



**2022 Joint conference of the European
Frequency and Time Forum & the IEEE
International Frequency Control Symposium**

Conference booklet



<https://eftf-ifcs2022.sciencesconf.org>



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1 Program at a glance

start time	2023/04/29 sat.	2023/04/29 mon.	2023/04/29 tue.	2023/04/27 wed.	2023/04/28 thu.
	Speaker introduction	Speaker introduction	Speaker introduction	Speaker introduction	Speaker introduction
08:00	Tutorials (1160)	Plenary 1 EFTF awards ceremony Plenary talk by R. Pense	Posters 2 Virtual session (1140)	Session 6	Session 9
08:30					
09:00					
09:10					
09:20	F. Verste	E. Burt	P. Muralt	G3 RF Acoustic & Devices	G5 Timecrystals
09:30					
09:40					
09:50					
10:00	Coffee break	Coffee break	Coffee break	G3 Coil Standards	G5 Traceability Second
10:10					
10:20					
10:30					
10:40	Tutorials (1160)	Session 1 In-person session (1140)	Session 3	Session 7	Session 10
10:50					
11:00					
11:10					
11:20	N. Newbury	C. Salomon	V. Zaja	G3 Fundamental Physics & Metrology	G5 Optical Time Transfer &
11:30					
11:40					
11:50					
12:00	Lunch	Lunch	Lunch	G4 Resonant Sensors & Networks	G6 Stable Lasers
12:10					
12:20					
12:30					
12:40	4	WFE event	Session 4	Session 8	G2 Oscillators & Meas.
12:50					
13:00					
13:10					
13:20	Tutorials (1160)	Session 2	Session 5	G1 V Devices	G3 Chip-scale Atomic Clocks
13:30					
13:40					
13:50					
14:00	P. Deléglise	U. Ster	V. Plesky	G2 MEMS Time-to-Digital Converters & Freq. Dividers	G5 Optical Time Transfer I
14:10					
14:20					
14:30					
14:40	Coffee break	Coffee break	Coffee break	G4 MEMS Time-to-Digital Converters & ultrasonic Transc.	G3 Novel Time-to-Digital Converters & sensors
14:50					
15:00					
15:10					
15:20	Tutorials (1160)	Plenary 1 In-person session (1140)	Plenary 2 In-person session (1140)	G1 MEMS Time-to-Digital Converters & ultrasonic Transc.	G3 Novel Time-to-Digital Converters & sensors
15:30					
15:40					
15:50					
16:00	C. Calosso	C. Roos	S. Shave	G2 MEMS Time-to-Digital Converters & Freq. Dividers	G5 Optical Time Transfer I
16:10					
16:20					
16:30					
16:40	Reception buffet (- 20:00)	Reception buffet (- 20:00)	Reception buffet (- 20:00)	G3 Novel Time-to-Digital Converters & sensors	G5 Optical Time Transfer I
16:50					
17:00					
17:10					
17:20					
17:30					
17:40					
17:50					
18:00					

2 Welcome from the chairs

Dear participant,

it is a great pleasure for us to welcome you to the 2022 joint meeting of the European Frequency and Time Forum and IEEE International Frequency Control Symposium. After the in-person joint meeting in Orlando in 2019 and the virtual joint meeting in 2021, we are looking forward to meeting again physically in Paris, France, at the conference center of the Cité des Sciences museum. We hope this edition will perpetuate the long standing quality of EFTF and IFCS conferences, with a tutorial session, an industrial exhibition, and technical poster and oral sessions.

Because travel restrictions still affect several countries, this conference will follow a hybrid format, with talks, posters and discussions accessible to remote participants. The hybrid format will be as close as possible to the traditional physical conference format: remote participants will be able to present their talk and to listen to other virtual or on-site talks live, with a real-time Q&A feature. The authors of posters on-site will have the opportunity to present their work physically to their colleagues, while all posters will be presented in an interactive virtual reality platform during the second poster session.

This adventure to redefine the format of our conferences, in a context where hybrid events may eventually become the norm, owes a lot to UFFC and SFMC, who fully support the event despite its uncertain conditions ; but also to the participants, some willing to travel in the still fragile sanitary conditions, others willing to adhere to the virtual format.

We will have the pleasure to listen to two outstanding plenary speakers. Nobel Laureate in physics, Roger Penrose of the Oxford Mathematical Institute, eclectic scientist famous for his work on general relativity, cosmology and the geometrical objects he discovered, will talk about the connection between time, relativity and black holes. David Kaiser, MIT, famous for his award winning physics books, will discuss his work on closing loop holes in tests of Bell inequalities in the cosmos.

In-person participants will have the opportunity to enjoy a private visit of the science museum, and especially the "Banquet" exhibition, a journey through gastronomy. The visit will be followed by a gala dinner under the guidance of the Solar Impulse plane.

We wish you a stimulating and inspiring conference in Paris!

Jérôme Lodewyck, *General Co-Chair*
Eric Burt, *General Co-Chair*
Yann Le Coq, *TPC Co-Chair*
Andrew Ludlow, *TPC Co-Chair*
Philip Tuckey, *Chair of the EFTF EC*
Ekkehard Peik, *Chair of the IFCS SC*

3 Hybrid format

All the oral sessions are accessible from the CONFlux platform at <https://eftf-ifcs-virtual.org>. The login information has been sent to you by email before the conference. The talks can be watched live via Zoom, or recorded (after a delay of 24 to 48 hours). Remote presenters are able to present their talk live or pre-recorded. Live remote Q&A is possible via the Zoom chat.

A traditional on-site poster will take place on Monday 25th from 16:20 to 18:00. A virtual poster session on the CONFlux platform will take place on Tuesday 16th from 8:40 to 10:30. Both in person and virtual participants can present their poster at the virtual poster session. A shorter virtual poster session is scheduled on Monday 25th at 18:00 to allow for student finalists from the North-America time zones to present their poster.

4 Practical information

Wifi Access

SSID: IFCS 2022

Password: ifcs@2022

Direction

The conference center spreads over three floors, S1, S2, and S3, from top to bottom.

- **S1 floor:** main entrance of the conference center. You will find at this floor:
 - The registration booths
 - The **poster area**
 - The “Commissariat Général” on the right hand side just before entering the conference center. Place for the **speakers’ breakfast**, and for the **WIE event** on Monday 25th during lunch.
- **S2 floor:** down the staircase from S1. You will find at this floor:
 - The technical **exhibition**
 - The **coffee breaks**
 - The entrance of **Room 1** (Gaston Berger amphitheater) for Plenaries and breakout sessions 1
- **S3 floor:** down the staircase from S1. You will find at this floor:
 - The sessions **Rooms 2 and 3** (Louis Armand Est and Ouest)
 - Salles 1 and 2 for **satellite events (student events, EFTF EC)**

Lunches

Lunches will be served at “Le Loft”. Walk 20 meters in the opposite direction from the entrance of the conference center, and go down the staircase. Le Loft is **on the left of the aquarium**.

Speaker’s breakfast

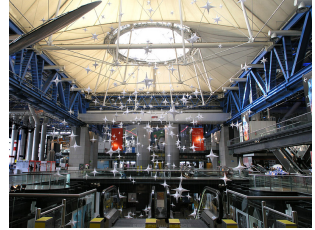
Every day, the speakers and chairmen are invited to have breakfast together. Speakers will be able to upload and check their slides on the conference computers. The breakfast starts at 8:00, at the “Commissariat général”.

Welcome reception

You are invited to the welcome reception, on Sun. 24th at 18:00 at “Le Loft”.

Gala dinner

The gala dinner will take place in the Cité des Sciences museum on Tuesday April 26th at 20:00. The museum is access from the central escalators in the venue main hall. The gala dinner is accessible with your conference badge. Note that badges labeled “Exhibitor” or “Visitor” are not eligible unless they have a separate gala dinner ticket. From 18:00 to 20:00, the dinner participants are invited to a **private visit of the museum**. Enjoy the exhibitions “Banquet”, a journey through gastronomy ; the “Bio inspirée” ecosystem ; and “Jean”, a history.



No Recording or Job Postings Please refrain from taking any video or photographs during any of the conference sessions or poster presentations. It is also IEEE policy that there be no job posting, of any kind, at the Symposium or at the Tutorials. Your cooperation is appreciated.

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

Event Conduct and Safety Statement IEEE believes that science, technology, and engineering are fundamental human activities, for which openness, international collaboration, and the free flow of talent and ideas are essential. Its meetings, conferences, and other events seek to enable engaging, thought-provoking conversations that support IEEE’s core mission of advancing technology for humanity. Accordingly, IEEE is committed to providing a safe, productive, and welcoming environment to all participants, including staff and vendors, at IEEE- related events. IEEE has no tolerance for discrimination, harassment, or bullying in any form at IEEE-related events. All participants have the right to pursue shared interests without harassment or discrimination in an environment that supports diversity and inclusion. Participants are expected to adhere to these principles and respect the rights of others. IEEE seeks to provide a secure environment at its events. Participants should report any behavior inconsistent with the principles outlined here, to on site staff, security or venue personnel, or to eventconduct@ieee.org.

5 Organizing committee

General chairs



Jérôme Lodewyck
SYRTE, Observatoire de Paris



Eric Burt
NASA, Jet Propulsion
Laboratory

Technical chairs



Yann Le Coq, SYRTE
SYRTE, Observatoire de Paris



Andrew Ludlow
NIST

Tutorial chairs

Jerome Delporte, CNES
Troy Olsson, U. Pennsylvania

Awards chairs

Per Olof Hedekvist, RISE Sweden
James Camparo, The Aerospace Corporation

Exhibit chairs

Ronald Holzwarth, Menlo Systems GmbH
Craig Nelson, NIST

Finance chairs

Fabrice Sthal, SFMC

Debra Coler, OEWaves, Inc.

Academic chairs

Pascale Defraigne, Royal Observatory Belgium

Azadeh Ansari, Georgia Institute of Technology

Diversity and inclusion chair & WIE chair

Sinda Mejri, European Space Operations Centre - ESOC

Editorial chair

Greg Weaver, Johns Hopkins APL

SFMC general secretary

Joël Petetin, SFMC

6 Technical program committee

	EFTF	IFCS
Chairs	Yann Le Coq	Andrew Ludlow
Group 1	Thomas Baron Marie Bousquet Mario De Miguel Marc Faucher Raphaël Levy Ming-Huang Li Matteo Rinaldi	Troy Olsson Reza Abdolvand Azadeh Ansari Cristian Cassela Amelie Hagelauer Wei-Chang Li Alexandre Reinardt Max Zeng-Hui Wang
Group 2	Claudio Calosso Guillaume De Giovanni Jeremy Everard Serge Galliou Wan-Thai Hsu Attila Kinali-Dogan Olivier Llopis Enrico Rubiola Michael Underhill François Vernotte	Archita Hati Franklyn Ascarrunz Magnus Danielson Markus Lutz Andrey Matsko Craig Nelson Jeronimo Segovia-Fernandez Michael Tobar
Group 3	Fang Fang Marco Belloni Francois-Xavier Esnault Kurt Gobble Motohiro Kumagai Salvatore Micalizio Gaetano Mileti Stefan Weyers	Rodolphe Boudot Serge Grop David Howe John Kitching Liang Liu Tom McClelland Peter Schwindt Robert Tjoelker
Group 4	Ashwin Seshia Sylvain Ballandras Jérôme Juillard Joshua Lee Teona Mirea Paul Muralt Leonhard Reindl Valentina Zega	Laura Popa Hanna Cho Andreja Erbes Philip Feng Sid Ghosh Harris Hall Ruonan Liu Sid Tallur Gregory Weaver

Group 5	Pascale Defraigne Anne Amy-Klein J��rome Delporte Miho Fujieda Per-Olof Hedekvist Paul Koppang Kun Liang Ilaria Sesia Philip Tuckey Pierre Waller Peter Whibberley	Davide Calonico Jerome Delporte Marina Gertsvolf Judah Levine Huang-Tien Lin Giuseppe Marra Dirk Piester Laura Sinclair
Group 6	Rachel Godun Pierre Dub�� Ronald Holzwarth Jerome Lodewyck Helen Margolis Tanja Mehlst��ubler Uwe Sterr Thomas S��dmeyer Alexey Taichenachev Masami Yasuda	John McFerran Murray Barrett Tara Fortier Tetsua Ido Haifeng Jiang David Leibrandt Nils Nemitz Ekkehard Peik Marco Pizzocaro

7 Sponsors

We thank our sponsors for supporting the event



FIRST-TF is a French thematic network aiming at gathering all the actors involved in time-frequency on a national scale. Building a network of experts, FIRST-TF supports collaborative projects in Time & Frequency metrology with a broad spectrum of applications, from fundamental physics to satellite-

based positioning systems. In the current socio-economical context where synchronization-related problems are omnipresent, encouraging laboratory innovations and ensuring effective technology transfers are of high importance for the network. Finally, the FIRST-TF network coordinates opportunities in teaching as well as tools for lifelong learners, the general public and school audiences on space-time metrology, a fascinating topic at the crossroads of several disciplinary fields.



TOPTICA develops and manufactures high-end laser systems for scientific and industrial applications. The portfolio includes diode lasers, ultrafast fiber lasers, terahertz systems and frequency combs. OEM customers, scientists, and over a dozen Nobel laureates

all acknowledge the world-class exceptional specifications of TOPTICA's lasers, as well as their reliability and longevity. Founded in 1998 near Munich (Germany), TOPTICA became one of the leading laser photonics companies by aiming for, and consistently delivering high-end specifications. TOPTICA's diode lasers are appreciated for excellent coherence, wide tuning range and ideal beam profiles.



Menlo Systems is a leading developer and global supplier of instrumentation for precision metrology on the highest level. The company with headquarters in Martinsried near Munich is known for its Nobel Prize

winning optical frequency comb technology. Our main product lines are optical frequency combs, solutions for time and frequency distribution, ultrastable lasers, terahertz systems, and femtosecond lasers. We deliver state-of-the-art products to customers from industry and academia worldwide. To push the

limits of the measurable, we work closely with selected customers and develop new solutions for laser-based precision measurements.



NEL Frequency Controls is a technology leader in the development and manufacture of leading edge frequency control products. Customers choose NEL to supply the optimal solution for applications requiring crystal oscillators with challenging performance specifications such as ultra low phase noise, ultra low power, and ultra high frequency capability. NEL's research and product development efforts support next generation customer applications that push performance boundaries in system speed, bandwidth, resolution, accuracy, and power consumption. Our customers benefit from our broad, low cost product offering, which reflects globally competitive frequency control solutions. Customer technologists can rely on NEL for total technical support in selecting the best frequency control solution for their application.



Vescent develops and manufactures novel electro-optic and laser technologies. We offer frequency-stabilized diode laser systems, precision control electronics, accessory electro-optic modules, and now mode-locked lasers and frequency combs. Our scientists and engineers are continuously developing cutting-edge solutions to technical challenges. We are adding to our SLICE line of control electronics that includes the unique SLICE-QTC four-channel temperature controller and the SLICE-DHV high-bandwidth high-voltage amplifier.

8 Exhibitors

Please visit our industrial exhibitors, located around the coffee breaks.



9 Awards

The 2022 EFTF awards



Young Scientist Award:

Marco Schioppo

”For his contributions to ultrastable lasers and measurement precision in optical frequency metrology that have impacted on the development and characterisation of optical atomic clocks.”



EFTF Award:

Sébastien Bize

”For outstanding contributions to the development of microwave and optical frequency standards for tests of fundamental physics and the realization of the SI second.”



Marcel Ecabert Award:

Gérard Petit

”For his long-standing involvement and key contributions in the timing activities of the BIPM and more generally in International time and frequency metrology”

The 2022 IFCS awards



The Sawyer Award:

Elizabeth Donley

"For selfless and sustained leadership in the frequency control community."



The Cady Award:

Sylvain Ballandras

"For outstanding contributions to the modeling and development of crystal resonators and sensors."



The Rabi Award:

Thomas Udem

"For the development of the optical frequency comb and its application to precision measurement and fundamental physics."

10 Invited speakers

Hanna Cho	Constructive Utilization of Nonlinear Dynamics in MEMS	The Ohio State University
John Clark	Design Challenges for MEMS Resonator-Based High Performance Oscillators in Commercial Applications	Microchip
Michele Giunta	Photonic Microwave Generator As Quantum-Enabled Local Oscillator for Radars	Menlo Systems GmbH
Peter Schwindt	Integrated Photonics and Vacuum Package Development for a COLD-Atom Interferometer	Sandia National Laboratories
José A. De La Paz Espinosa	Long-Lived Spin Squeezing in a Metrologically Relevant Regime	LNE-SYRTE, Observatoire de Paris
Luca Lorini	Performance and Reliability of Rb Fountains Over a several-year-Long Period	LNE-SYRTE, Observatoire de Paris
Veronique Rochus	Ultrasonic sensors and transducers for biomedical applications	IMEC
Isabelle Dufour	H2MEMS Project: Resonant MEMS for Detection of Hydrogen Release in Radioactive Waste Disposal Facility	Université de Bordeaux
Levent Degertekin	CMUTs and CPUTs for Imaging and Sensing	Georgia Institute of Technology
Noël Dimarcq	Roadmap Towards the Redefinition of the Si Second	CNRS – Université Cote d’Azur
Jürgen Müller	Benefit of Optical Clocks for Geodesy	Leibniz University Hannover
Qi Shen	Long Distance Free Space Optical Time and Frequency transfer: Towards satellite–ground Link at 10^{-18} Instability	University of Science and Technology of China
Emily Caldwell	Photon Efficient Optical Time Transfer	National Institute of Standards and Technology
Adam Kaufman	Tweezer clocks: a New Platform for Quantum Metrology	JILA, University of Colorado Boulder, NIST
Murray Barrett	High Accuracy Assessment of a $^{176}\text{Lu}^+$ Frequency Reference	Center for Quantum Technologies
Antoine Rolland	300 GHz Wave Generated with a Dissipative Kerr Soliton Divider	IMRA America, Inc
Steven King	Optical Frequency Ratios Between a Highly Charged Ion Clock and a $^{171}\text{Yb}^+$ Clock	Physikalisch-Technische Bundesanstalt
Jialing Yu	Noise Contributions in Crystalline Mirror Coatings	Physikalisch-Technische Bundesanstalt

11 Student paper competition finalists

The student poster finalists will present their poster in front of a jury. A winner will be selected for each group, who will receive a prize during the gala dinner. The first four posters will be presented at the virtual poster session 1b. The 24 other will be presented at the poster session 2.

5178	Michael D'Agati	High-Q Factor Multiferroic Resonant MEMS Low Frequency Magnetic Field Sensors	G4*
5267	Xintian Liu	Temperature-Insensitive Resonant Strain Sensor	G4*
5156	Zhao Xuanyi	Improving Thermal Linearity and Quality Factor of Al ₇₂ Sc ₂₈ N Contour Mode Resonators	G1*
5291	Mo Dicheng	A 7GHz-13.4 GHz Complementary Switchable Thickness Extensional Bulk Acoustic Resonators using Laminated Ferroelectric Sc _{0.28} Al _{0.72} N	G1*
5289	Onurcan Kaya	Frequency Reprogrammable Al _{0.7} Sc _{0.3} N Acoustic Delay Line with up to 13.5 % Bandwidth	G1
5159	Gabriel Garibaldi	X-Band Multi-frequency 30%Compound ScAlN Microacoustic Resonators and Filters for 5G	G1
5062	Pierre Travers	Parametric Study on the Phase Noise of an Optoelectronic Oscillator Submitted to Vibrations	G2
5200	Rachel Cannon	Miniaturized High-Reliability Lasers for Quantum Technologies	G2
5203	Alexis Bougaud	Numerical Study of a COEO Device Versus Loop Chromatic Dispersion and Detuning	G2
5230	Antoine Baudiquez	Comparison Between cross-Spectrum and Spectrum Average Generalized to q-Devices	G2
5014	Clément Carlé	Tackling light-Shifts in a microcell Atomic Clock with Symmetric Auto-Balanced Ramsey Sequence	G3
5105	Gabriela Martinez	Progress Toward Miniaturized Atomic Beam Sources	G3
5006	Jize Han	Toward a high-Performance Transportable Microwave Frequency Standard Based on sympathetically-Cooled ¹¹³ Cd ⁺ Ions	G3
5050	Samuel Walby	Normalised Detection of Clock States by Cold Atom Recapture Method	G3
5134	Antonacci Marco	Planar Grin Lenses for MEMS Energy harvesters: a Macroscale Proof of Concept	G4
5169	Terence Blésin	Microwave-Optical Transduction Using High Overtone Bulk Acoustic Resonances	G4

5036	Emily Caldwell	Photon Efficient Optical Time Transfer	G5
5060	Nicolas Maron	Free Space Optical Link for Frequency Comparison and Chronometric Geodesy	G5
5021	Jaffar Kadum	Optical Frequency Transfer with 1×10^{-21} Uncertainty Using a DFB Laser-Based Fiber Brillouin Amplifier	G5
5046	Qi Li	New Method for Cascaded fiber-Optic Radio Frequency Transfer	G5
5023	Nicholas Nardelli	Transfer Oscillator Technique for Generation of 10 GHz low-Noise Microwaves with High Accuracy	G6a
5096	Jialiang Yu	Noise Contributions in Crystalline Mirror Coatings	G6a
5195	Anat Siddharth	Low-Noise near-Ultraviolet Photonic Integrated Lasers	G6a
5239	Sheng Zhou	Towards a Continuous Active Optical Clock Using superradiance on the Strontium Clock Transition	G6a
5101	Johannes Kramer	$^{27}\text{Al}^+$ Clock at PTB - Recent Improvements on the Error Budget	G6b
5247	Irene Goti	New Absolute Frequency Measurement of the Improved ^{171}Yb Optical Lattice Clock at INRiM	G6b
5235	Miguel Cifuentes	Generating LG Modes for Atom Trapping in a Sr Optical Lattice Clock	G6b
5191	Qixin Liu	Recent Progress of Mercury Lattice Clock in SIOM	G6b

12 Events

12.1 EFTF-IFCS's Women In Engineering event

SPEAKING WITH CONFIDENCE “IT’S NOT WHAT YOU SAY, IT’S HOW YOU SAY IT!”

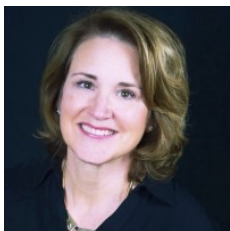
Date: 25th April 2022, at 12:30 pm, during lunch, at the “Commissariat Général” room, -1 level, at the entrance of the conference center

Description: Inspiring, thought provoking and pragmatic! Please join us for a 1.5 hour workshop created especially for you! Together with your peers from around the world, we will be exploring ways in which messages can be delivered and how the way you speak can be a direct link to thriving professionally and gaining positive visibility. If you are curious to discover more about the following questions, please don't hesitate to join us.

One a scale of 1-10, how impactful are you in the meetings you attend? How can you leave a lasting (positive) impression on the audience? Why not only what you say but how you say it really matters? What are the ingredients necessary to define an effective message?

Jody will share with you a powerful formula that you may begin to use to prepare for your next meeting or presentation that is in alignment with your authentic self and will help boost your confidence. This workshop has been designed to be very dynamic, interactive and fun! You will have the unique opportunity to network and exchange in a variety of ways, including working in small and large groups, sharing collective intelligence, and beginning to define your next impactful message.

Facilitators:



Jody Julien

Professional Coach & Facilitator
J2 Coaching & Consulting

My professional experience includes over 25 years in a variety of global executive roles in the areas of Human Resources Operations I have lived and worked in North and South America, as well as in Europe I have a unique advantage of having worked within a multitude of work environments ranging from CAC 40 and Fortune 500 companies, academic, and start-ups. As member of the International Coach Federation (I have been a certified executive leadership and life coach since 2007 I hold a Master's Degree in Strategic Human Resources and a Bachelor's Degree in International Business

and French I head up international mentoring programs for profit and non-profit organizations and give lectures on the benefits of mentoring and reverse mentoring partnerships I am the founder of J2 Coaching & Consulting since 2011 a global firm specializing in professional development and international organizational effectiveness.



Dr. Sinda Mejri
Scientist
Optical Frequency & Timing Expert
European Space Agency

12.2 Student event

The student representatives organize two **student events**, scheduled on Wednesday, April 27th, from 18:00 to 20:00 at the lowest S3 level, Satellite room 2



12.3 UFFC's Young Professionals event

Title: Startup Stories and Lessons

Date: Monday, April 25th, 16:30 to 17:30, Room 2, level S3

Description: Are you excited about starting a company and commercializing your technical ideas? Do you want to learn more strategies and problems you may never have thought of? You may have attended several startup workshops or panels, but the experience and tips may be too general. In this meet-up event, Dr. Mark Schafer, an established professional and experienced entrepreneur in ultrasonics for medical applications, will share his personal stories of running startups, some successful and some less so, and then draw thought-provoking lessons and tips leading to business success. Come and join us to enjoy the opportunity to talk with Dr. Mark Schafer and network with peers sharing common interests in entrepreneurship.

Organizer: IEEE UFFC-s Young Professionals Committee, IEEE EFTF-TFCS 2022 Committee



Speaker Bio: **Mark E. Schafer** (Senior Member, IEEE) was born in Pittsburgh, PA, USA. He received the S.B. degree in electrical engineering from the Massachusetts Institute of Technology, Cambridge, MA, USA, in 1979, the M.S. degree in acoustics from Pennsylvania State University, State College, PA, USA, in 1982, and the Ph.D. degree in biomedical engineering from Drexel University, Philadelphia, PA, USA, in 1988. He is a serial entrepreneur and an inventor on over 30 patents. After 35 years as an independent consultant, entrepreneur, and corporate technology leader, he recently joined Drexel's School of Biomedical Engineering, Science and Health Systems as a

Research Professor. In addition to his research work, he consults with firms worldwide on design, development, intellectual property, regulatory, and clinical aspects of medical ultrasound products, including diagnostic, therapeutic, and surgical applications. He has authored numerous journal articles and book chapters on ultrasound measurement and applications. Dr. Schafer is a fellow of the American Institute of Ultrasound in Medicine, the Acoustical Society of America, and the American Institute of Medical and Biological Engineering. He was a recipient of the Chief's Award for Technology Transfer, U.S. Department of Agriculture and the Past President of the Ultrasonic Industry Association. He is currently the President of the IEEE UFFC.

12.4 Lab tour at Paris Observatory

The LNE-SYRTE time and frequency laboratory at Paris Observatory offers a lab tour for the participant of the conference, on Thursday April 28th, from 14h30 to 18h30. The visit covers optical and microwave time and frequency metrology, atom interferometers and inertial sensors, and theory.



Note that the Observatory premises can only welcome a limited number of participants. Please register early by filling the online form available on the conference website!

Access: 77 avenue Denfert Rochereau, 75014 Paris

Public transportation: RER B or Metro 4, “Denfert Rochereau” station

13 Tutorials

The conference will propose three parallel tutorial tracks on Sun. April 24th 2022. The tutorials are expected to be given on-site. They will be recorded and available for students who registered the virtual tutorials plan.

Track 1:

- **François Vernotte:** Frequency Stability Estimation: Allan Variance and Friends
- **Nathan Newbury:** Optical time & frequency transfer over fiber and free-space
- **Pascale Defraigne:** Time transfer by satellites
- **Claudio Calosso:** Low-noise digital electronics for T/F metrology

Track 2 :

- **Eric Burt:** The physics of atomic clocks
- **Christophe Salomon:** Fundamental physics with atomic devices
- **Uwe Sterr:** Technical challenges in setting up high performance optical cavities
- **Christian Roos:** Quantum engineering for metrology

Track 3 :

- **Paul Muralt:** Piezoelectric transducers and their miniaturization
- **Valentina Zega:** A mechanical perspective on MEMS gyroscopes: from new working principles to simulation challenges
- **Victor Plessky:** High Frequency Acoustic Resonators based on LN membranes
- **Sunil Bhawe:** MEMS + Photonic Systems

Abstracts

Pascale Defraigne, Royal Observatory of Belgium

Title: Time transfer by satellites

Abstract: Satellites are an ideal relay to transfer time and frequency to a remote location. They can be used for time dissemination as well as for remote clock comparisons. In this tutorial, we will mainly detail the current operational techniques used by the timing community, i.e. the Global Navigation

Satellite Systems (GNSS) and the Two Way Satellite Time and Frequency Transfer (TWSTFT). We will furthermore give an overview of the current developments using Low Earth Orbit satellites, and using optical links to satellites.

Nate Newbury, NIST, USA

Title: Optical time & frequency transfer over fiber and free-space

Abstract: Optically based methods of time-frequency transfer have been developed to support long distance connections between clocks over both fiber-optic networks and free-space (i.e. the air). As with optical clocks, these methods often exploit the high coherence possible with cavity-stabilized lasers and frequency combs. I will discuss and compare the approaches of optical time-frequency transfer over fiber optics and free space. The tutorial will discuss the basics of fiber-optic based methods, which are now well-developed and varied, and will then focus in more detail on recent work in free-space time-frequency transfer.

Claudio Calosso, INRiM, Italy

Title: Low-noise digital electronics for time and frequency metrology

Bio: Claudio Eligio Calosso was born Asti (Italy) in 1973. In 2002, he received his Ph.D. degree in communication and electronic engineering at the Polytechnic of Turin (Italy) and, in the same year, he joined to IEN. Now he is permanent researcher at INRiM (Italy), where he develops low noise digital electronics for time and frequency applications. His activities include primary frequency standards, vapor cells clocks, frequency dissemination over fiber links, phasemeters, frequency division and synthesis and, recently, real-time time scale generation. He is also interested in signal analysis, with particular attention to the role of aliasing in time interval counters and two-sample variances.

Abstract: This tutorial focuses on the role of electronics in time and frequency metrology. It shows why a proper design of the electronic apparatus is a key aspect of an application: a new experiment, instrument or facility. After a brief comparison of off-the-shelf commercial versus custom solutions, the tutorial will show how to develop a custom high-performance and flexible apparatus. High performance is provided by low noise components, while flexibility is guaranteed by digital devices, in particular by Field Programmable Gate Arrays (FPGAs). Practical examples among vapor cell clocks, coherent fiber links and timescale generation in realtime are then provided for

clarifying the advantages of this approach.

François Vernotte, FEMTO-ST, Observatory THETA, Besançon, France

Title: Frequency Stability Estimation: Allan Variance and Friends

Bio: François Vernotte received the Ph.D. degree in engineering sciences from the University of Franche-Comté (UFC), Besançon, France, in 1991. He has been with the Time and Frequency Team, Observatory THETA, UFC, since 1989 and is now with FEMTO-ST. His favorite tools are statistical data processing (time series and spectral analysis), parameter estimation (inverse problem and Bayesian statistics), and simulation (Monte-Carlo). His current research interests include long-term stability of oscillators, such as atomic clocks and millisecond pulsars.

Abstract: After a reminder of the notations, quantities and models used in the time and frequency field, we will first focus on the archetypal Allan variance (AVAR). We will see that it can be considered as a statistical estimator of frequency stability as well as a spectral analysis tool. We will also explore the different ways to compute AVAR and its confidence intervals.

Then, we will review the most used variances bringing out their advantages and drawbacks as well as the method to define a new variance adapted to a particular type of data. Along this way, we will see how the variance approach can be compared to wavelet analysis. We will end this chapter with the main innovations that have been made in this domain such as the three-cornered hat method, the dynamic variances and the increased confidence variances.

The last part of the tutorial will be devoted to the practical use of the variances by answering a few basic questions: how to interpret an AVAR curve? How to obtain a reliable fit of variance measurements? Is it possible to extrapolate a variance curve to assess the very long term stability of an oscillator? Of course, similar questions from the audience will be welcome.

Uwe Sterr, PTB, Germany

Title: Technical challenges in setting up high performance cavities

Abstract: Ultrastable lasers are widely used in precision measurements and optical clocks. At present, most of these systems obtain their stability from Fabry-Perot reference cavities, thus relating the fractional frequency instability to fractional length fluctuations of the cavity. However, as macroscopic devices these cavities are susceptible to many perturbing influences and, ultimately, limited by fundamental thermodynamic fluctuations.

In this tutorial I will give an overview on cavity geometries, their mounting, and present approaches to decouple these systems from environmental noise. Depending on their application also transportability, ruggedness, and temperature control, possibly at cryogenic temperatures needs to be considered. I will also address the optical and electronic interfacing of lasers to cavities, and finally give an outlook towards promising novel technological developments.

Christophe Salomon, Senior Research Director at CNRS, Ecole Normale Supérieure, France

Title: Fundamental Physics with Atomic Devices

Bio: The research of Christophe Salomon is in the field of Quantum Optics and Atomic Physics. He obtained his PhD in 1984 at Paris 13 University (France) on high resolution laser spectroscopy in the infrared domain. For his post-doctoral stay, he moved to JILA (Colorado, USA), where he worked with 2005 Nobel laureate J. Hall on ultra-stable lasers and laser cooling of atoms. In 1985, he joined the laser cooling group created at Ecole Normale Supérieure, Paris, by C. Cohen-Tannoudji (1997 Nobel laureate). Since then at ENS, Christophe Salomon worked on various developments and applications of laser cooled and trapped atoms, notably atomic fountain clocks and precision measurements, space clocks, Bose-Einstein condensation, matter wave solitons, and superfluid Fermi gases.

Abstract: Atoms and molecules are used in a variety of precision experiments aiming at testing fundamental physical laws. Dark matter and dark energy constitute a major part of the mass budget of the Universe but have unknown origin. The unification of the Standard Model of particle physics with gravity also represents a major challenge. We will show how atomic physics devices can be used to test modern physical theories and search for new physics beyond the Standard Model. We will describe tests of general relativity and the search for variations of fundamental constants with ultra-stable clocks, equivalences principle tests and the search for an electric dipole moment of the electron.

Eric Burt, JPL, USA

Title: The Physics of Atomic Clocks

Bio: Eric Burt received a B.S. degree with honors in mathematics from the University of Michigan, Ann Arbor, Michigan in 1979, a M.S. degree in physics from the University of Washington, Seattle, Washington in 1990 and

a Ph.D. in physics from the University of Washington in 1995. His Ph.D. thesis, supervised by Prof. Warren Nagourney, was in the field of experimental atomic physics on the trapping and laser-cooling of single indium ions. From 1995 to 1997 he was a postdoctoral fellow at the University of Colorado, in Boulder, Colorado working with Carl Wieman and Eric Cornell on experiments with Bose-Einstein condensates including the first experiment to demonstrate a dual-species condensate and the first experiment to demonstrate higher-order (laser-like) coherence in condensate atoms. From 1997 to 2001 he worked at the U.S. Naval Observatory in Washington, D.C. developing a laser-cooled cesium fountain atomic clock. From 2001 to the present he has worked at the Jet Propulsion Laboratory, California Institute of Technology most recently as a Principal Member of Technical Staff. His work at JPL has included development of both ion and laser-cooled neutral atomic clocks and using atomic clocks to place limits on fundamental constant variation. He was the lead clock developer for NASA's Deep Space Atomic Clock (DSAC) and is the lead clock technologist for the follow-on project, DSAC-2. Dr. Burt is a member of the American Physical Society, and a senior member of the IEEE. He has served as vice-chair for group 3 (microwave atomic clocks) and as chair of the technical program committee for the IEEE Frequency Control Symposium and is currently co-general chair for that conference. He is also currently the Secretary/Treasurer for the APS Topical Group on Precision Measurement and Fundamental Constants.

Abstract: The basic fundamentals of atomic clocks are derived from work performed by Rabi and Ramsey in the 1930's on magnetic resonance. In this tutorial we will introduce magnetic resonance as it applies to clocks. In particular we will describe the types of internal atomic states used in atomic clocks and will describe the Bloch sphere and how it can be used to visualize various clock interrogation methods. We will then discuss the underlying principles of several key clock technologies including optical pumping, Lamb-Dicke confinement, laser-cooling, and both neutral atom and ion trapping. Finally, we will cover some of the primary systematic frequency shifts that atomic clocks experience. These include the magnetic Zeeman shift, electric effects such as the AC Stark shift, or light shift and its various orders, collision shifts, and the Doppler shift.

Christian Roos, Innsbruck Univ, Austria

Title: Quantum engineering for metrology

Abstract: Experiments in metrology and in quantum information processing

using trapped ions and neutral atoms share many common requirements. Both research fields require quantum engineering techniques for coherently controlling both motional and electronic degrees of the trapped particles. This tutorial will give an overview of techniques for cooling and manipulating trapped ions with laser pulses with a focus on multi-ion experiments.

Paul Muralt, EPFL, Switzerland, IEEE Fellow 2013, IFCS C.B. Sawyer Memorial award 2016, Distinguished lecturer IEEE UFFC in 2017

Title: Piezoelectric transducers and their miniaturization

Abstract: A transducer is a device converting energy from one form to another. In piezoelectric transducers the two energy forms are mechanical and electrical. They are based on piezoelectric materials, which have the property to transform mechanical quantities into electrical signals (direct effect), and reciprocally, electrical signals into mechanical quantities (converse effect). In the ideal case, this effect is linear in both directions. These very versatile properties gave rise to roughly 100 application types. Their development started quite precisely 100 years ago. Today, several important applications are unthinkable without piezoelectric transducers, such as wireless communication, time and frequency control, ultrasound imaging, vibration sensors, and actuators for nano-probe techniques. During recent years, vibration energy harvesting has joined the long list of applications. Needless to underline that the electrical energy form is the most suited one for our modern, digital world.

This tutorial will first present the basic relations governing piezoelectricity. The importance of thermodynamical potentials, choice of variables and boundary conditions will be discussed. The thin film situation will be treated particularly. Two thin film materials systems will be introduced: the linear system (Al,Sc)N and the ferroelectric system Pb(Zr,Ti)O₃. Apart of the classical parallel plate capacitor geometry, interdigitated electrode systems are discussed in some more details for the interesting case of ferroelectric materials. A second part of the tutorial will treat application related requirements for materials, properties and structures. Many applications are based on resonators. Their frequencies are defined by the dimensions of shapes (bulk waves), periodicity of interdigitated electrodes (surface acoustic waves or Lamb waves), or a mixture of both (plate waves), in combination with the involved sound velocities. Resonator structures may also include passive elastic materials. High quality factors are key requirements for good resonators. Some piezoelectric materials like AlN thin films, or LiNbO₃ single crystals

are excellent choices in this respect and therefore dominate the RF filter market for mobile communication (1.8-5 GHz). In these resonators, the energy oscillates between elastic and electronic form, and they are part of passive elements in an electronic circuit. Energy harvesting requires a combination of different properties and structures. Suitable resonators must couple to some environmental vibration frequency spectrum, and the device constitutes an active energy source in the electronic circuit. The tutorial will also cover to some extent microfabrication and process issues as far as relevant for the presented matter.

Valentina Zega, Politecnico di Milano, Italy

Title: A mechanical perspective on MEMS gyroscopes: from new working principles to simulation challenges

Abstract: In recent years, the rapid spread of innovative applications and the increasing request of high performances at reduced footprints and costs, is posing new challenges for Micro-Electro-Mechanical Systems (MEMS) gyroscopes designers. They have to daily deal with complex multiphysics systems experiencing highly nonlinear dynamic responses and at the same time have to satisfy unprecedented requests in terms of scale factor stability against environmental fluctuations. In this tutorial, a mechanical perspective on the topic is provided. Firstly, a powerful numerical tool able to simulate a priori and in real-time the behavior of MEMS gyroscopes both in the linear and nonlinear regime will be proposed. Subsequently, an innovative working principle based on the Frequency Modulation (FM) and able to improve MEMS gyroscopes scale factor stability will be presented.

Sunil Bhawe, Purdue, United States

Title: MEMS + Photonic Systems

Bio: Professor Sunil Bhawe received the B.S. and Ph.D. degrees from Berkeley in EECS in 1998 and 2004 respectively. In April 2015, he joined the Elmore Family School of Electrical and Computer Engineering at Purdue University where he is currently the Faculty Director of the Scifres Nanofabrication Laboratory. Sunil received the NSF CAREER Award in 2007, the DARPA Young Faculty Award in 2008, the IEEE Ultrasonics Society's Young Investigator Award in 2014 and the Google Faculty Research Award in 2020. His students have received Best Paper Awards at MEMS 2021, IFCS 2021, IFCS 2020, IEEE Photonics 2012, Ultrasonics 2009 and IEDM 2007. Before

joining Purdue, Sunil was an associate professor at Cornell and sensor architect at Analog Devices. Sunil co-founded Silicon Clocks Inc. in 2004 and DEEPLIGHT SA in 2021.

Abstract: Optomechanical systems offer one of the most sensitive methods for detecting mechanical motion using shifts in the optical resonance frequency of the optomechanical resonator. These systems are used for measuring mechanical thermal noise displacement or mechanical motion actuated by optical forces. Meanwhile, piezoelectric actuation and detection is the main transduction scheme used in RF MEMS resonators. The use of piezoMEMS is convenient as it allows direct integration with electronics used for processing the RF signals.

In this tutorial I will present architectures based on piezoMEMS technology to demonstrate stress-optical modulation and tuning of silicon nitride and silicon photonic integrated circuits. We will define fundamental performance metrics and compare various monolithic and heterogeneous optomechanical systems. In the second part of the course, I will introduce new applications enabled by optomechanics including acousto-optic modulators, inertial sensors, magnetic-free optical isolators, and fast tunable lasers for LIDAR and microcombs.

Victor Plessky

Title: High Frequency Acoustic Resonators based on LN membranes

Bio: Victor Plessky was born in Gomel, (Belarus) 02 July 1952. He has got PhD degree from Moscow Physical-Technical Institute (“FizTech”) in year 1978 and D. Sc. Degree for Russian Government in 1987. He works more than 45 years in the area of surface acoustic wave (SAW) physics and devices. He predicted theoretically (together with Yu. Gulyaev and independently from Auld, Gagnepain, and Tan) the existence of Surface Transverse Waves (STW) a new type of waves now used for design of high-Q GHz frequency range resonators. His theory of the leaky wave propagation in periodic grating (so-called “Plessky equation”) was basic for understanding of the leaky waves propagation characteristics. Recently he invented XBARS – thin lithium niobate film resonators operating as laterally excited A1 Lamb mode. He has published more than 300 papers and authored about 50 patents. As a Visiting Professor, he collaborated many years with Helsinki University of Technology, Espoo, Finland. He was lecturing in Freiburg Uni., in EPFL (Lausanne), and in Angstrom Lab, (Sweden). He also held position of Chair of Excellence in ENSMM (Technical University, Institute FEMTO) in Besançon, France,

for years 2011-2012. He was supervisor and consultant of 15 Ph.D. theses. Dr. V. Plessky holds a title of “Full Professor” granted to him by Russian Government in 1995. He was a winner of a Lenin Komsomol award (3rd state Premium in ex-USSR) for young scientists, 1978, and got the “Outstanding paper” award from IEEE in 2001. He served for many years in TPC of IEEE IUS, and other conferences. Currently he is retired but continues to work as a consultant and lecturer. His current research interests are in area of micro/nano acoustic physics and devices. His hobby is gardening (see on photo).

Abstract: Modern mobile phones and Hi-Fi devices demand filters operating at 3 GHz - 7 GHz frequency range with large bandwidth and low loss. Such filters are usually ladder circuits built of resonators with large relative distance between the anti-resonance and the resonance and a few orders impedance difference between them. Ideally, these resonators must be manufacturable with optical lithography, and the filters must tolerate an input power of a few watts. This tutorial will cover the development of such devices based on Lamb modes in thin, submicron, crystalline platelet of strong piezoelectrics, such as lithium niobate (LN). Commercial availability of ion-sliced layers of different cuts of LN transferred on Si, SiC and other substrates opens wonderful possibilities for using materials with desired properties. In the first part of this tutorial, we discuss the Lamb modes in LN membrane of different cut angle most suitable for resonator applications. We concentrate on low order modes, such as S0, SH0, S1, SH1 and A1 – providing the strongest piezo-coupling. Suspended cavity membranes can reach excellent Q-factor and strong coupling. Meanwhile their technology is difficult, they are fragile, and the devices can have power handling problems because of low heat evacuation from the thin LN membrane. Therefore, we will also discuss layered structures when such a membrane is mounted on a substrate – solving part of these problems at the cost of reduced coupling. In another part of tutorial, we give an example of successful, at least at sample level, devices such as XBARs exploiting A1 mode in ZY-LN and YBARs - periodic system of bulk wave resonators, based on SH1 Lamb mode. This technology inevitably will dominate the area of micro-nano acoustic devices for frequencies higher 3 GHz in the foreseeable future.

14 Plenary speakers



Roger Penrose
University of Oxford

Title: The Journey from Black-Hole Singularities to a Cyclic Cosmology

Date: Monday April 25th, 9:20, Room 1

Abstract: The “singularity theorems” of the 1960s, demonstrated that large enough celestial bodies, or collections of such bodies, would collapse gravitationally, to what are referred to as “singularities”, where the equations and assumptions of Einstein’s classical theory of general relativity cannot be mathematically continued. These singularities are normally expected to lie deep within what are now referred to as black holes, and would, themselves, not be observable from the outside. Nevertheless, their presence is regarded as fundamentally problematic for classical physics and it is argued that a quantum theory of gravity would be needed to resolve the issue.

Similar arguments (largely developed by Stephen Hawking) apply also to the “Big-Bang” picture of the origin of the universe, showing, again, the inevitability of a “singular” structure of such an initial state. However, a puzzling yet fundamental distinction between these two types of singularity is found, deeply connected with the 2nd law of thermodynamics. It is hard to see how any ordinary procedures of “quantization” of the gravitational field can resolve this problem, and it is argued, irrespective of the singularity

issue, that the structure of quantum theory itself may be profoundly altered when gravity is involved.

Yet, a deeper understanding of the special nature of the Big Bang is obtained from the perspective of conformal geometry, removing the distinction between “big” and “small”, and whereby the Big-Bang singularity, unlike those in black holes, becomes non-singular, and can be regarded as the conformal continuation of a previous “cosmic aeon”, leading to the picture of conformal cyclic cosmology (CCC) according to which the entire universe consists of a succession of such cosmic aeons, each of whose big bang is the conformal continuation of the remote future of a previous aeon. Some recently observed effects provide some remarkable support for this CCC picture.



David Kaiser
Massachusetts Institute of Technology

Title: Cosmic Bell Experiments: Testing Quantum Theory with the Cosmos

Date: Wednesday April 27th, 16:50, Room 1

Abstract: For decades, physicists have conducted experimental tests of quantum entanglement, a phenomenon that Albert Einstein once dismissed as “spooky action at a distance.” Despite Einstein’s misgivings, the experiments have consistently found results compatible with quantum theory; today entanglement is at the heart of next-generation devices like quantum computers and quantum encryption. Yet every experimental test has been subject to one or more “loopholes”, which (in principle) could account for the results even in the absence of genuine quantum entanglement. This talk describes the latest experimental tests of quantum entanglement, including my group’s recent “Cosmic Bell” experiments that used real-time astronomical measurements of light from very distant quasars as random inputs, to determine which

measurements to perform on pairs of Earthbound entangled particles. Our experiments provided compelling evidence that quantum entanglement is a robust feature of our world, while constraining certain types of alternative models—which exploit a particularly subtle loophole—more thoroughly than ever before.

Bio: David Kaiser is Germeshausen Professor of the History of Science and Professor of Physics at the Massachusetts Institute of Technology. He is the author of several award-winning books about modern physics. His latest book, *Quantum Legacies: Dispatches from an Uncertain World* (2020), was honored as among the best books of the year by *Physics Today* and *Physics World* magazines, and also named a Choice Outstanding Academic Title. A Fellow of the American Physical Society, Kaiser has received MIT’s highest awards for excellence in teaching. His work has been featured in *Science*, *Nature*, the *New York Times*, and the *New Yorker* magazine. His group’s recent efforts to conduct a “Cosmic Bell” test of quantum entanglement were featured in the documentary film, *Einstein’s Quantum Riddle*.

Sessions Program

Session A1L-1 – 25/04 10:50 – 12:30

G1: Surface Acoustic Wave Devices

Location: Room 1

Session chair: Thomas Baron , Femto-st

10:50	5047	High Quality Factor Hybrid SAW/BAW Resonators
Saher Barsoum ¹ , Clémence Hellion ¹ , Elisa Vermandé ¹ , Jean-Marie Quemper ¹ , Marie Bousquet ¹ , Alexandre Reinhardt ¹ , Thierry Laroche ² , Sylvain Ballandras ² , Bertrand Dubus ³ ¹ CEA-LETI, France, ² Frec n sys, France, ³ ISEN, France		
11:10	5094	Surface Cavity Wave Structures for Ultra-Compact Radio Frequency Filters
Eric Michoulier, Alexandre Clairet, Saly Ndiaye, Florent Bernard, Emilie Courjon, Thierry Laroche, Sylvain Ballandras Frec n sys, France		

11:30	5056	Shear-Horizontal Surface Acoustic Wave on Ca ₃ TaGa ₃ Si ₂ O ₁₄ Piezoelectric Single Crystal
Ryoto Suzuki ² , Masashi Suzuki ² , Shoji Kakio ² , Noritoshi Kimura ¹ ¹ Piezo Studio Inc., Japan, ² University of Yamanashi, Japan		
11:50	5090	A High-Performance NS-SAW Resonator Using 30° Y-Cut Lithium Niobate
Shuxian Wu ¹ , Zonglin Wu ¹ , Hangyu Qian ¹ , Feihong Bao ¹ , Gongbin Tang ² , Feng Xu ¹ , Jie Zou ¹ ¹ Fudan University, China, ² Institute of Novel Semiconductors, Shandong University, China		
12:10	5233	High-Q SAW Resonator Using 36° YX-Cut Lithium Tantalate on Silicon Carbide Substrate
Zonglin Wu ¹ , Shuxian Wu ¹ , Hangyu Qian ¹ , Feihong Bao ¹ , Guomin Yang ¹ , Jie Zou ¹ , Gongbin Tang ² ¹ Fudan University, China, ² Institute of Novel Semiconductors, Shandong University, China		

Session A1L-2 – 25/04 10:50 – 12:30

G6: Clocks I

Location: Room 2

Session chair: Ekkehard Peik , PTB

10:50	5179	High Accuracy Assessment of a 176Lu+ Frequency Reference
Kyle Arnold ² , Michael Lee ¹ , Bianca Lee ² , Qichen Qin ² , Wen Yi Tan ² , Zhao Qi ² , Zhang Zhao ² , Zhiqiang Zhang ¹ , Murray Barrett ¹ ¹ Center for Quantum Technologies, National University of Singapore, Singapore, ² CQT, Singapore		
11:30	5265	Frequency Shift Evaluations of an 171Yb+(E3) Optical Clock Using Ancillary Transitions
Nils Huntemann ¹ , Melina Filzinger ¹ , Martin Steinel ¹ , Richard Lange ¹ , Burghard Lipphardt ¹ , Hu Shao ¹ , Tanja E. Mehlstäubler ² , Thomas Lindvall ³ , Ekkehard Peik ¹ ¹ Physikalisch-Technische Bundesanstalt, Germany, ² Physikalisch-Technische Bundesanstalt and Leibniz Universität Hannover, Germany, ³ VTI Technical Research Centre of Finland Ltd, Germany		
11:50	5044	Robust Operation of Two Sr Optical Lattice Clocks and Their Stability
Matthew Johnson, William Bowden, Richard Hobson, Marco Schioppo, Filip Butuc-Mayer, Ian Hill National Physical Laboratory, United Kingdom		

12:10	5180	Ca+ Optical Clocks: Recent Progress and Prospects on Applications
Yao Huang, Hua Guan, Kelin Gao Innovation Academy for Precision Measurement Science and Technology, Chinese Academy of Sciences, China		

Session A1L-3 – 25/04 10:50 – 12:30

G5: Optical Frequency Transfer

Location: Room 3

Session chair: Pierre Waller , ESA

10:50	5187	A Coherent Optical Fibre Link Between France and Italy
Matias Risaro ¹ , Simone Donadello ¹ , Alberto Mura ¹ , Cecilia Clivati ¹ , Irene Goti ³ , Stefano Condio ² , Marco Pizzocaro ¹ , Michele Gozzelino ¹ , Giovanni A. Costanzo ³ , Filippo Levi ¹ , Davide Calonico ¹ , Etienne Cantin ⁴ , Olivier Lopez ⁴ , Anne Amy-Klein ⁴ , Mads Tønnes ⁵ , Benjamin Pointard ⁵ , Clara Zyskind ⁵ , Changlei Guo ⁵ , Manuel Andia ⁵ , William Moreno ⁵ , Yannick Foucault ⁵ , Miguel-Angel Cifuentes Marin ⁵ , Haosen Shang ⁵ , Maxime Mazouth ⁵ , Rodolphe Le Targat ⁵ , Michel Abgrall ⁵ , Luca Lorini ⁵ , Jérôme Lodewyck ⁵ , Paul-Éric Pottie ⁵ , Sébastien Bize ⁵ ¹ INRiM - Istituto Nazionale di Ricerca Metrologica, Italy, ² INRiM - Istituto Nazionale di Ricerca Metrologica / Politecnico di Torino, Italy, ³ INRiM - Istituto Nazionale di Ricerca Metrologica and Politecnico di Torino, Italy, ⁴ Laboratoire de Physique des Lasers, Université Sorbonne Paris Nord, CNRS, France, ⁵ LNE-SYRTE, Observatoire de Paris - Université PSL, CNRS, Sorbonne Université, France		
11:10	5140	A 5000 km Extended Optical Frequency Reference Dissemination with REFIMEVE
Etienne Cantin ² , Olivier Lopez ² , Christian Chardonnet ⁴ , Anne Amy-Klein ² , Mads Tønnes ³ , Benjamin Pointard ³ , Rodolphe Le Targat ³ , Paul-Éric Pottie ³ , Martin Rabault ¹ , Vincent Menoret ¹ , Marie Houssin ⁵ , Nicolas Quintin ⁶ ¹ IXblue, France, ² Laboratoire de Physique des Lasers, Université Sorbonne Paris Nord, CNRS, France, ³ LNE-SYRTE, Observatoire de Paris - Université PSL, CNRS, Sorbonne Université, France, ⁴ LPL, Université Sorbonne Paris Nord, CNRS, France, ⁵ PIIM, Aix Marseille University, CNRS, France, ⁶ RENATER, France		
11:30	5167	Noise Behavior and Uncertainty Contributions of Coherent Optical Fiber Links
Mads Tønnes ² , Philip Tuckey ³ , Rodolphe Le Targat ² , Paul-Éric Pottie ² , Etienne Cantin ¹ , Olivier Lopez ¹ , Anne Amy-Klein ¹ ¹ Laboratoire de Physique des Lasers, Université Sorbonne Paris Nord, CNRS, France, ² LNE-SYRTE, Observatoire de Paris - Université PSL, CNRS, Sorbonne Université, France, ³ Observatoire de Paris, France		

11:50	5021	Optical Frequency Transfer with 1×10^{-21} Uncertainty Using a DFB Laser-Based Fiber Brillouin Amplifier
Jaffar Kadum, Alexander Kuhl, Jigxian Ji, Thomas Waterholter, Sebastian Koke Physikalisch-Technische Bundesanstalt, Germany		
12:10	5133	Noise Limit on the Accuracy of Frequency Locking of Lasers for Ultra-Accurate Fiber-Optic Time Transfer
Łukasz Śliwczyński, Przemysław Krehlik, Łukasz Buczek AGH University of Science and Technology, Poland		

Session A2L-1 – 25/04 14:00 – 16:00

G1: Acoustic Devices

Location: Room 1

Session chair: Cristian Cassella, Northeastern University

14:00	5124	A Capacitive Coupling Technique to Mitigate Frequency Mismatch Effects in MEMS Resonators
Luca Colombo ¹ , Giuseppe Michetti ¹ , Pietro Simeoni ¹ , Mary E. Galanko Klemash ² , Sarah S. Bedair ² , Matteo Rinaldi ¹ ¹ Northeastern University, United States, ² US Army Research Laboratory, United States		
14:20	5125	Accurate Simulation of Voltage Amplification in High-Performance MEMS-Based Matching Networks
Luca Colombo ¹ , Giuseppe Michetti ¹ , Pietro Simeoni ¹ , Mary E. Galanko Klemash ² , Tobias M. Kiebal ² , Sarah S. Bedair ² , Matteo Rinaldi ¹ ¹ Northeastern University, United States, ² US Army Research Laboratory, United States		
14:40	5286	Constructive Utilization of Nonlinear Dynamics in MEMS
Jun Yu, Hanna Cho Ohio State University, United States		
15:20	5282	Ultrahigh Quality Factors in Ferroelectric Hf _{0.5} Zr _{0.5} O ₂ Resonators with Remote Electrical Drive
Xu-Qian Zheng, Troy Tharpe, Philip X.-L. Feng, Roozbeh Tabrizian University of Florida, United States		
15:40	5237	Terminal Gain in LN-on-Si Lamb Mode Acoustoelectric Waveguides
Hakhamanesh Mansoorzare, Reza Abdolvand University of Central Florida, United States		

Session A2L-2 – 25/04 14:00 – 16:00

G4: MEMS/NEMS & Ultrasonic Transducers

Location: Room 2

Session chair: Ashwin Seshia , University of Cambridge

14:00	5038	Temperature-Independent Near-Zero Power Flame Detector Based on MEMS Photoswitch
Sila Deniz Caliskan, Vageswar Rajaram, Sungho Kang, Antea Risso, Zhenyun Qian, Matteo Rinaldi Northeastern University, United States		
14:20	5307	CMUTs and CPUTs for Imaging and Sensing
F. Levent Degertekin Georgia Institute of Technology, United States		
15:00	5178	High-Q Factor Multiferroic Resonant MEMS Low Frequency Magnetic Field Sensors
Michael D'agati ³ , Sydney Sofronici ³ , Yujia Huo ³ , Peter Finkel ² , Konrad Bussmann ² , Keith McLaughlin ¹ , Brad Wheeler ¹ , Thomas Mion ² , Margo Staruch ² , Roy H. Olsson III ³ ¹ Leidos, United States, ² Naval Research Laboratory, United States, ³ University of Pennsylvania, United States		
15:20	5267	Temperature-Insensitive Resonant Strain Sensor
Xintian Liu, Qianyi Xie, Alper Ozgurluk, Clark T.-C. Nguyen University of California, Berkeley, United States		
15:40	5272	MoTe2 NEMS Resonators for Near-Infrared Light Detection
S M Enamul Hoque Yousuf, Xu-Qian Zheng, Philip X.-L. Feng University of Florida, United States		

Session A2L-3 – 25/04 14:00 – 16:00

G3: Novel Techniques for Atomic Clocks/Sensors

Location: Room 3

Session chair: Rodolphe Boudot , FEMTO-ST/CNRS

14:00	5269	Integrated Photonics and Vacuum Package Development for a Cold-Atom Interferometer
Peter Schwindt ¹ , Jongmin Lee ¹ , Hayden McGuinness ¹ , Daniel Soh ¹ , Justin Christensen ¹ , Roger Ding ¹ , Gregory Hoth ¹ , Bethany Little ¹ , Adrian Orozco ¹ , Randy Rosenthal ¹ , Anthony Lentine ¹ , Michael Gehl ¹ , Ashok Kodigala ¹ , Eirik Skogen ¹ , Aaron Ison ¹ , Charles Walker ¹ , Grant Biedermann ² ¹ Sandia National Laboratories, United States, ² University of Oklahoma, United States		

14:40	5162	Grating Magneto-Optical Trap with Integrated Magnetic Chip
Alan Bregazzi, James McGilligan, Aidan Arnold, Paul Griffin, Erling Riis University of Strathclyde, United Kingdom		
15:00	5077	Millimeter-Wave Oscillator Disciplined by Molecular Rotational Spectroscopy
James Greenberg, Antoine Rolland, Martin Fermann IMRA America, Inc., United States		
15:20	5105	Progress Toward Miniaturized Atomic Beam Sources
Gabriela Martinez ² , John Kitching ¹ , William McGehee ¹ , Chao Li ³ , Chandra Raman ³ ¹ National Institute of Standards and Technology, United States, ² National Institute of Standards and Technology and University of Colorado Boulder, United States, ³ NIST, United States		

Session A3P-4 – 25/04 16:20 – 18:00

Posters 1, In-Person (G1)

Location: Poster Area 1

Session chair: Thomas Baron , Femto-st

Poster	5236	Solidly Mounted Resonators Based on ZnO/SiO2 Acoustic Reflectors and Their Performance After High Temperatures Exposure
José Manuel Carmona-Cejas, Teona Mirea, Marta Clement Lorenzo, Jimena Olivares Roza GMME-CEMDATIC-ETSI de Telecomunicación. Universidad Politécnica de Madrid, Spain		
Poster	5285	Optimization of Al72Sc28N Lamb Wave Resonator Design for kt2 Enhancement
Meruyert Assylbekova, Michele Pirro, Luca Colombo, Matteo Rinaldi Northeastern University, United States		

Session A3P-5 – 25/04 16:20 – 18:00

Posters 1, In-Person (G2)

Location: Poster Area 2

Session chair: Guillaume De Giovanni , InnoDef

Poster	5007	Comparison of Additive Noise of DAC Technologies for Low Noise Microwave Frequency Synthesizers
Jean-Marc Lesage, Jean-François Penn DGA, France		

Poster	5064	Low Jitter Optical Pulse Train Based on a Phase Modulated Optoelectronic Oscillator
Sacha Welinski ¹ , Loic Morvan ¹ , Daniel Dolfi ² , Vincent Crozatier ¹		
¹ Thales Research & Technology, France, ² Thales Research and Technology, France		

Session A3P-6 – 25/04 16:20 – 18:00

Posters 1, In-Person (G3)

Location: Poster Area 3

Session chair: Marco Belloni , ESA

Poster	5066	LEMAC: LTF-EPFL Miniature Atomic Clock
Matthieu Pellaton ³ , Christoph Affolderbach ³ , Yuanyan Su ¹ , Etienne Batori ³ , Maddalena Violetti ² , Anja K. Skrivervik ¹ , Gaetano Mileti ³		
¹ École Polytechnique Fédérale de Lausanne, Switzerland, ² Toscana Life Sciences, École Polytechnique Fédérale de Lausanne, Italy, ³ Université de Neuchâtel, Switzerland		
Poster	5089	Laser Intensity and Frequency Stabilization Implemented on a Miniature CPT Clock Breadboard
Jeremie Cotxet ³ , Francois Guty ² , Ghaya Baili ² , Loic Morvan ⁴ , Daniel Dolfi ⁵ , David Holleville ¹ , Stephane Guérandel ¹		
¹ LNE-SYRTE, Observatoire de Paris, France, ² Thales R&T France, France, ³ Thales R&T France and LNE-SYRTE, France, ⁴ Thales Research & Technology, France, ⁵ Thales Research and Technology, France		
Poster	5098	Experimental Determination of Relaxation Rates in a Ramsey-Mode Rubidium Cell Atomic Clock
Etienne Batori ³ , Christoph Affolderbach ³ , Florian Gruet ³ , Matthieu Pellaton ³ , Gaetano Mileti ³ , Yuanyan Su ¹ , Maddalena Violetti ² , Anja K. Skrivervik ¹		
¹ École Polytechnique Fédérale de Lausanne, Switzerland, ² Toscana Life Sciences, École Polytechnique Fédérale de Lausanne, Switzerland, ³ Université de Neuchâtel, Switzerland		
Poster	5160	An Elongated Atomic Vapour Cell for Precsision Navigation and Timing
Sean Dyer, Paul Griffin, Aidan Arnold, Erling Riis, James McGilligan		
University of Strathclyde, United Kingdom		
Poster	5271	Nondestructive Microwave Detection for Compact Quantum Inertial Sensors
William Dubosclard, Leonid Sidorenkov, Carlos Leonardo Garrido Alzar		
LNE-SYRTE, Observatoire de Paris - Université PSL, CNRS, Sorbonne Université, France		

Poster	5280	Air Pressure Dependent Frequency Shift in a Passive H-Maser - Modeling and Compensation
Harald Hauglin, Thomas Rødningen, Vetle Øversjøen Justervesenet - Norwegian Metrology Service, Norway		

Session A3P-7 – 25/04 16:20 – 18:00

Posters 1, In-Person (G4)

Location: Poster Area 4

Session chair: Laura Popa , Exponent Inc.

Poster	5079	MEMS Resonator Parameter Estimation from Fast Frequency Sweeps
Jerome Juillard ² , Zalfa Jouni ² , Laurent Bourgois ² , Erwan Libessart ² , Margot Morlans ³ , Jean Guérard ³ , Raphael Lévy ³ , Alexis Brenes ¹ , Elie Lefeuvre ¹ ¹ C2N, France, ² CentraleSupélec/GEEPS, France, ³ ONERA, France		
Poster	5261	Atomic Interferometry for Gravity Gradient Measurement
Raphaël Piccon, Sumit Sarkar, Sebastien Merlet, Franck Pereira Dos Santos LNE-SYRTE, Observatoire de Paris - Université PSL, CNRS, Sorbonne Université, France		

Session A3P-8 – 25/04 16:20 – 18:00

Posters 1, In-Person (G5)

Location: Poster Area 5

Session chair: ,

Poster	5073	A New Approach for Absolute Calibration of a GNSS Receiver: Use of a Software-Defined Radio (SDR) Technique
Pierre Uhrich, Franziska Riedel, Baptiste Chupin, Michel Abgrall LNE-SYRTE, Observatoire de Paris - Université PSL, CNRS, Sorbonne Université, France		
Poster	5093	R2CGGTTs: Status and Evolution
Pascale Defraigne ² , Elisa Pinat ² , Gérard Petit ¹ ¹ BIPM Bureau International des Poids et Mesures, France, ² Royal Observatory of Belgium, Belgium		
Poster	5102	An Efficient Timing System for IFMIF-DONES Facility Based on Ethernet Time Transfer Protocols
Carlos Megías ² , Víctor Vázquez ² , Eduardo Ros ² , Mauro Cappelli ¹ , Javier Díaz ² ¹ ENEA, Italy, ² Universidad de Granada, Spain		

Poster	5103	Towards a More Reliable Communication Architecture in the Time Laboratory of the Royal Observatory of Belgium
Bruno Bertrand ² , Aydin Ergen ² , Henri Martin ² , Natalia Vandenschrieck ¹ , Pascale Defraigne ² ¹ ECAM Institut Supérieur Industriel, Belgium, ² Royal Observatory of Belgium, Belgium		
Poster	5231	Monitoring of Multi-GNSS Time Dissemination
Pierre Waller, Cedric Plantard ESA/ESTEC, Netherlands		
Poster	5252	A New SDR-Based TX-RX Structure for Accurate Time and Frequency Transfer Over Optical Fibers
Yan Xie, Erik Dierikx, Marijn van Veghel VSL, Netherlands		
Poster	5273	Czech Optical Infrastructure CITAF
Vladimir Smotlacha, Josef Vojtech CESNET, Czech Rep.		
Poster	5275	Stimulated Brillouin Scattering And Raman Amplification In Standard Telco Fibres For Metrology Applications
Jan Radil, Josef Vojtech CESNET, Czech Rep.		
Poster	5201	Realization of a White Rabbit Timing Link in Italy
Filippo Levi ² , Davide Calonico ² , Elena Cantoni ² , Giancarlo Cerretto ² , Roberto Concas ² , Franco Fiasca ² , Alberto Mura ² , Andrea Perucca ² , Marco Sellone ² , Ilaria Sesia ² , Giovanna Signorile ² , Tung Than Thai ² , Sani Šarčević ¹ ¹ IMBH, Bosnia, ² INRiM - Istituto Nazionale di Ricerca Metrologica, Italy		
Poster	5254	Redefinition of the Si Second: Impact on Users and Stimulus for the Redefinition Subgroup a of the CCTF Task Force “Roadmap to the Redefinition of the Second”
Marina Gertszov ² , Gaetano Miletì ³ , Frédéric Meynadier ¹ ¹ BIPM Bureau International des Poids et Mesures, France, ² National Research Council Canada, Canada, ³ Université de Neuchâtel, Switzerland		

Session A3P-9 – 25/04 16:20 – 18:00

Posters 1, In-Person (G6)

Location: Poster Area 6

Session chair: ,

Poster	5019	Automated Validation of Frequency Comb Data for Optical Time Scale Steering
Jacob Tunesi, Alissa Silva, Adam Parsons, Jake Paterson, Marco Schioppo, Anthony Harwood, Helen S. Margolis National Physical Laboratory, United Kingdom		
Poster	5029	Towards the Development of an Optical Lattice Clock Using Bosonic Isotopes of Mercury
Clara Zyskind, Manuel Andia, Changlei Guo, Sébastien Bize LNE-SYRTE, Observatoire de Paris - Université PSL, CNRS, Sorbonne Université, France		
Poster	5045	Towards the Generation and Fiber-Link Transfer of Ultra-Stable 895 nm Signal for Characterization of a Microcell-Stabilized Laser
Anthony Gusching ¹ , Ivan Ryger ¹ , Moustafa Abdel Hafiz ¹ , Nicolas Passilly ¹ , Jacques Millo ¹ , Rodolphe Boudot ² ¹ FEMTO-ST Institute, France, ² FEMTO-ST Institute, CNRS, France		
Poster	5052	Lifetime Assessment and Performance of a Microfabricated Strontium Atomic Vapor Cell
Jacob Pate ² , John Kitching ¹ , Matthew Hummon ¹ ¹ National Institute of Standards and Technology, United States, ² National Institute of Standards and Technology and University of Colorado Boulder, United States		
Poster	5061	Controlling Long Linear In+/Yb+ Crystals for Precision Spectroscopy
Tabea Nordmann ¹ , Hartmut Nimrod Hausser ¹ , Jonas Keller ¹ , Jan Kiethe ¹ , Leon Schomburg ¹ , Hongli Liu ¹ , Nishant Bhatt ¹ , Tanja E. Mehlstäubler ² ¹ Physikalisch-Technische Bundesanstalt, Germany, ² Physikalisch-Technische Bundesanstalt and Leibniz Universität Hannover, Germany		
Poster	5072	Active Rejection at the Level of 10 ⁻⁷ of the Residual Amplitude Modulation
Jonathan Gillot, Santerelli Falzon Tetsing-Talla, Séverine Denis, Gwenhaél Goavec-Merou, Jacques Millo, Clément Lacroûte, Yann Kersalé FEMTO-ST Institute, France		
Poster	5095	A Simple Frequency Stabilization Technique for Averaging Birefringent Noise in Crystalline Mirror Coatings
Jialiang Yu ² , Thomas Legero ² , Fritz Riehle ² , Chun Yu Ma ² , Sofia Herbers ² , Daniele Nicolodi ² , Dhruv Kedar ¹ , Eric Oelker ³ , Jun Ye ¹ , Uwe Sterr ² ¹ JILA, NIST and university of Colorado, United States, ² Physikalisch-Technische Bundesanstalt, Germany, ³ University of Glasgow, United Kingdom		

Poster	5112	Optical Cavity Setup for Future Hybrid Lock Concept
Timm Wegehaupt, Josep Sanjuan, Martin Gohlke, Thilo Schuldt, Claus Braxmaier DLR e.V., Germany		
Poster	5135	A Flexible All-Digital Transfer Beat Implementation for Precision Frequency Metrology
Andreas Noack, Mattias Misera, Julia-Aileen Coenders, Erik Benkler, Uwe Sterr Physikalisch-Technische Bundesanstalt, Germany		
Poster	5152	A Hot Vapor Optical Clock Targeting Miniature Dimensions with Frequency Instability Below 10-13
Roman Blum, Sylvain Karlen, Stefan Kundermann, Steve Lecomte CSEM SA, Switzerland		
Poster	5155	Current Activities of CCTF to Update the Roadmap for a Re-definition of the Second: Options for the Redefinition
Sébastien Bize ² , Ekkehard Peik ⁴ , Chris Oates ³ , Gérard Petit ¹ ¹ BIPM Bureau International des Poids et Mesures, France, ² LNE-SYRTE, Observatoire de Paris - Université PSL, CNRS, Sorbonne Université, France, ³ National Institute of Standards and Technology, United States, ⁴ Physikalisch-Technische Bundesanstalt, Germany		
Poster	5175	Towards a Transportable Yb Lattice Clock at SYRTE
William Moreno ³ , Fatima Rahmouni ³ , Benjamin Pointard ³ , Paul-Éric Pottie ³ , Pacôme Delva ³ , Jérôme Lodewyck ³ , Rodolphe Le Targat ³ , Jésus Romero González ⁴ , Marie-Françoise Lalancette ⁵ , Guillaume Lion ² , Olivier Jamet ¹ ¹ IGN, France, ² Institut de Physique du Globe de Paris, Université de Paris, CNRS, IGN, ENSG-Géomatique, France, ³ LNE-SYRTE, Observatoire de Paris - Université PSL, CNRS, Sorbonne Université, France, ⁴ Real Instituto y Observatorio de la Armada, Spain, ⁵ SHOM, France		
Poster	5198	Set-Up for Continuous Superradiance Clock Based on Strontium Atoms
Marcin Bober, Omid Vartehparvar, Sławomir Bilicki, Domagoj Kovačić, Adam Ledziński, Piotr Morzyński, Mateusz Narożnik, Marcin Witkowski, Mehrdad Zarei, Michał Zawada Nicolaus Copernicus University, Poland		
Poster	5219	Superradiant Active Atomic Clock at UMK
Marcin Bober ² , Sławomir Bilicki ² , Georgy Kazakov ³ , Anahit Gogyan ¹ , Domagoj Kovačić ² , Adam Ledziński ² , Piotr Morzyński ² , Mateusz Narożnik ² , Marcin Witkowski ² , Omid Vartehparvar ² , Mehrdad Zarei ² , Michał Zawada ² ¹ Institute for Physical Research of National Academy of Sciences of Armenia, Armenia, ² Nicolaus Copernicus University, Croatia, ² Nicolaus Copernicus University, Poland, ³ Quantum metrology group, Atominstitut TU Wien, Austria		

Poster	5226	Distortion of the Mercury 1S0-3P0 Clock Line in Two-Species Atomic Clock
Adam Linek, Roman Ciuryło, Piotr Żuchowski, Marcin Witkowski Nicolaus Copernicus University, Poland		
Poster	5227	Accurate Bootstrapping of an Optical Frequency Comb to a 1542 nm Reference
Benjamin Pointard, Michel Abgrall, Michel Lours, Paul-Éric Pottie, Rodolphe Le Targat LNE-SYRTE, Observatoire de Paris - Université PSL, CNRS, Sorbonne Université, France		
Poster	5232	Towards Molecular Hg ₂ Clock for Testing Fundamental Physics
Marcin Witkowski, Roman Ciuryło, Adam Linek, Rodolfo Munoz Rodriguez, Michał Zawada Nicolaus Copernicus University, Poland		
Poster	5241	New Physics Searches with Isotope Shifts of Two Hg Clock Transitions
Marcin Witkowski ² , Roman Ciuryło ² , Anahit Gogyan ¹ , Adam Linek ² , Rodolfo Munoz Rodriguez ² , Paweł Tecmer ² , Michał Zawada ² ¹ Institute for Physical Research of National Academy of Sciences of Armenia, Armenia, ² Nicolaus Copernicus University, Poland		
Poster	5243	Evaluation of Systematic Shifts and Frequency Ratio of 5s2 1S0-5s5p 3P0 Clock Transition for 87Sr and 88Sr Optical Clock
Domagoj Kovačić, Sławomir Bilicki, Marcin Bober, Piotr Morzyński, Adam Ledziński, Omid Vartehparvar, Mehrdad Zarei, Michał Zawada Nicolaus Copernicus University, Poland		
Poster	5246	Second-Stage Cooling of Indium Ions for Multi-Ion Clock Operation
Hartmut Nimrod Hausser ² , Tabea Nordmann ² , Jonas Keller ² , Jan Kiethe ² , Moritz von Boehn ² , Nishant Bhatt ² , Valeriy Yudin ¹ , Oleg Prudnikov ¹ , Tanja E. Mehlstäubler ³ ¹ Institute of Laser Physics, Novosibirsk State University, Russia, ² Physikalisch-Technische Bundesanstalt, Germany, ³ Physikalisch-Technische Bundesanstalt and Leibniz Universität Hannover, Germany		
Poster	5250	The Design of an Ultra-Stable Cavity with Crystalline Mirror Coatings for Atomic Optical Clock
Mateusz Narożnik, Michał Zawada, Marcin Bober Nicolaus Copernicus University, Poland		
Poster	5251	Automatic Real-Time Control of Magnetic Field in an Optical Atomic Clock
Mehrdad Zarei, Adam Ledziński, Marcin Bober, Michał Zawada, Piotr Morzyński Nicolaus Copernicus University, Poland		

Poster	5235	Generating LG Modes for Atom Trapping in a Sr Optical Lattice Clock
Miguel-Angel Cifuentes Marin, Haosen Shang, Yannick Foucault, Rodolphe Le Targat, Jérôme Lodewyck LNE-SYRTE, Observatoire de Paris - Université PSL, CNRS, Sorbonne Université, France		
Poster	5239	Towards a Continuous Active Optical Clock Using Superradiance on the Strontium Clock Transition
Sheng Zhou, Francesca Famà, Camila Beli Silva, Stefan Alaric Schäffer, Shayne Bennetts, Florian Schreck University of Amsterdam, Netherlands		
Poster	5048	Transportable Hz Laser System for Quantum Applications
Filippo Bregolin, Pierre Thoumany, Dominik Niemietz, Florian Tauser, Thomas Puppe, Rafa Wilk TOPTICA Photonics AG, Germany		
Poster	5148	Optically Loaded Strontium Lattice Clock
Matteo Barbiero, Davide Calonico, Filippo Levi, Marco G. Tarallo INRiM - Istituto Nazionale di Ricerca Metrologica, Italy		
Poster	5234	Towards the Development of an Optical Lattice Clock Testbed Setup for the iqClock Project
Abhilash Jha, Alok Singh, Qiushuo Sun, Markus Gellesch, Jonathan M. Jones, Richard Barron, Yogeshwar Kale, Manan Jain, Vijay Singh, Kai Bongs, Yeshpal Singh University of Birmingham, United Kingdom		

Session B1P-4 – 26/04 08:40 – 10:20

Posters 2, Virtual (G1)

Location: Poster Area 1

Session chair: Thomas Baron , Femto-st

Poster	5012	Analysis of the Wave Modes for Super High-Frequency SAW Devices on the SiO ₂ /IDT/LiNbO ₃ Structure
Danhua Li ² , Salahuddin Raju ¹ , Mansun Chan ¹ , Chanjian Zhou ² ¹ Hong Kong University of Science and Technology, Hong Kong, ² South China University of Technology, China		
Poster	5051	Fundamental Precision Limit of Frequency Measurement of Linear Harmonic Oscillators
Mingkang Wang ¹ , Rui Zhang ² , Robert Ilıc ¹ , Yuxiang Liu ² , Vladimir Aksyuk ¹ ¹ National Institute of Standards and Technology, United States, ² Worcester Polytechnic Institute, United States		

Poster	5116	Study on Quality Factor of the Ring Electrode QCM Resonator
Jianguo Hu, Tian-Ling Ren Tsinghua University, China		
Poster	5174	Improvement in Laser Pulse Methods for Piezoelectric Device Analysis Using Laser Speckle Interferences
Kengo Hara, Yasuaki Watanabe, Ryosuke Nishihara Tokyo Metropolitan University, Japan		
Poster	5293	The Effect of Reflector Trench Width on the Anchor Loss of a Lateral-Extensional Resonator
Ankesh Todi, Hamideh Kermani, Reza Abdolvand University of Central Florida, United States		
Poster	5296	Tunable Te Mode Resonators Based on Ferroelectric AlScN Thin Film for RF Applications
Mingyo Park, Azadeh Ansari Georgia Institute of Technology, United States		
Poster	5123	Updated BVD Modelling of AlN-Based Solidly Mounted Resonators Working at Cryogenic and High Temperatures from -160 °C Up to 130 °C
Eduardo Lugo-Hernández ³ , José Manuel Carmona-Cejas ² , Teona Mirea ² , Jimena Olivares ¹ , Juan Carlos Collado Gómez ³ , Jordi Mateu Mateu ³ ¹ CEMDATIC-ETSI de Telecomunicación Universidad Politécnica de Madrid, Spain, ² GMME-CEMDATIC-ETSI de Telecomunicación. Universidad Politécnica de Madrid, Spain, ³ Universitat Politecnica de Catalunya, Spain		

Session B1P-5 – 26/04 08:40 – 10:20

Posters 2, Virtual (G2)

Location: Poster Area 2

Session chair: Guillaume De Giovanni , InnoDef

Poster	5071	Cancellation of Amplitude-to-Phase Noise Conversion by Adjusting Sweet Point of the Mixer
Panxue Ma ¹ , Dongrui Yu ² , Xing Chen ¹ , Ziyang Chen ² , Bin Luo ¹ , Hong Guo ² ¹ Beijing University of Posts and Telecommunications, China, ² Peking University, China		
Poster	5194	Sub-10-Attosecond Timing Jitter Mode-Locked Ti:sapphire Lasers
Hao Xu, Zhaolong Li, Ping Guo, Lin Dan, Jianye Zhao Peking University, China		

Poster	5298	Figures of Merit of a Locked Tunable Oscillator
Andrey Pluteshko Advantex LLC, Russia		
Poster	5142	Impact of Insulation Resistance of MLC Capacitor on Hysteresis Parameter of an OCXO
Kamal Kumar S, Nalini Cv, Chandrashekar Mariyappa Rakon India Private Limited, India		
Poster	5153	Effective Detection Mechanism of Missing Output Clock Pulse of an OCXO Used for 5G Application
Kamal Kumar S, Nalini Cv, Chandrashekar Mariyappa Rakon India Private Limited, India		
Poster	5111	Direct Measurement of Laser Noise Spectrum with a Frequency-to-Voltage Converter
Gaspere Antona ³ , Giovanni A. Costanzo ² , Michele Gozzelino ¹ , Salvatore Micalizio ¹ , Claudio Eligio Calosso ¹ , Filippo Levi ¹ ¹ INRiM - Istituto Nazionale di Ricerca Metrologica, Italy, ² INRiM - Istituto Nazionale di Ricerca Metrologica and Politecnico di Torino, Italy, ³ Politecnico di Torino, Italy		

Session B1P-6 – 26/04 08:40 – 10:20

Posters 2, Virtual (G3)

Location: Poster Area 3

Session chair: Fang Fang , NIM

Poster	5006	Toward a High-Performance Transportable Microwave Frequency Standard Based on Sympathetically-Cooled 113Cd+ Ions
Jize Han, Haoran Qin, Nongchao Xin, Shengnan Miao, Yiting Chen, Ying Zheng, Jianwei Zhang, Lijun Wang Tsinghua University, China		
Poster	5008	A High-Stability Compact Optical System for Integrating Sphere Cold Atom Clock
Xiumei Wang ³ , Jin He ⁴ , Weili Wang ¹ , Chengyuan Zhang ¹ , Yanjun Chen ¹ , Liang Wang ¹ , Yaxuan Liu ¹ , Lianshan Gao ¹ , Jingbiao Chen ² ¹ Beijing Institute of Radio Measurement and Metrology, China, ² Peking University, China, ³ PKU-HKUST Shen Zhen-HongKong Institution, China, ⁴ PKU-HKUST Shenzhen-Hong Kong Institution, China		

Poster	5022	Progress Towards a Microwave Frequency Standard Based on Sympathetically-Cooled $^{113}\text{Cd}^+$ Ions
Shengnan Miao, Jianwei Zhang, Haoran Qin, Nongchao Xin, Yiting Chen, Jize Han, Lijun Wang Tsinghua University, China		
Poster	5028	Progresses Toward a Microwave Clock Based on Laser-Cooled $^{171}\text{Yb}^+$ Ions
Nongchao Xin, Janwei Zhang, Shengnan Miao, Haoran Qin, Yiting Chen, Jize Han, L. J. Wang Tsinghua University, China		
Poster	5041	Magnetic-Field-Insensitive Coherent-Population-Trapping Resonances Excited by Bichromatic Linearly Polarized Fields on the D1 Line of ^{133}Cs
Kenta Matsumoto ³ , Sota Kagami ³ , Akihiro Kiriara ³ , Shinya Yanagimachi ¹ , Takeshi Ikegami ² , Atsuo Morinaga ² ¹ AIST, Japan, ² Micromachine Center, Japan, ³ NEC Corporation, Japan		
Poster	5081	Ramsey-CPT Resonance Observation Using Different Laser Sideband Combinations for the Two Interrogation Pulses
Masahiro Fukuoka, Shigeyoshi Goka Tokyo Metropolitan University, Japan		
Poster	5085	Novel Light-Shift Measurement Method with Multiple Photo Detectors for Gas-Cell Based Atomic Clocks
Masahiro Fukuoka, Akira Hanatani, Shigeyoshi Goka Tokyo Metropolitan University, Japan		
Poster	5141	Anomalous Level-Crossing Resonances in Rb Vapor Cells with Buffer Gas
Wei Xiao, Meng Liu, Teng Wu, Xiang Peng, Hong Guo Peking University, China		
Poster	5145	Digital Design of High-Precision Magnetic Field for Hydrogen Maser
Miao Li ² , Xirui Li ¹ , Zichen Liu ² , Erxi Fang ² , Yong Cai ¹ ¹ Shanghai Astronomical Observatory Chinese Academy of Science, China, ² Soochow University, China		
Poster	5199	Advances of Chip-Scale Atomic Clock in Peking University in 2021
Jianye Zhao ¹ , Ping Guo ¹ , Lin Dan ¹ , Hao Xu ¹ , Hongling Meng ² ¹ Peking University, China, ² Zhongkeqidi Optoelectronic Technology(Guangzhou) Co., Ltd., China		

Poster	5207	Noise Sources Evaluation of Compact Optically Pumped Cesium Beam Atomic Clock
Xuan He ¹ , Shengwei Fang ² , Zhichao Yuan ² , Jiayuan Chen ² , Xianghui Qi ² , Xuzong Chen ² , Qing Wang ² ¹ Institute of Quantum Electronics, Peking University, China, ² Peking University, China		
Poster	5109	Optical Generation of Microwave Signals for Fountain Clocks in Continuous Operation
Burghard Lipphardt, Patrick Walkemeyer, Michael Kazda, Johannes Rahm, Stefan Weyers Physikalisch-Technische Bundesanstalt, Germany		
Poster	5259	Initial Study of the Distributed Cavity Phase Shift for the New Microwave Cavities of Cs Fountains at NIST
Gregory Hoth, Bijunath Patla, Neil Ashby, Vladislav Gerginov National Institute of Standards and Technology, United States		

Session B1P-7 – 26/04 08:40 – 10:20

Posters 2, Virtual (G4)

Location: Poster Area 4

Session chair: Laura Popa , Exponent Inc.

Poster	5042	A Scale Factor Enhancement Method Based on Parametric Modulation for a Resonant MEMS Accelerometer
Jingqian Xi ² , Fangzheng Li ² , Lu Gao ² , Lei Xu ² , Yuan Wang ² , Chun Zhao ² , Chengxin Li ³ , Kunfeng Wang ¹ , Xingyin Xiong ¹ , Xudong Zou ¹ ¹ Aerospace Information Research Institute Chinese Academy of Sciences, China, ² Huazhong University of Science and Technology, China, ³ University of Leuven, Belgium		
Poster	5221	A High Sensitivity Temperature Sensor Using SH-SAW Resonator
Hangyu Qian ¹ , Shuxian Wu ¹ , Zonglin Wu ¹ , Feihong Bao ¹ , Guomin Yang ¹ , Jie Zou ¹ , Gongbin Tang ² ¹ Fudan University, China, ² Institute of Novel Semiconductors, Shandong University, China		
Poster	5268	Analysis of the Responses of Low-Noise Polymer-Plasticizer Coated Chemical Sensors in Liquids
Nicholas Post, Florian Bender, Fabien Josse Marquette University, United States		

Session B1P-8 – 26/04 08:40 – 10:20

Posters 2, Virtual (G5)

Location: Poster Area 5

Session chair: ,

Poster	5010	Stable 2.4 GHz Radio Frequency Transmission Based on Phase Modulation
Chenxia Liu ² , Tianwei Jiang ¹ , Tao Liu ² , Song Yu ¹ ¹ Beijing University of Posts and Telecommunications, China, ² North China Electric Power University, China		
Poster	5020	A WDM-Based System for Optical Frequency, Microwave Frequency and 1 PPS Time Signal Transfer via a Fiber Link
Qi Zang, Xiang Zhang, Xue Deng, Dan Wang, Qian Zhou, Dongdong Jiao, Jie Liu, Ruifang Dong, Tao Liu University of Chinese Academy of Sciences, National Time Service Center, CAS, China		
Poster	5026	A New Joint Time Scale Method of Hydrogen Maser and Cesium Atomic Clock
Meng Jiang ² , Shaowu Dong ¹ ¹ National Time Service Center, Chinese Academy of Sciences, China, ² Xi'an Polytechnic University, China		
Poster	5046	New Method for Cascaded Fiber-Optic Radio Frequency Transfer
Qi Li, Liang Hu, Jinbo Zhang, Jianping Chen, Guiling Wu Shanghai Jiao Tong University, China		
Poster	5055	Wavelet Analysis for Time and Frequency Transfer
Sheng Li, Hong Guo Peking University, China		
Poster	5065	Optimization of EDFA Operating Parameters of Gain, SNR and Input Power in Frequency Transfer System
Xuan Yang ¹ , Panxue Ma ¹ , Yufei Zhang ² , Guohua Wu ¹ , Ziyang Chen ² , Bin Luo ¹ , Hong Guo ² ¹ Beijing University of Posts and Telecommunications, China, ² Peking University, China		
Poster	5078	Asymmetric Channel Attack Against Practical Round-Trip Fiber Time Synchronization System
Zihao Liu ¹ , Yiming Bian ¹ , Yichen Zhang ¹ , Yang Li ² , Bingjie Xu ² , Song Yu ¹ ¹ Beijing University of Posts and Telecommunications, China, ² Institute of Southwestern Communication, Peking University, China		

Poster	5086	Correcting for Site Displacement in GNSS All-in-View Time Transfer
Wen-Hung Tseng ³ , Tzu-Pang Tseng ¹ , Shinn-Yan Lin ² ¹ National Kaoshiung University of Science and Technology, Taiwan, ² Telecommunication Laboratories, Taiwan, ³ Telecommunication Laboratories, Chunghwa Telecom Co., Ltd., Taiwan		
Poster	5106	Phase-Modulation-Based Coarse Time Synchronization for Linear Optical Sampling System
Haojie Wang ¹ , Chao Zhou ² , Ziyang Chen ² , Bin Luo ¹ ¹ Beijing University of Posts and Telecommunications, China, ² Peking University, China		
Poster	5115	Optical Time Transmission Over Dual 100 GHz-Grid Optical Channels in the Czech Republic
Sarbojeet Bhowmick, Radek Velc, Lada Altmannova CESNET, Czech Rep.		
Poster	5210	Detection of Stimulated Brillouin Scattering in Bi-Directional Fiber-Optic Links
Karol Salwik, Łukasz Śliwczyński, Przemysław Krehlik AGH University of Science and Technology, Poland		
Poster	5211	A Self-Time-Keeping Synchronization System Based on Timing Drift Fitting Algorithm
Yefeng Gao, Junwei Ren, Guangkun Guo, Ke Liu, Dong Hou University of Electronic Science and Technology of China, China		
Poster	5220	The National System for Distribution of Reference Optical Carrier - First Link Evaluation
Krzysztof Turza ² , Artur Binczewski ² , Wojbor Bogacki ² , Przemysław Krehlik ¹ , Łukasz Śliwczyński ¹ ¹ AGH University of Science and Technology, Poland, ² Poznan Supercomputing and Networking Center, Poland		
Poster	5223	An Optimization Algorithm for Optical Gain in the Multi-EDFAs-Based Fiber-Optic Time Synchronization
Bo Liu ¹ , Weicheng Kong ² , Xinxing Guo ³ , Bo Li ³ , Shougang Zhang ³ , Ruifang Dong ³ , Tao Liu ⁴ ¹ National Time Service Center, Chinese Academy of Sciences, China, ² University of Chinese Academy of Sciences, CAS, China, ³ University of Chinese Academy of Sciences, National Time Service Center, CAS, China, ⁴ University of the Chinese Academy of Sciences, National Time Service Center, CAS, China		

Poster	5228	Ultra-Stable Optical Frequency Transfer via 609 km Communication Fiber Link
Xiang Zhang, Xue Deng, Qi Zang, Dan Wang, Qian Zhou, Mengfan Wu, Tao Liu, Ruifang Dong, Shougang Zhang University of Chinese Academy of Sciences, National Time Service Center, CAS, China		
Poster	5240	Coherent Optical Frequency Transfer via a Fiber Link Laid Along the Railroad
Qian Zhou ¹ , Xiang Zhang ¹ , Qi Zang ¹ , Xue Deng ¹ , Mengfan Wu ¹ , Jie Liu ¹ , Dan Wang ¹ , Tao Liu ² , Ruifang Dong ¹ ¹ University of Chinese Academy of Sciences, National Time Service Center, CAS, China, ² University of the Chinese Academy of Sciences, National Time Service Center, CAS, China		
Poster	5188	Time and Frequency Dissemination and Time Scales Task Force on the Roadmap for the Redefinition of Second
Davide Calonico ² , Tetsuya Ido ³ , Gianna Panfilo ¹ ¹ BIPM Bureau International des Poids et Mesures, France, ² INRiM - Istituto Nazionale di Ricerca Metrologica, Italy, ³ National Institute of Information and Communications Technology, Italy		
Poster	5206	Improvements in the Realization of the Italian Time Scale UTC(IT)
Elio Bertacco ¹ , Elena Cantoni ¹ , Giancarlo Cerretto ¹ , Roberto Costa ¹ , Franco Fiasca ¹ , Valerio Formichella ¹ , Filippo Levi ¹ , Alberto Mura ¹ , Andrea Perucca ¹ , Marco Pizzocaro ¹ , Fabrizio Pollastri ¹ , Marco Sellone ¹ , Ilaria Sesia ¹ , Giovanna Signorile ¹ , Paolo Terzi ¹ , Tung Than Thai ¹ , Daniele Rovera ³ , Giovanni A. Costanzo ² ¹ INRiM - Istituto Nazionale di Ricerca Metrologica, Italy, ² INRiM - Istituto Nazionale di Ricerca Metrologica and Politecnico di Torino, Italy, ³ Rovera Freelance Consulting, France		
Poster	5024	Combined Time and Frequency Transfer Over Fibre Using Spread Spectrum Technique
Wei Huang, Shukree Wassan, Elvira Castello, Jochen Kronjäger National Physical Laboratory, United Kingdom		
Poster	5025	Self-Lasing Techinque for Controlling the Gain of Bi-Directional EDFA Used for Optical Frequency Transfer
Shukree Wassan, Wei Huang, Elvira Castello, Jochen Kronjäger National Physical Laboratory, United Kingdom		
Poster	5083	Operation of UTC(KZ) Based on Passive Hydrogen Masers
Marat Konkanov ¹ , Sultanbek Smagulov ¹ , Konstantin Mishagin ² , Nikita Arkhipov ² ¹ Kazakhstan Institute of Standartization and Metrology, Kazakhstan, ² Vremya-CH JSC, Russia		

Poster	5108	GLONASS Time and the Accuracy of Positioning and Timing by GLONASS Signals in 2021
Andrei Druzhin, Tatiana Primakina, Aleksandr Feoktistov Russian Institute of Radionavigation and Time, Russia		

Session B1P-9 – 26/04 08:40 – 10:20

Posters 2, Virtual (G6)

Location: Poster Area 6

Session chair: John McFerran , UWA

Poster	5032	Progress on the Evaluation of the Blackbody Radiation Shift Uncertainty of NRC's Strontium Ion Clock
Bin Jian ² , Pierre Dubé ² , Miroslav Doležal ¹ ¹ Czech Metrology Institute, Czech Rep., ² National Research Council Canada, Canada		
Poster	5033	Optical Frequency Division with a Comb Based on Difference Frequency Generation
Sebastian Müller, Reinhard Unterreitmayr, Thomas Puppe, Rafa Wilk TOPTICA Photonics AG, Germany		
Poster	5037	Measurement of Molecular Iodine Hyperfine Transition Near 554 nm
Yiting Chen, Jianwei Zhang, J. Z. Han, Nongchao Xin, Shengnan Miao, Haoran Qin, L. J. Wang Tsinghua University, China		
Poster	5057	Progress Towards a Cs-Limited Uncertainty at 3×10^{-16} of the Absolute Frequency Measurement of NMIJ-Yb1
Takumi Kobayashi ¹ , Daisuke Akamatsu ² , Kazumoto Hosaka ¹ , Yusuke Hisai ² , Akiko Nishiyama ¹ , Akio Kawasaki ¹ , Masato Wada ¹ , Hajime Inaba ¹ , Takehiko Tanabe ¹ , Feng-Lei Hong ² , Masami Yasuda ¹ ¹ National Metrology Institute of Japan, National Institute of Advanced Industrial Science & Technology, Japan, ² YNU, Japan		
Poster	5075	Progress Towards Development of a Transportable Sr+ Ion Optical Clock at NRC
Kosuke Kato, Pierre Dubé National Research Council Canada, Canada		
Poster	5082	Application of Velocity Grating Spectrum in Calcium-Beam Optical Clock
Duo Pan, Tianyu Liu, Haosen Shang, Tiantian Shi, Jingbiao Chen Peking University, China		

Poster	5084	Dual-Frequency Faraday Laser with THz Frequency Separation
Jianxiang Miao, Jia Zhang, Tiantian Shi, Duo Pan, Jingbiao Chen Peking University, China		
Poster	5092	Doubly-Locked Dual-Frequency Faraday Laser for Absolute Frequency Measurement
Jianxiang Miao, Jia Zhang, Tiantian Shi, Duo Pan, Jingbiao Chen Peking University, China		
Poster	5107	Blackbody Radiation and Lattice Light Shift in Sr
Christian Lisdat, Sören Dörscher, Ingo Nosske, Uwe Sterr Physikalisch-Technische Bundesanstalt, Germany		
Poster	5149	Four Branches Er:fiber-Based Optical Frequency Comb for Frequency Comparison of Optical Clocks
Pan Zhang ² , Bingjie Rao ² , Mingkun Li ² , Xiguang Yang ² , Xin Chen ² , Yanyan Zhang ¹ , Shougang Zhang ³ , Haifeng Jiang ⁴ ¹ Key Laboratory of Time and Frequency Primary Standards, National Time Service Center, CAS, China, ² National Time Service Center, Chinese Academy of Sciences, China, ³ University of Chinese Academy of Sciences, National Time Service Center, CAS, China, ⁴ University of Science and Technology of China, National Time Service Center, CAS, China		
Poster	5181	Multi-Branch Fiber Frequency Comb for Precision Frequency Measurement of Molecular Transitions
Mingkun Li ² , Pan Zhang ² , Bingjie Rao ² , Lulu Yan ² , Yanyan Zhang ¹ , Haifeng Jiang ⁴ , Shougang Zhang ³ ¹ Key Laboratory of Time and Frequency Primary Standards, National Time Service Center, CAS, China, ² National Time Service Center, Chinese Academy of Sciences, China, ³ University of Chinese Academy of Sciences, National Time Service Center, CAS, China, ⁴ University of Science and Technology of China, National Time Service Center, CAS, China		
Poster	5182	An Er:fiber Femtosecond Optical Frequency Comb for Measurement of the D1 Line in Cold 6Li Atoms
Bingjie Rao ² , Pan Zhang ² , Mingkun Li ² , Lulu Yan ² , Xiguang Yang ² , Xin Chen ² , Shougang Zhang ³ , Haifeng Jiang ⁴ , Yanyan Zhang ¹ ¹ Key Laboratory of Time and Frequency Primary Standards, National Time Service Center, CAS, China, ² National Time Service Center, Chinese Academy of Sciences, China, ³ University of Chinese Academy of Sciences, National Time Service Center, CAS, China, ⁴ University of Science and Technology of China, National Time Service Center, CAS, China		
Poster	5189	Progress on a Compact Ultra-Stable Laser System for Photonic Microwave Generation
Yani Zuo, Shaoyang Dai, Shiyang Cao, Fei Meng, Fasong Zheng, Weiliang Chen, Kun Liu, Tianchu Li, Fang Fang National Institute of Metrology, China, China		

Poster	5215	Traceable Characterization of THz Electric Fields by Precision Spectroscopy of Cold Trapped HD ⁺ Ions
Florin Lucian Constantin CNRS, France		
Poster	5253	Frequency Comb Development at the NRC
Claude Marceau, Scott Beattie, Marina Gertsiov National Research Council Canada, Canada		
Poster	5196	The iqClock Industry Clock Demonstrator - a Progress Update
Markus Gellesch ⁷ , Yogeshwar Kale ⁷ , Abhilash Jha ⁷ , Alok Singh ⁷ , Jonathan M. Jones ⁷ , Qiushuo Sun ⁷ , Richard Barron ⁷ , Manan Jain ⁷ , Vijay Singh ⁷ , Kai Bongs ⁷ , Yeshpal Singh ⁷ , Pierre Thoumany ⁵ , Filippo Bregolin ⁵ , Florian Tauser ⁵ , Rafa Wilk ⁵ , Juergen Stuhler ⁵ , Joe Popple ⁴ , Stephen Bardell ⁴ , Bhavesh Patel ⁴ , Naveen Betadur ⁴ , Karen Munyard ⁴ , Ole Kock ⁴ , Ben Hammond ⁴ , Patrick Bowen ³ , Peter Morten Moselund ³ , Poul Varming ³ , Anthony Flavin ² , Marco Menchetti ¹ , Andrew Lord ¹ , Iqclock Consortium ⁶ ¹ BT, United Kingdom, ² Chronos Technology, United Kingdom, ³ NKT Photonics, Denmark, ⁴ Teledyne e2v, United Kingdom, ⁵ TOPTICA Photonics AG, Germany, ⁶ University of Amsterdam, Netherlands, ⁷ University of Birmingham, United Kingdom		
Poster	5229	Blue-Detuned Optical Lattice for Sr Long-Range Interactions
Shengnan Zhang, Balsant Tiwari, Sandhya Ganesh, Preetam Ramchurn, Kai Bongs, Yeshpal Singh University of Birmingham, United Kingdom		
Poster	5173	A Field-Deployable Optical Clockwork in the Visible Spectrum Capable of Supporting Instabilities Below 1×10 ⁻¹⁷
Henry Timmers, Andrew Attar, Bennett Sodergren, Star Fassler, Evan Barnes, Saeid Rostami, Kurt Vogel, Kevin Knabe Vescent Photonics, United States		
Poster	5191	Recent Progress of Mercury Lattice Clock in SIOM
Qixin Liu, Ye Zhang, Zexin Yu, Jianfang Sun, Zhen Xu SIOM, China		

Session B2L-1 – 26/04 10:50 – 12:30

G2: Optical Oscillators

Location: Room 1

Session chair: Olivier Llopis , LAAS-CNRS, Université de Toulouse

10:50	5062	Parametric Study on the Phase Noise of an Optoelectronic Oscillator Submitted to Vibrations
Pierre Travers ² , Yohann Léguillon ² , François Louf ¹ , Pierre-Alain Boucard ¹ , Loïc Morvan ³ , Daniel Dolfi ⁴ , Vincent Crozatier ³ ¹ Laboratoire de Mécanique et Technologie, France, ² Thales Land and Air Systems, France, ³ Thales Research & Technology, France, ⁴ Thales Research and Technology, France		
11:10	5013	A CPT-Based Cs Cell Self-Sustained Microwave Oscillator
Rodolphe Boudot ² , Moustafa Abdel Hafiz ¹ , Michael Petersen ¹ , Enrico Rubiola ¹ , Claudio Eligio Calosso ³ ¹ FEMTO-ST Institute, France, ² FEMTO-ST Institute, CNRS, France, ³ INRiM - Istituto Nazionale di Ricerca Metrologica, Italy		
11:30	5137	Influence of the Optical Amplifier on Optoelectronic Oscillator with Optical Gain
Guillaume Dangoisse ³ , Perrine Berger ³ , Vincent Crozatier ³ , Frédéric van Dijk ¹ , Christophe Caillaud ¹ , Michaël Verdun ² , Nadège Le Grand ² , Xavier Prat ² , Guillaume Canat ² ¹ III-V Lab, France, ² Lumibird, France, ³ Thales Research & Technology, France		
11:50	5203	Numerical Study of a COEO Device Versus Loop Chromatic Dispersion and Detuning
Alexis Bougaud, Olivier Llopis, Arnaud Fernandez LAAS, France		

Session B2L-2 – 26/04 10:50 – 12:30

G6: Spectroscopy & Applications

Location: Room 2

Session chair: Ronald Holzwarth , MenloSystems

10:50	5264	High Precision, SI-Traceable, Mid-Infrared Molecular Spectroscopy
Nicolas Cahuzac ¹ , Yuhao Liu ¹ , Marylise Saffre ¹ , Etienne Cantin ² , Olivier Lopez ² , Dang Bao An Tran ¹ , Rosa Santagata ¹ , Mathieu Manceau ¹ , Anne Amy-Klein ² , Benoît Darquie ¹ , Mads Tønnes ³ , Benjamin Pointard ³ , Michel Abgrall ³ , Luca Lorini ³ , Yann Le Coq ³ , Rodolphe Le Targat ³ , Hector Alvarez-Martinez ⁵ , Dan Xu ⁴ , Paul-Éric Pottier ³ ¹ Laboratoire de physique des lasers, France, ² Laboratoire de Physique des Lasers, Université Sorbonne Paris Nord, CNRS, France, ³ LNE-SYRTE, Observatoire de Paris - Université PSL, CNRS, Sorbonne Université, France, ⁴ Observatoire de Paris, France, ⁵ Real Instituto y Observatorio de la Armada, Spain		

11:10	5256	Towards an Active Frequency Reference Driven by a Thermal Beam of 88Sr Atoms
Francesca Famà ¹ , Camila Beli Silva ¹ , Sheng Zhou ¹ , Mikkel Tang ² , Stefan Alaric Schäffer ¹ , Shayne Bennetts ¹ , Florian Schreck ¹ ¹ University of Amsterdam, Netherlands, ² University of Copenhagen, Denmark		
11:30	5031	Constraining Variations in Fundamental Constants Using a Network of Clocks
Adam Parsons ² , Marco Schioppo ² , Jacob Tunesi ² , Ian Hill ² , Billy Robertson ² , Alexandra Tofful ² , Richard Hendricks ² , Anne Curtis ² , R.C. Thompson ¹ , Krzysztof Szymaniec ² , Helen S. Margolis ² , Rachel Godun ² ¹ Imperial College London, United Kingdom, ² National Physical Laboratory, United Kingdom		
11:50	5247	New Absolute Frequency Measurement of the Improved 171Yb Optical Lattice Clock at INRiM
Irene Goti ³ , Stefano Condio ² , Matias Risaro ¹ , Cecilia Clivati ¹ , Michele Gozzelino ¹ , Giovanni A. Costanzo ³ , Filippo Levi ¹ , Marco Pizzocaro ¹ , Davide Calonico ¹ ¹ INRiM - Istituto Nazionale di Ricerca Metrologica, Italy, ² INRiM - Istituto Nazionale di Ricerca Metrologica / Politecnico di Torino, Italy, ³ INRiM - Istituto Nazionale di Ricerca Metrologica and Politecnico di Torino, Italy		

Session B2L-3 – 26/04 10:50 – 12:30

G5: Optical Timebases & Applications

Location: Room 3

Session chair: Dirk Piester , PTB

10:50	5080	Benefit of Optical Clocks for Geodesy
Jürgen Müller Leibniz University Hannover, Germany		
11:30	5192	Reassessment of Lab-Side Uncertainties for High-Precision Optical Clock Contributions to Tai
Nils Nemitz, Hidekazu Hachisu, Nozomi Ohtsubo, Hiroyuki Ito, Tetsuya Ido National Institute of Information and Communications Technology, Japan		
11:50	5213	Testing a Robust Algorithm for Optical Time Scales Generation
Valerio Formichella ¹ , Giovanna Signorile ¹ , Marco Pizzocaro ¹ , Irene Goti ³ , Stefano Condio ² , Cecilia Clivati ¹ , Matias Risaro ¹ , Filippo Levi ¹ , Davide Calonico ¹ , Ilaria Sesia ¹ , Lorenzo Galleani ⁴ ¹ INRiM - Istituto Nazionale di Ricerca Metrologica, Italy, ² INRiM - Istituto Nazionale di Ricerca Metrologica / Politecnico di Torino, Italy, ³ INRiM - Istituto Nazionale di Ricerca Metrologica and Politecnico di Torino, Italy, ⁴ Politecnico di Torino, Italy		

Session B3L-1 – 26/04 14:00 – 16:00

G2: MEMS, OCXO & Frequency Divider

Location: Room 1

Session chair: Magnus Danielson , Net Insight

14:00	5248	Design Challenges for MEMS Resonator-Based High Performance Oscillators in Commercial Applications
John Clark, Pierre Guebels, Andrew R. Brown, Seungbae Lee, Wanling Pan Microchip, United States		
14:40	5276	Time-Temperature Superposition Based Accelerated Aging Method for Packaged MEMS Resonators
Jeronimo Segovia-Fernandez, Enis Tuncer, Sean Chang, Ernest Yen Texas Instruments, United States		
15:00	5277	A Thermal-Stress FEM to Predict Aging in Packaged MEMS Resonators
Jeronimo Segovia-Fernandez, Yutaka Suzuki, Mahmud Chowdhury, Javier Rojas, Ernest Yen Texas Instruments, United States		
15:20	5177	30 GHz Regenerative Frequency Divide-by-3
Archita Hati ¹ , Marco Pomponio ² , Connor Humiston ² , John Lettang ² , Craig Nelson ¹ ¹ National Institute of Standards and Technology, United States, ² National Institute of Standards and Technology and University of Colorado Boulder, Italy, ² National Institute of Standards and Technology and University of Colorado Boulder, United States		
15:40	5185	Ultra-Stable Oscillator Stabilization Using an Artificial Neural Network
Olukayode Okusaga ² , John Hamilton ² , Trey Schmidt ¹ , Samuel Reynolds ² , Jefferey Garstecki ² , Gregory Weaver ² ¹ Johns Hopkins APL, United States, ² Johns Hopkins Applied Physics Laboratory, United States		

Session B3L-2 – 26/04 14:00 – 16:00

G6: Combs

Location: Room 2

Session chair: Tara Fortier , NIST

14:00	5023	Transfer Oscillator Technique for Generation of 10 GHz Low-Noise Microwaves with High Accuracy
Nicholas Nardelli ² , Tara Fortier ¹ , Marco Pomponio ² , Esther Baumann ² , Craig Nelson ¹ , Thomas Schibli ² , Archita Hati ¹ ¹ National Institute of Standards and Technology, United States, ² National Institute of Standards and Technology and University of Colorado Boulder, United States		
14:20	5183	Broadband Nonlinear Wavelength Conversion with Integrated Microresonators
Jennifer Black ¹ , Su-Peng Yu ² , Zachary Newman ² , David Carlson ² , Jizhao Zang ¹ , Scott Papp ¹ ¹ National Institute of Standards and Technology, United States, ² NIST, United States		
14:40	5161	300 GHz Wave Generated with a Dissipative Kerr Soliton Divider
Antoine Rolland IMRA America, Inc., United States		
15:20	5126	Shaped Supercontinuum for Precision Frequency Transfer
Kevin Lee, Antoine Rolland, Peng Li, Jie Jiang, Martin Fermann IMRA America, Inc., United States		
15:40	5104	Response Function of Homodyne Wavelength Difference Stabilization
James Cahill ³ , Tanvir Mahmood ¹ , Patrick Sykes ³ , Curtis Menyuk ² , Weimin Zhou ³ ¹ CCDC ARL, United States, ² UMBC, United States, ³ US CCDC Army Research Laboratory, United States		

Session B3L-3 – 26/04 14:00 – 16:00

G5: Optical Time Transfer I

Location: Room 3

Session chair: Anne Amy Klein , LPL

14:00	5036	Photon Efficient Optical Time Transfer
Emily Caldwell ¹ , Laura Sinclair ¹ , William Swann ¹ , Nathan Newbury ¹ , Benjamin Stuhl ³ , Jean-Daniel Deschènes ² ¹ National Institute of Standards and Technology, United States, ² Octosig Consulting, United States, ³ Space Dynamics Laboratory, National Institute of Standards and Technology, United States		

14:40	5060	Free Space Optical Link for Frequency Comparison and Chronometric Geodesy
Nicolas Maron ² , Francois-Xavi Esnault ¹ , Thomas Lévêque ¹ , Peter Wolf ² ¹ Centre National d'Études Spatiales, France, ² LNE-SYRTE, Observatoire de Paris - Université PSL, CNRS, Sorbonne Université, France		
15:00	5279	Estimation Architectures for Precise Time and Frequency Transfer in a LEO Constellation
Christopher Flood ² , Penina Axelrad ² , Andrew J. Metcalf ¹ , Benjamin K. Stuhl ¹ ¹ Air Force Research Lab, United States, ² University of Colorado Boulder, United States		
15:20	5157	How to Implement Mutual Network Synchronization in the Presence of Large Cross-Coupling Delays
Lucas Wetzel ¹ , Dimitrios Prousalis ¹ , Rabia Riaz ² , Christian Hoyer ² , Niko Joram ² , Frank Ellinger ² , Frank Jülicher ¹ ¹ Max Planck Institute for the Physics of Complex Systems, Germany, ² Technische Universität Dresden, Germany		
15:40	5154	Wireless PTP Transmission with FWA Technology
Marco Sellone ² , Filippo Levi ² , Alberto Mura ² , Davide Calonico ² , Stefano Zanolì ¹ , Gabriele Balzano ¹ ¹ HAL Service, Italy, ² INRiM - Istituto Nazionale di Ricerca Metrologica, Italy		

Session B4L-1 – 26/04 16:20 – 18:00

G1/4 Joint

Location: Room 1

Session chair: Valentina Zega , Politecnico di Milano, Italy

16:20	5169	Microwave-Optical Transduction Using High Overtone Bulk Acoustic Resonances
Terence Blésin ¹ , Anat Siddharth ¹ , Hao Tian ² , Rui Ning Wang ¹ , Alaina Attanasio ² , Sunil Bhawe ² , Tobias Kippenberg ¹ ¹ École Polytechnique Fédérale de Lausanne, Switzerland, ² Purdue University, United States		
16:40	5284	Self-Aligned Single-Electrode Actuation of Tangential and Wineglass Modes
Ozan Erturk ³ , Sunil Bhawe ³ , Kilian Shambaugh ² , Sang-Goo Lee ¹ ¹ iBule Photonics, Korea, ² Polytec Inc., United States, ³ Purdue University, United States		

17:00	5283	AlScN-on-SiC Thin-Film Micromachined Resonant Transducers Operating in High-Temperature Environment Up to 600°C
Wen Sui ² , Haoran Wang ² , Jaesung Lee ² , Afzaal Qamar ³ , Mina Rais-Zadeh ¹ , Philip X.-L. Feng ² ¹ NASA Jet Propulsion Laboratory, California Institute of Technology, United States, ² University of Florida, United States, ³ University of Michigan Ann Arbor, United States		
17:20	5172	Multi-Level Analog Programmable Graphene Resistive Memory with Fractional Channel Ferroelectric Switching in Hafnium Zirconium Oxide
Ved Gund, Benyamin Davaji, Shubham Jadhav, Hyunjea Lee, Debdeep Jena, Huili Grace Xing, Amit Lal Cornell University, United States		
17:40	5295	Turnover Temperature in Lateral-Field-Excited Thin-Film Lithium Tantalate Contour Resonators
Yasaman Majd, Hamideh Kermani, Parvin Akhkandi, Garrett Goodale, Reza Abdolvand University of Central Florida, United States		

Session B4L-2 – 26/04 16:20 – 18:00

G6: Clocks & Combs

Location: Room 2

Session chair: Tanja Mehlstaebler, PTB

16:20	5302	Simple Millimeter Wave Generation with Stability Tied to a Self-Referenced Frequency Comb
Alexander Lind ² , Eugene Tsao ³ , Franklyn Quinlan ¹ , Scott Diddams ² ¹ National Institute of Standards and Technology, United States, ² National Institute of Standards and Technology and University of Colorado, Boulder, United States, ³ NIST, United States		
16:40	5202	Quantum Nondemolition Detection for Strontium Optical Lattice Clock
Haosen Shang, Miguel-Angel Cifuentes Marin, Yannick Foucault, Rodolphe Le Targat, Jérôme Lodewyck LNE-SYRTE, Observatoire de Paris - Université PSL, CNRS, Sorbonne Université, France		
17:00	5255	Advancing Optical Lattice Clock Performance with Enhanced Quantum Control Techniques
Chun-Chia Chen ¹ , Jacob Siegel ¹ , Xiaogang Zhang ¹ , William McGrew ¹ , Youssef Hassan ¹ , Kyle Beloy ¹ , Andrew Ludlow ² ¹ National Institute of Standards and Technology, United States, ² National Institute of Standards and Technology and University of Colorado Boulder, United States		

17:20	5303	Tweezer Clocks: a New Platform for Quantum Metrology
Adam Kaufman JILA, National Institute of Standards and Technology and University of Colorado Boulder, United States		

Session B4L-3 – 26/04 16:20 – 18:00

G3: Timekeeping Clocks

Location: Room 3

Session chair: François-Xavier Esnault , CNES

16:20	5146	Cold-Atom-Based Commercial Microwave Clocks at 1×10^{-15} Relative Instability Over More Than a Month
Bruno Pelle ¹ , Luc Archambault ¹ , Bruno Desruelle ¹ , Arnaud Landragin ² ¹ IXblue, France, ² SYRTE, Observatoire de Paris, France		
17:00	5050	Normalised Detection of Clock States by Cold Atom Recapture Method
Samuel Walby ³ , Martin Knapp ³ , Josh Whale ¹ , Andrew Wilson ¹ , Richard Hendricks ¹ , Christopher Foot ² , Krzysztof Szymaniec ¹ ¹ National Physical Laboratory, United Kingdom, ² University of Oxford, United Kingdom, ³ University of Oxford / National Physical Laboratory, United Kingdom		
17:20	5262	Reevaluating the Collisional Shift of the NRC-FCs2 Primary Frequency Standard
Scott Beattie, Bin Jian, Marina Gertszvolf National Research Council Canada, Canada		
17:40	5217	Frequency Stability Improvement of a Passive Hydrogen Maser with a Single-State Selection System
Victor Polyakov, Yuri Timofeev, Nikolai Demidov JSC Vremya-CH, Russia		

Session C1L-1 – 27/04 08:40 – 10:20

G3: Cell Standards

Location: Room 1

Session chair: Gaetano Mileti , Université de Neuchâtel

08:40	5035	LaLI-POP: Lamp and Laser Integrated Pulsed-Optically Pumped Atomic Clock
Michael Huang, Arielle Little, James Camparo Aerospace Corporation, United States		

09:00	5168	Multipole Moments of the CPT Density Matrix in Polarization Modulation Conditions
Zachary Warren, James Camparo Aerospace Corporation, United States		
09:20	5110	Frequency-Doubled Laser System at 780 nm for Pulsed Vapor-Cell Clocks
Michele Gozzelino, Salvatore Micalizio, Elio Bertacco, Filippo Levi, Claudio Eligio Calosso INRiM - Istituto Nazionale di Ricerca Metrologica, Italy		
09:40	5121	Versatile Microfabricated Alkali Vapor Cells Using Local Sealing
Vincent Maurice ⁵ , Clément Carlé ² , Shervin Keshavarzi ² , Ravinder Chutani ⁴ , Samuel Queste ² , Ludovic Gauthier-Manuel ¹ , Jean-Marc Cote ² , Rémy Vicarini ¹ , Rodolphe Boudot ³ , Nicolas Passilly ² ¹ FEMTO-ST, France, ² FEMTO-ST Institute, France, ³ FEMTO-ST Institute, CNRS, France, ⁴ IEMN, France, ⁵ IEMN - Centrale Lille, France		
10:00	5176	New Approaches for Cost Reduction in Microfabricated Atomic Clocks
Motoaki Hara ¹ , Yuichiro Yano ¹ , Satoshi Shinada ¹ , Zhijian Zhao ² , Masaya Toda ² , Hiroyuki Ito ³ , Takahito Ono ² , Tetsuya Ido ¹ ¹ National Institute of Information and Communications Technology, Japan, ² Tohoku University, Japan, ³ Tokyo Institute of Technology, Japan		

Session C1L-2 – 27/04 08:40 – 10:20

G6: Techniques & Theory

Location: Room 2

Session chair: Murray Barrett , NUS

08:40	5195	Low-Noise Near-Ultraviolet Photonic Integrated Lasers
Anat Siddharth ¹ , Thomas Wunderer ² , Grigory Lihachev ¹ , Andrey Voloshin ¹ , Camille Haller ¹ , Rui Ning Wang ¹ , Marke Teepe ² , Zhihong Yang ² , Junqiu Liu ¹ , Johann Riemensberger ¹ , Nicolas Grandjean ¹ , Noble Johnson ² , Tobias Kippenberg ¹ ¹ École Polytechnique Fédérale de Lausanne, Switzerland, ² Palo Alto Research Center, United States		
09:00	5209	Towards the Development of a Compact-Monolithic Iodine Frequency Stabilized Laser Setup for Ground Tests of LISA Payload
Alexis Mehlman ⁴ , David Holleville ² , Michel Lours ³ , Rodolphe Le Targat ³ , Sébastien Bize ³ , Ouali Acef ³ , Aurélien Boutin ¹ , Karine Lepage ¹ , Ludovic Fulop ¹ ¹ iXblue, France, ² LNE-SYRTE, Observatoire de Paris, France, ³ LNE-SYRTE, Observatoire de Paris - Université PSL, CNRS, Sorbonne Université, France, ⁴ SYRTE Laboratory, Observatoire de Paris/iXblue, France		

09:20	5144	Improving the Signal/Noise Ratio on Optical Comb-Based Frequency Measurements Using a Track&Hold Amplifier
Matias Risaro ² , Paolo Savio ¹ , Davide Calonico ² , Filippo Levi ² , Cecilia Clivati ² ¹ Fondazione LINKS, Italy, ² INRiM - Istituto Nazionale di Ricerca Metrologica, Italy		
09:40	5040	Atomic Structure Calculations for the Intercombination and Clock Levels in Hg and Cd
Jesse Schelfhout, John McFerran University of Western Australia, Australia		
10:00	5218	Spectroscopic Effects Nonlinear in Atomic Density Caused by the Free Motion of Atoms in a Gas
Valeriy Yudin ² , Alexey Taichenachev ¹ , Maksim Basalae ³ , Oleg Prudnikov ² , Sergey Bagayev ¹ ¹ Institute of Laser Physics SB RAS, Russia, ² Institute of Laser Physics, Novosibirsk State University, Russia, ³ Novosibirsk State University, Russia		

Session C1L-3 – 27/04 08:40 – 10:20

G5: Traceability & the SI Second

Location: Room 3

Session chair: Per Olof Hedekvist, RISE

08:40	5304	Roadmap Towards the Redefinition of the Si Second
Noel Dimarcq CNRS -Université Cote d'Azur - Observatoire Cote d'Azur, France		
09:20	5113	Current Activity of the Consultative Committee for Time and Frequency to Address the Needs of Time and Frequency Metrology and its Applications
Noel Dimarcq ² , Patrizia Tavella ¹ ¹ BIPM Bureau International des Poids et Mesures, France, ² CNRS -Université Cote d'Azur - Observatoire Cote d'Azur, France		
09:40	5088	Traceability to UTC from GNSS Measurements
Pascale Defraigne ⁵ , Pierre Uhrich ¹ , Joseph Achkar ¹ , Andreas Bauch ⁴ , Judah Levine ² , Michael Wouters ³ ¹ LNE-SYRTE, Observatoire de Paris - Université PSL, CNRS, Sorbonne Université, France, ² National Institute of Standards and Technology, United States, ³ National Measurement Institute, Australia, ⁴ Physikalisch-Technische Bundesanstalt, Germany, ⁵ Royal Observatory of Belgium, Belgium		

10:00	5136	Selected Aspects of Traceability and Uncertainty of Frequency Measurements with Counters
Dirk Piester, Egle Staliuniene, Andreas Bauch Physikalisch-Technische Bundesanstalt, Germany		

Session C2L-1 – 27/04 10:50 – 12:30

G3: Fundamental Physics & Precision Metrology

Location: Room 1

Session chair: Sebastien Bize , SYRTE

10:50	5305	Long-Lived Spin Squeezing in a Metrologically Relevant Regime
Jose Alberto De La Paz Espinosa ² , Carlos Leonardo Garrido Alzar ² , Meng-Zi Huang ¹ , Alice Sinatra ¹ , Jakob Reichel ¹ ¹ ENS-Université PSL, CNRS, Sorbonne Université, France, ² LNE-SYRTE, Observatoire de Paris - Université PSL, CNRS, Sorbonne Université, France		
11:30	5244	Test of the Sagnac Effect by Accurate Measurements with a Dual-Axis Cold-Atom Gyroscope
Mohamed Guessoum ³ , Romain Gautier ² , Quentin Bouton ² , Leonid Sidorenkov ¹ , Arnaud Landragin ⁴ , Remi Geiger ² ¹ LNE-SYRTE, Observatoire de Paris - Université PSL, CNRS, Sorbonne Université, France, ² SYRTE, France, ³ SYRTE - Observatoire de Paris, France, ⁴ SYRTE, Observatoire de Paris, France		
11:50	5147	Ultra-High Precision Laser Spectroscopy of Antihydrogen
Janko Nauta Swansea University, United Kingdom		
12:10	5297	Precision Metrology with Photons, Phonons and Spins
Michael Tobar, Jeremy Bourhill, William Campbell, Elrina Hartman, Eugene Ivanov, Maxim Goryachev, Benjamin McAllister, Aaron Quiskamp, Catriona Thomson, Alexey Veryaskin, Zijun Zhao University of Western Australia, Australia		

Session C2L-2 – 27/04 10:50 – 12:30

G4: Resonant Sensors & Energy Harvesters

Location: Room 2

Session chair: Jérôme Juillard , CentraleSupélec

10:50	5063	H2MEMS Project: Resonant MEMS for Detection of Hydrogen Release in Radioactive Waste Disposal Facility
Isabelle Dufour ⁴ , Luis Iglesias Hernandez ⁴ , Priyadarshini Shanmugam ⁵ , Jean-Francois Michaud ⁵ , Laurent Colin ⁵ , Daniel Alquier ⁵ , Dominique Certon ⁵ , Maria-Dolores Manrique-Juarez ³ , Thierry Leïchl�� ³ , Fabrice Mathieu ³ , Laurent Mazonq ³ , Liviu Nicu ³ , Luan Nguyen ² , S��bastien Chenot ² , Marc Portail ² , Johan Bertrand ¹ ¹ Andra, France, ² CNRS-CRHEA, France, ³ CNRS-LAAS, France, ⁴ Universit�� de Bordeaux, France, ⁵ Universit�� de Tours, France		
11:30	5138	Electrostatic Frequency Tuning of a Quatrefoil Suspension Gyroscope
Madan Parajuli ² , Guillermo Sobreviola ¹ , Ashwin Seshia ² ¹ Silicon Microgravity, United Kingdom, ² University of Cambridge, United Kingdom		
11:50	5249	A Highly Sensitive Magnetic Field SAW Sensor on Metglas
Prince Mengue ¹ , Omar Elmazria ¹ , Baptiste Paulmier ¹ , Anna Maria Friedel ¹ , S��bastien Petit-Watelot ¹ , Thomas Hauet ¹ , Sergei Zhgoon ² , Daniel Lacour ¹ , Michel Hehn ¹ , Sami Hage-Ali ¹ ¹ Institut jean lamour, France, ² National Research University “MPEI”, Russia		
12:10	5134	Planar Grin Lenses for MEMS Energy Harvester: a Macroscale Proof of Concept
Valentina Zega, Marco Antonacci, Attilio Frangi, Alberto Corigliano, Emanuele Riva Politecnico di Milano, Italy		

Session C2L-3 – 27/04 10:50 – 12:30

G5: Optical Time Transfer II

Location: Room 3

Session chair: Laura Sinclair , NIST

10:50	5197	One Year of WR Link Operation Between Two UTC(k)
Pierre Waller ¹ , Cedric Plantard ¹ , Erik Dierikx ² , Yan Xie ² ¹ ESA/ESTEC, Netherlands, ² VSL, Netherlands		
11:10	5100	Fiber Optic Time Transfer from UTC(k) to a VLBI Antenna in a Coherent Communication Network
Per Olof Hedekvist ¹ , Sven-Christian Eb��nhag ¹ , Carsten Rieck ¹ , Magnus Bergroth ² ¹ RISE Research Institutes of Sweden AB, Sweden, ² SUNET, Sweden		

11:30	5120	A Pulsed-Optical Frequency and Timing Distribution System for Deep Space Antennas
Kemal Shafak ¹ , Anan Dai ¹ , Franz. X. Kärtner ¹ , Benjamin Rudin ⁴ , Florian Emaury ⁴ , Oliver Lange ³ , Werner Lange ³ , Sinda Mejri ² ¹ Cycle GmbH, Germany, ² European Space Agency, Germany, ³ Lange-Electronic GmbH, Germany, ⁴ Menhir Photonics AG, Switzerland		
11:50	5242	Long Distance Free Space Optical Time and Frequency Transfer: Towards Satellite–Ground Link at 10-18 Instability
Qi Shen ² , Jian-Yu Guan ² , Lei Hou ² , Ting Zeng ² , Min Li ² , Jin-Jian Han ² , Meng-Zhe Lian ² , Yan-Wei Chen ² , Yuan Cao ² , Zhao-Hui Li ¹ , Jin-Cai Wu ¹ , Jian-Jun Jia ¹ , Sheng-Kai Liao ² , Ji-Gang Ren ² , Juan Yin ² , Cheng-Zhi Peng ² , Haifeng Jiang ³ , Qiang Zhang ² , Jian-Wei Pan ² ¹ Key Laboratory of Space Active Opto-Electronic Technology, Shanghai Institute of Technical Physics, China, ² University of Science and Technology of China, China, ³ University of Science and Technology of China, National Time Service Center, CAS, China		

Session C3L-1 – 27/04 14:00 – 16:00

G1: Aluminum Scandium Nitride Devices

Location: Room 1

Session chair: Azadeh Ansari , Georgia Institute of Technology

14:00	5159	X-Band Multi-Frequency 30% Compound ScAlN Microacoustic Resonators and Filters for 5G-Advanced and 6G Applications
Gabriel Giribaldi, Michele Pirro, Bernard Herrera Soukup, Meruyert Assylbekova, Giuseppe Michetti, Luca Colombo, Matthew Conte, Matteo Rinaldi Northeastern University, United States		
14:20	5289	Frequency Reprogrammable Al _{0.7} Sc _{0.3} N Acoustic Delay Line with Up to 13.5 % Bandwidth
Onurcan Kaya, Xuanyi Zhao, Cristian Cassella Northeastern University, United States		
14:40	5184	High-Performance SAW Resonators at 3 GHz Using AlScN on a 4H-SiC Substrate
Xingyu Du, Zichen Tang, Chloe Leblanc, Deep Jariwala, Roy H. Olsson III University of Pennsylvania, United States		
15:00	5156	Improving Thermal Linearity and Quality Factor of Al ₇₂ Sc ₂₈ N Contour Mode Resonators Using Acoustic Metamaterials Based Lateral Anchors
Xuanyi Zhao, Onurcan Kaya, Michele Pirro, Sungho Kang, Cristian Cassella Northeastern University, United States		

15:20	5291	A 7 GHz – 13.4 GHz Complementary-Switchable Thickness-Extensional Bulk Acoustic Resonator Using Laminated Ferroelectric Sc _{0.28} Al _{0.72} N
Dicheng Mo, Shaurya Dabas, Sushant Rassay, Roozbeh Tabrizian University of Florida, United States		
15:40	5281	Intrinsically Tunable Laminated Ferroelectric Sc _{0.28} Al _{0.72} N Extensional Resonator Based on Local Polarization Switching
Shaurya Dabas, Dicheng Mo, Sushant Rassay, Roozbeh Tabrizian University of Florida, United States		

Session C3L-2 – 27/04 14:00 – 16:00

G6: Clocks II

Location: Room 2

Session chair: Uwe Sterr , PTB

14:00	5158	Optical Frequency Ratios Between a Highly Charged Ion Clock and a ¹⁷¹ Yb ⁺ Clock
Steven King ² , Lukas Spieß ² , Alexander Wilzewski ² , Peter Micke ² , Tobias Leopold ² , Erik Benkler ² , Richard Lange ² , Nils Huntemann ² , Piet Schmidt ³ , José Crespo López-Urrutia ¹ ¹ Max-Planck-Institut für Kernphysik, Germany, ² Physikalisch-Technische Bundesanstalt, Germany, ³ Physikalisch-Technische Bundesanstalt and Leibniz Universität Hannover, Germany		
14:40	5245	First Measurements with a Portable Yb Optical Lattice Clock
Wesley Brand, Robert Fasano, Yun-Jihh Chen, Richard Fox, Andrew Ludlow National Institute of Standards and Technology and University of Colorado Boulder, United States		
15:00	5288	Compact and Portable Cavity-Stabilized Laser with Broadband EOM Feedback for Low Phase Noise
Megan Kelleher ³ , Charles McLemore ³ , Dahyeon Lee ³ , Scott Diddams ² , Franklyn Quinlan ¹ ¹ National Institute of Standards and Technology, United States, ² National Institute of Standards and Technology and University of Colorado, Boulder, United States, ³ University of Colorado Boulder, United States		
15:20	5164	Two-Color Grating Magneto-Optical Trap for Narrow-Line Laser Cooling
Saskia Anna Bondza ² , Christian Lisdat ² , Stefanie Kroker ² , Tobias Leopold ¹ ¹ Deutsches Luft- und Raumfahrtzentrum, Germany, ² Physikalisch-Technische Bundesanstalt, Germany		

15:40	5054	Absolute Frequency Measurement of the Sr+ Ion Optical Clock with a Fourfold Uncertainty Reduction
Pierre Dubé, Bin Jian, Marina Gertsvolt National Research Council Canada, Canada		

Session C3L-3 – 27/04 14:00 – 16:00

G3: Chip-scale Atomic Clocks

Location: Room 3

Session chair: John Kitching , NIST

14:00	5011	Chip Scale Rubidium Oscillator for Space Application
Serge Grop ² , Jacques Haesler ¹ , Joseph Gouloumet ² , Sylvain Karlen ¹ , Davide Grassani ¹ , Vito Genna ² , Christian Schori ² , Laurent Balet ¹ , Benjamin Gallinet ¹ , Fabien Droz ¹ , Steve Lecomte ¹ ¹ CSEM SA, Switzerland, ² Orovia Switzerland, Switzerland		
14:20	5014	Tackling Light-Shifts in a Microcell Atomic Clock with Symmetric Auto-Balanced Ramsey Sequence
Clément Carlé ¹ , Moustafa Abdel Hafiz ¹ , Nicolas Passilly ¹ , Jean-Marie Danet ⁴ , Claudio Eligio Calosso ³ , Rodolphe Boudot ² ¹ FEMTO-ST Institute, France, ² FEMTO-ST Institute, CNRS, France, ³ INRiM - Istituto Nazionale di Ricerca Metrologica, Italy, ⁴ SYRLINKS, France		
14:40	5119	Adapting a Flat-Form Factor Miniature Atomic Clock to a Commercial Package: Preliminary Characterization
Davide Grassani ¹ , Laurent Balet ¹ , Olivia Hefti ² , Sylvain Karlen ¹ , Fabien Droz ¹ , Joseph Gouloumet ³ , Serge Grop ³ , Christian Schori ³ , Jacques Haesler ¹ , Steve Lecomte ¹ ¹ CSEM SA, Switzerland, ² CSEM/PSI, Switzerland, ³ Orovia Switzerland, Switzerland		
15:00	5097	Long-Term Instability of a Pulsed Optically Pumped Micro-Cell Rubidium Frequency Standard
Etienne Batori ³ , Christoph Affolderbach ³ , Florian Gruet ³ , Matthieu Pellaton ³ , Gaetano Mileti ³ , Yuanyan Su ¹ , Maddalena Violetti ² , Anja K. Skrivervik ¹ ¹ École Polytechnique Fédérale de Lausanne, Switzerland, ² Toscana Life Sciences, École Polytechnique Fédérale de Lausanne, Switzerland, ³ Université de Neuchâtel, Switzerland		
15:20	5074	Low Phase Noise Low Power Atomic Clocks
Peter Cash, Igor Kosvin, Hoklay Park, Matt Stanczyk, Mike F. Wacker Microchip Technology, United States		
15:40	5151	Miniature Atomic Clock Driven by an Application Specific Integrated Circuit (ASIC)
Yves-Julien Regamey, David Ruffieux, Sylvain Karlen, Jacques Haesler, Steve Lecomte CSEM SA, Switzerland		

Session D1L-1 – 28/04 08:40 – 10:20

G1: RF Acoustic Techniques & Devices

Location: Room 1

Session chair: Alexandre Reinhardt , CEA

08:40	5087	Conception of Wide Band Surface Acoustic Waves Filter in L-Band Based on Lithium Niobate Substrate
Alexandre Clairet ¹ , Thierry Laroche ¹ , Eric Michoulier ¹ , Bruno Lelong ² , Jean-Michel Hodé ² , Florent Bernard ¹ , Emilie Courjon ¹ , Sylvain Ballandras ¹ ¹ Frec n sys, France, ² Thales DMS, France		
09:00	5058	Self-Excitation in Electrostatically Actuated Non-Identical Coupled Curved Microbeams
Lior Medina ¹ , Ashwin Seshia ² ¹ Tel-Aviv University, Israel, ² University of Cambridge, United Kingdom		
09:20	5238	Transverse Mode Suppression Based on Optimized Tilted Transducer for NS-SAW Resonator
Shuxian Wu ¹ , Ming Li ³ , Feng Xu ¹ , Feihong Bao ¹ , Gongbin Tang ² , Jie Zou ¹ ¹ Fudan University, China, ² Institute of Novel Semiconductors, Shandong University, China, ³ Shandong University, China		
09:40	5004	Study on the Spurious Modes in FBAR Resonators with Quasi-Free Edges
Chin-Yu Chang ¹ , Yan-Ming Huang ¹ , Tzu-Hsuan Hsu ¹ , Yung-Hsiang Chen ² , Rakesh Chand ³ , Yelehanka Pradeep ³ , Yens Ho ² , Ming-Huang Li ¹ , Weileun Fang ¹ , Sheng-Shian Li ¹ ¹ National Tsing Hua University, Taiwan, ² Vanguard International Semiconductor Corporation, Taiwan, ³ Vanguard International Semiconductor Corporation Singapore PTE. Ltd., Singapore		

Session D1L-2 – 28/04 08:40 – 10:20

G3/6 Joint: Ion Clocks

Location: Room 2

Session chair: Rachel Godun , NPL

08:40	5129	An Ensemble of Prototype Yb+ Microwave Ion Clocks
Daniel Thrasher, Peter Schwindt, Brendan Gunning, Erik Skogan, Ganapathi Subramania, Mary Crawford, Yuan-Yu Jau Sandia National Laboratories, United States		

09:00	5122	Evaluation of a Sympathetically Cooled In+ Ion Clock
Tanja E. Mehlstäubler ² , Tabea Nordmann ¹ , Jonas Keller ¹ , Jan Kiethe ¹ , Hartmut Nimrod Hausser ¹ , Leon Schomburg ¹ , Hongli Liu ³ , Nishant Bhatt ¹ , Richard Lange ¹ , Nils Huntemann ¹ , Ekkehard Peik ¹ , Erik Benkler ¹ , Sören Dörscher ¹ , R. Schwarz ¹ , Christian Lisdat ¹		
¹ Physikalisch-Technische Bundesanstalt, Germany, ² Physikalisch-Technische Bundesanstalt and Leibniz Universität Hannover, Germany, ³ PTBPhysikalisch-Technische Bundesanstalt, Germany		
09:20	5101	27Al+ Clock at PTB - Recent Improvements on the Error Budget
Johannes Kramer ⁴ , Fabian Dawel ³ , Marek Hild ² , Steven King ² , Nicolas Spethmann ² , Piet Schmidt ³ , Miroslav Doležal ¹		
¹ Czech Metrology Institute, Czech Rep., ² Physikalisch-Technische Bundesanstalt, Germany, ³ Physikalisch-Technische Bundesanstalt and Leibniz Universität Hannover, Germany, ⁴ PTB Braunschweig, Germany		
09:40	5165	Tailored Optical Clock Transition in 40Ca+
Lennart Pelzer ⁴ , Kai Dietze ⁴ , Johannes Kramer ⁴ , Fabian Dawel ⁴ , Ludwig Krinner ⁴ , Nicolas Spethmann ³ , Piet Schmidt ⁴ , Victor Jose Martinez-Lahuerta ² , Klemens Hammerer ² , Nati Aharon ¹ , Alex Retzker ¹		
¹ Hebrew University of Jerusalem, Israel, ² Leibniz Universität Hannover, Germany, ³ Physikalisch-Technische Bundesanstalt, Germany, ⁴ Physikalisch-Technische Bundesanstalt and Leibniz Universität Hannover, Germany		
10:00	5030	A High-Performance Sympathetically-Cooled Cd+ Microwave Frequency Standard
Haoran Qin, Jize Han, Nongchao Xin, Shengnan Miao, Yiting Chen, Jianwei Zhang, Lijun Wang		
Tsinghua University, China		

Session D1L-3 – 28/04 08:40 – 10:20

G5: Timescales

Location: Room 3

Session chair: Gerard Petit , Time Department, BIPM

08:40	5069	A New Way to Set the Maximum Weight in the Weighting Algorithm of UTC
James Milton ² , Gianna Panfilo ¹		
¹ BIPM Bureau International des Poids et Mesures, France, ² University of Edinburgh, United Kingdom		

09:00	5099	Improvements to the UTC(NPL) Steering Protocol – On-Demand Estimation of Time Offset from UTC
Josh Whale, Richard Hendricks, Adam Peverell, Krzysztof Szymaniec, Peter Whibberley, Conway Langham, Elizabeth Laier English National Physical Laboratory, United Kingdom		
09:20	5171	Design of a Robust and Precise Timing Facility for the European Navigation Satellite System
Johann Furthner, Laura Agazzi, Pia Kindl, Thomas Schilling, Markus Schmitt German Aerospace Center (DLR), Germany		
09:40	5076	A ‘Total’ Imputation Algorithm That Fills Gaps in Time Series Measurements for ADEV and Phase Noise Characterizations of Power-Law Noise Models
David Howe ¹ , Chloe Champagne ² , Noah Schlossberger ³ ¹ National Institute of Standards and Technology and University of Colorado Boulder, United States, ² Naval Research Lab, Wash DC, United States, ³ University of Colorado Boulder, United States		
10:00	5212	Mixing UTCr and Cesium Fountain Measurements for the Generation of UTC(IT)
Valerio Formichella ¹ , Giovanna Signorile ¹ , Tung Than Thai ¹ , Michele Gozzelino ¹ , Ilaria Sesia ¹ , Filippo Levi ¹ , Giovanni A. Costanzo ² ¹ INRiM - Istituto Nazionale di Ricerca Metrologica, Italy, ² INRiM - Istituto Nazionale di Ricerca Metrologica and Politecnico di Torino, Italy		

Session D2L-1 – 28/04 10:50 – 12:30

G2: Oscillators & Measurements

Location: Room 1

Session chair: Enrico Rubiola , FEMTO-ST, Besançon

10:50	5225	Photonic Microwave Generator As Quantum-Enabled Local Oscillator for Radars
Maximilian Bradler ¹ , Maurice Lessing ¹ , Benjamin Sprenger ¹ , Marc Fischer ¹ , Michele Giunta ¹ , Ronald Holzwarth ¹ , Jonathan M. Jones ² , Darren Griffiths ² , Jithin Kannanthara ² , Mike Antoniou ² , Chris Baker ² , Mohammed Jahangir ² , Yeshpal Singh ² , Kai Bongs ² ¹ Menlo Systems GmbH, Germany, ² University of Birmingham, United Kingdom		

11:30	5200	Miniaturized High-Reliability Lasers for Quantum Technologies
Rachel Cannon ² , Sean Dyer ³ , Erling Riis ³ , James McGilligan ³ , Paul Griffin ³ , Douglas Bremner ¹ , Una Marvet ¹		
¹ Alter Technology TÜV Nord UK Ltd, United Kingdom, ² Alter Technology TÜV Nord UK Ltd/University of Strathclyde, United Kingdom, ³ University of Strathclyde, United Kingdom		
11:50	5274	The Cool Oscillator Energy-Mode Model for Advanced Performance Analysis and Prediction
Michael Underhill		
Underhill Research, United Kingdom		
12:10	5230	Comparison Between Cross-Spectrum and Spectrum Average Generalized to Q-Devices
Antoine Baudiquez ² , Éric Lantz ¹ , Enrico Rubiola ² , François Vernotte ²		
¹ Femto-ST, France, ² FEMTO-ST Institute, Italy, ² FEMTO-ST Institute, France		

Session D2L-2 – 28/04 10:50 – 12:30

G6: Stable Lasers

Location: Room 2

Session chair: Rodolphe Le Targat , SYRTE

10:50	5096	Noise Contributions in Crystalline Mirror Coatings
Jialiang Yu ² , Thomas Legero ² , Fritz Riehle ² , Chun Yu Ma ² , Sofia Herbers ² , Daniele Nicolodi ² , Dhruv Kedar ¹ , Eric Oelker ³ , Jun Ye ¹ , Uwe Sterr ²		
¹ JILA, NIST and university of Colorado, United States, ² Physikalisch-Technische Bundesanstalt, Germany, ³ University of Glasgow, United Kingdom		
11:30	5067	Towards a 4×10^{-17} Fractional Frequency Instability Laser Based on a Room Temperature Optical Cavity
Marco Schioppo, Jacob Tunesi, Anthony Harwood, Helen S. Margolis		
National Physical Laboratory, United Kingdom		
11:50	5091	Multi-Spectral Hole Probing for Laser Frequency Stabilization
Michael Hartman ³ , Shuo Zhang ² , Xiuji Lin ³ , Rodolphe Le Targat ² , Philippe Goldner ¹ , Bess Fang ³ , Signe Seidelin ⁴ , Yann Le Coq ²		
¹ Chimie ParisTech, France, ² LNE-SYRTE, Observatoire de Paris - Université PSL, CNRS, Sorbonne Université, France, ³ SYRTE, France, ⁴ Université Grenoble Alpes, France		
12:10	5214	Ultrastable Laser System for Sr Lattice Clocks
Manuel Brekenfeld ¹ , Benjamin Rauf ¹ , Sarah Saint-Jalm ¹ , Maurice Lessing ¹ , Andreas Fricke ¹ , Benjamin Sprenger ¹ , Marc Fischer ¹ , Michele Giunta ¹ , Ronald Holzwarth ¹ , Gar-Wing Truong ² , Seth B. Cataño-Lopez ² , Garrett D. Cole ²		
¹ Menlo Systems GmbH, Germany, ² Thorlabs Crystalline Solutions, United States		

Session D2L-3 – 28/04 10:50 – 12:30

G5: Microwave Satellite Time Transfer

Location: Room 3

Session chair: Pascale Defraigne , ORB

10:50	5070	CNES Accurate Monitoring of GNSS Time Scales Based on Absolute Calibration
Jerome Delporte, David Valat CNES, France		
11:10	5117	Continuous IPPP Links for UTC
G�rard Petit, Fr�d�ric Meynadier, Aur�lie Harmegnies, Camille Parra BIPM Bureau International des Poids et Mesures, France		
11:30	5049	Inventory of Error Sources Limiting GNSS-Based Frequency Transfer
Ahmed Elmaghraby, Thomas Krawinkel, Steffen Sch�n Leibniz Universit�t Hannover, Germany		
11:50	5208	Understanding TWSTFT Diurnals
Fr�d�ric Meynadier ¹ , Carsten Rieck ³ , Kenneth Jaldehag ² ¹ BIPM Bureau International des Poids et Mesures, France, ² RISE, Sweden, ³ RISE Research Institutes of Sweden AB, Sweden		
12:10	5034	GNSS Time Transfer Exploiting High-Gain Antennas
Esteban Garbin ³ , Ricardo Piriz ³ , Francisco Gonzalez ¹ , Erik Schoenemann ¹ , Daniel Garcia ⁴ , Cedric Platard ¹ , Florian Reckeweg ¹ , Pierre Waller ² ¹ ESA, Netherlands, ¹ ESA, Germany, ² ESA/ESTEC, Netherlands, ³ GMV, Spain, ⁴ Prodetel, Spain		

15 Next conference



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