p><b>Investigation on Light Shift in CPT-Ramsey Resonance for Compact Atomic Clocks</b></p> <p><i>Yuichiro Yano{2}, Wujie Gao{2}, Shigeyoshi Goka{2}, Masatoshi Kajita{1}</i></p> <p><i>{1}National Institute of Information and Communications Technology, Japan; {2}Tokyo Metropolitan University, Japan</i></p>	<p><b>50 GHz Optical Frequency Comb Generation Based on an Optoelectronic Oscillator</b></p> <p><i>Xiaopeng Xie, Huanfa Peng, Tao Sun, Cheng Zhang, Peng Guo, Lixin Zhu, Weiwei Hu, Zhangyuan Chen</i></p> <p><i>Peking University, China</i></p>	<p><b>Exploring Parametric Resonance Effects in Bulk-Mode CMOS-MEMS Resonators</b></p> <p><i>Jaesung Lee{1}, Cheng-Syun Li{1}, Zenghui Wang{1}, Ming-Huang Li{2}, Chi-Hang Chin{2}, Sheng-Shian Li{2}, Philip Feng{1}</i></p> <p><i>{1}Case Western Reserve University, United States; {2}National Tsing Hua University, Taiwan</i></p>
<b>15:00</b>		
		<p><b>Si MEMS Disk Resonator Supported by Double-Ended Tuning Fork Absorbers</b></p> <p><i>Takahiro Ohtsuka, Makiko Kageyama, Yu Iwai, Akihiko Tashiro, Atsushi Kamijo, Noritoshi Kimura</i></p> <p><i>Nihon Dempa Kogyo Co., Ltd., Japan</i></p>

## WEDNESDAY POSTER SESSION

15:40 – 17:40

*(prefix numbers register poster location in Poster Session B, Exhibits Hall)*

**Session:** B3P-D: Materials, Filters & Resonators II

**Room:** Poster Area

**Session Chair:** Ji Wang, Ningbo University

**(15) Growth and Piezoelectric Properties of ReCa<sub>4</sub>O(BO<sub>3</sub>)<sub>3</sub> (Re=Y,Sm) Crystals**

*Kainan Xiong, Shanghai Institute of Ceramics / Chinese Academy of Sciences, China  
Yanqing Zheng, Shanghai Institute of Ceramics / Chinese Academy of Sciences, China  
Xiaoniu Tu, Shanghai Institute of Ceramics / Chinese Academy of Sciences, China  
Quanming Lin, Shanghai Institute of Ceramics / Chinese Academy of Sciences, China  
Yaqiao Li, Shanghai Institute of Ceramics / Chinese Academy of Sciences, China  
Erwei Shi, Shanghai Institute of Ceramics / Chinese Academy of Sciences, China*

**(16) Electromagnetic Intermodulation Interference Using Quartz Oscillators**

*Wen-Teng Chang, National University of Kaohsiung, Taiwan  
Kuei-Jie Tseng, National University of Kaohsiung, Taiwan  
Su-Hao Lai, National University of Kaohsiung, Taiwan*

**(17) Experimental Investigations of SC-Cut Resonators with B-Mode Reduction**

*Aleksei Lozhnikov, PJSC Omskiy Nauchno Issledovatel'skiy Institut Priborostroeniya, Russia  
Aleksandr Lepetaev, Omsk State Technical University, Russia*

**(18) Analysis of Quality Factor of Quartz-Crystal Tuning Fork Fabricated by Etching Process**

*Hideaki Itoh, Shinshu University, Japan*

**(19) Crystal Growth and High Temperature Applications of 3" Langatate**

*Xiaoniu Tu, Shanghai Institute of Ceramics / Chinese Academy of Sciences, China  
Yanqing Zheng, Shanghai Institute of Ceramics / Chinese Academy of Sciences, China  
Kainan Xiong, Shanghai Institute of Ceramics / Chinese Academy of Sciences, China  
Quanming Lin, Shanghai Institute of Ceramics / Chinese Academy of Sciences, China  
Yaqiao Li, Shanghai Institute of Ceramics / Chinese Academy of Sciences, China  
Ying Shi, Shanghai University, China  
Erwei Shi, Shanghai Institute of Ceramics / Chinese Academy of Sciences, China*

**(20) Deposition of Highly C-Axis-Oriented ScAlN Thin Films by RF Magnetron Sputtering Using a Sc-Al Alloy Target**

*Satoshi Fujii, Chiba University, Japan  
Shogo Shimizu, Chiba University, Japan  
Masahiro Sumisaka, Chiba University, Japan  
Yu Suzuki, Furuya Metal Company Ltd., Japan  
Shouhei Otomo, Furuya Metal Company Ltd., Japan  
Tatsuya Omori, Chiba University, Japan  
Ken-Ya Hashimoto, Chiba University, Japan*

**(21) Surface Acoustic Wave Resonator Using Layered Phononic Crystals**

*Jia-Hong Sun, Chang Gung University, Taiwan  
Jyun-Hua Zhou, Chang Gung University, Taiwan*

**(22) A Study on Raising the Fundamental TS-Mode Resistance by Energy Trapping for 3rd Overtone Resonator Performance Enhancement**

*Shih-Yung Pao, TXC Corporation, Taiwan*  
*Wen-Yuan Chang, TXC Corporation, China*  
*Bi-Qing Hsu, TXC Corporation, China*  
*Yen-Ting Lai, Tatung University, Taiwan*  
*Yung-Yu Chen, Tatung University, Taiwan*  
*Tao Lin, TXC Corporation, China*  
*Min-Chiang Chao, TXC Corporation, China*

**(23) Ultra-Sensitive Whispering Gallery Mode Spectroscopy of Low Loss Crystals at Cryogenic Temperatures**

*Maxim Goryachev, University of Western Australia, Australia*  
*Warrick Farr, University of Western Australia, Australia*  
*Natalia Carvalho, University of Western Australia, Australia*  
*Daniel Creedon, University of Western Australia, Australia*  
*Jean-Michel Le Floch, University of Western Australia, Australia*  
*Karim Benmessai, University of Western Australia, Australia*  
*Pavel Bushev, Universität des Saarlandes, Germany*  
*Michael Tobar, University of Western Australia, Australia*

**(24) Equivalent Network Representation in Cylindrical Coordinates for Trapped-Energy Resonators Operating in Backward-Wave-Type Thickness Vibration Modes**

*Ken Yamada, Tohoku Gakuin University, Japan*  
*Daisuke Suzuki, Tohoku Gakuin University, Japan*  
*Yudai Kon, Tohoku Gakuin University, Japan*

**(25) A Study for the Relationship Between Drive Level and the Activation Energy in Arrhenius Accelerated Aging Model for Small Size Quartz Resonators**

*Chun Nan Shen, TXC Corporation, China*  
*Jun Jun Xu, TXC Corporation, China*  
*Min-Chiang Chao, TXC Corporation, China*

**(26) Anchor Loss Reduction in AlN Lamb Wave Resonators Using Phononic Crystal Strip Tethers**

*Chih-Ming Lin, University of California, Berkeley, United States*  
*Jin-Chen Hsu, National Yunlin University of Science and Technology, Taiwan*  
*Debbie Senesky, Stanford University, United States*  
*Albert Pisano, University of California, San Diego, United States*

**Session:** B3P-E: Oscillators, Synthesizers, Noise & Circuit Techniques II

**Room:** Poster Area

**Session Chair:** Fabrice Sthal, FEMTO-ST

**(11) Thermal Effect of the Microwave Mach-Zehnder Interferometric Switch**

*Yu Zhang, Beijing Institute of Technology, China*  
*Kun Liu, National Institute of Metrology, China*  
*Fang Fang, National Institute of Metrology, China*  
*Nianfeng Liu, National Institute of Metrology, China*  
*Tianchu Li, National Institute of Metrology, China*

**(12) A Chip-Scale Atomic Resonator-Based Stabilization System for Optoelectronic Oscillator**

*Zheng Chen, Peking University, China*  
*Yaolin Zhang, Peking University, China*  
*Jianye Zhao, Peking University, China*

**(13) Spectral Properties of Dithered Nyquist-Rate Single-Bit Quantized Amplitude-Modulated Sinewaves**

*Paul Sotiriadis, National Technical University of Athens, Greece*

**(29) Digitally Controlled Thermostat for a High-Stable Crystal Oscillator**

*Nikolay Vorobyev, FEMTO-ST Institute, France*

*Joël Imbaud, FEMTO-ST Institute, France*

*Philippe Abbe, FEMTO-ST Institute, France*

*Fabrice Sthal, FEMTO-ST Institute, France*

**(30) Nonlinear Model of Crystal Resonator and its Application to Phase Noise Simulation of Oscillator**

*Tsubasa Yasuda, Yokohama National University, Japan*

*Shasika Shaminda Senanayaka, Yokohama National University, Japan*

*Kohei Uchino, Yokohama National University, Japan*

*Takehiko Adachi, Yokohama National University, Japan*

**Session:** B3P-F: Microwave Standards II

**Room:** Poster Area

**Session Chair:** Yuan-Yu Jau, Sandia National Laboratories

**(47) An Atomic Clock Based on Coherent Population Beating**

*Dawei Li, Peking University, China*

*Daiting Shi, Peking University, China*

*Ermeng Hu, Peking University, China*

*Yigen Wang, Peking University, China*

*Lu Tian, Peking University, China*

*Jianye Zhao, Peking University, China*

*Zhong Wang, Peking University, China*

**(48) The Research of Control System for Cesium Atomic Fountain Clock**

*Dandan Liu, National Time Service Center / Chinese Academy of Sciences, China*

*Xinliang Wang, National Time Service Center / Chinese Academy of Sciences, China*

*Rui Lin, National Time Service Center / Chinese Academy of Sciences/University of Chinese Academy of Science, China*

*Jiang Chen, National Time Service Center / Chinese Academy of Sciences, China*

*Hui Zhang, National Time Service Center / Chinese Academy of Sciences, China*

*Jun Ruan, National Time Service Center / Chinese Academy of Sciences, China*

*Yong Guan, National Time Service Center / Chinese Academy of Sciences, China*

*Fengxiang Yu, National Time Service Center / Chinese Academy of Sciences/University of Chinese Academy of Science, China*

*Junru Shi, National Time Service Center / Chinese Academy of Sciences/University of Chinese Academy of Science, China*

*Shougang Zhang, National Time Service Center / Chinese Academy of Sciences, China*

**(49) Effects of Polarization on Recoil-Induced Resonances of Rubidium Atoms in Diffuse Laser Light**

*Wenli Wang, Shanghai Institute of Optics and Fine Mechanics / Chinese Academy of Sciences, China*

*Jun Qian, Shanghai Institute of Optics and Fine Mechanics / Chinese Academy of Sciences, China*

*Jianliao Deng, Shanghai Institute of Optics and Fine Mechanics / Chinese Academy of Sciences, China*

*Yuzhu Wang, Shanghai Institute of Optics and Fine Mechanics / Chinese Academy of Sciences, China*

**(50) Research on Modification of H-maser Drift**

*Aimin Zhang, National Institute of Metrology, China  
Weibo Wang, National Institute of Metrology, China  
Yuan Gao, National Institute of Metrology, China  
Kun Liang, National Institute of Metrology, China  
Zhiqiang Yang, National Institute of Metrology, China  
Kun Liu, National Institute of Metrology, China*

**(71) Researches of Local Oscillator Locking of Atomic Fountain Clock and its Frequency Shift**

*Richang Dong, Shanghai Institute of Optics and Fine Mechanics / Chinese Academy of Sciences, China  
Rong Wei, Shanghai Institute of Optics and Fine Mechanics / Chinese Academy of Sciences, China  
Yuanbo Du, Shanghai Institute of Optics and Fine Mechanics / Chinese Academy of Sciences, China  
Yuzhu Wang, Shanghai Institute of Optics and Fine Mechanics / Chinese Academy of Sciences, China*

**(72) Progress in the Development of Commercial Optically Pumped Cesium Atomic Clock**

*Yuanhong Cao, Chengdu Spaceon Electronics Co. Ltd., China  
Xingwen Zhao, Chengdu Spaceon Electronics Co. Ltd., China  
Lin Yang, Chengdu Spaceon Electronics Co. Ltd. / Sichuan Spaceon Time & Frequency Tech. Co., Ltd, China  
Haijun Chen, CETC-12 institute, China  
Shougang Zhang, National Time Service Center / Chinese Academy of Sciences, China*

**(73) Low Power Chip-Scale CPT Atomic Clock with New Microwave Frequency Modulation Technique**

*Cheng Xing, Peking University, China  
Yaolin Zhang, Peking University, China  
Jiutao Wu, Peking University, China  
Jianye Zhao, Peking University, China*

**(74) Laser Power Stabilization for the Detection of the Populations of the Atomic Double Levels in Cs Fountain Clock**

*Rui Lin, National Time Service Center / Chinese Academy of Sciences/University of Chinese Academy of Science, China  
Dandan Liu, National Time Service Center / Chinese Academy of Sciences, China  
Jun Ruan, National Time Service Center / Chinese Academy of Sciences, China  
Wenyu Zhao, National Time Service Center / Chinese Academy of Sciences, China  
Xinliang Wang, National Time Service Center / Chinese Academy of Sciences, China  
Jiang Chen, National Time Service Center / Chinese Academy of Sciences, China  
Yong Guan, National Time Service Center / Chinese Academy of Sciences, China  
Hui Zhang, National Time Service Center / Chinese Academy of Sciences, China  
Fengxiang Yu, National Time Service Center / Chinese Academy of Sciences/University of Chinese Academy of Science, China  
Junru Shi, National Time Service Center / Chinese Academy of Sciences/University of Chinese Academy of Science, China  
Shougang Zhang, National Time Service Center / Chinese Academy of Sciences, China*

**Session:** B3P-H: Time & Frequency II

**Room:** Poster Area

**Session Chair:** Huang-Tien Lin, Chunghwa Telecom Co., Ltd.

**(41) GNSS System Time Offset Monitoring at NTSC**

*Huijun Zhang, National Time Service Center / Chinese Academy of Sciences, China*

*Lin Zhu, National Time Service Center / Chinese Academy of Sciences, China*

*Xiaohui Li, National Time Service Center / Chinese Academy of Sciences, China*

*Haifeng Jiang, National Time Service Center / Chinese Academy of Sciences, China*

*Xue Zhang, National Time Service Center / Chinese Academy of Sciences, China*

**(42) The Research of Demarcating and Evaluating Method of System Error of Mobile Station**

*Weijin Qin, National Time Service Center / Chinese Academy of Sciences, China*

*Pei Wei, National Time Service Center / Chinese Academy of Sciences, China*

*Xiaoqian Ren, National Time Service Center / Chinese Academy of Sciences, China*

*Xuhai Yang, National Time Service Center / Chinese Academy of Sciences, China*

*Hong Chang, National Time Service Center / Chinese Academy of Sciences, China*

**(43) A New Method of Time Difference Calibration of TWSTFT Earth Station Based on Two Portable Stations**

*Guoyong Wang, National Time Service Center / Chinese Academy of Sciences, China*

*Ya Liu, National Time Service Center / Chinese Academy of Sciences, China*

*Xiaohui Li, National Time Service Center / Chinese Academy of Sciences, China*

*Ruifang Dong, National Time Service Center / Chinese Academy of Sciences, China*

**(77) Effect of Temperature on Precision of TWSTFT Clock Comparison in Chinese Area Positioning System**

*Fen Cao, National Time Service Center / Chinese Academy of Sciences, China*

*Xuhai Yang, National Time Service Center / Chinese Academy of Sciences, China*

*Tao Liu, National Time Service Center / Chinese Academy of Sciences, China*

*Zhigang Li, National Time Service Center / Chinese Academy of Sciences, China*

*Yao Kong, National Time Service Center / Chinese Academy of Sciences, China*

*Hui Lei, National Time Service Center / Chinese Academy of Sciences, China*

*Liang Chen, National Time Service Center / Chinese Academy of Sciences, China*

*Chugang Feng, Shanghai Astronomical Observatory, China*

**(78) The Optimum Selection Method and Performance Analysis for Weil Code of Satellite Navigation System**

*Juan Du, National Time Service Center / Chinese Academy of Sciences, China*

*Ji Guo, National Time Service Center / Chinese Academy of Sciences, China*

*Xiaochun Lu, National Time Service Center / Chinese Academy of Sciences, China*

*Xue Wang, National Time Service Center / Chinese Academy of Sciences, China*

*Lin Yang, Chengdu Spaceon Electronics Co. Ltd. / Sichuan Spaceon Time & Frequency Tech. Co., Ltd, China*

*Jun Ruan, National Time Service Center / Chinese Academy of Sciences, China*

**(79) The TWSTFT Links Circling the World**

*Huang-Tien Lin, Chunghwa Telecom Co., Ltd., Taiwan*

*Yi-Jiun Huang, Chunghwa Telecom Co., Ltd., Taiwan*

*Wen-Hung Tseng, Chunghwa Telecom Co., Ltd., Taiwan*

*Chia-Shu Liao, Chunghwa Telecom Co., Ltd., Taiwan*

*Fang-Dar Chu, Chunghwa Telecom Co., Ltd., Taiwan*

**(80) The Analysis of Differential Code Bias of BeiDou Satellite Navigation System**

*Yinhua Liu, National Time Service Center / Chinese Academy of Sciences, China  
Xiaohui Li, National Time Service Center / Chinese Academy of Sciences, China  
Jun Ruan, National Time Service Center / Chinese Academy of Sciences, China  
Huijun Zhang, National Time Service Center / Chinese Academy of Sciences, China  
Lin Yang, Chengdu Spaceon Electronics Co. Ltd. / Sichuan Spaceon Time & Frequency  
Tech. Co., Ltd, China*

**Session:** B3P-J: Optical Frequency Standards II

**Room:** Poster Area

**Session Chair:** John McFerran, UWA

**(44) Alkali Pressure Shifts and Their Temperature Dependence: Measurements with the Rb Isoclinic Point**

*Nathan Wells, Aerospace Corporation, United States  
Travis Driskell, Aerospace Corporation, United States  
James Camparo, Aerospace Corporation, United States*

**(45) Mid-Infrared Frequency Comb Based on Highly-Efficient Optical Parametric Oscillator**

*Shigeo Nagano, National Institute of Information and Communications Technology, Japan  
Hiroyuki Ito, National Institute of Information and Communications Technology, Japan  
Motohiro Kumagai, National Institute of Information and Communications Technology,  
Japan  
Masatoshi Kajita, National Institute of Information and Communications Technology, Japan  
Yuko Hanado, National Institute of Information and Communications Technology, Japan*

**(46) Coherence Transfer from 1064 nm to the Region of 700-1000 nm with an Optical Frequency Comb**

*Yanyi Jiang, East China Normal University, China  
Haiqin Chen, East China Normal University, China  
Su Fang, East China Normal University, China  
Zhiyi Bi, East China Normal University, China  
Long Sheng Ma, East China Normal University, China*

**(75) Development of an Er: fiber-Based Femtosecond Laser at NTSC**

*Yanyan Zhang, National Time Service Center / Chinese Academy of Sciences, China  
Wenyu Zhao, National Time Service Center / Chinese Academy of Sciences, China  
Sen Meng, Xi'an Shiyou University, China  
Lulu Yan, National Time Service Center / Chinese Academy of Sciences, China  
Wenge Guo, Xi'an Shiyou University, China  
Shougang Zhang, National Time Service Center / Chinese Academy of Sciences, China  
Haifeng Jiang, National Time Service Center / Chinese Academy of Sciences, China*

**(76) New Analytic Estimate of Thermal Noise in Spindle Optical Cavities**

*Guanjun Xu, National Time Service Center / Chinese Academy of Sciences, China  
Linbo Zhang, National Time Service Center / Chinese Academy of Sciences, China  
Jie Liu, National Time Service Center / Chinese Academy of Sciences, China  
Jing Gao, National Time Service Center / Chinese Academy of Sciences, China  
Dongdong Jiao, National Time Service Center / Chinese Academy of Sciences, China  
Long Chen, National Time Service Center / Chinese Academy of Sciences, China  
Ruifang Dong, National Time Service Center / Chinese Academy of Sciences, China  
Tao Liu, National Time Service Center / Chinese Academy of Sciences, China  
Shougang Zhang, National Time Service Center / Chinese Academy of Sciences, China*



## THURSDAY ORAL SESSIONS

Thursday 22 May		
Room 101A	Room 101B	Room 101CD
<b>C1L-A: Atomic Fountains and Precision Measurements</b>	<b>C1L-B: Modeling &amp; Characterization of Sensors</b>	<b>C1L-C: Phononics and Non-Linear Phenomena</b>
Andre Luiten, The University of Adelaide	Philip Feng, Case Western Reserve University Svenja Knappe, NIST	Jan Kuypers, Sand 9
<b>8:00</b>		
<p><b>Cold-Atom Clocks as Part of a Timing Ensemble*</b></p> <p><i>Christopher Ekstrom, James Hanssen, Thomas Swanson, Jennifer Taylor, Steven Peil</i></p> <p><i>United States Naval Observatory, United States</i></p>	<p><b>Nonlinear Dynamics and All Mechanical Phonon Lasing in Electromechanical Resonators*</b></p> <p><i>Hiroshi Yamaguchi, Imran Mahboob, Hajime Okamoto</i></p> <p><i>Nippon Telegraph and Telephone Corporation Basic Research Laboratories, Japan</i></p>	<p><b>Love Waves in a Quartz-Based Phononic Structure</b></p> <p><i>Tsung-Tsong Wu{1}, Ting-Wei Liu{1}, Yu-Ching Lin{2}, Yao-Chuan Tsai{2}, Takahito Ono{2}, Shuji Tanaka{2}</i></p> <p><i>{1}National Taiwan University, Taiwan; {2}Tohoku University, Japan</i></p>
<b>8:20</b>		
		<p><b>Phononic Crystals for Acoustic Confinement in CMOS-MEMS Resonators</b></p> <p><i>Bichoy Bahr, Radhika Marathe, Dana Weinstein</i></p> <p><i>Massachusetts Institute of Technology, United States</i></p>
<b>8:40</b>		
<p><b>Testing Speed of Light Isotropy Using Rotating Cryogenic Sapphire Microwave Oscillators</b></p> <p><i>Stephen Parker{3}, Moritz Nagel{1}, Evgeny Kovalchuk{1}, Paul Stanwix{3}, Eugene Ivanov{3}, John Hartnett{2}, Achim Peters{1}, Michael Tobar{3}</i></p> <p><i>{1}Humboldt University of Berlin, Germany; {2}University of Adelaide, Australia; {3}University of Western Australia, Australia</i></p>	<p><b>Multimode Characteristics of High-Frequency CMOS-MEMS Resonators</b></p> <p><i>Jaesung Lee{1}, Cheng-Syun Li{1}, Ming-Huang Li{2}, Chi-Hang Chin{2}, Sheng-Shian Li{2}, Philip Feng{1}</i></p> <p><i>{1}Case Western Reserve University, United States; {2}National Tsing Hua University, Taiwan</i></p>	<p><b>Orientation Dependence of Nonlinearity and TCF in High-Q Shear-Modes of Silicon MEMS Resonators</b></p> <p><i>Haoshen Zhu, Joshua Lee</i></p> <p><i>City University of Hong Kong, Hong Kong</i></p>

<b>9:00</b>		
<p style="text-align: center;"><b>Accuracy Evaluation of the KRISS-F1 Fountain Clock</b></p> <p><i>Sang Eon Park{1}, Myoung-Sun Heo{1}, Taeg Yong Kwon{1}, Kurt Gibble{2}, Sang-Bum Lee{1}, Chang-Yong Park{1}, Won-Kyu Lee{1}, Dai-Hyuk Yu{1}</i>  {1}Korea Research Institute of Standards and Science, Korea, South; {2}Pennsylvania State University, United States</p>	<p style="text-align: center;"><b>Modelling of Hysteresis and Creep in SAW Strain Sensors</b></p> <p><i>Victor Kalinin</i></p> <p><i>Transense Technologies PLC, United Kingdom</i></p>	<p style="text-align: center;"><b>Special Amplitude-Frequency Effects in VHF Quartz Resonators</b></p> <p><i>Randall Kubena{2}, Richard Joyce{2}, Brian Rose{1}, Yook-Kong Yong{3}</i></p> <p><i>{1}Consultant, United States; {2}HRL Laboratories LLC, United States; {3}Rutgers University, United States</i></p>
<b>9:20</b>		
<p style="text-align: center;"><b>PHARAO Flight Model : Integration and "On Ground" Performances Tests</b></p> <p><i>Francois-Xavier Esnault</i></p> <p><i>Centre National d'Études Spatiales, France</i></p>	<p style="text-align: center;"><b>Packaging the SAW Torque Sensor with Teflon</b></p> <p><i>Yanping Fan, Xiaojun Ji, Ping Cai, Yulin Han</i></p> <p><i>Shanghai Jiao Tong University, China</i></p>	<p style="text-align: center;"><b>High-Q and Low TCF HBAR Based on LiTaO3 Substrate</b></p> <p><i>Thomas Baron{3}, Gilles Martin{3}, Nicolas Chrétien{3}, Valérie Petrini{3}, Guillaume Combe{3}, Fabien Henrot{3}, Florent Bassignot{3}, Alexandre Reinhardt{1}, Pierre-Patrick Lassagne{1}, Jean-Marc Lesage{2}, David Rabus{5}, Luc Chommeloux{5}, Sylvain Ballandras{4}</i>  {1}CEA-Leti, France; {2}DGA Information Superiority, France; {3}FEMTO-ST Institute, France; {4}FreC'N'Sys SAS, France; {5}SENSeOR, France</p>
<b>9:40</b>		
<p style="text-align: center;"><b>A High Performance Rb Atomic Clock</b></p> <p><i>Lin Yang{2}, Runchang Du{1}, Yuanhong Cao{1}, Qing He{3}</i>  {1}Chengdu Spaceon Electronics Co. Ltd., China; {2}Chengdu Spaceon Electronics Co. Ltd. / Sichuan Spaceon Time &amp; Frequency Tech. Co., Ltd, China; {3}Southwest China Research Institute of Electronic Equipment, China</p>	<p style="text-align: center;"><b>Fast Calibration of Wireless and Passive Temperature Sensors Based on SAW Resonators</b></p> <p><i>Yulin Han, Tao Han, Weibiao Wang</i></p> <p><i>Shanghai Jiao Tong University, China</i></p>	<p style="text-align: center;"><b>Phononic SAW Transducers with Complete Frequency Bandgap Characteristics</b></p> <p><i>Ventsislav Yantchev{2}, Victor Plessky{1}</i></p> <p><i>{1}GVR Trade SA, Switzerland; {2}Uppsala University, Sweden</i></p>

**Thursday 22 May**

Room 101A	Room 101B	Room 101CD
<b>C2L-A: Optical Frequency Transfer</b>	<b>C2L-B: Digital Electronics and Noise</b>	<b>C2L-C: High Frequency Piezoelectric Resonators</b>
Kwangyun Jung, KAIST James Cahill, US Army Research Laboratory	Aaron Partridge, SiTime	Randy Kubena, HRL Laboratories
<b>10:20</b>		
<p align="center"><b>Optimization of Modulation Techniques for Suppression of GEMRS in Frequency Transfer Systems</b></p> <p><i>James Cahill{2}, Olukayode Okusaga{2}, Weimin Zhou{2}, Curtis Menyuk{1}, Gary Carter{1}</i>  <i>{1}University of Maryland Baltimore County, United States; {2}US Army Research Laboratory, United States</i></p>	<p align="center"><b>Phase Noise and Jitter in Digital Electronic Components*</b></p> <p><i>Claudio Calosso{2}, Enrico Rubiola{1}</i>  <i>{1}FEMTO-ST Institute, France; {2}Istituto Nazionale di Ricerca Metrologica, Italy</i></p>	<p align="center"><b>Piezoelectric Acoustic Wave Devices Based on Heterogeneous Integration Technology*</b></p> <p><i>Shuji Tanaka</i>  <i>Tohoku University, Japan</i></p>
<b>10:40</b>		
<p align="center"><b>Laser-to-Laser Remote Transfer and Synchronization with Sub-Fs Precision Over a 3.5 km Fiber Link</b></p> <p><i>Kemal Safak{3}, Ming Xin{2}, Michael Y. Peng{4}, Patrick T. Callahan{4}, Franz X. Kärtner{1}</i>  <i>{1}CFEL-DESY / Massachusetts Institute of Technology / University of Hamburg, Germany; {2}Deutsches Elektronen-Synchrotron, Germany; {3}Deutsches Elektronen-Synchrotron / University of Hamburg, Germany; {4}Massachusetts Institute of Technology, United States</i></p>		
<b>11:00</b>		
<p align="center"><b>Optical Frequency Transfer via 1840 km Fiber Link with Superior Stability</b></p> <p><i>Stefan Droste{1}, Filip Ozimek{2}, Thomas Udem{1}, Katharina Predehl{1}, Theodor W. Hänsch{1}, Harald Schnatz{2}, Gesine Grosche{2}, Ronald Holzwarth{1}</i>  <i>{1}Max Planck Institute of Quantum Optics, Germany; {2}Physikalisch-Technische Bundesanstalt, Germany</i></p>	<p align="center"><b>All Digital Frequency Synthesis Based on Pulse Direct Digital Synthesizer with Spurs Free Output and Improved Noise Floor*</b></p> <p><i>Paul Sotiriadis</i>  <i>National Technical University of Athens, Greece</i></p>	<p align="center"><b>Residual Noise Reduction in AlN Resonators by Prolonged RF Excitation</b></p> <p><i>Nancy Saldanha, Usama Zaghloul, Gianluca Piazza</i>  <i>Carnegie Melon University, United States</i></p>

<p style="text-align: center;"><b>11:20</b></p> <p style="text-align: center;"><b>Characterization of a 450-km-Baseline GPS Carrier-Phase Link Using an Optical Fiber Link</b></p> <p><i>Stefan Droste{1}, Christian Grebing{2}, Julia Leute{2}, Sebastian Raupach{2}, Andreas Bauch{2}, Gesine Grosche{2}, Ronald Holzwarth{1}</i>  <i>{1}Max Planck Institute of Quantum Optics, Germany; {2}Physikalisch-Technische Bundesanstalt, Germany</i></p>	<p><i>continued from previous time slot</i></p>	<p style="text-align: center;"><b>11:20</b></p> <p style="text-align: center;"><b>Phase Change Material Programmable Vias for Switching and Reconfiguration of Aluminum Nitride Piezoelectric MEMS Resonators</b></p> <p><i>Gwendolyn Hummel, Yu Hui, Matteo Rinaldi</i></p> <p style="text-align: center;"><i>Northeastern University, United States</i></p>
<b>11:40</b>		
<p style="text-align: center;"><b>Microwave Transfer Through Optical Frequency Comb Toward 10-19 Instability Using Fiber-Loop Optical-Microwave Phase Detectors</b></p> <p><i>Kwangyun Jung{1}, Junho Shin{1}, Jinho Kang{1}, Jungwon Kim{1}, Stephan Hunziker{2}, Chang-Ki Min{3}</i>  <i>{1}Korea Advanced Institute of Science and Technology, Korea, South; {2}Paul Scherrer Institute, Switzerland; {3}Pohang Accelerator Laboratory, Korea, South</i></p>	<p style="text-align: center;"><b>Delta-Sigma Modulation Techniques to Reduce Noise and Spurs in All-Digital RF Transmitters</b></p> <p><i>Kostas Galanopoulos, Charis Basetas, Paul Sotiriadis</i></p> <p style="text-align: center;"><i>National Technical University of Athens, Greece</i></p>	<p style="text-align: center;"><b>L-Band Lamb Mode Resonators in Gallium Nitride MMIC Technology</b></p> <p><i>Laura Popa, Dana Weinstein</i></p> <p style="text-align: center;"><i>Massachusetts Institute of Technology, United States</i></p>
<b>12:00</b>		
	<p style="text-align: center;"><b>On the Generation of Random Dithering Sequences with Specified Both Power Spectral Density and Probability Density Function</b></p> <p><i>Paul Sotiriadis</i></p> <p style="text-align: center;"><i>National Technical University of Athens, Greece</i></p>	<p style="text-align: center;"><b>Low TCF Lithium Tantalate Contour Mode Resonators</b></p> <p><i>Renyuan Wang{1}, Sunil A. Bhave{1}, Kushal Bhattacharjee{2}</i>  <i>{1}Cornell University, United States; {2}RF Micro Devices, Inc., United States</i></p>

**Thursday 22 May**

Room 101A	Room 101B	Room 101CD
<b>C3L-A: Ion Clocks</b>	<b>C3L-B: Phase Noise</b>	<b>C3L-C: Micromechanical Filters and MEMS Resonators</b>
Tetsuya Ido, NICT	Michael Driscoll, Consultant	Sheng-Shian Li, National Tsing Hua University
<b>13:20</b>		
<p align="center"><b>A High-Accuracy Mobile AI+ Optical Clock*</b></p> <p><i>S M Brewer{3}, J S Chen{1}, D R Leibrandt{1}, Chin-Wen Chou{1}, D J Wineland{1}, J C Bergquist{1}, T Rosenband{2}</i></p> <p><i>{1}National Institute of Standards and Technology, United States; {2}National Institute of Standards and Technology / Harvard University, United States; {3}National Institute of Standards and Technology / Massachusetts Institute of Technology, United States</i></p>	<p align="center"><b>The Pursuit for Low Cost and Low Phase Noise Synthesized Signal Sources: Theory &amp; Optimization</b></p> <p><i>Ajay Poddar{1}, Ulrich Rohde{2}</i></p> <p><i>{1}Synergy Microwave Corporation, United States; {2}Synergy Microwave Corporation / Brandenburgische Technische Universität, Germany</i></p>	<p align="center"><b>A Passband-Corrected High Rejection Channel-Select Micromechanical Disk Filter</b></p> <p><i>Mehmet Akgul, Clark Nguyen</i></p> <p><i>University of California, Berkeley, United States</i></p>
<b>13:40</b>		
	<p align="center"><b>Correlation Measurements Between PM and AM Noise in Oscillators</b></p> <p><i>Archita Hati, Craig Nelson, David Howe</i> <i>National Institute of Standards and Technology, United States</i></p>	<p align="center"><b>A Protocol for Automated Passband Correction of High-Order Microelectromechanical Filters</b></p> <p><i>Henry Barrow, Clark Nguyen</i> <i>University of California, Berkeley, United States</i></p>
<b>14:00</b>		
<p align="center"><b>The Comparison of the 40Ca+ Ion Clocks with the Improvement of the Clock Laser Stability</b></p> <p><i>Yao Huang, Peiliang Liu, Wu Bian, Hua Guan, Kelin Gao</i> <i>Wuhan Institute of Physics and Mathematics / Chinese Academy of Sciences, China</i></p>	<p align="center"><b>Modeling Spectral Description of Lock Phenomena in Harmonic Oscillator</b></p> <p><i>Kia Hock Tan, Eng Hock Lim, Fook Loong Lo</i> <i>Universiti Tunku Abdul Rahman, Malaysia</i></p>	<p align="center"><b>Active Q-Control for Improved Insertion Loss Micromechanical Filters</b></p> <p><i>Thura Lin Naing, Jalal Naghsh Nilchi, Ruonan Liu, Tristan Rocheleau, Clark Nguyen</i> <i>University of California, Berkeley, United States</i></p>

14:20

**Miniature Microwave Frequency Standard with Trapped  $^{171}\text{Yb}^+$**

*Yuan-Yu Jau<sup>{3}</sup>, Peter D.D. Schwindt<sup>{3}</sup>, Adrian Casias<sup>{3}</sup>, Darwin Serkland<sup>{3}</sup>, Ron Manginell<sup>{3}</sup>, Mathew Moorman<sup>{3}</sup>, Robert Boye<sup>{3}</sup>, Aaron Ison<sup>{3}</sup>, Ted Winrow<sup>{3}</sup>, Andrew McCants<sup>{3}</sup>, John Prestage<sup>{1}</sup>, Nan Yu<sup>{1}</sup>, James Kellogg<sup>{1}</sup>, Dan Boschen<sup>{2}</sup>, Igor Kosvin<sup>{2}</sup>  
<sup>{1}</sup>Jet Propulsion Laboratory, United States;  
<sup>{2}</sup>Microsemi Corporation, United States; <sup>{3}</sup>Sandia National Laboratories, United States*

**Collapse of the Cross-Spectral Function**

*Craig Nelson, Archita Hati, Dave Howe*

*National Institute of Standards and Technology, United States*

**Temperature Dependence of Torsional and Flexural Modes in 6H-SiC Microdisk Resonators**

*Rui Yang<sup>{1}</sup>, Zenghui Wang<sup>{1}</sup>, Jaesung Lee<sup>{1}</sup>, Kalyan Ladhane<sup>{2}</sup>, Darrin Young<sup>{2}</sup>, Philip Feng<sup>{1}</sup>*

*<sup>{1}</sup>Case Western Reserve University, United States;  
<sup>{2}</sup>University of Utah, United States*

14:40

**Improvement of the Signal-to-Noise Ratio of the Clock Signal for the Frequency Standard Based on  $^{113}\text{Cd}^+$  Ions**

*Kai Miao, Jianwei Zhang, Shiguang Wang, Zhengbo Wang, Lijun Wang  
Tsinghua University, China*

**Oscillator Phase Noise Reduction Using Self-Injection Locked and Phase Locked Loop (SILPLL)**

*Li Zhang<sup>{1}</sup>, Afshin Daryoush<sup>{1}</sup>, Ajay Poddar<sup>{2}</sup>, Ulrich Rohde<sup>{3}</sup>*

*<sup>{1}</sup>Drexel University, United States; <sup>{2}</sup>Synergy Microwave Corporation, United States; <sup>{3}</sup>Synergy Microwave Corporation / Brandenburgische Technische Universität, United States*

**A Temperature-Stable Clock Using Multiple Temperature-Compensated Micro-Resonators**

*Vikram A. Thakar, Cesar Figueroa, Zhengzheng Wu, Mina Rais-Zadeh*

*University of Michigan, United States*

15:00

**Coupling Theory for Fluctuating Spurs in Oscillators**

*Michael Underhill  
Underhill Research Limited, United Kingdom*