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WELCOME FROM THE GENERAL CHAIR

It is my pleasure to welcome you to the 70th Anniversary of the International Frequency Control Symposium. We celebrate this important milestone in the Symposium's history in New Orleans, a venue that is known for its hospitality, and rich culture that is world recognized. On behalf of the staff and the many volunteers that helped organize the symposium, I invite you to partake in the unique cultural offerings of New Orleans which include world renowned Jazz, food, architecture, and deep history. The Symposium Staff will be happy to provide you with Tourist information. Further information for learning about the numerous events in the city and optimizing your New Orleans experience can be found on the city's Tourism site: http://www.neworleansonline.com/.

The historic Roosevelt hotel, a Waldorf Astoria property, is the actual site of this year's symposium. The hotel has excellent facilities for Oral Sessions providing an enhanced and comfortable experience for the attendees. The Poster Sessions will be held at the site of Exhibitors to provide the attendees the opportunity to mingle and network with colleagues and poster presenters, as well as learn about the latest and most advanced offerings of vendors.

To commemorate the 70th Anniversary of the Symposium, our Technical Program Chair, Dr. Elizabeth Donley, has led a team of dedicated volunteers to organize an outstanding Technical Program. The Program includes, for the first time, three exciting Plenary Speakers, one for each day of the Symposium.

There are three Award Ceremonies, one on each of the Symposium days. In addition to IFCS' awards, Rabi, Sawyer, and Cady awards, we are pleased to also celebrate two of the UFFC Society's highest recognitions, the 2016 UFFC Achievement Award to David Allan, and the 2015 UFFC Distinguished Service Award to Jackie Hines.

The UFFC Society's President, Professor Clark Nguyen will be attending the Symposium, chairing a Technical Session on Tuesday, and hosting the Students Breakfast on Thursday. We are extremely grateful for Professor Nguyen's support of the Symposium.

We have also arranged for two social programs, the Exhibitors Reception on Tuesday Evening, and the Symposium Dinner on Wednesday evening. One of the favorite New Orleans bands (Bucktown All Stars) will provide entertainment after dinner with a wide range of local music to enjoy and dance to. Both social programs will be held at the Roosevelt to make it convenient for all participants.

Women active in the technical areas of the IEEE IFCS symposium are encouraged to attend a special networking and social hour event organized by the women of the UFFC Society. The event will take place before the symposium banquet on Wednesday, May 11th. Each attendee is encouraged to submit a one-page biography about herself for display during the event.

There is also a special "Careers in Frequency and Timing" session arranged for students and young members of the community. Representatives from Government Labs, University, and Industry will discuss career opportunities in their respective institutions for students and young investigators attending the symposium, in a Panel setting.

A major offering of the IFCS 2016 Program is a visit to one of the LIGO detectors in Livingston, Louisiana. This timely visit, which is part of the Gravitational Wave Detection theme that runs through two of the Plenary talks, is a most unique opportunity for symposium participants and their guests, and will take place on Friday morning, after the conclusion of the Symposium.

I hope that you will enjoy all symposium programs, including the outstanding Technical Program, and all social and networking events that we have organized for you. This,

however, would not have been possible without the generous support of our sponsors and Exhibitors, which I gratefully acknowledge. In particular, I would like to thank NIST Time and Frequency Division for their generous support that was key in attracting and supporting participation of students in the Symposium. I would also like to thank and acknowledge the expert support I personally received from the staff of Conference Catalysts, LLC, our Symposium Treasurer Debra Coler of OEwaves, and my capable Assistant, Andrea Santwier. They all helped to make it a most pleasant experience for me in organizing the IFCS 2016.

Please join all of us in celebrating the 70th Anniversary of IFCS. I wish you a most pleasant and rewarding symposium experience.

Lute Maleki
IFCS 2016 General Chair

WELCOME FROM THE TECHNICAL PROGRAM COMMITTEE CHAIR

I am delighted to welcome you to the 70th IEEE International Frequency Control Symposium in New Orleans! We have done our best to create a Technical Program that is fitting for this special anniversary in the history of the IFCS.

The program was created with the leadership of the General Chair, Lute Maleki, and through the hard work of the TPC Vice-Chairs of the six topical groups and all of the TPC members. I thank everyone for their time and dedication. But of course, the most important contribution to the program is from the authors who are attending the symposium and presenting their latest exciting results as lectures, posters, and manuscripts.

The program features three outstanding plenary lectures – one for each morning of the symposium. On Tuesday, Joe Taylor of Princeton University will present a lecture entitled "Reflections on an astrophysical clock-comparison experiment." On Wednesday, Nergis Mavalvala from MIT will present a lecture on "Gravitational wave detection using precision interferometry." And finally, on Thursday, Alexander Rose from the Long Now Foundation will present a lecture on "Designing for longevity."

The three-day technical program consists of 110 lectures, including 28 invited lectures, and 145 posters. The posters will remain on display during the entire symposium, and will be presented by their authors on either Tuesday or Wednesday afternoon. The Student Paper Competition will be part of Tuesday's poster session, featuring 20 student finalists that were selected from 72 submitted abstracts representing all six topical groups. The winners will be awarded during the symposium banquet on Wednesday evening.

In addition to the main technical program, we are pleased to offer a day of outstanding tutorials on Monday that will be presented by 12 world-renowned expert lecturers. The three tutorial tracks focus on Optomechanical Systems, Timekeeping and Noise, and Sensors. We are also pleased to have exhibits held by 16 leading manufacturers and suppliers of frequency control products and equipment from around the world. In addition, we are excited to provide the opportunity for symposium attendees to tour the Laser Interferometer Gravitational-Wave Observatory (LIGO) in Livingston, Louisiana on the Friday after the symposium.

I am confident that this year's technical program will inspire you to have new ideas and form new relationships with colleagues in the IFCS community. Welcome, and enjoy the program!

Elizabeth Donley
2016 IFCS TPC Chair

PRACTICAL INFORMATION

Symposium Address

130 Roosevelt Way
New Orleans, Louisiana, 70112, USA

Emergency Number

Dial 911 from any phone in case of emergency.

Symposium Badge

The Symposium badge must be worn to all Symposium events. Attendees without a badge may be denied entrance to events.

No Recording or Job Posting

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.

Cell Phones

Out of courtesy to speakers and attendees, please turn off cell phones during sessions.

Symposium Proceedings

The Symposium Proceedings will be distributed via mail to registered attendees after the Symposium. The Proceedings are provided only in electronic format on a USB.

Speakers' Breakfasts

Speakers and Session Chairs for the Oral Sessions of the Symposium are required to attend a complimentary Speakers' Breakfast on the morning of their presentation/session from 7:30-8:30 am in Bienville Room. This breakfast is limited to one speaker per presentation. Note that this breakfast is mandatory for speakers.

Symposium Lunches

Lunch will be provided for Symposium attendees on Tuesday and Wednesday (and on Monday for Tutorial registrants). Attendees are free to have lunch on their own on Thursday. A lunch ticket for each eligible day is included in your name badge. Please be sure to have your ticket ready before entering the lunch room.

Exhibitors' Reception

Please join us for the Exhibitors' Reception on Tuesday, May 10, 18:00 - 20:00 in the Crescent City Ballroom. The reception is included in Symposium registration.

Symposium Banquet

The Symposium Banquet will be hosted on Wednesday, May 11 in the Waldorf Astoria Ballroom at the Roosevelt Hotel. A ticket to the Banquet is included with each full registration. Guest tickets may be purchased at the registration desk. There will be a high-energy jazz performance by the Bucktown Allstars.

Symposium App

The Whova app provides you with the most comfortable tool for planning your participation at IEEE IFCS 2016. Browse the complete program directly from your phone or tablet and create your very own agenda on the fly. The app is available for iOs, Android, and Blackberry/Windows devices. To download the mobile app, type 'whova' in Google Play, iTunes App Store or the Windows Phone Store. Internet or mobile data is required to download the app and agenda but is not required to run the app on your device. Whova allows attendees to network, get real-time live event updates, and more.

Internet

Internet will be provided in the meeting room space at the Roosevelt Hotel.

Tipping & Taxes

In restaurants, bars, and nightclubs, tip service staff and bartenders 15% to 20% of the check, tip checkroom attendants $1 per garment, and tip valet-parking attendants $1 per vehicle.

The sales tax in New Orleans is 9%.

Smoking

Smoking is banned in all public places in New Orleans, including bars.

Drinking Laws

The legal age for purchase and consumption of alcoholic beverages is 21; proof of age is required and often requested at bars, nightclubs, and restaurants.

Do not carry open containers of alcohol in your car or any public area that isn't zoned for alcohol consumption. The city of New Orleans, Louisiana allows the possession and consumption on the street of any alcoholic beverage in an open plastic container (not in glass bottles or containers).

IEEE IFCS 2016 ORGANIZING COMMITTEE

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Conference Management & Exhibits:
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IEEE IFCS 2016 TECHNICAL PROGRAM COMMITTEE

Group 1: Materials, Resonators, & Resonator Circuits

Sheng-Shian Li, National Tsing Hua University, Taiwan
Sarah Bedair, US Army Research Labs, USA
Yoonkee Kim, US Army CERDEC, USA
Randy Kubena, HRL Laboratories. USA
Jan H. Kuypers, Qorvo, USA
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Shuji Tanaka, Tohoku University, Japan
Ji Wang, Ningbo University, China
Zenghui (Max) Wang, Case Western Reserve University, USA
Dana Weinstein, Purdue University, USA
Yook-Kong Yong, Rutgers University, USA

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

Ajay Poddar, Synergy Microwave Corporation, USA
Michael Driscoll, Consultant, USA
Marvin Frerking, Innovative Technology Products, USA
Serge Galliou, FEMTO-ST, France
Wan-Thai Hsu, TXC Corporation, Taiwan
Xianhe Huang, Chengdu University, China
Eugene Ivanov, University of Western Australia, Australia
Olivier Llopis, LAAS, France
Craig Nelson, NIST, USA
Ulrich Rohde, Synergy Microwave Corporation, USA
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Paul Sotiriadis, National Technical University of Athens, Greece
Fabrice Sthal, FEMTO-ST, France
Kia Hock Tan, Universiti Tunku Abdul Rahman, Malaysia
Michael Tobar, University of Western Australia, Australia
Michael Underhill, Underhill Research Limited, United Kingdom

Group 3: Microwave Frequency Standards

Scott Crane, U.S. Naval Research Laboratory, USA
Eric Burt, JPL, USA
Francois-Xavier Esnault, CNES, France
Kurt Gibble, Penn State, USA
David Howe, NIST, USA
John Kitching, NIST, USA
Motohiro Kumagai, NICT, Japan
Filippo Levi, INRIM, Italy
Tianchu Li, NIM, China
Robert Lutwak, DARPA, USA
Salvatore Micalizio, INRIM, Italy
Gaetano Mileti, Université de Neuchâtel, Switzerland
Robert Tjoelker, JPL, USA
Qinghua Wang, Spectratime, Switzerland

Group 4: Resonant Sensors and Transducers

Svenja Knappe, NIST, USA
Jeffrey C. Andle, IntelliSAW, USA
Sylvain Ballandras, FEMTO-ST, France
Sunil Bhave, Purdue University, USA
Mark Cheng, Wayne State University, USA
Philip Feng, Case Western Reserve University, USA
Jackie Hines, ASR&D Corporation, USA
Fabien Josse, Marquette University, USA
Shigeru Kurosawa, AIST, Japan
Ryszard Lec, Drexel University, USA
Ralf Lucklum, Universität Magdeburg, Germany
Paul Muralt, EPFL, China
Clark Nguyen, U. C. Berkeley, USA
Mauricio Pereira da Cunha, University of Maine, USA
Leonhard Reindl, Uni Freiburg, Germany
Matteo Rinaldi, Northeastern University, USA
Clemens Ruppel, EPCOS AG, USA
Ashwin Seshia, University of Cambridge, United Kingdom
Isao Shimoyama, University of Tokyo, Japan
Sid Tallur, Analog Devices, USA
Guillermo Villanueva, Ecole Polytechnique Federal de Lausanne, Switzerland
Greg Weaver, Johns Hopkins APL, USA

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

Stefania Romisch, NIST, USA
Jean Pierre Aubry, Consultant, Switzerland
Andreas Bauch, PTB, Germany
Jérôme Delporte, CNES, France
Per Olof Hedekvist, SP Tech. Research Inst. of Sweden, Sweeden
Jan Johansson, SP Tech. Research Inst. of Sweden, Sweeden
Judah Levine, NIST, USA
Shinn-Yan (Calvin) Lin, Chunghwa Telecom Co., Ltd., Taiwan
Demetrios Matsakis, U.S. Naval Observatory, USA
Jeff Sherman, NIST, USA
Samuel Stein, Microsemi, USA
Pierre Waller, ESA, The Netherlands
Aimin Zhang, NIM, China
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Feng-Lei Hong, Yokohama National University, Japan
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Dave Leibrandt, NIST, USA
Long-Sheng Ma, East China Normal University, China
John McFerran, University of Western Australia, Australia
Marianna Safronova, University of Delaware, USA
Alexey Taichenachev, Inst. of Laser Physics, Russia
Nan Yu, JPL, USA

SPECIAL THANKS

The 2016 IEEE International Frequency Control Symposium is possible with support from:

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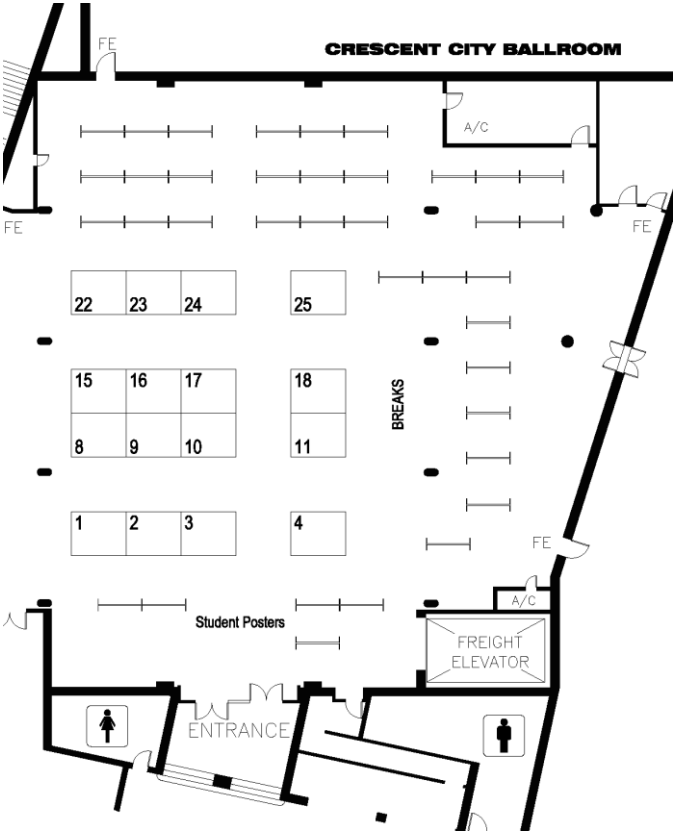
EXHIBIT HALL

The Exhibit Hall is in the Crescent City Ballroom. Exhibition hours are as follows:

Tuesday, May 10
10:00 AM - 12 Noon & 1:00 PM - 5:30 PM
Exhibitor Reception: 6:00 PM - 8:00PM

Wednesday, May 11
9:00 AM - 12 Noon & 1:00 PM - 5:00 PM

Thursday, May 12
9:00 AM - 12 Noon



1. Saunders & Associates
2. Advanced Modular Systems, Inc.
3. Stable Laser Systems
4. hQphotonics Inc.
8. Holzworth Instrumentation
9. IEEE UFFC Society
10. Microsemi Frequency & Time Corp
11. Meyer Burger (Germany) AG
15. Toptica Photonics
16. scia Systems GmbH
17. OEWaves
18. Noise XT
22. GuideTech
23. Menlo Systems
24. Frequency Electronics
25. SpectraDynamics

EXHIBITORS

Advanced Modular Systems
http://www.amssb.com/
Booth 2

Advanced Modular Systems Inc. was founded in response to an industry need for the unique requirements of the high volume manufacturing of piezoelectric thin films. Our projects range from simple software and electronics upgrades to fully automated production cluster tools with multiple modules. AMSystems provides world-class and efficient solutions to R&D and production customers alike. Our customers range from: university laboratories to large wafer manufacturing facilities that produce up to 50,000 wafers annually. Our easy to use, customized systems address all of our customers' unique process needs. We are a technology driven company, so our tools are designed based on our customers' process requirements. We provide novel solutions, continuous improvements, and outstanding service and support to our customers.

Frequency Electronics
http://fregelec.com/
Booth 24

Frequency Electronics, Inc. is a world leader in the design, development and manufacture of high precision timing, frequency control and synchronization products for space and terrestrial applications. Frequency's products are used in satellite payloads and in other commercial, government and military systems including C4ISR markets, missiles, UAVs, aircraft, GPS, secure radios, energy exploration and wireline and wireless communication networks. Frequency has received over 100 awards of excellence for achievements in providing high performance electronic assemblies for over 150 space and DOD programs. The Company invests significant resources in research and development and strategic acquisitions world-wide to expand its capabilities and markets.

GuideTech
http://www.guidetech.com/
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Come see our new instrument line: GT9000 2 to 24 channel “CTIA” & “TIC” with Integrated touch screen display, GT9001P-USB3 2 channel Portable “CTIA” & “TIC”, GT9000R 19” Rack-Mount 2 to 24 channel “CTIA” & “TIC”. Since 1988, A world leader in the design, development and manufacturing of High-Precision 0.9pS resolution, 4M m/s, Zero dead time Continuous Time & Frequency measurements for Scientific Laboratories, Research and Automated Test Applications. GuideTech’s products are used in commercial, education, research, government and military systems/applications.

Holzworth Instrumentation Inc.
http://www.holzworth.com/
Booth 8
Holzworth Instrumentation is a global provider of Phase Noise Analyzers and RF Synthesizer products that exhibit industry leading performance and high reliability. Based in Boulder Colorado, Holzworth designs and manufactures cross correlation analyzers with NIST traceable accuracy and broadband RF sources with excellent spectral purity. Holzworth products have been integrated into commercial/defense test systems and OEM applications, since 2004.

hQphotonics
Booth 4
hQphotonics specializes in low-phase-noise microwave oscillators based on electro-optical frequency division. Our first-generation product achieves a phase noise level competitive with high performance sapphire-loaded cavity oscillators. We offer low-phase-noise microwave oscillators over a wide frequency range (8-40 GHz). hQphotonics is founded by Caltech scientists and is located in Pasadena, California.

Menlo Systems
http://www.menlosystems.com/
Booth 23
Menlo Systems is a leading developer and global supplier of instrumentation for high-precision metrology. Known for its Nobel Prize winning optical frequency comb technology, the Munich-based company and its US subsidiary also supply femtosecond phase stabilization units, femtosecond lasers, THz systems, and a broad spectrum of high-sensitivity ultrafast photodetectors. In the US or Canada, please contact: ussales@menlosystems.com. For inquiries outside North America, please contact sales@menlosystems.com.

Meyer Burger
http://www.meyerburger.ch/en/
Booth 11
Meyer Burger (Germany) AG - BU MicroSystems is a global supplier of ion beam and plasma processing systems. The modular design of the systems allows a flexible adaption to various methods of surface treatment, such as reactive ion etching (RIE), plasma-enhanced chemical layer deposition (PECVD) or ion beam etching and deposition (IBE, IBD). The complex systems are mainly used in the semiconductor industry, precision optics and sensor manufacturing as well as in laboratory applications. The company has long-customer relationships with leading industrial and academic research institutions. The product range of MicroSystems ranges from systems for wafer processing on large-scale applications to strip processing plants, on which a wide range can be realized in technical processes. The systems differ from competitors primarily by the manufactured in-house core components such as plasma and ion beam sources. Consistent modular in design of systems to different plant types for the respective process requirements can be optimized.

Microsemi Corporation
http://www.microsemi.com/
Booth 10
Microsemi Corporation (Nasdaq: MSCC) offers a comprehensive portfolio of semiconductor and system solutions for communications, defense & security, aerospace and industrial markets. Products include high-performance, radiation-hardened and highly reliable analog mixed-signal integrated circuits, FPGAs, SoCs and ASICs; power management products; timing and voice processing devices; RF solutions; discrete components; security technologies and scalable anti-tamper products; Power-over-Ethernet ICs and midspans; as well as custom design capabilities and services. Microsemi is headquartered in Aliso Viejo, Calif., and has approximately 3,400 employees globally.

Noise XT
http://noisext.com/
Booth 18
Noise XT is the performance leader manufacturer for low phase noise Analyzers and Frequency Synthesizers. Since 1992 our continuous collaboration with our customers and innovation allowed us to offer you the lowest noise floor of the industry. Our wideband solutions can match your current and future needs as you grow. Frequency Stability, Jitter and Phase Noise are part of our DNA and we look forward answering your questions and taking your challenges from DC to 140 GHz.

OEWaves
http://www.oewaves.com/
Booth 17
OEwaves, Inc. transforms novel microwave photonic technologies, from concept to marketplace, enabling new capabilities in communications, radar, and test and measurement systems. The company's core technologies include the opto-electronic oscillator (OEO) and whispering gallery mode (WGM) optical resonator. OEwaves' products include microwave and millimeter wave oscillators, and ultra-narrow linewidth lasers. OEwaves has also developed a unique cross-correlation phase noise measurement system for characterization of the phase noise of high performance microwave oscillators operating at 1-40 GHz, and a system for measuring frequency noise of high performance lasers.

Saunders & Associates
http://www.saunders-assoc.com/
Booth 1
Saunders & Associates Inc. started in 1967 providing consultation to the quartz crystal industry. A need to make more accurate crystal measurements resulted in the development of a unique crystal test oscillator. This oscillator testmeter became the first item of the test equipment line. Since its inception, Saunders & Associates has delivered systems critical to the manufacture of Frequency Control Devices. Saunders leads with technology and this strategy has positioned their products as industry standard in the areas of parameter measurement, fine tuning and testing of these devices.

scia Systems GmbH
http://www.scia-systems.com/
Booth 16
scia Systems manufactures advanced ion beam and plasma processing equipment. The systems are used in the production of microelectronics, MEMS and precision optical components, in both, high volume production as well as applications in research and development. Key applications are frequency and thickness trimming to Angstrom precision, in manufacturing of BAW/SAW devices, with the industry proven scia Trim 200 system. Furthermore, the scia Magna 200 deposits SiO2 temperature compensation films and piezoelectric AlN films. High homogeneity, rapid deposition rates and excellent material properties can be achieved, due to its unique Double Ring Magnetron architecture. scia Systems provides highly reliable tools together with a superior technology support. The tools are flexible and modular in design. Several vacuum process chambers can be combined into cluster or in-line solutions, according to customer-specific requirements.

SpectraDynamics, Inc.
http://www.spectradynamics.com/
Booth 25
Founded in 1994, SpectraDynamics, Inc. (SDI) is a Colorado, USA-based company specializing in high performance time and frequency distribution systems. In association with the National Institute of Standards and Technology, SpectraDynamics participated in the research and development of technology to provide the low noise electronics needed to support atomic time and frequency standards. This experience was leveraged to develop novel frequency synthesis architectures and time and frequency measurement methods.

Stable Laser Systems
http://www.stablelasers.com/
Booth 3
Stable Laser Systems provides components, systems, and accessories for stabilization and dissemination of Hz-level laser linewidths and ultra-low drift. SLS hardware includes stable reference cavities and associated hardware, electronics, and components for stabilization, tuning, and disseminating precision laser frequency. SLS products are ideal for research laboratories, industrial settings, and field applications. Systems are provided fully characterized and with performance warranty. Designs are available to match customer specification, and custom work is our forte, including rack-mounted systems and fiber-coupled cavities. Accelerate your research with our expert solutions and service!

TOPTICA Photonics
http://www.toptica.com/
Booth 15
TOPTICA is the world leader in diode laser and ultrafast technology for industrial and scientific markets. We offer the widest range of single mode tunable light in the 190 to 2900nm and 0.1-2.7 THz spectral region with various accessories to measure, characterize, stabilize and analyze light. With our Passion for Precision, TOPTICA delivers!

IEEE Ultrasonics, Ferroelectrics, and Frequency Control Society
http://www.ieee-uffc.org/
Booth 9
IEEE is the largest technical society in the world. It consists of more than 40 societies and councils with a membership over 400,000. The UFFC Society, with more than 2,000 members, is one of the IEEE societies. According to the UFFC-S Constitution, the fields of interest of the UFFC-S shall include theory, technology, materials, and applications relating to: The generation, transmission, and detection of ultrasonic waves and related phenomena. Medical ultrasound and associated technologies. Ferroelectric, piezoelectric, and piezomagnetic materials. Frequency generation and control, timing, and time coordination and distribution. The UFFC-S is a technical leader in the three areas: ultrasonics, ferroelectrics, and frequency control, as shown in its name. The UFFC-S sponsors and organizes three annual symposia whose locations are rotated around the world. Three proceedings, one from each technical area, are published and are accessible from IEEE Xplore.

IEEE IFCS 2016 AWARDS

The 2016 C.B. Sawyer Award

Dr. Paul Muralt, École Polytechnique Fédérale de Lausanne, Switzerland

"For his outstanding contribution to understand growing mechanism of piezoelectric thin films and materials, the development of innovative structures for acoustic-wave-based resonators and transducers and the promotion of their use for effective time-and-frequency applications"

The 2016 W.G. Cady Award

Bernd W. Neubig, AXTAL GmbH & Co. KG, Germany

"For 40 years of contributions to the area of piezoelectric frequency control devices as a successful researcher, educator, and entrepreneur and the efforts in the international standardization of piezoelectric devices"

The 2016 I.I. Rabi Award

Dr. John Kitching, National Institute of Standards and Technology, USA

"For his pioneering work on Chip-Scale Atomic Devices"

IFCS 2017 Award Nominations

Nominations are now open for the 2017 IFCS Awards. Nominations should be sent to the IFCS Awards Chair at gregory.weaver@jhuapl.edu.

STUDENT PAPER COMPETITION

A very strong group of submissions to the Student Paper Competition was received and reviewed by the Technical Program Committee. The list of finalists is given below. The competition features 20 student finalists that were selected from 72 submitted abstracts representing all six topical groups. From these finalists, one winner will be chosen for each group. Judging of the winners will be based on:

(1) Quality and content of the work
(2) Interest to our community
(3) Significance of the contribution of the student to the work
(4) Quality of the presentation

The competition will take place in the poster session on Tuesday, May 10, 2016. The awards will be announced at the Exhibitors' Reception and presented at the Symposium Banquet.

Student Paper Competition Finalists

Group 1:

(200) Adarsh Ganesan, University of Cambridge
"Observation of Intrinsic Mode Splitting in a Parametric Micromechanical Resonator"

(201) Mohammad Mahdavi, University of Texas at Dallas
"An Analog Micro-Electromechanical XOR"

(202) Beheshteh Khazaeili Najafabadi, University of Central Florida
"*Orientation-Dependent Acceleration Sensitivity of Silicon-Based MEMS Resonators"*

(203) Ruonan Liu, UC Berkeley
"*RF-Powered Micromechanical Clock Generator"*

Group 2:

(204) Etienne Vaillant, FEMTO-ST
"*Phase Noise Measurement of AlN Contour-Mode Resonators"*

(205) Paulo Carvalho, University of São Paulo
"Area Optimized CORDIC-Based Numerically Controlled Oscillator for Electrical Bio-Impedance Spectroscopy"

(206) Tianchi Sun, Drexel University
"*Improved Optically SILPLL Based Forced Oscillators"*

(207) Anisha Apte, BTU Cottbus
"*Colpitts Oscillators"*

Group 3/5 (combined into a single competition):

(208) Gregory Hoth, NIST
"*Scale Factor Measurements for a Gyroscope Based on an Expanding Ball of Atoms"*

(209) Moustafa Abdel Hafiz, FEMTO-ST – CNRS
"*A High-Performance CPT-Based Cs Cell Atomic Clock"*

(210) Liron Stern, Hebrew University of Jerusalem
"*Chip-Scale Atomic Cladding Wave Guides for Optical Frequency References in the Telecom and NIR Regime"*

(211) Ting Zeng, National Time Service Center, Chinese Academy of Sciences
"Research on Glowworm Swarm Optimization Localization Algorithm Based on Wireless Sensor Network"

Group 4:

(212) Megha Agrawal, University of Cambridge
"*A Microfluidic Platform for Glucose Sensing Using Broadband Ultrasound Spectroscopy"*

(213) Xuqian Zheng, Case Western Reserve University
"*Characterization of Thin Film Lead Zirconate Titanate (PZT) Multimode Piezoelectric Cantilevers Vibrating in Ultrasonic Band"*

(214) Michael Breen, University of Illinois
"*High Speed Mid-Infrared Detectors Based on MEMS Resonators and Spectrally Selective Metamaterials"*

(215) Maribel Maldonado-Garcia, University of Texas at Dallas
"Miniaturized Aerosol Impactors with Integrated Piezoelectric Thin Film Resonant Mass Balances"

Group 6:

(216) Erwan Lucas, Ecole Polytechnique Federale de Lausanne
"*Low Noise Microwave Generation via Temporal Soliton Formation in a Crystalline Optical microresonator with a Narrow Linewidth Laser"*

(217) Maxime Favier, LNE-SYRTE
"*Frequency Ratio of a Mercury Optical Lattice Clock with Primary and Secondary Frequency Standards*"

(218) Yuan Yao, East China Normal University
"High Precision Optical Frequency Divider"

(219) Jwo-Sy Chen, NIST
"Characterization of Ion Motion near the 3D Ground State in an Aluminum Ion Clock"

MEMORIALS

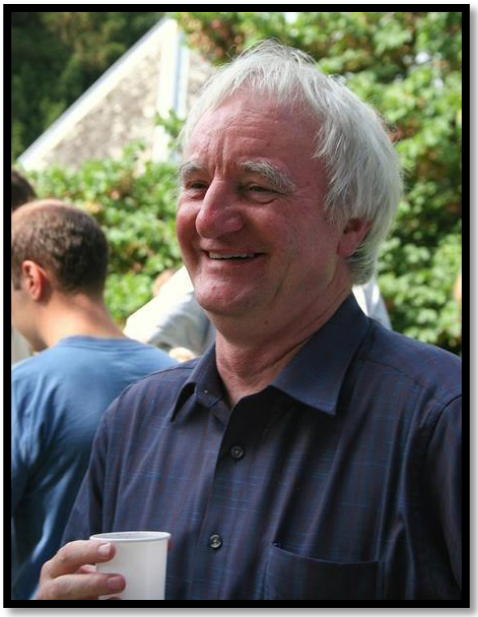
Michael J. Mirarchi 1922 – 2015

Mike's company, Synergistic Management a division of General Technical Services managed the Frequency Control Conferences from 1982 to 2010. His influence and leadership in this community will always be a part of the legacy of IFCS. He will be remembered for his "Italian" wit and humor, he was a friend to all and he will be missed.

As a scientist and engineer, he made significant contributions through his research and development efforts in the field of laser night vision and range finder technologies, electro-optics and radar, and electronic warfare for ground and airborne application. He was a pioneer in the laser field. His work led to the incredible reduction of size and weight of the initial prototype of the laser rangefinder built in 1961 from 500 pounds to a 2-pound hand held unit with a significantly better rangefinder capacity and accuracy.

MEMORIALS

André Clairon 1947 - 2015



André Clairon was a physicist at LNE-SYRTE, Observatoire de Paris, who made profound and continuing contributions to Time and Frequency Metrology. His work was recognized by several awards including the Rabi award and the EFTF award in 2003.

He had a global approach to research showing the same interest for experiment and theory, for fundamental science, technology and applications. Beyond T&F, he worked in several other fields such as atom interferometry, laser cooling of atoms, and laser development.

His most prominent achievement is probably the pioneering realization of high accuracy atomic fountain frequency standards. Nowadays, International Atomic Time is defined by such standards with uncertainties in the low 10^{-16}.

André Clairon was a great colleague and collaborator, characterized by a relentless curiosity and creativity, hard and rigorous work while being always kind and modest. Let's continue to be inspired by him!

FUTURE SYMPOSIA

2017 Joint Conference of the European Frequency and Time Forum & IEEE International Frequency Control Symposium

July 9-13, 2017
Micropolis, Besançon, France

EFTF and IFCS are pleased to announce that the next joint conference of their long-established cooperation will take place at Micropolis, Besançon, the city that hosted the first European Frequency and Time Forum in 1987 and the first joint conference EFTF-IFCS in 1999. Micropolis Convention Center is now connected to Besançon historic downtown by a direct line of modern tramway and offers all equipment and amenities to host the plenary and parallel sessions of this new exciting event.

Lute Maleki and Bernard Dulmet will be the General Co-Chairs of the 2017 Joint Conference. Elizabeth Donley and Jérôme Delporte will be the Technical Program Co-Chairs. The Joint Program Committee will gather valued scientists from EFTF and IFCS Scientific Committee. The topics of the Conference will cover the following areas:

Group 1: Materials, Filters, and Resonators

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

Group 3: Microwave Frequency Standards

Group 4: Sensors and Transducers

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

Group 6: Optical Frequency Standards

We expect the Conference Website eftf-ifcs2017.org to be online by July 2016, with the first Call for Papers to be issued by November 2016. Please consider submitting your abstracts by February 2017.

All members of Local Organizing Committee, brought together under the banner of The Société Française de Microtechniques et de Chronométrie, are eager to welcome you to renew the success of the two previous EFTF-IFCS Joint Meetings held in our city.

TUTORIAL SCHEDULE

MONDAY, MAY 9			
	Track A (Optomechanical Systems)	**Track B (Timekeeping and Noise)**	**Track C (Sensors)**
	Salon III	Salon IV	Salon V
8:30 – 10:30	**Cavity Quantum Optomechanics** Prof. Tobias J. Kippenberg, EPFL, Switzerland	**Characterization of Clocks and Oscillators** Dr. Judah Levine, National Institute of Standards and Technology, USA	**Atomic Sensors** Dr. Svenja Knappe, NIST-Boulder, USA
10:30 – 10:50	**Break – *Roosevelt Promenade***		
10:50 – 12:50	**Chipscale Cavity Optomechanics and Cavity Optoelectromechanics** Prof. Hong X. Tang, Department of Electrical Engineering, Yale University, USA	**Microwave Atomic Clocks** Dr. Eric Burt, Jet Propulsion Laboratory, California Institute of Technology, USA	**MEMS Inertial Sensors** Prof. Ashwin A. Seshia, University of Cambridge, UK
12:50 – 13:50	**Lunch – *Roosevelt Promenade***		
13:50 – 15:50	**Brillouin Optomechanics and Opto-Mechano-Fluidics** Prof. Gaurav Bahl, University of Illinois at Urbana-Champaign, USA	**Precise Time Scales and Navigation Systems, the Ultimate Challenge to Time Metrology** Dr. Patrizia Tavella, Italian Metrology Institute, INRIM, Torino, Italy	**Modeling, Design, Materials and Fabrication of Piezoelectric Micromachined Ultrasonic Transducers** Prof. David Horsley, University of California Davis, USA
15:50 – 16:10	**Break – *Roosevelt Promenade***		
16:10 – 18:10	**Mixing Light and Sound on chip: The Physics and Technology of Brillouin Interactions** Prof. Peter T. Rakich, Yale University, USA	**Introduction to Optical Atomic Clocks** Dr. Chris Oates, NIST-Boulder, USA	**Resonant Infrared Detectors** Dr. Vikrant Gokhale, NIST-Gaithersburg, USA

IEEE WOMEN IN ENGINEERING

Wednesday, May 11th, from 6:00 PM to 7:00 PM

Conti/Lafitte Room at the Roosevelt Hotel

Women active in the technical areas of the IEEE IFCS symposium are encouraged to attend a special networking and social hour event organized by the women of the UFFC Society. The event will take place before the symposium banquet on Wednesday, May 11th, from 6:00 to 7:00 PM in the Conti/Lafitte Room at the Roosevelt Hotel.

STUDENT CAREER PANEL

"Careers in Frequency and Timing"

Tuesday, May 10th, from 12:10 PM to 1:10 PM

Bienville Room at the Roosevelt Hotel

MODERATOR
Lute Maleki, OEwaves

PANELISTS:
Dr. Chris Oates, Acting Chief, NIST Time & Frequency Division
Dr. Jennifer Sebbey-Strabley, Sr. Technical Manager, Advanced Sensing Technologies, Honeywell
Dr. Sam Stein, Chief Scientist, Atomic Physics Center of Excellence, Microsemi
Prof. Clark Nguyen, U.C. Berkeley

PLENARY SESSION INVITED TALKS

Joe Taylor, Princeton University

Tuesday, May 10th, 8:30 AM

Reflections on an Astrophysical Clock-Comparison Experiment

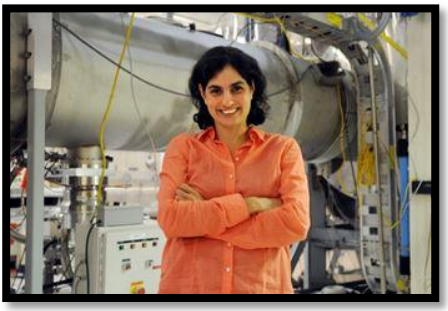
Abstract: Pulsars are rapidly spinning, strongly magnetized neutron stars, the collapsed remnants of supernova explosions. They are sometimes described as nature's most precise clocks. The 1974 discovery of an orbiting pulsar provided a unique opportunity to explore the fundamental nature of gravity beyond the weak-field, slow-motion regime that exists everywhere in the solar system. The resulting clock-comparison experiment firmly established the existence of gravitational waves as predicted by Einstein's general theory of relativity, and lent strong support to the case for ambitious efforts to detect such waves directly.

Biography: Using the Arecibo Observatory in Puerto Rico in 1974, Joe Taylor and his student Russel Hulse made the first discovery of a pulsar in a binary system. The orbit of this binary system slowly shrinks as it loses energy from emission of gravitational radiation. Over a thirty-year period Taylor and his colleagues made measurements of the rate of shrinkage of the orbit that match the prediction of General Relativity to much better than 1% accuracy. Together Taylor and Hulse received the 1993 Nobel Prize for Physics "for the discovery of a new type of pulsar, a discovery that has opened up new possibilities for the study of gravitation".

In addition to the Nobel Prize, Professor Taylor has been recognized with many other awards, including the first Heineman Prize of the American Astronomical Society, the Henry Draper Medal of the National Academy of Sciences, the Tomalla Foundation Prize, the Magellanic Premium, the Carty Award for the Advancement of Science, the Einstein Prize, the Wolf Prize in Physics, and the Schwartzchild Medal. He was also among the first group of MacArthur Fellows.

Professor Taylor is the James S. McDonnell Distinguished University Professor in Physics, Emeritus, at Princeton. Joe Taylor is also known by his amateur radio call sign K1JT.

PLENARY SESSION INVITED TALKS



Nergis Mavalvala, The Massachusetts Institute of Technology

Wednesday, May 11th, 8:30 AM

Gravitational Wave Detection Using Precision Interferometry

Abstract: Laser interferometer gravitational wave detectors are poised to launch a new era of gravitational wave astronomy and unprecedented tests of general relativity. I will describe experimental efforts worldwide to detect gravitational waves, and the progress to date. Terrestrial gravitational wave detectors must be sensitive to displacements of less than 1e-19 m/rtHz in their most sensitive band around 100 Hz. The limits to the sensitivity of the present generation of interferometric gravitational wave detectors and the path to higher sensitivity future gravitational wave detectors will also be discussed.

Biogaphy: Nergis Mavalvala is a physicist whose research links the world of quantum mechanics, usually apparent only at the atomic scale, with some of the most powerful, yet elusive, forces in the cosmos. She received a B.A. from Wellesley College in 1990 and a Ph.D. from the Massachusetts Institute of Technology in 1997. She was a postdoctoral fellow and research scientist at the California Institute of Technology between 1997 and 2002. Since 2002, she has been on the Physics faculty at the Massachusetts Institute of Technology where she is now a Professor of Physics and recipient of a 2010 MacArthur "genius" award. She is a Fellow of the American Physical Society and the Optical Society of America. In her spare time, she loves to bicycle long distances, play sports, and hang out with her family.

PLENARY SESSION INVITED TALKS

Alexander Rose, The Long Now Foundation

Thursday, May 12th, 8:45 AM

Designing for Longevity

Abstract: How do you build a monument scale astronomical machine that will last as long as civilization? For the last fifteen years Alexander Rose has been working on building this icon of long-term thinking with The Long Now Foundation. Rose is currently managing the 10,000 Year Clock project underway in West Texas where they have used giant custom robots and explosives to excavate over 500 vertical feet through solid rock to house the Clock. He will discuss the building of the Clock as well as the research and design process that has taken him as far as the arctic Seed Vault in Svalbard, and deep underground to the ultra-secret Mormon genealogical vaults in Salt Lake City.

Biography: Alexander was hired in 1997 to build the 10,000 Year Clock with computer scientist Danny Hillis. Alexander speaks about the work of The Long Now Foundation all over the world at venues ranging from the TED conference to corporations and government agencies.

As the director of Long Now, Alexander founded The Interval and has facilitated projects such as the 10,000 Year Clock, The Rosetta Project, Long Bets, Seminars About Long Term Thinking, Long Server and others. Alexander shares several design patents on the 10,000 Year Clock with Danny Hillis, the first prototype of which is in the Science Museum of London, and the monument scale version is now under construction in West Texas.

Alexander curates speaking series at The Interval and The Battery SF, has been a part of the Thiel Fellowship Network, and founded the Robot Fighting League.

Alexander graduated with a bachelor of arts honors degree from Carnegie Mellon University in Industrial Design in 01995, as well as attended the Art Center College of Design. He was an artist in residence at Silicon Graphics Inc., and a founding partner of the robotics company Inertia Labs.

Alexander's combat robots have won over six world championship titles appearing in the hit ABC TV show BattleBots. He has also built large pyrotechnic displays for the Burning Man festival, robotic bartenders, and other dangerous machines. Alexander was also a world champion paintball player holding multiple world titles with his team the Ironmen from 1990 through 1995. At Carnegie Mellon University, Alexander was the lead designer for a record setting human power vehicle team.

Alexander lives in California on the Sausalito waterfront and enjoys mountain biking, climbing, and mountaineering whenever he can get out.

TUESDAY, MAY 10		
Salon II	Salon III	Salon IV & V
A1L-A: Trapped-Ion Optical Clocks	**A1L-B: Two-way Time & Frequency Transfer Systems**	**A1L-C: Phase Noise and OEO's**
Dave Leibrant, NIST	Stefania Romisch, NIST	Ajay Poddar, Synergy Microwave Corporation
10:10 – 10:50	**10:10 – 10:50**	**10:10 – 10:50**
Towards a Nuclear Clock Based on the Isomeric Transition in Thorium-229 (INVITED) *E. Hudson* *UCLA, United States*	**Two-Way Carrier-Phase Satellite Frequency Transfer for Remote Frequency Comparison (INVITED)** *M. Fujieda, T. Gotoh, H. Takiguchi, H. Hachisu, T. Ido* *National Institute of Information and Communications Technology, Japan*	**Global Internet Access from Space for Humanitarian Applications (INVITED)** *T. Lee* *IEEE Humanitarian Activities Committee, IEEE MTT-S, United States*
10:50 – 11:10	**10:50 – 11:10**	**10:50 – 11:10**
Optical Frequency Standards and Applications *J.-S. Chen, S. Brewer, D. Hume, C. Chou, A. Hankin, D. Wineland, T. Rosenband, D. Leibrandt* *NIST, United States*	**Introduction of Software-Defined Receivers in Two-Way Satellite Time and Frequency Transfer** *Y. Huang{3}, W. Tseng{3}, S. Lin{3}, S. Yang{1}, M. Fujieda{2}* *{1}Korea Research Institute of Standards and Science, Korea, South; {2}National Institute of Information and Communications Technology, Japan; {3}Telecommunication Laboratories, Chunghwa Telecom, Co., Ltd., Taiwan*	**Validity of Cross-Spectrum PN Measurement** *U. Rohde{2}, A. Poddar{4}, K. Hoffmann{1}, E. Rubiola{3}* *{1}Bayerische Akademie, Munich, Germany; {2}BTU Cottbus, Germany; {3}FEMTO-ST Institute, Besancon, France; {4}Synergy Microwave Corp, United States*

TUESDAY, MAY 10		
Salon II	Salon III	Salon IV & V
11:10 – 11:30	**11:10 – 11:30**	**11:10 – 11:30**
Evaluation of the Blackbody Radiation Shift Uncertainty of NRC's Sr+ Ion Clock *B. Jian{1}, P. Dubé{1}, A. Madej{2}* *{1}National Research Council of Canada, Canada; {2}York University, Canada*	**Impact of Turbulence on High Precision Ground-Satellite Frequency Transfer with Two-Way Coherent Optical Links** *C. Robert{1}, J. Conan{1}, P. Wolf{2}* *{1}ONERA, the French Aerospace Labr, Fance, France; {2}SYRTE, Observatoire de Paris, CNRS, LNE, France*	**Power Splitter Thermal Noise Correlations in Cross-Spectrum Noise Measurements** *A. Hati, C. Nelson, D. Howe* *NIST, United States*
11:30 – 11:50	**11:30 – 11:50**	**11:30 – 11:50**
Reducing Ion Trap-Induced Frequency Uncertainties to the 10^-19 Level - Micromotion Revisited *J. Keller, T. Burgermeister, D. Kalincev, J. Kiethe, T. Mehlstäubler* *Physikalisch-Technische Bundesanstalt, Germany*	**Connecting Remote Clocks Across Turbulent Air: Synchronization of a Microwave Clock to an Optical Clock to Within Femtoseconds** *L. Sinclair{1}, H. Bergeron{1}, W. Swann{1}, C. Nelson{1}, E. Baumann{1}, F. Giorgetta{1}, I. Coddington{1}, N. Newbury{1}, J. Deschênes{2}* *{1}National Institute of Standards and Technology, United States; {2}Universite Laval, Canada*	**Improved Optically SILPLL Based Forced Oscillators** *T. Sun{1}, A. Daryoush{1}, A. Poddar{2}, L. Zhang{2}, U. Rohde{2}* *{1}Drexel University, United States; {2}Synergy Microwave Corp, United States*

TUESDAY, MAY 10		
Salon II	Salon III	Salon IV & V
11:50 – 12:10	**11:50 – 12:10**	**11:50 – 12:10**
A Transportable 40Ca+ Single-Ion Optical Clock with Frequency Uncertainty at 10^{-17} Level *J. Cao, P. Zhang, J. Shang, K. Cui, S. Chao, S. Wang, J. Yuan, H. Shu, X. Huang* *Wuhan Institute of Physics and Mathematics, Chinese Academy of Sciences, China*	**Advanced Optical Fiber Links for National and Continental Scale Frequency Metrology** *F. Stefani{2}, W. Lee{2}, M. Lours{2}, P. Pottie{2}, N. Quintin{3}, N. Chiodo{3}, F. Wiotte{3}, C. Chardonnet{3}, A. Amy-Klein{3}, O. Lopez{3}, G. Santarelli{1}, E. Camisard{4}, F. Camargo{6}, B. Desruelle{6}, V. Salmon{5}* *{1}Laboratoire Photonique, Numérique et Nanosciences (LP2N), France; {2}LNE-SYRTE, France; {3}LPL, France; {4}RENATER, France; {5}Syrlinks, France; {6}μQuans, France*	**Ultra Low Noise 10 GHz Dual Loop Optoelectronic Oscillator: Experimental Results and Simple Model** *O. Lelièvre{3}, V. Crozatier{4}, G. Baili{4}, P. Berger{4}, G. Pillet{4}, D. Dolfi{4}, L. Morvan{4}, F. Goldfarb{1}, F. Bretenaker{1}, O. Llopis{2}* *{1}Laboratoire Aimé Cotton, France; {2}Laboratoire d'Analyse et d'Architecture des Systèmes, France; {3}Thales Research & Technology, France; {4}Thales Research&Technology, France*

TUESDAY, MAY 10		
Salon II	Salon III	Salon IV & V
A2L-A: **FOCUS SESSION: Space Clocks**	**A2L-B:** **Spectroscopic Sensors**	**A2L-C:** **FOCUS SESSION: Quartz Resonators, Materials, & Oscillators**
Robert Tjoelker, JPL	Clark Nguyen, U.C. Berkeley	Yook-Kong Yong, Rutgers University
13:10 – 13:40	**13:10 – 13:30**	**13:10 – 13:40**
History of Space Qualified Atomic Clock Development for the GPS Program (INVITED) *R. Beard{2}, J. White{1}* *{1}Sotera Defense Solutions, Inc., United States; {2}U.S. Naval Research Laboratory, United States*	**High Speed Mid-Infrared Detectors Based on MEMS Resonators and Spectrally Selective Metamaterials** *M. Breen, W. Streyer, R. Lu, A. Gao, D. Wasserman, S. Gong* *University of Illinois, United States*	**A Review of the Timing and Filtering Technologies in Smartphones (INVITED)** *C. S. Lam* *Skyworks Solutions, Inc., United States*
	13:30 – 13:50	
13:40 – 14:10		**13:40 – 14:10**
Space Passive Hydrogen Maser -A Passive Hydrogen Maser for Space Applications- (INVITED) *J. Li, J. Zhang, Y. Bu, W. Wang* *Beijing Institute of Radio Metrology and Measurement, China*	**Optomechanical Nanoresonator Readout with Optical Downmixing** *L. Leoncino{1}, M. Sansa{1}, G. Scherrer{1}, M. Gely{1}, H. Blanc{1}, O. Lartigue{1}, K. Ribaud{1}, P. Grosse{1}, J. Fedeli{1}, P. Alain{2}, E. Gil-Santos{2}, I. Favero{2}, L. Duraffourg{1}, G. Jourdan{1}, S. Hentz{1}* *{1}CEA, LETI, MINATEC Campus, France; {2}MPQ Paris Diderot, France*	**SH-SAW Biosensor on Quartz (INVITED)** *M. Goto{1}, H. Yatsuda{1}, J. Kondoh{2}* *{1}Japan Radio Co., Ltd., Japan; {2}Shizuoka University, Japan*

TUESDAY, MAY 10		
Salon II	Salon III	Salon IV & V
	13:50 – 14:10	
	Frequency Locked Cascaded Micro Ring Resonators Enabling Real Time and Highly Precise Long and Short Time Refractive Index Sensing *L. Stern, A. Naiman, G. Keinan, N. Mazurski, U. Levy* *Hebrew University of Jerusalem, Israel*	
14:10 – 14:40	**14:10 – 14:30**	**14:10 – 14:40**
Interspacecraft Laser Intererometry on the Path to a Gravitational Wave Observatory in Space: the LISA and GRACE Follow-On missions (INVITED) *B. Spero* *Jet Propulsion Laboratory, California Institute of Technology, United States*	**A Microfluidic Platform for Glucose Sensing Using Broadband Ultrasound Spectroscopy** *M. Agrawal, A. Seshia* *University of Cambridge, United Kingdom*	**Growth, Characterization and Piezoelectric Applications of Langasite-Type and YCOB Crystals (INVITED)** *Y. Zheng{4}, K. Xiong{4}, X. Tu{4}, E. Shi{4}, S. Zhang{1}, B. Neubig{2}, H. Zu{3}, Q. Wang{3}* *{1}Australian Institute for Innovative Materials, University of Wollongong, Australia; {2}AXTAL GmbH & Co. KG, Germany; {3}Department of Mechanical Engineering and Materials Science, University of Pittsburgh, United States; {4}Shanghai Institute of Ceramics, Chinese Academy of Sciences, China*

TUESDAY, MAY 10		
Salon II	Salon III	Salon IV & V
	14:30 – 15:10	
14:40 – 15:10		**14:40 – 15:10**
Optical Frequency Comb for Space Applications: Fiber Based Optical Frequency Comb Operation on Sounding Rockets *M. Lezius{3}, M. Giunta{3}, C. Deutsch{3}, R. Holzwarth{3}, A. Dinkelaker{1}, M. Krutzik{1}, A. Kohfeld{1}, A. Wicht{1}, A. Peters{1}, O. Hellmig{4}, H. Duncker{4}, K. Sengstock{4}, P. Windpassinger{2}, K. Lampmann{2}* *{1}HU Berlin, Germany; {2}Johannes Gutenberg-Universität, Germany; {3}Menlo Systems GmbH, Germany; {4}Universität Hamburg, Germany*	**Nano-Optomechanics in Liquids: New Miniature Probes of Fluidic Information (INVITED)** *E. Gil-Santos{2}, C. Baker{2}, D. Nguyen{2}, W. Hease{2}, S. Ducci{2}, G. Leo{2}, I. Favero{3}, C. Gomez{1}, A. Lemaître{1}* *{1}CNRS, France; {2}Université Paris Diderot, France; {3}Université Paris Diderot / CNRS, France*	**IEC/TC 49's International Standardization Activities on Quartz Crystal Devices (INVITED)** *M. Okazaki{1}, Y. Yamamoto{2}* *{1}IEC/TC49, Japan; {2}Nihon Dempa Kogyo Co.,LTD, Japan*

TUESDAY POSTER SESSIONS

15:30 – 17:30
Crescent City Ballroom
(prefix numbers indicate poster space)

Session: A3P-D: Student Paper Competition
Session Chair: Clemens Ruppel, EPCOS AGl

(200) Observation of Intrinsic Mode Splitting in a Parametric Micromechanical Resonator
A. Ganesan, C. Do, A. Seshia
University of Cambridge, UK

(201) An Analog Micro-Electromechanical XOR
M. Mahdavi, A. Ramezany, H. Ravi, S. Pourkamali
University of Texas at Dallas, United States

(202) Orientation-Dependent Acceleration Sensitivity of Silicon-Based MEMS Resonators
B. Khazaeili, R. Abdolvand
University of Central Florida, United States

(203) RF-Powered Micromechanical Clock Generator
R. Liu, J. N. Nilchi, C. T.-C. Nguyen
University of California at Berkeley, United States

(204) Phase Noise Measurement of AlN Contour-Mode Resonators
E. Vaillant{1}, F. Sthal{1}, J. Imbaud{1}, V. Petrini{1}, P. Abbe{1}, L. Arapan{1}, G. Piazza{2}, J. Segovia-Fernandez{2}
{1}FEMTO-ST Institute, Besançon, France; {2}Carnegie Mellon University, United States

(205) Area Optimized CORDIC-Based Numerically Controlled Oscillator for Electrical Bio-Impedance Spectroscopy
P. de Carvalho, J. Palacio, W. Van Noije
University of São Paulo, Brazil

(206) Improved Optically SILPLL Based Forced Oscillators
T. Sun{1}, A. S. Daryoush{1}, A. Poddar{2}, L. Zhang{2}, U. Rohde{2}
{1} Drexel University, United States; {2} Synergy Microwave, United States

(207) Colpitts Oscillators
A. Apte{2}, A. Poddar{4}, U. Rohde{1}, E. Rubiola{3}
{1}Bayerische Akademie, Germany; {2}BTU Cootbus, Germany; {3}FEMTO-ST Institute, France; {4}Synergy Microwave, United States

(208) Scale Factor Measurements for a Gyroscope Based on an Expanding Ball of Atoms
G. W. Hoth, B. Pelle, S. Riedl, J. Kitching, E. A. Donley
NIST, United States

(209) A High-Performance CPT-Based Cs Cell Atomic Clock
M. Abdel Hafiz, R. Boudot
FEMTO-ST – CNRS, Besançon, France

(210) Chip-Scale Atomic Cladding Wave Guides for Optical Frequency References in the Telecom and NIR Regime
L. Stern, B. Desiatov, N. Mazurski, U. Levy
Hebrew University of Jerusalem, Israel

(211) Research on Glowworm Swarm Optimization Localization Algorithm Based on Wireless Sensor Network
T. Zeng, Y. Hua, X. Zhao, T. Liu
National Time Service Center, Chinese Academy of Sciences, China

(212) A Microfluidic Platform for Glucose Sensing Using Broadband Ultrasound Spectroscopy
M. Agrawal, A. A. Seshia
University of Cambridge, UK

(213) Characterization of Thin Film Lead Zirconate Titanate (PZT) Multimode Piezoelectric Cantilevers Vibrating in Ultrasonic Band
X.-Q. Zheng{1}, L. M. Sanchez{2}, J. S. Pulskamp{2}, R. G. Polcawich{2}, P. X.-L. Feng{1}
{1} Case Western Reserve University, United States; {2} U.S. Army Research Laboratory, United States

(214) High Speed Mid-Infrared Detectors Based on MEMS Resonators and Spectrally Selective Metamaterials
M. Breen, W. Streyer, R. Lu, A. Gao, D. Wasserman, S. Gong
University of Illinois, United States

(215) Miniaturized Aerosol Impactors with Integrated Piezoelectric Thin Film Resonant Mass Balances
M. Maldonado-Garcia{1}, M. Mahdavi{1}, S. Pourkamali{1}, J. C. Wilson{2}
{1} University of Texas at Dallas, United States; {2} University of Denver, United States

(216) Low Noise Microwave Generation via Temporal Soliton Formation in a Crystalline Optical microresonator with a Narrow Linewidth Laser
E. Lucas{1} , J. D. Jost{1} , C. Lecaplain{1} , K. Beha{2} , R. Holzwarth{2} , T. J. Kippenberg{1}
{1} Ecole Polytechnique Federale de Lausanne, Switzerland; {2} Menlo Systems, Germany

(217) Frequency Ratio of a Mercury Optical Lattice Clock with Primary and Secondary Frequency Standards
M. Favier, R. Tyumenev, S. Bilicki, E. Bookjans, D. Nicolodi, M. Abgrall, J. Guéna, Y. Le Coq, R. Le Targat, J. Lodewyck, L. De-Sarlo, S. Bize
LNE-SYRTE, France

(218) High Precision Optical Frequency Divider
Y. Yao, Y. Jiang, H. Yu, Z. Bi, L. Ma
East China Normal University, China

(219) Characterization of Ion Motion near the 3D Ground State in an Aluminum Ion Clock
J. S. Chen, S. M. Brewer, D. B. Hume, C. W. Chou, A. M. Hankin, D. J. Wineland, T. R. Rosenband, and D. R. Leibrandt
NIST, United States

Session: A3P-E: Resonator Theory, Materials & Processing Techniques
Session Chair: Randy Kubena, HRL Laboratories

(1) Improving Manufacturability of FBAR Filters on 200mm Wafers
S. Mishin, Y. Oshmyansky
AMS, United States

(3) Analysis of Spurious Modes Suppressed on Inverted Mesa Quartz Resonators
Z. Huang{1}, J. Li{1}, C. Yang{2}, M. Weng{2}
{1}National Formosa University, Taiwan; {2}Taitien Electronics Co., Ltd., Taiwan

(5) Development of Small BVA Quartz resonator
W. Cui, L. Pan, L. Ye, W. Zhou, W. Zheng, Z. Wang, X. Liu
Beijing Institute of Radio Metrology and Measurement, China

(7) Impact of Coatings on the Quality Factor of a Quartz Crystal Resonator at Liquid Helium Temperature
S. Galliou{2}, X. Vacheret{2}, P. Abbé{2}, R. Bourquin{2}, M. Goryachev{4}, M. Tobar{4}, S. Deléglise{3}, L. Neuhaus{3}, T. Karassouloff{3}, T. Briant{3}, P. Cohadon{3}, A. Heidmann{3}, V. Dolique{1}, L. Pinard{1}, C. Michel{1}, R. Flaminio{1}, G. Cagnoli
{1}CNRS/IN2P3, France; {2}FEMTO-ST, France; {3}LKB, France; {4}UWA, Australia

(9) Extension of the Frequency Aging Model of Crystal Resonators and Oscillators by the Arrhenius Factor
S. Wang{2}, J. Wu{2}, B. Neubig{1}, T. Ma{2}, J. Wang{2}
{1}AXTAL GmbH & Co. KG, Germany; {2}Ningbo University, China

(11) Free Vibrations of Finite Quartz Crystal Cylinders with the Rayleigh-Ritz Method
J. Wang{2}, P. Hu{2}, B. Huang{2}, S. Zhgoon{1}, J. Shen{3}, M. Chao{3}, T. Ma{2}, J. Du{2}
{1}Moscow Power Engineering Institute, Russia; {2}Ningbo University, China; {3}TXC (Ningbo) Corporation, China

(13) Analysis of Thickness-Shear Vibrations of Finite Circular Quartz Crystal Plates
J. Wang, C. Hao, B. Huang, T. Ma, J. Du, L. Yi, D. Huang
Ningbo University, China

(15) Thickness Shear Vibration of ZnO Thin Film with Disspation
J. Du, X. Fu, J. Lou, B. Huang, J. Wang
Ningbo University, China

(17) Anchor Losses Dependance on Electrode Material in Contour Mode Resonators
A. Lozzi{1}, G. Villanueva{1}, E. Yen{2}
{1}École polytechnique fédérale de Lausanne, Switzerland; {2}Texas Instruments Inc, United States

(19) Large Arrays of Single-Layer MoS2 Nanomechanical Resonators by Scalable Transfer-Printing
H. Jia{1}, R. Yang{1}, A. Nguyen{2}, S. Naghibi{2}, L. Bartels{2}, P. Feng{1}
{1}Case Western Reserve University, United States; {2}University of California, Riverside, United States

(21) Experimental Study and Investigation on Effect of Angle of SC-Cut on Thermal Hysteresis of OCXO
N. Cv, Kamal Kumar S, Ramakrishna, Mariyappa Chandrashekar, Prathibha
Centumrakon India PVT LTD, India

(23) Reflective Delay Line Multi-Transit Analysis for SAW Devices and Sensors
D. Malocha
University of Central Florida, United States

(25) Effects of Initial Nonlinear Strains and Nonlinear Elastic Constants in Force-Frequency and Acceleration Sensitivity of Quartz Resonators
Y. Yong, J. Chen
Rutgers University, Dept. of Civil Environmental Engineering, United States

(27) Piezoelectric Coefficients of AlScN Thin Films in Comparison
R. Matloub, M. Hadad, P. Muralt
EPFL, Switzerland

Session: A3P-F: Oscillators, Synthesizers, Noise & Circuit Techniques I
Session Chair: Craig Nelson, NIST

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(31) A Novel Voltage Controlled Temperature Compensated Crystal Oscillator for Eliminating the Trim Effect
Q. Bai, X. Huang, D. Liu
University of Electronic Science and Technology of China, China

(33) Investigation of New Ultra Low Noise Oscillation Circuit Based on Pulse Excitation Technology
A. Lepetaev, A. Kosykh
Omsk State Technical University, Russia

(35) Development of High-Stability Miniaturized Oven Controlled Crystal Oscillator
W. Hsieh, C. Chen, C. Weng, C. Hsu, S. Kao, C. Chiang
TXC Corporation, Taiwan

(37) Low Phase Noise Charge-Pump Phase-Locked Loop Design at 2.8 GHz
M. Keykhali, N. Gencer
Middle East Technical University, Turkey

(39) Low Power Frequency Subtractor for Temperature-Compensated Resonant Sensors
C. Do, A. Seshia
University of Cambridge, United Kingdom

(41) Temperature and Trim Effect Compensation of a VCXO Using a Multi-Dimensional Segmented Polynomial Array
J. Esterline, A. Snavely
Esterline Research and Design, United States

(43) Improvement of Short-Term Frequency Stability of the Chip Scale Atomic Clock
T. Bagala{1}, A. Fibich{1}, P. Kubinec{1}, V. Stofanik{2}
{1}FEEI SUT, Slovakia; {2}FEEI SUT/SAS, Slovakia

(45) A Novel UWB BALUN: Application in 5G Systems
U. Rohde{1}, A. Poddar{3}, V. Madhavan{2}
{1}BTU Cottbus, Germany; {2}Synergy Microwave Corp, United States; {3}Synergy Microwave Corp., United States

(47) A 5×7 mm High Reliability Crystal Oscillator for Extreme Environmental Applications
G. Maronich, R. Duong, A. Vishwanathan
Q-Tech Corporation, United States

(49) Self-Sustaining Oscillation in a MEMS Oscillator Without External Power Supply
C. Chen{1}, D. Czaplewski{1}, D. Lopez{1}, D. Zanette{2}
{1}Argonne National Laboratory, United States; {2}Centro Atomico Bariloche and Instituto Balseiro, Argentina

(51) Frequency Reference for Crystal Free Radio
O. Khan, B. Wheeler, D. Burnett, F. Maksimovic, S. Mesri, K. Pister, A. Niknejad
University of California, Berkeley, United States

Session: A3P-G: Microwave Clocks I
Session Chair: Scott Crane, U.S. Naval Research Laboratory

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(61) Light-Shift Reduction from Improved Laser Phase Noise in a Cold-Atom CPT Clock
E. Ivanov{2}, X. Liu{1}, J. Kitching{1}, E. Donley{1}
{1}NIST, United States; {2}UWA, Australia

(63) Improvements in an Optically Pumped Cesium Clock
Y. Cao{2}, X. Zhao{2}, R. Du{2}, L. Yang{2}, L. Liu{2}, X. Zheng{2}, H. Chen{1}, S. Zhang{3}
{1}CETC-12 institute, China; {2}Chengdu Spaceon Electronics, China; {3}National Time Service Center, China

(65) Stochastic Characterization of GPS on-Orbit Rb Clock Lamplight Jumps
J. Camparo{2}, I. Sesia{1}, V. Formichella{1}, G. Signorile{1}, P. Tavella{1}
{1}INRiM, Italy; {2}The Aerospace Corporation, United States

(67) A Vapor Cell Atomic Clock of 87Rb Based on Ramsey-CPT with Dispersion Detection
P. Cheng{2}, X. Sun{2}, C. Xu{2}, L. Zhao{1}, J. Zhang{2}, L. Wang{2}
{1}Beihang University, China; {2}Tsinghua University, China

(69) Advances of Chip-Scale Atomic Clock in Peking University in 2015
J. Zhao, Y. Zhang, S. Zhang, J. Leng, Z. Wang
Peking University, China

(71) Acousto-Optic Modulators in Raman-Nath Diffraction Regime as Phase Modulators in Modulation Transfer Spectroscopy
V. Baryshev, V. Epikhin, I. Blinov, S. Donchenko
FGUP VNIIFTRI, Russia

(73) Progress of the Dual-Traps Microwave Frequency Standard Based on 113Cd+ Ions
Y. Zuo, J. Zhang, K. Miao, L. Wang
Tsinghua University, China

(75) Progress Toward a CPT-Ramsey Clock Based on a Continous Cold Cesium Beam
X. Yan, J. Huang, C. Wu, J. Zhang, L. Wang
Tsinghua University, China

(77) The Recent Progress of Portable CPT Atomic Clocks in BIRMM
R. Yang, Z. Zhang
Beijing Institute of Radio Metrology and Measurement, China

Session: A3P-H: Atomic Sensors
Session Chair: Svenja Knappe, NIST

(81) Long-Term Stability Dependence of the Quantum Magnetometers Dual Scheme on the Correlation of Their Double Resonance Signals
A. Baranov, S. Ermak, E. Sagitov, R. Smolin, V. Semenov
Peter the Great St. Petersburg Polytechnic University, Russia

(83) Characterization of Spin Polarization for Cesium Vapor Confined Within Hollow Core Fibers
P. Bouzi{1}, J. Lou{3}, G. Miller{3}, G. Cranch{3}, F. Fatemi{2}
{1}National Research Council, United States; {2}U. S. Army Research lab, United States; {3}U. S. Naval Research Lab, United States

(85) Imaging Magnetic Field Gradients Using Nested Nonlinear Magneto-Optic Rotation (NMOR) Features
P. Kunz, D. Meyer, Q. Quraishi, F. Fatemi
Army Research Labs, United States

(87) Dead-Zone Free Multi-Beam Atomic Sensor for 4He Magnetometer
W. Gong, H. Wang, T. Wu, Z. Lin, W. Li, X. Peng, J. Chen, H. Guo
Peking University, China

(89) Sensitivity Enhancement of a Dead-Zone Free All-Optical 4He Atomic Magnetometer Based on a Liquid-Crystal Polarization Rotator
T. Wu, X. Peng, S. Wu, Q. Cao, Z. Lin, H. Wang, W. Li, H. Guo
Peking University, China

(91) Unshielded Scalar Magnetometer Based on Nonlinear Magneto-Optical Rotation with Amplitude Modulated Light
W. Li{2}, X. Peng{2}, S. Li{2}, C. Liu{2}, H. Guo{2}, P. Lin{1}, W. Zhang{1}
{1}National Institute of Metrology (NIM), China; {2}Peking University, China

(93) Chip-Scale Atomic Magnetometer Characterization
S. Krzyzewski{2}, S. Geller{1}, A. Perry{2}, D. Sheng{2}, J. Kitching{1}, S. Knappe{2}
{1}NIST, United States; {2}University of Colorado Boulder/NIST, United States

Session: A3P-J: Timekeeping, Time & Freq Transfer, GNSS Apps I
Session Chair: Jérôme Delporte, CNES

(101) Algorithm Research for UTC(NIM) Realization
Y. Gao{3}, A. Zhang{3}, J. Zhu{1}, W. Wang{3}, Y. Huang{2}
{1}Beijing University of Technology, China; {2}National Metrology Center for Industry of GNSS, China; {3}NIM, China

(103) A New Steering Strategy Relying on the Master Clock for Maser
S. Zhao, S. Dong, D. Yin, H. yuan, W. Guang, S. Bai, W. Li
National Time Service Center,Chinese Academy of Sciences, China

(105) Propagation Frequency Shifts and Impact on Time and Frequency Transfer
M. Underhill
Underhill Research Limited, United Kingdom

(107) Study of the Monitored Method of Atomic Clock Data Exception Based on the Model of Dynamic Neural Network Time Series-NAR
X. Wang, H. Song, W. Wu, Y. Liu, W. Li, S. Bai
National Time Service Center, Chinese Academy of Science NTSC, China

(109) Billions Served Daily: the NIST Internet Time Service
J. Sherman, J. Levine
NIST, United States

(111) On Systematic Uncertainties in Coordinated Universal Time (UTC)
D. Matsakis
U.S. Naval Observatory, United States

Session: A3P-K: Optical Frequency Standards & Applications I
Session Chair: Daniele Nicolodi, LNE-SYRTE

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(121) Optical Sampling ADC Based on Dual Optical Frequency Combs with Rubidium Frequency Reference
H. Meng, J. Leng, J. Zhao
Peking University, China

(123) Single-Port Er Fiber Comb for High-Stability Frequency Comparison of Optical Lattice Clocks
N. Ohmae{2}, N. Kuse{1}, M. Fermann{1}, H. Katori{2}
{1}IMRA America Inc., United States; {2}The University of Tokyo, Japan

(125) Research on Cs Active Faraday Optical Frequency Standard with 459 nm Pumping
X. Zhang, Z. Jiang, Z. Tao, H. Shang, C. Zhang, J. Chen
Peking University, China

(127) An EOM with Ultra-Low Residual Amplitude Modulation
Z. Tai, L. Yan, Y. Zhang, W. Zhao, X. Zhang, S. Zhang, H. Jiang
National Time Service Center, China

(129) Minimization of the Excess Micromotion of Single Trapped and Laser Cooled 40Ca+
H. Guan, Y. Huang, W. Bian, K. Gao
Wuhan Institute of Physics and Mathematics (WIPM) of Chinese Academy of Sciences, China

(131) Optical Comb Frequency-Controlled by Rotating Polarization State
Y. Zhang, L. Yan, S. Fan, M. Chen, W. Zhao, W. Guo, S. Zhang, H. Jiang
National Time Service Center, China

(133) The Implementation of Optical Frequency Standard Based on Direct Frequency Comb and Rb Two-Photon Transitions
J. Leng, S. Zhang, Y. Zhang, J. Zhao
Peking University, China

(135) A Compact Optical Clock Scheme Based on Caesium Atomic Beam
S. Zhang{2}, X. Zhang{2}, Z. Jiang{2}, D. Pan{2}, X. Peng{2}, H. Chen{1}, J. Chen{2}, H. Guo{2}
{1}Beijing Vacuum Research Institute, China; {2}Peking University, China

(137) Rb-Based Optical Frequency Reference at 1572 nm
W. Moreno, R. Matthey, F. Gruet, P. Brochard, S. Schilt, G. Mileti
Université de Neuchâtel, Laboratoire Temps-fréquence, Switzerland

(139) Long Term Stability of Optical Frequency Combs
L. Nugent-Glandorf, A. Hati, C. Nelson, D. Howe
NIST, United States

(141) Detailed Problems in Cesium Active Optical Clock
D. Pan, X. Xue, J. Chen
Peking University, China

(143) Ultra Low Noise Er:fiber Frequency Comb Comparison
W. Hänsel, M. Giunta, K. Beha, M. Fischer, M. Lezius, R. Holzwarth
Menlo Systems GmbH, Germany

(145) An Optical Frequency Standard Using Two-Photon Spectroscopy in Rubidium
G. Phelps{3}, N. Lemke{3}, D. Blakley{3}, K. Martin{2}, C. Erickson{1}, J. Burke{1}
{1}Air Force Research Laboratory, United States; {2}Applied Technology Associates, United States; {3}Space Dynamics Laboratory, United States

(147) Towards Non-Destructive Detection of Atomic Populations in a Strontium Optical Lattice Clock
R. Le Targat, E. Bookjans, G. Vallet, S. Bilicki, J. Lodewyck
LNE-SYRTE, Observatoire de Paris, France

WEDNESDAY, MAY 11		
Salon II	Salon III	Salon IV & V
B1L-A: **Microwave Clocks and Precision Measurements**	**B1L-B:** **GNSS Systems**	**B1L-C:** **FOCUS SESSION: Novel Micro Resonators and Applications**
Eric Burt, JPL	Patrizia Tavella, INRIM	Scott Diddams, NIST
10:10 – 10:30	**10:10 – 10:50**	**10:10 – 10:40**
Low Noise Microwave - Millimeterwave Axion Dark Matter Haloscope: ORGAN *S. Parker, B. McAllister, E. Ivanov, M. Tobar* *University of Western Australia, Australia*	**GNSS Integrity Assurance and Verification: Techniques, Examples, and Lessons Learned (INVITED)** *S. Pullen* *Stanford University, United States*	**New Directions for Optical Frequency Division: Soliton Microcombs and Electro-Optical-Modulation (INVITED)** *K. Vahala* *Caltech, United States*
10:30 – 10:50		
Quantum Test of the Equivalence Principle and Space-Time Aboard the International Space Station *N. Yu{1}, J. Williams{1}, S. Chiow{1}, I. Hahn{1}, J. Liu{1}, J. Kohel{1}, P. Yates{1}, R. Thompson{1}, M. Jadusingh{1}, C. Gorman{1}, H. Müller{2}* *{1}Jet Propulsion Laboratory, United States; {2}University of California, Berkeley, United States*		

WEDNESDAY, MAY 11		
Salon II	Salon III	Salon IV & V
		10:40 – 11:10
10:50 – 11:10	**10:50 – 11:10**	
Scale Factor Measurements for a Gyroscope Based on an Expanding Ball of Atoms *G. Hoth, B. Pelle, S. Riedl, J. Kitching, E. Donley* *NIST, United States*	**Progress on Absolute Calibrations of GNSS Reception Chains at CNES** *J. Delporte, D. Valat, T. Junique, F. Marmet* *CNES, France*	**Turn-Key Operation and Stabilization of Kerr Frequency Combs (INVITED)** *A. Matsko, A. Savchenkov, D. Eliyahu, W. Liang, E. Dale, V. Ilchenko, L. Maleki* *OEwaves Inc., United States*
11:10 – 11:30	**11:10 – 11:30**	**11:10 – 11:40**
Present Status of Primary Frequency Standards at NPL, India *A. Acharya, P. Arora, V. Bharath, S. Yadav, A. Agarwal, A. Sen Gupta* *CSIR National Physical Laboratory, India*	**A Study of GPS Carrier-Phase Time Transfer Noise Based on Eight GPS Receivers at NIST** *J. Yao, J. Levine* *NIST, United States*	**High Quality on-Chip Resonators for Frequency Combs (INVITED)** *M. Lipson* *Columbia University, United States*
11:30 – 11:50	**11:30 – 11:50**	
Design Innovations for Miniaturized GPS Quality Clocks *C. Fertig, J. Strabley, K. Salit, K. Nelson, R. Compton, T. Stark, C. Langness* *Honeywell Aerospace, United States*	**Galileo in-Orbit Satellite Clocks Assessment at NTSC** *H. Zhang{2}, X. Li{1}, L. Zhu{1}, B. Yu{3} {1}National Time Service Center, China; {2}National Time Service Center, the Chines, China; {3}University of Chinese Academy of Sciences, China*	

WEDNESDAY, MAY 11		
Salon II	Salon III	Salon IV & V
		11:40 – 12:10
11:50 – 12:10	**11:50 – 12:10**	
Cavity Phase and Microwave Lensing Frequency Shifts of PHARAO *P. Peterman{3}, K. Gibble{3}, P. Laurent{2}, C. Salomon{1}* *{1}Ecole Normale Supérieure, CNRS, UPMC, France; {2}Observatoire de Paris, PSL Research University, CNRS, Sorbonne Universités, UPMC Univ. Paris 06, France; {3}The Pennsylvania State University, United States*	**Investigating a Null Test of the Einstein Equivalence Principle with Clocks at Different Gravitational Potentials** *S. Peil, D. Matsakis* *USNO, United States*	**Low Noise Microwave Generation via Temporal Soliton Formation in a Crystalline Optical Microresonator with a Narrow Linewidth Laser (INVITED)** *E. Lucas{1}, J. Jost{1}, C. Lecaplain{1}, K. Beha{2}, R. Holzwarth{2}, T. Kippenberg{1}* *{1}Ecole Polytechnique Federale de Lausanne, Switzerland; {2}Menlo Systems, Germany*

WEDNESDAY, MAY 11		
Salon II	Salon III	Salon IV & V
B2L-A: **FOCUS SESSION: Optical Frequency Control (DODOS)**	**B2L-B:** **FOCUS SESSION: 50 Years of the Allan Deviation**	**B2L-C:** **Novel Resonant Circuits**
Robert Lutwak, DARPA	David Allan, Allan's Time	Zenghui (Max) Wang, Case Western Reserve Univ.
13:10 – 13:40	**13:10 – 13:30**	**13:10 – 13:30**
Chip-Scale Optical Resonator Enabled Synthesizer: (CORES) Miniature systems for Optical Frequency Synthesis (INVITED) *J. Bowers{5}, A. Beling{6}, A. Bluestone{5}, S. Bowers{6}, L. Chang{5}, S. Diddams{4}, G. Fish{1}, T. Kippenberg{3}, T. Komljenovic{5}, E. Norberg{1}, S. Papp{4}, K. Srinivasan{4}, L. Theogarajan{5}, K. Vahala{2}, N. Volet{5}* *{1}Aurrion, United States; {2}Caltech, United States; {3}EPFL, Switzerland; {4}NIST, United States; {5}UCSB, United States; {6}UVA, United States*	**The 50th Anniversary of the Allan Variance (INVITED)** *J. Levine{2}, D. Allan{1}* *{1}Allan's Time, United States; {2}NIST, United States*	**RF-Powered Micromechanical Clock Generator** *R. Liu, J. Naghsh Nilchi, C. Nguyen* *University of California at Berkeley, United States*

WEDNESDAY, MAY 11		
Salon II	Salon III	Salon IV & V
	13:30 – 13:50	**13:30 – 13:50**
13:40 – 14:10		
Integrated Micro-Optical Synthesizer (µOS) (INVITED) *S. J. B. Yoo{4}, L. Maleki{3}, A. Matsko{3}, L. Coldren{5}, M. Rodwell{5}, L. Johansson{1}, M. Fejer{2}, C. Langrock{2}, J. Campbell{6}* *{1}Freedom Photonics, LLC, United States; {2}Ginzton Laboratories, Stanford University, United States; {3}OEwaves, Inc, United States; {4}University of California, Davis, United States; {5}University of California, Santa Barbara, United States; {6}University of Virginia, Charlottesville, United States*	**Memory-Efficient High-Speed Algorithm for Multi-Tau PDEV Analysis** *M. Danielson{2}, F. Vernotte{3}, E. Rubiola{1}* *{1}CNRS FEMTO-ST Institute, Dept Time and Frequency, France; {2}Net Insight AB, Sweden; {3}Observatory THETA/UTINAM, UBFC/UFC and CNRS, France*	**An Analong Micro-Electromechanical XOR** *M. Mahdavi, A. Ramezany, H. Ravi, S. Pourkamali* *University of Texas at Dallas, United States*
	13:50 – 14:10	**13:50 – 14:10**
	Three-Cornered Hat Versus Allan Covariance *F. Vernotte{3}, E. Rubiola{1}, C. Calosso{2}* *{1}CNRS/Femto-ST, France; {2}INRIM/Physics Metrology Division, Italy; {3}UBFC/UFC/Observatory THETA/UTINAM, France*	**Observation of Intrinsic Mode Splitting in a Parametric Micromechanical Resonator** *A. Ganesan, C. Do, A. Seshia* *University of Cambridge, United Kingdom*

WEDNESDAY, MAY 11		
Salon II	Salon III	Salon IV & V
14:10 – 14:40	**14:10 – 14:50**	**14:10 – 14:30**
Heterogeneously Integrated Optical Synthesizer (HiOS) (INVITED) *M. Wu{2}, C. Chang-Hasnain{2}, F. Aflatouni{4}, P. Delfyett{3}, S. Fathpour{3}, G. Hoefler{1}* *{1}Infinera, United States; {2}Univeristy of California, Berkeley, United States; {3}University of Central Florida, United States; {4}University of Pennsylvania, United States*	**Optimal Stopping and Quickest Detection of Hidden Changes (INVITED)** *G. Peskir* *The University of Manchester, United Kingdom*	**Piezoelectric Disk Flexure Resonator with 1 dB Loss** *R. Rudy{2}, J. Pulskamp{2}, S. Bedair{2}, R. Polcawich{2}, J. Puder{1}* *{1}Oak Ridge Institute for Science and Education, United States; {2}US Army Research Laboratory, United States*
		14:30 – 14:50
		Ferroelectric PZT MEMS HF/VHF Resonators/Filters *J. Pulskamp, R. Rudy, S. Bedair, J. Puder, R. Polcawich* *US Army Research Laboratory, United States*
14:40 – 15:10	**14:50 – 15:10**	**14:50 – 15:10**
Electronic-Photonic Integration Platform Enabling a Chip-Scale Optical Synthesizer (INVITED) *D. Vermeulen{1}, Z. Su{1}, N. Li{1}, K. Shtyrkova{1}, P. Callahan{1}, E. Salih Magden{1}, P. Purnawirman{1}, E. Timurdogan{1}, J. Bradley{1}, E. Ippen{1}, F. Kärtner{1}, F. Kaertner{4}, M. R. Watts{4}, G. Leake{2}, D. Coolbaugh{2}, V. Stojanovic{3}* *{1}Massachusetts Institute of Technology, United States; {2}University at Albany, United States; {3}University of California, Berkeley, United States {4} DESY and Universitaet Hamburg*	**Detection of Extremely Weak Microwave Signals in Fundamental Physics Experiments** *E. Ivanov, S. Parker, M. Tobar* *UWA, Australia*	**Thick Aluminum Nitride Contour-Mode Resonators Mitigate Theromelastic Damping** *C. Cassella{2}, G. Piazza{1}* *{1}Carnegie Mellon University, United States;{2}Northeastern University, United States*

WEDNESDAY POSTER SESSIONS

15:30 – 17:30
Crescent City Ballroom
(prefix numbers indicate poster space)

Session B3P-E- Device Design
Session Chair: Sheng-Shian Li, National Tsing Hua Univ.

(2) Improvement of Methods in Analyzing the Propagation of Plate Waves in FBARs
N. Nguyen{2}, S. Rooth{1}, A. Johannessen{2}, U. Hanke{2}
{1}Kongsberg Norspace, Norway; {2}University College of Southeast Norway, Norway

(4) An Ovenized CMOS-MEMS Oscillator with Isothermal Resonator and Sub-mW Heating Power
C. Liu, M. Li, C. Chen, S. Li
National Tsing Hua University, Taiwan

(6) New Radio-Frequency Resonators Based on Periodically Poled Lithium Niobate Thin Film and Ridge Structures
F. Bassignot{2}, G. Haye{2}, F. Henrot{3}, L. Gauthier-Manuel{3}, B. Guichardaz{3}, H. Maillotte{3}, S. Ballandras{4}, E. Courjon{4}, J. Lesage{1}
{1}DGA/CELAR, France; {2}Femto-Engineering, France; {3}Femto-st, France; {4}Frec'N'Sys, France

(8) Ultra Wideband Balanced Fan-Shaped Three-Transducer Low-Loss Leaky SAW Filters
S. Doberstein
ONIIP, Russia

(10) Solidly Mounted Resonator Using Shear Horizontal Mode Plate Wave in LiNbO3 Plate
M. Kadota, S. Tanaka
Tohoku University, Japan

(12) High Velocity Lamb Waves in LiTaO3 Thin Plate for High Frequency Filter
N. Assila, M. Kadota, Y. Ohashi, S. Tanaka
Tohoku University, Japan

(14) Electronic Scheme for Full Control of Organic Piezoelectric MEMS Resonators
P. Ducrot{2}, I. Dufour{2}, C. Ayela{2}, F. Mathieu{1}, L. Nicu{1}
{1}LAAS-CNRS - Université de Toulouse, France; {2}University of Bordeaux, France

(16) Cross-Sectional Lamé Mode Filters for UHF Wideband Applications
C. Cassella, G. Chen, Z. Qian, G. Hummel, M. Rinaldi
Northeastern University, United States

(18) Magnetoelectric Bulk Acoustic Wave Resonator for Acoustic Spin Pumping
N. Polzikova, I. Pyataikin, S. Alekseev, I. Kotelyanskii, V. Luzanov
Kotelnikov IRE RAS, Russia

(20) Passive Temperature Compensation Method for MEMS Resonators Based on the Nonlinear Duffing Effect
G. Sobreviela{2}, M. Riverola{2}, A. Uranga{2}, N. Barniol{2}, E. Marigó{1}, M. Soundara-Pandian{1}
{1}SilTerra, Malaysia; {2}Universidad Autónoma de Barcelona, Spain

(22) Intrinsic Feedthrough Current Cancellation in a Seesaw CMOS-MEMS Resonator for Integrated Oscillators
M. Riverola, G. Sobreviela, A. Uranga, N. Barniol
Universitat Autònoma de Barcelona, Spain

(24) A SAW Filter Using SiO2/LiNbO3 Layered-Structure Phononic Crystals
J. Sun, Y. Yu, A. Chen
Chang Gung University, Taiwan

(26) Design and Characterization of Micromachined Piezoelectric Acoustic Flexural Plate Wave Devices
N. Weckman, A. Seshia
University of Cambridge, United Kingdom

Session B3P-F- Oscillators, Synthesizers, Noise & Circuit Techniques II
Session Chair: Fabrice Sthal, FEMTO-ST

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(32) Measurement of AM-to-PM Conversion in a Quartz-MEMS Resonator
A. Hati, C. Nelson, D. Howe
NIST, United States

(34) Oscillator Noise Analysis in the Context of Convex Optimization
W. Cheng, G. Nie
Wuhan University, China

(36) High Spectral Purity OEO (Opto-Electronic Oscillator) for High Dynamic Environment Platform
J. Lesage, C. Hallet, M. Le Pipec
DGA, France

(38) A Quality Factor Enhanced Dual-Loop Optoelectronic Oscillator
W. Tseng{2}, K. Feng{1}
{1}Institute of Communications Engineering, National Tsing Hua University, Taiwan; {2}Telecommunication Laboratories, Chunghwa Telecom, Taiwan

(40) Coupled Optoelectronic Oscillators: Design and Performance Comparison at 10 GHz and 30 GHz
V. Auroux{1}, A. Fernandez{1}, O. Llopis{1}, P. Beaure d'Augères{2}, A. Vouzellaud{2}
{1}LAAS-CNRS, France; {2}OSAT, France

(42) Oscillator Resistor Noise
M. Underhill
Underhill Research Limited, United Kingdom

(44) A Zynq Based Digital Phase and Amplitude Measurement System
G. Bres, C. Nelson, A. Hati, D. Howe
NIST, United States

(46) The Impact of Thermal Energy on Cross Spectrum PM Noise Measurements
Y. Gruson{1}, V. Giordano{1}, U. Rohde{2}, E. Rubiola{1}
{1}Femto-ST Institute, France; {2}Synergy Microwave Corporation, United States

(48) Phase Noise Measurements of High Overtone Bulk Acoustic Wave Resonators
E. Vaillant{3}, G. Combe{3}, V. Petrini{3}, G. Martin{3}, J. Imbaud{3}, T. Baron{3}, F. Sthal{3}, F. Esnault{1}, G. Cibiel{1}, J. Lesage{2}
{1}CNES, France; {2}DGA, France; {3}FEMTO-ST, France

(50) Precise Phase and Frequency Measurement Using All Digital Dual Mixer Time Difference Technique
A. Acharya, P. Arora, A. Sen Gupta
CSIR-National Physical Laboratory, India

(52) Compact Photonic Oscillator Employing FP Resonator Based on Travelling-Waveguide-Type EO Modulator
J. Dai, G. Xu, X. Xu, Y. Dai, F. Yin, Y. Zhou, J. Li, K. Xu
Beijing University of Posts and Telecommunications, China

Session B3P-G- Microwave Clocks II
Session Chair: Lin Yi, JPL

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(62) Magnetic State Selection Impact on Double Resonance Effect in H-Maser
M. Aleynikov
FGUP VNIIFTRI, Russia

(64) An Atomic Clock Based on Synchronously Stimulated Coherent Population Beating
Y. Zhuang, X. Zhao, E. Hu, L. Liu, Z. Wang
Peking University, China

(66) Dual-Mode Ramsey Cavity for a Dual Rb/Cs Atomic Clock
F. Sun, X. Huang, Q. Bai
University of Electronic Science and Technology of China, China

(68) Design and Experimental Study of the Hydrogen Source of Space Passive Hydrogen Maser
W. Wang, G. Shen, H. Zheng, J. Li, J. Zhang
Beijing Institute of Radio Metrology and Measurement, China

(70) Investigation of Micro Discharge Lamps for Trapped Hg+ Standard
T. Le, T. Bandi, S. Chung, J. Prestage, N. Yu
JPL, United States

(72) The Study of Second-Order Zeeman Shift of the Cesium Fountain Clock NTSC-F1
X. Wang, D. Liu, J. Ruan, H. Zhang, R. Lin, J. Chen, Y. Guan, F. Yu, J. Shi, S. Zhang
National Time Service Center, Chinese Academy of Science, China

(74) Progress in Brazilian Cesium Atomic Fountain-BrCsF
A. Rodriguez{2}, V. Bagnato{2}, C. Bueno{1}, R. Pechoneri{1}, D. Magalhães{1}
{1}Escola de Engenharia de São Carlos, Brazil; {2}Instituto de Física de São Carlos, Brazil

(76) Local Oscillator-Atomic System Interactions in Trapped Ion Frequency Standards
D. Enzer, W. Diener, D. Murphy, S. Rao, R. Tjoelker
Jet Propulsion Laboratory, United States

Session B3P-H- Sensors & Transducers
Session Chair: Sunil Bhave

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(80) Using QCM for Field Measurement of Liquid Viscosities in a Novel Mass-Sensitivity-Base Method
Q. Bai, X. Huang
University of Electronic Science and Technology of China, China

(82) Ultrasensitive Nonlinear Optical Mass Sensing Based on a Monolayer MoS2 Nanoresonator
H. Chen
Anhui University of Science and Technology, China

(84) Sensitivity Improvement of SAW Pressure Sensors Based on Finite Element Analysis
J. Ren{2}, K. Anurakparadorn{2}, X. Wei{1}
{1}Xi'an Jiaotong Univerisity, China; {2}Xi'an Jiaotong University, China

(86) Feasibility Study of Liquid-Level Detection by Using a Trapped-Energy Resonator
K. Yamada, Y. Kunii
Tohoku-Gakuin University, Japan

(88) Square-Extensional Mode Piezoelectric-on-Silicon Resonator for Physical Measurements of Liquids
A. Ali{1}, J. Lee{2}
{1}Department of Electronic Engineering, City University of Hong Kong, Hong Kong; {2}State Key Laboratory of Millimeter Waves, City University of Hong Kong, Hong Kong

(90) A Custom Benchtop Focused Ultrasound System for Ex Vivo and in Vivo Treatments
B. Nguyen, V. Frenkel, D. Hersh
University of Maryland School of Medicine, United States

(92) SAW Passive Multi-Sensor System: Status and Future Opportunities
D. Malocha{1}, J. Humphries{2}, A. Weeks{2}
{1}Univ. of Central Florida, United States; {2}University of Central Florida, United States

(94) Characterization of Materials for the Design of Wireless SAW Sensors in a High Temperature Environment
G. Wong{2}, T. Baron{2}, L. Arapan{2}, B. Dulmet{2}, J. Lesage{1}
{1}DGA, France; {2}FEMTO-ST, France

(96) Design of a Love Wave Mode Device for Use in a Microfabricated Glucose Sensor
T. Hoang, U. Hanke, E. Johannessen, A. Johannessen
University College of Southeast Norway, Norway

(98) Design of an Oscillator Circuit for Langasite Based Resonant Sensors
S. Kaluvan, H. Zhang
University of North Texas, United States

Session B3P-J- Timekeeping, Time & Freq Transfer, GNSS Apps II
Session Chair: Demetrios Matsakis, U.S. Naval Observatory

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(102) Analysis of System Time Performance in BeiDou Satellite Navigation System
J. Lu{1}, Y. Ren{2}, X. Li{2}, Y. Liu{2}, L. Yang{3}
{1}Beijing Institute of Tracking and Telecommunication Technology, China; {2}National Time Service Center,CAS, China; {3}Sichuan Spaceon Time & Frequency Tech. Co., Ltd, China

(104) Optical Carrier Transfer Over a 100 km Urban Fiber Link
X. Deng, J. Liu, D. Jiao, J. Gao, Q. Zang, G. Xu, R. Dong, T. Liu, S. Zhang
National Time Service Centre, Chinese Academy of Science, China

(106) Analyzing Prediction Methods and Precision of GNSS System Time Offset Using End-Point and Kalman Filter
L. Zhu, H. Zhang, X. Li, Y. Ren
National Time Service Center, China

(108) The Application of Phase Smoothed Pseudo-Range in Beidou Satellite Clock Evaluation
J. Zhang, H. Yuan, W. Guang, W. Li, H. Song
Nation Time Service Center of Chinese Academy of Sciences, China

(110) The Evaluation of BeiDou Time Transfer Performance
W. Guang, H. Yuan, J. Zhang, W. Li, Y. Wei
National Time Service Center, China

(112) The Influence of Antenna Positioning Error on TWSTFT
Y. Jing{2}, H. Song{2}, W. Guang{2}, S. Dong{2}, H. Li{1}, H. Zhang{1}, H. Yuan{2}, J. Zhang{1}
{1}National Time Service Center, China; {2}National Time Service Center,CAS, China

(114) Analysis on Periodicity Effect of BeiDou RDSS One Way Timing
Y. Lin
Beijing Satellite Navigation Center, China

(116) Practical Evalution of a 50 km Fiber Link Utilizing a Commercial Modem
C. Barnes, A. Hati, C. Nelson, D. Howe
NIST, United States

(118) The Method on Determining Invisible Satellite-Ground Clock Difference with Inter-Satellite-Link
W. Qin, X. Ren
NTSC,CAS, China

Session B3P-K- Optical Frequency Standards & Applications II
Session Chair: Lora Nugent-Glandorf, NIST

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(122) A Compact Vapor Cell for Spectroscopy of Neutral Calcium Atoms
J. Armstrong{2}, K. Martin{2}, N. Lemke{3}, C. Erickson{1}
{1}Air Force Research Laboratory, United States; {2}Applied Technology Associates, United States; {3}Space Dynamics Laboratory, United States

(124) A Transportable Calcium Atomic Beam Optical Clock
X. Zhang{2}, S. Zhang{2}, Z. Jiang{2}, M. Li{2}, H. Shang{2}, F. Meng{2}, W. Zhuang{1}, A. Wang{2}, J. Chen{2}
{1}National Institute of Metrology, China; {2}Peking University, China

(126) Study of a Fully Vacuum-Sealed Calcium Atomic Beam Tube for Optical Frequency Standard
H. Chen{1}, Y. Liang{1}, J. Yang{1}, Z. Liu{1}, J. Feng{1}, X. Zhang{2}, S. Zhang{2}, J. Chen{2}
{1}Beijing Vacuum Electronics Research Institute, China; {2}Peking University, China

(128) Towards High-Precision Measurement of Hyperfine Structure in the D2 Line of 133Cs Atom Using an Ultra-Stable Laser
C. Ortiz{2}, R. Gutiérrez{2}, J. López{2}, E. de Carlos López{1}, L. Hernández{1}
{1}CENAM, Mexico; {2}CINVESTAV / CENAM, Mexico

(130) Universal Fiber Comb-Based Transfer Oscillator for Atomic Clock Metrology
A. Rolland, F. Baynes, I. Hill, R. Hobson, W. Bowden, S. King, R. Williams, S. Kyriacou, P. Gill, H. Margolis
National Physical Laboratory, United Kingdom

(132) Self-Delay-Line-Referenced Optical Frequency Comb for Low-Phase Noise Microwave Generation
J. Cahill{2}, W. Zhou{2}, C. Menyuk{1}
{1}UMBC, United States; {2}US Army Research Laboratory, United States

(134) Cesium Faraday Anomalous Dispersion Optical Filter with Buffer Gas
J. Xiong{2}, L. Yin{2}, H. Guo{2}, B. Luo{1}
{1}Beijing University of Posts and Telecommunications, China; {2}Peking University, China

(136) An Excited State Voigt Optical Filter at 1.5 μm
L. Yin{2}, J. Li{2}, J. Xiong{2}, H. Guo{2}, B. Luo{1}
{1}Beijing University of Posts and Telecommunications, China; {2}Peking University, China

(138) Efficient Frequency Comb Generation
M. Malinowski, P. Delfyett, S. Fathpour
CREOL, United States

(140) Offset Frequency Measurement Through Quantum Interference of Two- and Three-Photon Processes
K. Wang{1}, S. Cundiff{1}, R. Muniz{2}, J. Sipe{2}
{1}university of michigan, United States; {2}university of toronto, Canada

(142) Lattice Induced Frequency Shifts and Improved Stability Operation of a 171Yb Optical Lattice Clock
R. Brown, K. Beloy, N. Phillips, M. Schioppo, N. Hinkley, W. McGrew, T. Yoon, R. Fasano, J. Sherman, C. Oates, A. Ludlow
nist, United States

(144) Toward an Aluminum-Ion Clock Using Quantum-Logic Spectroscopy with Calcium
A. Hankin, Y. Huang, S. Brewer, J. Chen, D. Hume, C. Chou, D. Wineland, T. Rosenband, D. Leibrandt
National Institute of Standards and Technology, United States

(146) The Stiffness Analysis of Vibration-Insensitive Spherical Optical Reference Cavities
G. Xu, L. Zhang, L. Chen, D. Jiao, J. Liu, T. Liu
National Time Service Center, China

(148) Three-Dimensional Optical Lattice Clock with a Degenerate Strontium Gas
J. Robinson, S. Campbell, R. Hutson, N. Darkwah Oppong, G. Marti, A. Goban, W. Zhang, L. Sonderhouse, J. Ye
NIST & University of Colorado, United States

THURSDAY, MAY 12		
Salon II	Salon III	Salon IV & V
C1L-A: **Optical Metrology and Applications**	**C1L-B:** **FOCUS SESSION: Sensing for Oil and Gas**	**C1L-C:** **Piezoelectric MEMS Technologies**
Rodolphe Le Targat, SYRTE	Greg Weaver, Johns Hopkins APL	Sarah Bedair, US Army Research Labs
10:10 – 10:50	**10:10 – 10:50**	**10:10 – 10:30**
Searching for Ultralight Dark Matter with Atomic Spectroscopy and Nuclear Resonance (INVITED) *D. Budker* *University of California at Berkeley, United States*	**Recent Developments in High Precision Quartz and Langasite Pressure Sensors for High Temperature and High Pressure Applications (INVITED)** *B. Sinha, M. Patel* *Schlumberger-Doll Research, United States*	**Orientation-Dependent Acceleration Sensitivity of Silicon-Based MEMS Resonators** *B. Khazaeili, R. Abdolvand* *University of Central Florida, United States*
		10:30 – 10:50
		Aluminum Nitride Cross-Sectional Lamé Mode Resonators with 260 MHz Lithographic Tuning Capability and High kt2>4% *G. Chen, C. Cassella, Z. Qian, G. Hummel, M. Rinaldi* *Northeastern University, United States*

THURSDAY, MAY 12		
Salon II	Salon III	Salon IV & V
10:50 – 11:10	**10:50 – 11:10**	**10:50 – 11:10**
Ultra-Low Phase Noise Frequency-Comb-Based Microwave Generation and Characterization *D. Nicolodi{4}, R. Bouchand{4}, X. Xie{4}, Y. Le Coq{4}, P. Tremblin{5}, G. Santarelli{5}, M. Giunta{6}, M. Lezius{6}, W. Haensel{6}, R. Holzwarth{6}, S. Datta{3}, A. Joshi{2}, C. Alexandre{1}* *{1}CNAM, France; {2}Discovery Semiconductor, United States; {3}Discovery Semiconductor Inc., United States; {4}LNE-SYRTE, France; {5}LP2N, France; {6}MenloSystems GmbH, Germany*	**The Elastic Stiffness of Langasite at High Temperatures and its Temperature Compensated Orientations (INVITED)** *Y.-K. Yong, G. Choi* *Rutgers University, United States*	**Mitigation of A0 Spurious Modes in AlN MEMS Resonators with SiO2 Addendums** *A. Gao, R. Lu, S. Gong* *University of Illinois at Urbana-Champaign, United States*
11:10 – 11:30	**11:10 – 11:30**	**11:10 – 11:30**
An Octave-Bandwidth Kerr Optical Frequency Comb on a Silicon Chip *T. Briles{1}, T. Drake{1}, J. Stone{1}, S. Diddams{1}, S. Papp{1}, Q. Li{2}, D. Westly{2}, R. Ilic{2}, K. Srinivasan{2}* *{1}NIST-Boulder, United States; {2}NIST-Gaithersburg, United States*	**Optimal Cuts to Extract the Nonlinear Material Constants of Langasite Single Crystals by Resonator Method (INVITED)** *H. Zhang* *University of North Texas, United States*	**Temperature Compensation of MEMS Resonators Using Sputtered Fluorine-Doped Silicon Dioxide** *S. Moradian, S. Shahraini, R. Abdolvand* *University of Central Florida, United States*

THURSDAY, MAY 12		
Salon II	Salon III	Salon IV & V
11:30 – 11:50	**11:30 – 11:50**	**11:30 – 11:50**
High Precision Optical Frequency Divider *Y. Yao, Y. Jiang, H. Yu, Z. Bi, L. Ma* *East China Normal University, China*	**Ultrasonic Signal Noise Reduction Processing in Borehole Imaging Application** *Z. Zhang, W. Han, R. Steinsiek, D. Patterson* *BakerHughes, United States*	**Effects of Volume Scaling in AlN Nano Plate Resonators on Quality Factor** *Z. Qian, Y. Hui, M. Rinaldi* *Northeastern University, United States*
11:50 – 12:10	**11:50 – 12:10**	**11:50 – 12:10**
300,000 Finesse Crystalline Coatings at 1542 nm for an Ultrastable Reference Cavity *G. Cole{2}, D. Follman{2}, P. Heu{2}, C. Deutsch{1}, M. Aspelmeyer{5}, W. Zhang{3}, L. Sonderhouse{3}, J. Robinson{3}, J. Ye{3}, M. Notcutt{4}* *{1}Crystalline Mirror Solutions GmbH, Austria; {2}Crystalline Mirror Solutions LLC, United States; {3}JILA, United States; {4}Stable Laser Systems, United States; {5}University of Vienna, Austria*	**MEMS Resonant Sensors for Real-Time Thin Film Sheer Stress Monitoring** *V. Qaradaghi, M. Mahdavi, A. Ramezany, S. Pourkamali* *University of Texas at Dallas(UTD), United States*	**Electrode Design of AlN Lamb Wave Resonators** *J. Zou, C. S. Lam* *Skyworks Solutions, Inc.*

THURSDAY, MAY 12		
Salon II	Salon III	Salon IV & V
C2L-A: **Microwave Clocks and Applications**	**C2L-B:** **Resonant Sensors**	**C2L-C:** **Emerging Trends in Resonators**
John Kitching, NIST	Matteo Rinaldi, Northeastern University	Michael Driscoll, Consultant
13:10 – 13:30	**13:10 – 13:30**	**13:10 – 13:50**
Chip-Scale Atomic Cladding Wave Guides for Optical Frequency References in the Telecom and NIR Regime *L. Stern, B. Desiatov, N. Mazurski, U. Levy* *Hebrew University of Jerusalem, Israel*	**Miniaturized Aerosol Impactors with Integrated Piezoelectric Thin Film Resonant Mass Balances** *M. Maldonado-Garcia{3}, M. Mahdavi{1}, S. Pourkamali{3}, J. Wilson{2}* *{1}University of Texas at Dallas, United States; {2}University of Denver, United States; {3}University of Texas at Dallas, United States*	**Design Considerations for an Axion Detector (INVITED)** *D. Tanner* *University of Florida, United States*
13:30 – 13:50	**13:30 – 13:50**	
Photonic Chip for Laser Stabilization to a Rubidium Atomic Vapor *M. Hummon, A. Dellis, J. Kitching, V. Aksyuk, K. Srinivasan, D. Westly, Q. Li, B. Roxworthy* *NIST, United States*	**Particulate Mass Sensing with Piezoelectric Bulk Acoustic Mode Resonators** *A. Zielinski, M. Kalberer, R. Jones, A. Prasad, A. Seshia* *University of Cambridge, United Kingdom*	

THURSDAY, MAY 12		
Salon II	Salon III	Salon IV & V
13:50 – 14:10	**13:50 – 14:10**	**13:50 – 14:10**
A High-Performance CPT-Based Cs Cell Atomic Clock *M. Abdel Hafiz, R. Boudot* *FEMTO-ST, France*	**Characterization of Thin Film Lead Zirconate Titanate (PZT) Multimode Piezoelectric Cantilevers Vibrating in Ultrasonic Band** *X. Zheng{1}, L. Sanchez{2}, J. Pulskamp{2}, R. Polcawich{2}, P. Feng{1}* *{1}Case Western Reserve University, United States; {2}U.S. Army Research Laboratory, United States*	**High Frequency Signal Sources Using Metamaterial Möbius Coupled Strips Resonator Tank Circuit** *U. Rohde{2}, A. Poddar{4}, K. Hoffmann{1}, E. Rubiola{3}* *{1}Bayerische Akademie der Wissenschaften München, Germany; {2}BTU Cottbus, Germany; {3}CNRS FEMTO-ST Institute, Dept. Time & Frequency, France; {4}Synergy Microwave Corp., United States*
14:10 – 14:30	**14:10 – 14:30**	**14:10 – 14:30**
A Compact Double-Modulation Coherent Population Trapping Clock *P. Yun, S. Mejri, F. Tricot, E. de Clercq, S. Guérandel* *LNE-SYRTE Observatoire de Paris, France*	**Miniaturized Digital Oven-Control Microsystem with High Power Efficiency and ±1.8ppm Frqeuncy Drift** *J. Woo{2}, D. Yang{2}, K. Najafi{2}, S. Lee{1}, J. Mitchell{1}* *{1}ePack, Inc., United States; {2}University of Michigan, Ann Arbor, United States*	**Phase Noise Measurements of AlN Contour-Mode Resonators** *E. Vaillant{2}, F. Sthal{2}, J. Imbaud{2}, V. Petrini{2}, P. Abbe{2}, L. Arapan{2}, G. Piazza{1}, J. Segovia-Fernandez{3}* *{1}CMU, United States; {2}FEMTO-ST, France; {3}UPENN, United States*

THURSDAY, MAY 12		
Salon II	Salon III	Salon IV & V
14:30 – 15:10	**14:30 – 14:50**	**14:30 – 14:50**
Entanglement Enhanced Metrology for Atom Interferometry (INVITED) *O. Hosten, N. Engelsen, R. Krishnakumar, M. Kasevich* *Stanford University, United States*	**Memory Operation via Thermal Modulation of MoS2 Nanomechanical Resonators** *Z. Wang, R. Yang, P. Feng* *Case Western Reserve University, United States*	**Towards Cryogenic Quartz Oscillators: Coupling of a Bulk Acoustic Wave Quartz Resonator to a SQUID** *M. Goryachev{2}, E. Ivanov{2}, M. Tobar{2}, S. Galliou{1}* *{1}FEMTO-ST, France; {2}University of Western Australia, Australia*
	14:50 – 15:10	**14:50 – 15:10**
	Polymer-Plasticizer Coatings for Shear Horizontal-Surface Acoustic Wave Sensors for Long-Term Monitoring of BTEX Analytes in Liquid-Phase *P. Adhikari{1}, F. Bender{1}, F. Josse{1}, A. Ricco{2}* *{1}Marquette University, United States; {2}Stanford University, United States*	**Initial Results on Low Phase Noise Multi-Element Local Oscillator for Use in Atomic Clocks** *T. Burtichelov{1}, J. Everard{2}* *{1}University of York, United Kingdom; {2}Unvierstiy of York, United Kingdom*

THURSDAY, MAY 12		
Salon II	Salon III	Salon IV & V
C3L-A: Optical Lattice Clocks	C3L-B: Time Dissemination & Synchronization	C3L-C: Integration Technologies
Jason Jones, University of Arizona	Samuel Stein, Microsemi	Dan Stevens, Consultant
15:30 – 15:50	**15:30 – 15:50**	**15:30 – 16:10**
International Strontium Optical Lattice Clocks Comparisons with an Optical Fiber Link *C. Lisdat{1}, G. Grosche{1}, S.M.F. Raupach{1}, C. Grebing{1}, A. Al-Masoudi{1}, S. Dörscher{1}, S. Häfner{1}, A. Koczwara{1}, S. Koke{1}, A. Kuhl{1}, T. Legero{1}, H. Schnatz{1}, U. Sterr{1}, C. Shi{2}, D. Nicolodi{2}, F. Stefani{2}, J.- L. Robyr{2}, S. Bilicki{2}, E. Bookjans{2}, F. Meynadier{2}, M. Abgrall{2}, M. Lours{2}, Y. Le Coq{2}, R. Le Targat{2}, J. Lodewyck{2}, P.-E. Pottie{2}, N. Quintin{3}, N. Chiodo{3}, F. Wiotte{3}, C. Chardonnet{3}, A. Amy-Klein{3}, O. Lopez{3}, H. Denker{4}, G. Santarelli{5}, E. Camisard{6}* *{1}Laboratoire de Physique des Lasers, France; {2}LNE-SYRTE, France; {3}PTB, Germany; {4} U. Hannover, Germany; {5} U. de Bordeaux, France; {6} Réseau National de télécommunications pour la Technologie, France*	**Commercial Software Defined Radio Measurement of Microwave and Optical Clocks** *J. Sherman* *NIST, United States*	**Co-Integration of a Quartz OCXO and MEMS Inertial Sensors for Improved Navigational Accuracy (INVITED)** *R. Kubena{1}, F. Stratton{1}, C. Huang{1}, R. Joyce{1}, D. Kirby{1}, D. Chang{1}, Y. Yong{2}* *{1}HRL Laboratories, United States; {2}Rutgers University, United States*
15:50 – 16:10	**15:50 – 16:10**	
Frequency Ratio of a Mercury Optical Lattice Clock with Primary and Secondary Frequency Standards *M. Favier, R. Tyumenev, S. Bilicki, E. Bookjans, D. Nicolodi, M. Abgrall, J. Guéna, Y. Le Coq, R. Le Targat, J. Lodewyck, L. De-Sarlo, S. Bize* *SYRTE, Obs. Paris, CNRS, UPMC Univ., France*	**Time Dissemination Services: The Experimental Results of the European H2020 DEMETRA Project** *P. Tavella* *INRIM, Italy*	

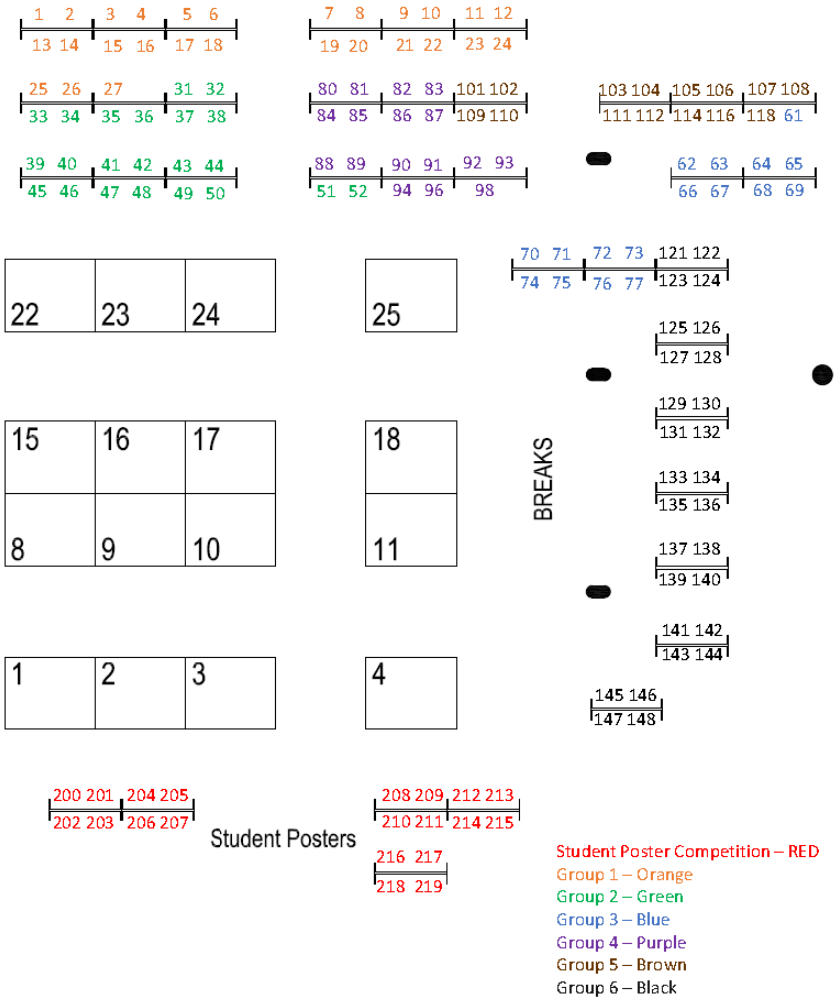
THURSDAY, MAY 12		
Salon II	Salon III	Salon IV & V
16:10 – 16:30	**16:10 – 16:30**	**16:10 – 16:30**
Yb Optical Lattice Clock Towards Low 10^-18 Standard Uncertainty *K. Beloy, R. Brown, N. Hinkley, W. McGrew, R. Fasano, M. Schioppo, T. Yoon, N. Phillips, J. Sherman, C. Oates, A. Ludlow* *National Institute of Standards and Technology, United States*	**Implementation of an Optical Fiber Frequency Distribution via Commercial DWDM** *S. Ebenhag{2}, M. Zelan{2}, P. Hedekvist{2}, M. Karlsson{1}* *{1}Chalmers University of Technology, Sweden; {2}SP Technical Research Institute of Sweden, Sweden*	**An 8V 50µW 1.2MHz CMOS-MEMS Oscillator** *M. Li, K. Tseng, C. Liu, C. Chen, S. Li* *National Tsing Hua University, Taiwan*
16:30 – 16:50	**16:30 – 16:50**	**16:30 – 16:50**
A Transportable Optical Lattice Clock *S. Koller, J. Grotti, S. Vogt, S. Häfner, S. Herbers, U. Sterr, C. Lisdat* *PTB, Germany*	**The Field Trial of the Frequency Dissemination System for Square Kilometre Array Radio Telescope** *C. Gao, B. Wang, Y. Yuan, X. Zhu, L. Wang* *The State Key Lab of Precision Measurement Technology and Instrument, China*	**Optimization of Unreleased CMOS-MEMS RBTs** *B. Bahr{1}, L. Daniel{1}, D. Weinstein{2}* *{1}MIT, United States; {2}Purdue University, United States*
16:50 – 17:10	**16:50 – 17:10**	**16:50 – 17:10**
Thermal Dynamics of Cold Atoms in 171Yb Optical Lattice Clocks *C. Han, M. Zhou, X. Zhang, Q. Gao, Y. Xu, P. Xu, S. Li, S. Zhang, X. Xu* *East China Normal University, China*	**Delay Measurement of 1PPS Signals in Timing Systems** *S. Römisch{2}, D. Rovera{1}, M. Siccardi{3}* *{1}LNE-SYRTE Observatoire de Paris. PSL Research University, CNRS, Sorbonne Universités, UPMC Univ.Pari, France; {2}NIST, United States; {3}SKK Electronics, Italy*	**3-GHz BAW Composite Resonators Integrated with CMOS in a Single-Chip Configuration** *G. Pillai{1}, A. Zope{1}, J. Tsai{2}, S. Li{1}* *{1}iNEMS, National Tsing Hua University, Taiwan; {2}Invensense Inc, United States*

THURSDAY, MAY 12		
Salon II	Salon III	Salon IV & V
17:10 – 17:30	**17:10 – 17:30**	**17:10 – 17:30**
Cryogenic Silicon Cavity Towards 10^-17 Stability *W. Zhang{3}, L. Sonderhouse{3}, J. Robinson{3}, J. Ye{3}, T. Legero{4}, D. Matei{4}, U. Sterr{4}, F. Riehle{4}, G. Cole{1}, D. Follman{1}, P. Heu{1}, C. Deutsch{1}, M. Aspelmeyer{2}* *{1}Crystalline Mirror Solutions LLC, Austria; {2}Faculty of Physics, VCQ, University of Vienna, Austria; {3}JILA, National Institute of Standards and Technology and University of Colorado, United States; {4}Physikalisch-Technische Bundesanstalt, Germany*	**Design of a Low Cost, Compact Round-Trip Delay Measurement System for Radio Telescope Time Transfer Applications** *R. Siebrits{3}, E. Bauermeister{3}, S. Malan{3}, G. Adams{3}, R. Gamatham{3}, J. Burger{3}, F. Kapp{2}, T. Gibbon{1}* *{1}Nelson Mandela Metropolitan University, South Africa; {2}Square Kilometre Array, South Africa; {3}Square Kilometre Array South Africa, South Africa*	**A Ring-Down Technique Implemented in CMOS-MEMS Resonator Circuits for Wide-Range Pressure Sensing Applications** *W. Chiu, C. Chou, M. Li, S. Li* *National Tsing Hua University, Taiwan*

POSTER LAYOUT

Posters are located in the Crescent City Ballroom. Use the prefix number registered with the poster paper in the previous program pages to locate the poster in the following layout.

Note **ALL** posters are to be put up prior to the Tuesday Poster Session (15:30).



ROOSEVELT HOTEL FLOORPLAN