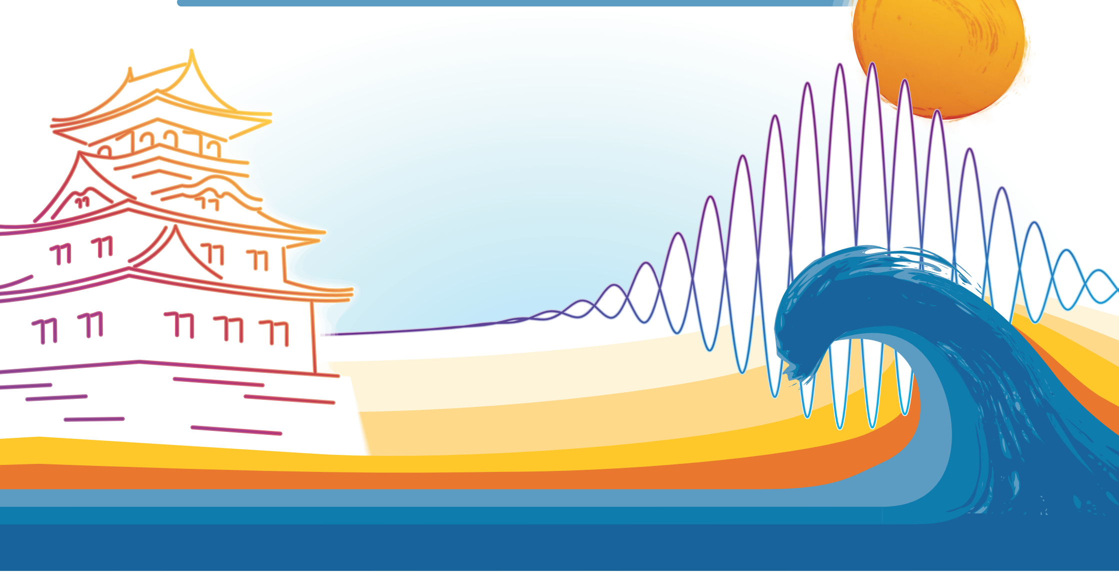
Symposium Proceedings

2023 Joint Conference of the European Frequency and Time Forum and IEEE International Frequency Control Symposium (EFTF/IFCS)

IEEE EFTF–IFCS 2023



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2023 Joint Conference of the European Frequency and Time Forum and IEEE International Frequency Control Symposium (EFTF/IFCS)

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Daily Program – Monday, May 15

Program of
Monday, May 15

8:30 – 18:00 REGISTRATION OPEN

9:10 – 10:50 TUTORIALS 1

TRACK 3	TRACK 2	TRACK 1
Microwave Frequency Standards	Measurements of Phase Fluctuations	Thin Film Lithium Niobate & Lithium Tantalate Acoustic Resonators
Lecture Hall 2	Lecture Hall 3	Lecture Hall 4

10:50 – 11:10 COFFEE BREAK

11:10 – 12:50 TUTORIALS 2

TRACK 3	TRACK 2	TRACK 1
Atomic Timekeeping in Space	Generation of Real-Time Timescale using Averaged Ensemble Clocks	XBARs and around-5 GHz Resonators & Filters Exploiting Thin Layers of LN
Lecture Hall 2	Lecture Hall 3	Lecture Hall 4

12:50 – 14:10 LUNCH BREAK

14:10 – 15:50 TUTORIALS 3

TRACK 3	TRACK 2	TRACK 1
Optical Clocks and their Applications	GNSS Time Transfer and its Calibration	Opto-mechanical Crystals: Hybrid Devices for Quantum Phys. to Metrology
Lecture Hall 2	Lecture Hall 3	Lecture Hall 4

15:50 – 16:10 COFFEE BREAK

16:10 – 17:50 TUTORIALS 4

TRACK 3	TRACK 2	TRACK 1
The SI Second: History, Future Redefinition and Impact	Low-Noise Digital Electronics for Time and Frequency Metrology	Electromechanical & Ultrasonic Sensors for Structural Health Monitoring
Lecture Hall 2	Lecture Hall 3	Lecture Hall 4

18:00 CONVENTION CENTER CLOSES

9:00 –
ADMINISTRATIVE
Committee Meetings (private)
Meeting Room
All day, check your schedules!

12:50 – 14:10
TUTORIAL ATTENDEES ONLY
Collect your Lunch Box!
Conference Center

14:15 – 18:00
EXHIBITORS
Technical Exhibition Set-up
Foyer Areas

18:00 – 20:00 SOCIAL EVENT
ALL ATTENDEES
IEEE IFCS-EFTF 2023
Welcome Reception
Toyama Grand Plaza

7 minute walk from the Conference Center

Register and get your badge here!

Join us on the hybrid platform
https://ifcs-eftf2023.conflux.events/

Daily Program – Tuesday, May 16

Program of
Tuesday, May 16

8:00 – 19:00 **REGISTRATION OPEN**

9:00 – 10:20 **PLENARY 1**

PLENARY

Takaaki Kajita

The KAGRA gravitational wave project

Main Hall

10:20 – 10:40 **COFFEE BREAK**

10:40 – 12:30 **LECTURES 1**

GROUP 6	GROUP 5	GROUP 4	GROUP 1
Searches for Fundamental Physics and Space-based Systems	Fiber Frequency Transfer	Resonant Sensors and Transducers	LN Acoustic Resonator Devices
Main Hall	Lecture Hall 2	Lecture Hall 3	Lecture Hall 4

12:30 – 14:00 **LUNCH BREAK**

14:00 – 15:50 **LECTURES 2**

GROUP 6	GROUP 3	GROUP 5	GROUP 2
Ion Clocks	Vapor Cell Clocks	GNSS and TWSTFT	Digital Techniques for Time and Frequency control
Main Hall	Lecture Hall 2	Lecture Hall 3	Lecture Hall 4

15:50 – 16:10 **COFFEE BREAK**

16:10 – 18:00 **LECTURES 3**

GROUP 6	GROUP 5	GROUP 4	GROUP 2
Transportable and Compact Systems	Fiber Time Transfer	Sensors for Structural Health Monitoring	Tools and Techniques for Phase & Frequency Noise Measurement
Main Hall	Lecture Hall 2	Lecture Hall 3	Lecture Hall 4

18:05 – 18:55

Satellite Meeting (private)

TWSTFT Meeting

Meeting Room

19:00 **CONVENTION CENTER CLOSES**

10:10 – 18:00

OPEN TO ALL

Technical Exhibition

Foyer Areas

12:10 – 13:40 closed for lunch

OPEN TO ALL

Technical Exhibition

Foyer Areas

12:30 – 14:00

ALL ATTENDEES

Lunch Buffet at Crowne Plaza Hotel

Otori Room

18:30 – 20:30

REGISTERED PARTICIPANTS

Women in Engineering Event at Crowne Plaza Hotel

Asuka Room

Daily Program – Wednesday, May 17

Program of
Wednesday, May 17

8:00 – 17:00 REGISTRATION OPEN

8:50 – 10:30 POSTERS 1

ALL GROUPS	ALL GROUPS	ALL GROUPS
Posters from all groups and topics		
Coffee Service in 2F Foyer		
1F Deli Area	3F North Area	3F South Area

8:45 – 15:50

OPEN TO ALL
Technical Exhibition
Foyer Areas

12:10 – 13:40
closed for lunch

10:40 – 12:30

GROUP 6	GROUP 1 + 4	GROUP 5
Optical Timescales and TAI Contributions	Piezoelectric MEMS/NEMS Resonators	Novel Concepts
Main Hall	Lecture Hall 2	Lecture Hall 3

12:30 – 14:00 LUNCH BREAK

12:30 – 14:00

ALL ATTENDEES
Lunch Buffet and UFFC Transactions Event at Crowne Plaza Hotel
Otori Room

14:00 – 15:50 LECTURES 5

GROUP 6	GROUP 5	GROUP 1
Neutral Atom and Nuclear Clocks	Timescales	MEMS and BAW Resonators
Main Hall	Lecture Hall 2	Lecture Hall 3

OPEN TO ALL
Technical Exhibition
Foyer Areas

16:00 – 16:45 NETWORKING EVENT

Event organized by IEEE Student Representatives and Young Professionals

Student - Professionals Networking Event
Meeting Room

15:55 – 18:00

ALL DINNER GUESTS
Excursions
Experience Toyama
as you travel to the Gala Dinner
Check your Ticket!

17:00 TICC CLOSES

LAST-CHANCE BUS
For the final bus to the Gala Dinner, please be at the Conference Center entrance NO LATER THAN 17:00!

18:00 - 21:00 SOCIAL EVENT

ALL DINNER GUESTS

IEEE IFCS-EFTF 2023
Gala Dinner

Shogawa Water Memorial Park

~ 22:00 RETURN TO TICC AND STATION

Daily Program – Thursday, May 18

Program of Thursday, May 18

8:00 – 20:00 REGISTRATION OPEN

8:50 – 10:40 LECTURES 6

GROUP 5	GROUP 6	GROUP 1
Sensing and Space	Combs and Photonic Microwave Generation	Piezoelectric and mm-wave Resonators
Main Hall	Lecture Hall 2	Lecture Hall 3

10:40 – 11:00 COFFEE BREAK

11:00 – 12:30 PLENARY 2

PLENARY

11:00 STUDENT POSTER AWARDS

John M. Doyle

Cold and ultra-cold polyatomic molecules for quantum science

Main Hall

12:30 – 14:00 LUNCH BREAK

12:35 – 13:40 INDUSTRY EVENT

Start-up Stories

Event organized by IEEE Young Professionals

David Horsley

Lecture Hall 3

14:00 – 15:50 LECTURES 7

GROUP 5	GROUP 6	GROUP 3
Free-Space Optical Links	Ultrastable Cavities and Laser Systems	Fountain and Cold Atom Clocks
Main Hall	Lecture Hall 2	Lecture Hall 3

16:00 – 17:40 POSTERS 2

ALL GROUPS	ALL GROUPS	ALL GROUPS
1F Deli Area	3F North Area	3F South Area

Posters from all groups and topics

Coffee Service in 2F Foyer

17:30 – 19:00 SPONSORED BAR

17:45 – 18:45 COMMITTEE MEETINGS

Administrative (private)	IFCS Technical Prog. Committee	EFTF Scientific Committee
	Lecture Hall 2	Lecture Hall 3

20:00 CONVENTION CENTER CLOSES

10:30 – 19:00

OPEN TO ALL

Technical Exhibition

Foyer Areas

12:10 – 13:40 closed for lunch

Grab a drink and enjoy the final chance to see the Exhibition!

12:30 – 14:00

ALL ATTENDEES

Lunch Buffet at Crowne Plaza Hotel

Otori Room

17:50 – 18:50

Student Pitch Comp.

Meeting Room

19:00 – 20:00

INVITED GUESTS

President's Reception at Crowne Plaza

Tenku Room

19:00 – 20:30

ALL ARE INVITED

Student Dinner and Scavenger Hunt

Castle Ruins Park

Daily Program – Friday, May 19

Program of
Friday, May 19

8:00 – 18:30 **REGISTRATION OPEN**

8:50 – 10:40 **LECTURES 8**

GROUP 3	GROUP 5	GROUP 2
Compact Optical / Microwave Clocks	Time Distribution	Photonic and Microwave Oscillators
Main Hall	Lecture Hall 2	Lecture Hall 3

10:40 – 11:00 **COFFEE BREAK**

11:00 – 11:30 **LECTURES 9**

GROUP 6
Special Session
Main Hall

Making Optical Lattice Clocks Compact and Useful for Real-World Applications

11:30 – 12:30 **PLENARY 3**

PLENARY
Awards
Main Hall

Presentation of IFCS and EFTF Awards
Summary of IFCS-EFTF 2023

12:30 – 14:00 **LUNCH BREAK**

14:00 – 15:45 **ATF LECTURES 1**

ATF
Selected Presentations
Main Hall

Asia-Pacific Workshop on Time and Frequency
All attendees are invited to join!

15:45 – 16:05 **COFFEE BREAK**

16:05 – 17:30 **ATF LECTURES 2**

ATF
Selected Presentations
Main Hall

Asia-Pacific Workshop on Time and Frequency
All attendees are invited to join!

18:30 **CONVENTION CENTER CLOSES**

12:30 – 14:00
ALL ATTENDEES
Collect your Lunch Box!
Conference Center

14:00 –
ADMINISTRATIVE
Committee Meetings (private)
Meeting Room

MAY 20 **LAB TOUR**
REGISTERED PARTICIPANTS
Tokyo Optical Clock Tour
Visit the Website for Details!

MAY 20 **LAB TOUR**
REGISTERED PARTICIPANTS
Osaka Ion Trapping Tour
Visit the Website for Details!

MAY 22 **LAB TOUR**
REGISTERED PARTICIPANTS
Tokyo Radio Science Tour
Visit the Website for Details!

Thank you for attending **IEEE IFCS–EFTF 2023**

Welcome from the Committee Chairs

Dear Colleagues and Friends:

We are delighted to welcome you to the 2023 Joint Conference of the IEEE Frequency Control Symposium and the European Frequency and Time Forum being held in the coastal city of Toyama in Japan. This year's conference builds on a rich tradition of joint conferences discussing the most recent advances and trends in the areas of time and frequency. The joint conference is held in conjunction with the Asia-Pacific workshop on Time and Frequency for the very first time this year.

The conference is conducted as a hybrid event with the opportunity for both in-person and virtual attendance. All attendees have access to the Conflux platform that hosts recorded presentations and technical materials relating to the lecture and poster presentations.

The conference program commences with twelve tutorials on Monday organized into three tracks. All tutorial participants, both online and in person, will be able to view recordings on the conference online platform for up to 30 days after the end of the conference.

A total of 358 technical papers have been accepted for presentation at the conference with each submitted abstract reviewed by an average of 11 members of the technical program committee. The program is organized into a number of parallel lecture tracks and poster sessions, interspersed by plenary and special sessions. We have two distinguished plenary speakers this year. Professor Takaaki Kajita from the University of Tokyo will present on the KAGRA gravitational wave project and its scientific goals in the plenary session on Tuesday. Professor John M. Doyle from Harvard University will present on polyatomic molecules for quantum science during the second plenary session on Thursday. Other highlights of the technical program include 29 invited lectures spanning the full spectrum of topics associated with the conference. Recordings of all presentations and digital versions of all posters will be available to all registered attendees, whether they are attending virtually, or simply wish to refresh their memory of a lecture they attended in person.

A select number of student papers have been shortlisted for the paper competition by the technical program committee and the winners will be announced during the second plenary on Thursday. The last regular session on Friday will present the laureates of this year IFCS and EFTF awards, followed by two additional sessions of the Asia-Pacific workshop on Time and Frequency that all participants are invited to join.

In-person attendees have the opportunity to take part in the Women in Engineering event, the Industry event, the UFFC Transactions event held during lunch time on Wednesday, and networking and professional mentoring sessions for students and young professionals. In the days following the conference, lab tours visit the laboratories at NICT, RIKEN, NAOJ and Osaka and Kyoto Universities. Additionally, excursions are planned around the city of Toyama to several local landmarks while headed to the Gala Dinner held in Shogawa Water Memorial Park on Wednesday evening.

We are grateful to our many sponsors and exhibitors and are pleased to acknowledge support from the IEEE UFFC society and SFMC, as well as from the many IFCS and EFTF volunteers without whom this conference would not be possible.

We wish you all an enjoyable and productive time in Toyama!

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NICT

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Health Policy

During the covid-19 pandemic, Japan has focused on the “3 Cs” of crowded places, closed spaces and close-contact settings.

An International Symposium is a challenging environment for health management.

We have based the Health Policy of IFCS–EFTF on managing these conditions with three rules:

Be considerate to your colleagues

Please help our attendees have a good time at IFCS–EFTF 2023 and return to their working places in excellent health after the event. If you are not feeling well, please stay at your hotel and attend virtually for the day. As we bring together members of our community from all over the world, we suggest that you wear a face covering as a courtesy to your colleagues. If you would like to wear a mask and do not have one, ask at the registration desk, we have one for you!

Poster sessions require special care

The presenters will spend the poster session in close discussion with a large, interested audience. We want ideas to be exchanged here, not viruses. As such, we urge each audience member to consider wearing a mask during this time. We **require** each presenter to wear a mask throughout the poster session time. We also **require** each presenter to come to the registration desk on the day of their poster display and get their temperature taken.

Encouragement to do the right thing

We have installed thermal cameras at the entrance to help spot attendees running a temperature. If the conference staff asks you to take a more accurate temperature measurement at this or any other time, you are **required** to cooperate in the interest of the health of your colleagues and the conference staff. If we find your temperature to be 38.0°C (100.4°F) or more, you will be asked to leave and return to your accommodation. We can help you find medical attention if you require it. Otherwise please rest and participate virtually until you have recovered. Thank you!

We also strive for the best possible air quality at all events and locations. We trust that the weather will play along when we have our Gala Dinner under open skies!

Helpful Information

Symposium Address
Toyama International Conference Center
1-2 Otemachi, Toyama, 930-0084, Japan

Emergency Numbers
In an emergency, dial 110 for the police or 119 for an ambulance or the fire department.

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

Health and Consideration
As we bring together members of our community from all over the world, we suggest that you wear a face covering (masks are available at the registration counter) as a courtesy to your colleagues. Attendees displaying signs of fever will be asked to attend virtually until their recovery.

Hybrid Conference Format
The Symposium will be accessible to virtual participation by making all lectures and posters available on demand using the Conflux platform at https://ifcs-eftf2023.conflux.events/ . Due to difficulties presented by the different time zones (as well as the associated cost) only the plenary sessions will be live-streamed. Virtual question and answers will take place on the message board for each presentation. We request all authors, including those presenting in person, to check this message board regularly and respond to questions. The virtual platform will be available for 30 days after the end of the Symposium.

Presenters' Slides on the Lecture Hall PCs
Please make sure that you have used the Dropbox link you received by email to upload the slides you would like to find on the PC in the lecture hall at least 72 hours in advance of your presentation. There is no designated opportunity to provide slides at the conference center. Please bring a backup copy on USB memory, but refrain from using this for last second updates.

Wireless Network
WLAN access will be provided at the convention center. The password will be displayed on signboards inside the building.

Symposium App
The Conflux platform provides you with the most comfortable tool for planning your participation at IEEE IFCS–EFTF 2023. Browse the complete program directly from your phone or tablet and create your very own agenda on the fly. To access the platform, scan the QR code to the right.

Photo Policy
Attendance at, or participation in, this conference constitutes consent to the use and distribution by IEEE of the attendees' image or voice for informational, publicity, promotional and/or reporting purposes in print or electronic communications media. No flash photography will be used.

Official Lecture Recordings
All speakers presenting at the venue have agreed to have their lectures recorded and made available online. As an audience member, please be aware that if you participate in the public question and answer sections, your voice or image may also be distributed. If you want to avoid incidental recording, please remain in the upper area of the Main Hall or near the entrance when in one of the other Lecture Halls.

No Unauthorized Recording

Video recording by participants and other attendees during any portion of the Symposium is not allowed without special prior written permission of IEEE. Photographs of copyrighted PowerPoint or other slides are for personal use only and are not to be reproduced or distributed. Do not photograph any such images that are labeled as confidential or proprietary.

Cell Phones

Out of courtesy to speakers and attendees, please keep your phone set to *Manner Mode* (silent) during sessions.

Symposium Lunch Buffet

A lunch buffet will be provided to all registered in-person Symposium attendees at the neighboring Crowne Plaza Hotel's Otori banquet hall on Tuesday, Wednesday, and Thursday. Please wear your Symposium badge to attend lunch.

Boxed Lunches

As attendees may be planning to leave early on the final day of the Symposium, lunch boxes will be provided at the conference center on Friday. There is no buffet at the hotel on this day. Lunch boxes will be available on Monday only for registered participants of the Tutorials.

Welcome Reception

The Welcome Reception is open to all attendees and their registered guests. It opens at 18:00 on Monday at Toyama Grand Plaza, shown on the map on the last page of the program. Please take the opportunity to register and receive your badge at the Welcome Reception to avoid delays on Tuesday morning! Your badge includes drink tickets for the event.

Optional Events

UFFC-S volunteers are hosting some events that are free to attend for registered in-person attendees, including the Women in Engineering Event, the Industry Event, and multiple Student Events. If you have pre-registered for these events, you should find a ticket with your badge. If you have not, please ask at the registration counter if any spare tickets are available!

Gala Dinner

Every regular in-person registration to the Symposium includes a ticket to the IEEE IFCS–EFTF 2023 Gala Dinner held from 18:00 on Wednesday, May 17. Additional tickets are available for sale for guests or exhibitor passes. The venue is

Shogawa Water Memorial Park
1550 Kanaya, Shogawa-machi, Tonami City, Toyama 932-0305, Japan,

about one hour away from the conference center. Be sure to join the Excursion that you are registered for so that you will be certain to have transportation to the Gala Dinner.

Excursions

Your Excursion will be listed on your Gala Dinner ticket. Buses will depart at various times from the conference center, the Crowne Plaza driveway, and the parking lot of the Castle Ruins Park, heading to different locations on the way to the Gala Dinner. Please be at the meeting point in front of the conference center on time. Even if there is a later bus, it may not have any available seats!

Exhibition and Bar Event

Please join us for an event supported by our industry sponsors and enjoy the exhibition areas with a cool drink while they are open for the last time on Thursday, 17:30 – 19:00. You will find some drink tickets with your badge.

Symposium Proceedings

The download link to the Symposium Proceedings will be distributed to attendees via email later in the year.

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.

The IEEE IFCS–EFTF 2023 organizing committee

The Joint Conference of the IEEE International Frequency Control Symposium and European Frequency and Time Forum is possible with support from:

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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.

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.

The roots of Pendulum Instruments date back to the 1950's, when Pendulum was the Swedish branch of Philips Test & Measurement division. Pendulum Instruments was a spin-off in 1998, and has grown substantially since then, via its own development and acquisitions. Today, our products fit the needs of metrology, aerospace and defense, telecom, oscillator manufacturing, RF and Microwave, electronic industries, contract manufacturing and automotive industries, in around 100 countries worldwide.

SpectraDynamics, Inc. (SDI) is a Colorado, USA-based company specializing in high performance instrumentation for quantum, timing and frequency applications. SpectraDynamics new product is a cold Rubidium microwave atomic clock (cRb-CLOCK). Other products include microwave and low noise frequency synthesizers, low noise frequency distribution amplifiers, and optical to RF synthesizers. Our customers include National Time and Frequency Laboratories, Government Agencies, Universities, Department of Defense Contractors and Telecommunications Companies.

As Japan's sole National Research and Development Agency specializing in the field of information and communications technology, NICT is charged with promoting the ICT sector and with research and development in ICT, to drives economic growth and create an affluent, safe, and secure society. NICT is responsible for the important tasks of Generation, Comparison, and Dissemination of Japan Standard Time and Frequency Standards.

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Booth 3–7:
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Booth 3–8: **Swabian Instruments GmbH**

Booth 3–9: **Piktime Systems**
Elproma Elektronika

IFCS 2023 Awards

The Sawyer Award

Aaron Partridge

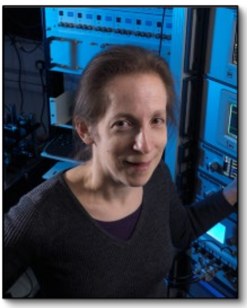
“For entrepreneurial and technical leadership in the field of MEMS-based timing references, and for extensive service to the Frequency Control community.”

The Cady Award

Sunil Bhave

“In recognition of recent breakthroughs in Piezoelectric-MEMS enabled frequency control of light in microresonators and diamond color centers."

The Rabi Award



Helen Margolis

“For exceptional technical contributions and leadership in the development of high accuracy atomic clocks for clock comparisons and tests of fundamental physics.”

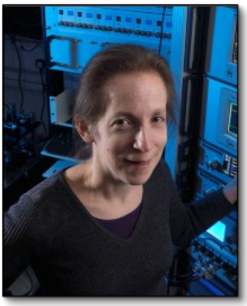
EFTF 2023 Awards

EFTF Young Scientist Award

Steven King

"For his contribution to the development of the Yb+ optical clock and the first optical clock based on a highly charged ion."

The European Frequency and Time Award



Helen Margolis

"For outstanding contributions to scientific developments and leadership in optical frequency metrology and progress towards the redefinition of the SI second."

The Marcel Ecabert Award

Wolfgang Schäfer

"For his enthusiasm and commitment in providing the Time and Frequency Community with forums for sharing experimental results."

IEEE Women-in-Engineering Event

Organized by UFFC-S

18:30 – 20:30 on Tuesday 16 May 2023
Location: ANA Crowne Plaza - ASUKA Room

Dinner and drinks will be provided for registered participants. Ask for remaining tickets at the registration desk!

Centering Intersectionality in Diversity, Equity, & Inclusion!

Join DEI and L&D professional Dwight vom Hofe and Sinda Mejri, UFFC D&I and WIE Chair for an exciting and informative workshop on how to center intersectionality in diversity, equity, and inclusion.

With over 15 years of experience in education, training, and learning design, Dwight is an expert in topics of race, gender, and sexuality in the workplace.

This workshop is perfect for anyone looking to enhance their knowledge and take their understanding of intersectionality to the next level. During this workshop, you will participate in interactive exercises and discussions that will help you understand how intersectionality fits within our DEI. We will dive into the topic of women in STEM and learn practical strategies for implementing real actions in your own community, work, and organization.

Don't miss this opportunity to learn from one of the best in the field and take your professional development to the next level.

Industry Event

Organized by UFFC-S Young Professionals Committee

12:35 – 13:40 on Thursday 18 May 2023 (doors open at 12:15)
Location: Lecture Hall 3 (2F)

Lunch will be provided, with priority to registered participants. Ask for remaining tickets at the registration desk!

Startup Stories and Lessons

Are you eager to turn your brilliant technical ideas into a successful startup? Do you wish to learn real-world strategies for building a team, attracting investors, and creating an effective go-to-market plan? If you have attended several startup workshops or panels, you may have found the experience and tips to be too general.

We are excited to invite you to a meet-up event with Dr. David Horsley, the co-founder, and CTO of Chirp Microsystems Inc. and Picosense Inc. Dr. Horsley is an accomplished entrepreneur with extensive experience running startups, some successful and some less so. At this event, he will share his personal stories and draw thought-provoking lessons and tips leading to business success.

Join us for a unique opportunity to meet Dr. Horsley, learn from his experiences, and network with peers who share common interests in entrepreneurship. Don't miss out on this chance to gain insights and knowledge that could help you turn your ideas into a thriving business.

David A. Horsley received his PhD in Mechanical Engineering from the University of California, Berkeley, in 1998. He is a Professor of Mechanical and Aerospace Engineering at the University of California, Davis, and an Adjunct Professor of Mechanical Engineering at the University of California, Berkeley, where he is co-director of the Berkeley Sensor and Actuator Center (BSAC).

He is also co-founder and CTO of Chirp Microsystems Inc. (acquired by TDK), a manufacturer of ultrasonic sensors using MEMS technology. Dr. Horsley was Co-Chair of the 2016 IEEE Sensors Conference, Co-Chair of the 2017 Transducers Research Foundation Napa Microsystems Workshop, and Co-Chair of the 2020 IEEE MEMS Conference.

Dr. Horsley is an IEEE Fellow, a Fellow of the National Academy of Inventors, is a recipient of the National Science Foundation's CAREER Award, the UC Davis Outstanding Junior Faculty Award, the 2016 NSF I/UCRC Association's Schwarzkopf Award for Technological Innovation, and the 2018 East Bay Innovation Award. He has authored or co-authored over 200 scientific papers and holds over 30 patents.

Student Events

The UFFC-S Student Representatives have organized several events at IFCS–EFTF 2023:

Student-Professional Networking (and Mock Interviews)

16:00 – 16:45 on Wednesday 17 May 2023
Location: Meeting Room (2F)
Drinks will be provided.

This event conflicts with the excursions, but not with the Gala Dinner!

All students are invited to participate in the student-professional networking event. Connect with professionals and practice key interviewing skills with mock interviews! Please bring your resume/CV (1 page).

If you did not pre-register, contact the organizers to learn if spaces are still available.

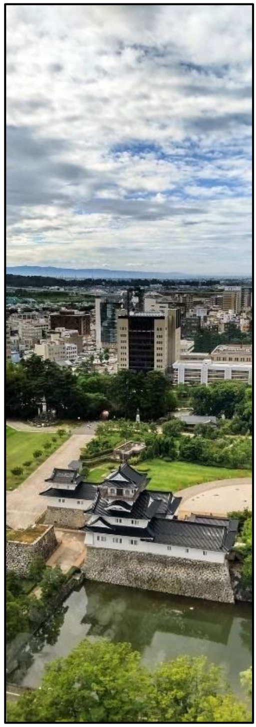
The event is organized in cooperation with the UFFC-S Young Professionals Committee.

Pitch Competition

17:50 – 18:50 on Thursday 18 May 2023
Location: Meeting Room (2F) and online

All students are welcome to join the IFCS student representatives for a hybrid pitch competition on Thursday. Prepare a 60 second elevator pitch and one PowerPoint slide to present to judges. The winners will be awarded with a certificate and monetary prize.

If you did not pre-register, contact the organizers to learn if spaces are still available.



Dinner and Scavenger Hunt

19:00 – 20:30 on Thursday 18 May 2023
Location: Toyama Castle Ruins Park (Lecture Hall 3 if bad weather)

Dinner will be provided, with priority to registered participants. Ask for remaining tickets at the registration desk.

All students are invited to join us for dinner and a scavenger hunt on Thursday! Food and drinks will be provided, along with prizes for those who solve the scavenger hunt! The event will be held outside as long as the weather allows it.

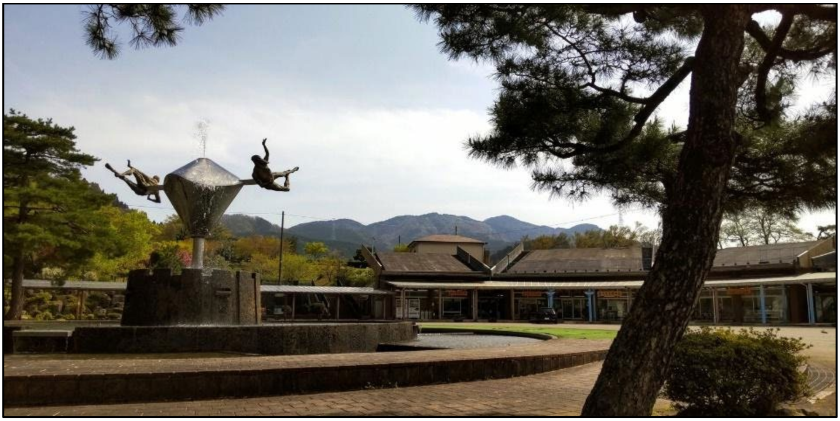
Excursions and Gala Dinner

15:55 – 22:00 on Wednesday 17 May 2023, buses depart at various times.

Location:
Shogawa Water Memorial Park
1550 Kanaya, Shogawa-machi, Tonami City, Toyama 932-0305, Japan

Take a break from the conference lectures and discover the beauty of Toyama.

The Gala Dinner location is about one hour of bus ride away from the conference center. After the end of the Dinner, buses will be waiting to return attendees to Toyama by 23:00.



Most of the participants in the Symposium have also selected one of the Excursion tours that take place on the way to the Gala Dinner location.

Please check your Gala Dinner ticket for your departure and be at the meeting point in front of the conference center in time – buses will be punctual!

If you cannot participate in the assigned tour, please contact the registration desk for options.

The following options for Excursions were available to choose from:

No excursion

Planned meeting time: 17:00

This is the last opportunity to travel to the Gala Dinner. Do not miss the bus!

Museum Excursion 1 – 4

Planned meeting time: 15:55 — Please be quick to join us after the last lecture of the day!

The Toyama Municipal Folk Craft Village is a collection of several small museums in the wooded hills west of downtown Toyama, where the buildings themselves are as interesting as the exhibits: Two of them are Gassho-style farmhouses, named for the steep shape of their roofs that resembles hands brought together in prayer. These houses have been carefully moved here from their original rural locations and are similar to the houses of the famous Gokayama area, which was declared a UNESCO World Heritage Site in 1995.

Since our visit will be short, we will split up into groups that each explore one of the museums. Our visits will be to:

1 The Folk Art Museum
2 The Thatched Roof House Museum
3 The Museum of Ceramic Art
4 The Folklore Museum

Chokeji Excursion

Planned meeting time: 16:00

The Chokeiji Temple is a Buddhist temple belonging to the Soto school of Zen Buddhism. It is located in the foothills of Kurehayama, only a short distance from the Folkcraft Village, where we will start our walking tour. Passing the charming museum buildings, we will soon reach the temple grounds, where the "500 Rakan" stand facing the Tateyama mountains. It is said that the calm and peaceful expressions on the faces of these more than 500 statues of the Buddha's disciples leave visitors deeply moved.

Shogawa Excursion

Planned meeting time: 16:05

This Excursions take you to Shogawa Water Memorial Park early, where you can spend some time exploring by yourself. Take a stroll along the Waterfront Promenade or wish for good luck at the Koi no Miya.

Just be back when the Gala Dinner is ready!

Nanto Excursion

Planned meeting time: 16:05

A bus will take us to Nanto, where we will begin a one-hour walk in the charming, old fashioned streets of the city. A highlight of the tour will be passing Zuisenji Temple with its massive gate adorned by beautiful woodcarvings. Following the back roads past the houses and fields of rural Japan, we will see more temples and shrines on our way to Shogawa Water Memorial park.

Senkoji Excursion

Planned meeting time: 16:10

Senkoji Temple is said to have been founded in 703, the third year of Japan’s Taiho era. Alongside Maitreya Yasui Temple in Nanto, it is the oldest temple in the Tonami area. Among the temples in the Toyama prefecture, it stands out as a rare example belonging to the Shingon branch of Japanese Buddhism. The temple guards many treasures, including a statue of Enma, a deity that judges the souls of the dead.

We will spend about forty minutes in the temple grounds, admiring the impressive architecture and taking in the atmosphere before we continue on to Shogawa Water Memorial Park for the Gala Dinner.

Senkoji Temple

Lab Tours

Toyama is just a 30km drive away from the Kamioka Observatory that is home to the KAGRA gravitational wave detector. Unfortunately, KAGRA will be participating in internationally coordinated experiments during the time of the conference and will not be able to accept visitor groups.

Other research institutes that would be of interest to attendees of IFCS–EFTF 2023 are mostly located in the Kanto and Kansai areas, centered in Tokyo and Osaka. We have arranged for tours in these areas on the days following the conference.

We thank the many attendees of IFCS–EFTF 2023 that have enquired about and registered for the laboratory tours despite their separation from the Symposium. The interest has been far larger than the available capacity for visitors, and we apologize to everyone that did not get the chance to join one of the tours.

Osaka Ion Trapping tour

On Saturday, May 20, this tour will visit institutes at Osaka University and Kyoto University that focus on experiments using ion trapping:

- Osaka University (10:30–11:30):
  On-chip ion trapping at the laboratory of Utako Tanaka
- Kyoto University (14:00–15:00):
  Quantum Optical Engineering Laboratory (Kazuhiko Sugiyama)

The tour will meet at Osaka University. An opportunity for lunch will be provided at Osaka University before the tour travels to Kyoto by public transport. Participants will need to cover their own food and transportation costs. Please check your email for detailed announcements.

Tokyo Optical Clock Tours

On Saturday, May 20, these tours will visit RIKEN and NICT in Tokyo and focus on their work on optical clocks and upcoming timekeeping technologies. Planned topics include:

- Optical lattice clocks both in RIKEN and NICT,
  including the portable system in development at RIKEN
- Indium ion clock development at NICT
- Timekeeping research: Chip-Level Integrated Frequency Standards (CLIFS)
- Standard Time and Frequency, link antennas

One tour will visit NICT first (10:00–12:00) and then travel to RIKEN (14:00–16:00). A second tour will visit the institutes in the opposite order. Buses will pick up participants in Tokyo's Shinjuku area and also transfer them between the two locations.

Participants may need to pay for their own meal at a location that is yet to be decided.

Tokyo Radio Science tour

On Monday, May 22, this tour will visit NAOJ and NICT in Tokyo and show radio-frequency technology applied in timekeeping and scientific applications.

Planned topics at the National Astronomical Observatory of Japan include:

- Advanced Technology Center: SIS clean room, ALMA THz-band receiver
- Telescope facility

Planned topics at the National Institute for Information and Communications Technology:

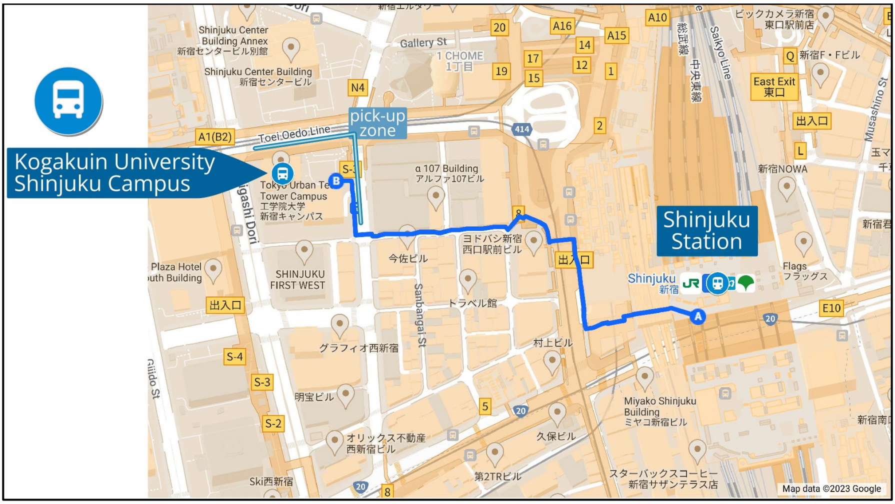
- Japan Standard Time
- Remote Sensing Laboratory
- Space Environment Laboratory
- Electromagnetic Compatibility Laboratory

The tour will visit NICT in Koganei first (10:00–12:00) and then travel to NAOJ in Mitaka (13:30–15:30). A bus will pick up participants in Tokyo's Shinjuku area and also transfer them between the two locations.

Participants may need to pay for their own meal at a location that is yet to be decided.

Bus Pickup

For the lab tours in the Tokyo area, the buses are expected to leave from Kogakuin University's Shinjuku Campus, and to return there after the tour. Please check your email for detailed announcements.



IFCS–EFTF 2023 Technical Program Committee

Scientific Chairs

IFCS: **Laura Sinclair**

EFTF: **Filippo Levi**

Group 1

Materials, Resonators & Resonator Circuits

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Wei-Chang Li
Troy Olsson
Mina Rais-Zadeh
Sarah Shahraini
Dana Weinstein

EFTF:
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Marie Bousquet
Marc Faucher
Raphaël Levy
Ming-Huang Li
Mario De Miguel Ramos
Matteo Rinaldi

Group 2

Oscillators, Synthesizers, Noise & Circuit Techniques

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Microwave Frequency Standards & Applications

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Yun-Jhih Chen
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Thomas McClelland
Ganghua Mei
Salvatore Micalizio
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Andreja Erbes
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Paul Muralt
Takahita Ono
Ashwin Seshia
Max Zenghui Wang
Valentina Zega

Group 5

Timekeeping, Time & Frequency Transfer, GNSS Applications

IFCS:
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Michael Coleman
Judah Levine
Huang-Tien Lin
Diego Luna
Giuseppe Marra
Qi Shen
Ilaria Sesia

EFTF:
Miho Fujieda (Vice-Chair)

Anne Amy-Klein
Pascale Defraigne
Jérome Delporte
Per-Olof Hedekvist
Kun Liang
Dirk Piester
Pierre Waller

Group 6

Optical Frequency Standards & Applications

IFCS:
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Murray Barrett
Flavio Cruz
Tetsuya Ido
Haifeng Jiang
Kaoru Minoshima
Nils Nemitz
Judith Olson
Ekkehard Peik
Marco Pizzocaro
Marco Schioppo
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Ronald Holzwarth
Won-Kyu Lee
Jérôme Lodewyck
Tanja Mehlstäubler
Nicola Poli
Thomas Südmeyer
Masami Yasuda

We thank all committee members for arranging the scientific core program of the Symposium.

Keynotes

The KAGRA gravitational wave project

Tuesday 16 May — 9:00 – 10:20 — Main Hall

Livestream will be available!

KAGRA aims to observe gravitational waves jointly carrying out the observation runs with LIGO in USA and Virgo in Europe.

Located 30 km from this conference venue, KAGRA is a laser interferometer with 3km × 3km arm lengths, deep underground in Kamioka. In order to achieve a high sensitivity to gravitational waves, various cutting-edge technologies are used. In particular, KAGRA uses cryogenic mirrors to reduce the thermal noises.

My plenary talk at IFCS–EFTF 2023 will discuss the KAGRA project and its scientific goals.

Takaaki Kajita is the Special University Professor at the University of Tokyo and a professor at the Institute for Cosmic Ray Research (ICRR) of the University of Tokyo. He is also the project leader of KAGRA, aiming to explore gravitational wave astronomy.

Professor Kajita received his Ph.D. from the University of Tokyo School of Science in 1986. His research is centered on the Kamiokande and Super-Kamiokande detectors at the Kamioka Observatory. In 1998, at the Neutrino International Conference held in Takayama, Gifu, he showed the analysis results which provided strong evidence for atmospheric neutrino oscillations.

In 2015 he shared the Nobel Prize in Physics for his role in discovering atmospheric neutrino oscillations.

Cold and ultra-cold polyatomic molecules for quantum science

Thursday 18 May — 11:00 – 12:30 — Main Hall

Livestream will be available!

Polar molecules, due to their intrinsic electric dipole moment and their controllable complexity, are a powerful platform for precision measurement searches for physics beyond the standard model (BSM) and, potentially, for quantum simulation/computation. This has led to many experimental efforts to cool and control molecules at the single quantum state level. Polyatomic molecules have attracted new focus as potential novel quantum resources with distinct advantages - and challenges - compared to both atoms and diatomic molecules.

I will discuss features of polyatomic molecules can be used in quantum simulation/computation, the search for BSM physics, and ultracold chemistry. I will discuss our results on the laser cooling of molecules into the ultracold regime, including the laser cooling of the polyatomic molecules SrOH, YbOH, CaOH and $CaOCH_3$.

Finally, if time permits, I will discuss recent measurements that support the vision of extending laser cooling to much larger molecules.

John Doyle, Henry B. Silsbee Professor of Physics, Harvard University, grew up in the U.S. and received his bachelor's and Ph.D. degrees from the Massachusetts Institute of Technology (M.I.T.) in 1986. After being a postdoc at M.I.T., he joined Harvard University as an assistant professor of physics in 1993.

John Doyle's research centers on using cold molecules for science including particle physics, collisions, and quantum information. Starting with the development a new technique for producing heavy, polar radical molecules in an intense cold beam, he launched with collaborators searches for physics beyond the Standard Model (BSM) through probing for the electron electric dipole moment. His group is a pioneer in the cooling and trapping of molecules, studying collisional processes in atoms and molecules and developing tools to achieve full quantum control over increasingly complex molecular systems. They pioneered the laser cooling of polyatomic molecules and are working to realize new techniques to trap and study interactions in polyatomic molecules.

John Doyle is the co-Director of the Harvard Quantum Initiative, director of the Japanese Undergraduate Research Exchange Program (JUREP), and co-founded the Harvard/MIT Center for Ultracold Atoms, where for twenty years was co-director. He has published papers in the areas of ultracold atoms, molecules, spectroscopy, precision measurement, ultracold neutrons, respiratory disease transmission mitigation, and dark matter detection and supervised the PhDs of over thirty students. He is a Humboldt, Fulbright, and American Physical Society (APS) Fellow and a winner of the APS Broida prize, and will become vice-president of the APS in 2023.

Student Poster Competition Finalists

The finalist Student Posters presented in-person will be displayed in the 1F Deli poster area during Poster Session 1c on Wednesday, May 17, 8:50 – 10:30.

Group 1

WINNER: Gabriel Giribaldi — **Northeastern University**

7370 - An Experimental Approach to Optimize Quality Factor and Power Linearity in 30% Scandium Aluminum Nitride CLMRs Operating Above 6 GHz

Chin-Yu Chang — **National Tsing Hua University**
7055 - A Self-Sustained Phononic Comb MEMS Oscillator with Loop Phase Tuning

Yong Guo — **Tohoku University**
7270 - Suppression of Transverse Mode on $LiNbO_3$ and Quartz Hetero Acoustic Layer Surface Acoustic Wave Resonator by Zigzag Shape Apodization

WINNER: Jack Kramer — **UT Austin**
7232 - Thin-Film Lithium Niobate Acoustic Resonator with High Q of 237 and k^2 of 5.1% at 50.74 GHz

Lipng Zhang — **Shanghai Institute of Microsystem and Information Technology**
7040 - SAW Resonators on 15°YX-$LiNbO_3$/SiO_2/Sapphire Substrate with Excellent Electromechanical Coupling

Joint groups 2 and 3

WINNER: Erwin Cano Vargas — **Deutsches Synchrotron (DESY), Hamburg University**
7099 - Low Noise Photonic Microwave Oscillator Based on a Novel Repetition Rate Stabilization

Haoran Qin — **Tsinghua University**
7010 - Progress on Ion Microwave Frequency Standards at Tsinghua University

Liu Chen — **Peking University**
7176 - Optically Pumped Cesium Beam Clock Using Monochromatic Light

Juliette Breurec — **FEMTO-ST**
7030 - Measurements of Frequency Shifts in a high-Performance CPT-Based Cesium Cell Atomic Clock

Group 4

Pengcheng Zhang — **Shanghai Jiao Tong University**
7044 - Tuning Strain and Quality Factor of 2D MoS2 NEMS Resonators Using Annealing and Electrostatic Gating

Jennyfer Vivas Gomez — **UCF**
7381 - Piezoelectric Micromachined Ultrasonic Transducer Integrated with Field Effect Transistor for Acoustic Sensing

Yunong Wang — **University of Florida**
7321 - Magnetic 2D Materials Nanomechanical Resonators with Electrical Tunability

WINNER: Nicolas Casilli — **Northeastern University**
7314 - An Ising Tag with a LiNbO3 Resonator for Temperature Threshold Sensing

Group 5

Jingxian Ji — **Physikalisch-Technische Bundesanstalt**
7050 - A Two-Way Free-Space Link for Optical Frequency Comparisons

Martina Matusko — **FEMTO-ST**
7063 - Automatic Characterization of a Fully-Digital Doppler Cancellation Technique for Local Ultra-Stable Frequency Dissemination

WINNER: Yufeng Chen — **Tsinghua University**
7187 - Long-Haul Fiber-Optic Time and Frequency Synchronization

Hannah Tomio — **Massachusetts Institute of Technology**
7185 - Calibration of the Optical Time Transfer and Ranging System of the CubeSat Laser Infrared CrosslinK (CLICK) Mission

Group 6

Emily Ahern — **University of Adelaide**
7345 - Development of a Compact Optical Clock for Small Satellite Applications

Naoto Mizukami — **INRiM, Politecnico di Torino and LENS**
7165 - Towards a Ba^{+}-Li Atom-Ion System for Investigating Collisional Shifts in Ion-Based Optical Clocks

WINNER: Alexander Aeppli — **JILA**
7071 - Towards a Systematic Accuracy Evaluation of the JILA Sr1 Optical Lattice Clock

Nicholas Nardelli — **NIST**
7175 - An Er/Yb:glass Frequency Comb for Precision Optical and Microwave Synthesis

Jize Han — **Tsinghua University**
7017 - Cooling and Crystallization of Trapped Single 171Yb+ Ion for Optical Frequency Standard

Tutorial Schedule – Monday, May 15

9:10 – 17:50 Lecture Halls 2 to 4 (2F)

The Tutorials at IFCS–EFTF 2023 provide the opportunity for registered participants of all skill levels to learn from acclaimed experts in the field. All twelve session of the Tutorial sessions will be recorded and are expected to be available on the hybrid conference platform within a few days. Tutorial recording are accessible for both virtual and on-site Tutorial participants.

If you chose the option for Tutorial participation during your registration, a boxed lunch will be offered. Check your badge for a ticket.

	Track 1 **Lecture Hall 4**	Track 2 **Lecture Hall 3**	Track 3 **Lecture Hall 2**
9:10 to 10:50	**Alexandre Reinhardt** CEA-LETI, France Thin film lithium niobate and lithium tantalate acoustic resonators	**Eugene Ivanov** UWA, Australia Measurements of Phase Fluctuations	**John Kitching** NIST, USA Microwave Frequency Standards
11:10 to 12:50	**Victor Plessky** Retired, Switzerland XBARs and around - 5 GHz resonators and filters exploiting thin layers of lithium niobate	**Yuko Hanado** NICT, Japan Generation of real-time timescale using averaged ensemble clocks	**James Camparo** Aerospace Corp, USA Atomic Timekeeping in Space
		Lunch Break	
14:10 to 15:50	**Rémy Braive** Univ Paris-Saclay, France Optomechanical crystals : Hybrid devices for applications from quantum physics to metrology	**Calvin Lin** TL, Taiwan GNSS time transfer and its calibration	**Hidetoshi Katori** Tokyo Univ, Japan Optical clocks and their applications
16:10 to 17:50	**Siddarth Tallur** IIT Bombay, India Electro-mechanical and ultrasonic sensors for structural health monitoring	**Claudio Calosso** INRIM, Italy Low-noise digital electronics for time and frequency metrology	**Felicitas Arias** Observatoire de Paris, France The SI second: History, future redefinition and impact

Technical Program for Tuesday, May 16

9:00 – 10:20
Keynote 1: Takaaki Kajita
The KAGRA gravitational wave project
Room: Main Hall
Chair: Tetsuya Ido (NICT) and Laura Sinclair (NIST)

10:20 – 10:40
Coffee Break

10:40 – 12:30
Searches for Fundamental Physics and Space-based Systems
Room: Main Hall
Chair: Michal Zawada (Nicolaus Copernicus)

INVITED: Searching for New Physics With Robust Quantum Metrology
Laura S. Dreissen[2], Chih-Han Yeh[1], Henning A. Fürst[1], Kai Grensemann[1], Tanja E. Mehlstäubler[1]
[1]Physikalisch-Technische Bundesanstalt, Germany; [2]Vrije Universiteit Amsterdam, Physikalisch-Technische Bundesanstalt, Netherlands

Isotope Shift Measurement in Ytterbium Ions to Search for a Dark Matter Boson
Chih-Han Yeh[1], Laura S. Dreissen[3], Melina Filzinger[1], Nils Huntemann[1], Julian C. Berengut[2], Henning A. Fürst[1], Tanja E. Mehlstäubler[1]
[1]Physikalisch-Technische Bundesanstalt, Germany; [2]University of New South Wales, Australia; [3]Vrije Universiteit Amsterdam, Physikalisch-Technische Bundesanstalt, Netherlands

A Laser Frequency Comb for Space Missions
Frederick Böhle, Daniela Penka, Martin Hirn, Jeremie Girardot, Stefan Groißmaier, Franz Baran, Matthias Lezius, Ronald Holzwarth
Menlo Systems GmbH, Germany

Absolute Frequency Measurement of NMIJ-Yb1 Referenced to NMIJ-F2 and Search for Dark Matter
Takumi Kobayashi[1], Akifumi Takamizawa[1], Daisuke Akamatsu[2], Akio Kawasaki[1], Akiko Nishiyama[1], Kazumoto Hosaka[1], Yusuke Hisai[2], Masato Wada[1], Hajime Inaba[1], Takehiko Tanabe[1], Masami Yasuda[1]
[1]National Metrology Institute of Japan, Advanced Industrial Science and Technology, Japan; [2]Yokohama National University, Japan

Geodetic Measurements and Quantitative Evaluation for Reduced Gravitational Redshift Uncertainty of NICT Optical Frequency Standards
Ryuichi Ichikawa[2], Hidekazu Hachisu[2], Mamoru Sekido[2], Tetsuya Ido[2], Yoshifumi Hiraoka[1], Eiichirou Harima[1], Shuntaro Fukaya[1], Koji Matsuo[1], Masahiro Nakashima[1], Yuichi Aoyama[3], Akihisa Hattori[3], Yoichi Fukuda[3]
[1]Geospatial Information Authority of Japan, Japan; [2]National Institute of Information and Communications Technology, Japan; [3]National Institute of Polar Research, Japan

10:40 – 12:30
Fiber Frequency Transfer
Room: Lecture Hall 2
Chair: Per-Olof Hedekvist (Research Institutes of Sweden)

INVITED: REFIMEVE Fiber Network for Time and Frequency Dissemination and Applications

Étienne Cantin[2], Olivier Lopez[2], Nicolas Cahuzac[2], Yuhao Liu[2], Mathieu Manceau[2], Benoit Darquié[2], Christian Chardonnet[2], Anne Amy-Klein[2], Martin Rabault[1], Grégoire Coget[1], Peter Rosenbusch[1], Vincent Ménoret[1], Nicolas Quintin[5], Mads Tønnes[3], Benjamin Pointard[3], Maxime Mazouth-Laurol[3], Héctor Álvarez Martínez[4], Caroline B. Lim[3], Philip Tuckey[3], Michel Abgrall[3], Rodolphe Le Targat[3], Paul-Éric Pottie[3]
[1]exail Quantum Sensors, 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]LNE-SYRTE Observatoire de Paris, Université PSL, CNRS, Sorbonne Université, ROA, France; [5]RENATER, France

Frequency Dissemination in the L-Band of the Swiss National Research and Education Network

Dominik Husmann[3], Laurent-Guy Bernier[3], Mathieu Bertrand[1], Davide Calonico[2], Konstantinos Chaloulos[4], Gloria Clausen[1], Cecilia Clivati[2], Jérôme Faist[1], Ernst Heiri[4], Urs Hollenstein[1], Anatoly Johnson[5], Fabian Mauchle[4], Ziv Meir[5], Frédéric Merkt[1], Alberto Mura[2], Giacomo Scalari[1], Simon Scheidegger[1], Hansjürg Schmutz[1], Mudit Sinhal[5], Stefan Willitsch[5], Jacques Morel[3]
[1]ETH Zürich, Switzerland; [2]INRiM Istituto Nazionale di Ricerca Metrologica, Italy; [3]Swiss Federal Institute of Metrology METAS, Switzerland; [4]SWITCH, Switzerland; [5]University of Basel, Switzerland

Simultaneous Distribution of Stable Frequency and Data Signals Over Hollow-Core Optical Fibers

Zitong Feng, Eric Numkam Fokoua, Francesco Poletti, David J Richardson, Radan Slavík
University of Southampton, United Kingdom

Automatic Characterization of a Fully-Digital Doppler Cancellation Technique for Local Ultra-Stable Frequency Dissemination

Martina Matusko[2], Ivan Ryger[1], Gwenaël Goavec-Merou[3], Jacques Millo[2], Clément Lacroûte[2], Émile Carry[1], Francisco Sebastian Ponciano-Ojeda[2], Jean-Michel Friedt[3], Marion Delehaye[2]
[1]FEMTO-ST Institute, France; [2]FEMTO-ST Institute, CNRS, University of Bourgogne Franche-Comté, ENSMM, France; [3]LNE-LTFB, FEMTO-ST Institute, Observatoire de Besançon, France

Ultralow-Noise Laser Repeater System for Cascaded Optical Fiber Link

Tomoya Akatsuka[1], Hiromitsu Imai[1], Takashi Goh[2], Toshikazu Hashimoto[3], Masao Takamoto[5], Hidetoshi Katori[6], Katsuya Oguri[1], Tetsuomi Sogawa[4]
[1]NTT Basic Research Laboratories, Japan; [2]NTT Device Innovation Center, Japan; [3]NTT Device Technology Laboratories, Japan; [4]NTT Science and Core Technology Laboratory Group, Japan; [5]RIKEN, Japan; [6]University of Tokyo, RIKEN, Japan

10:40 – 12:30
Resonant Sensors and Transducers
Room: Lecture Hall 3
Chair: Yao Zhu (Institute of Microelectronics, A STAR)

INVITED: Temperature Sensing for MEMS Sensors: A Review, and Chances for the Frequency-Control Community

Giacomo Langfelder, Paolo Frigerio
Politecnico di Milano, Italy

Magnetic 2D Materials Nanomechanical Resonators with Electrical Tunability

Yunong Wang, S M Enamul Hoque Yousuf, Xin Cong, Xiao-Xiao Zhang, Philip X.-L. Feng
University of Florida, United States

MEMS-Silicon Chip Bonding Verification Using GHz Pulse-Echo Simulation and Measurements

Shyam Trivedi[2], Yi Xuan Yeo[2], Mantalena Sarafianou[2], Eva Leong Ching Wai[2], Jaibir Sharma[2], Daniel Ssu Han Chen[2], Amit Lal[1], Kevin Tshun Chuan Chai[2]
[1]Cornell University, United States; [2]Institute of Microelectronics, Agency for Science, Technology and Research, Singapore

Acoustic Coupling and Remote Excitation in an Array of Multi-Mode Piezoelectric Micromachined Ultrasonic Transducers

Teng Zhang, Ashwin Seshia
University of Cambridge, United Kingdom

A New High-Sensitivity Differential Z-Axis FM Accelerometer

Valentina Zega[1], Attilio Frangi[1], Gabriele Gattere[2], Manuel Riani[2], Riccardo Nastri[1], Giacomo Langfelder[1]
[1]Politecnico di Milano, Italy; [2]STMicroelectronics N.V., Italy

10:40 – 12:30
LN Acoustic Resonator Devices
Room: Lecture Hall 4
Chair: Luca Colombo (Northeastern University)

INVITED: 200 mm Surface and Bulk Acoustic Wave Devices Based on Piezoelectric-on-Insulator Substrate

Marie Bousquet[1], A. Joulie[1], Clémence Hellion[1], Marc Sansa[1], Julien Delprato[1], Pierre Perreau[1], Grégory Enyedi[1], G. Lima[1], J. Guerrero[1], G. Castellan[1], A. Tantet[1], S. Chevallet[1], T. Monniez[1], Isabelle Huyet[3], Alexandre Clairet[2], Thierry Laroche[2], Sylvain Ballandras[2], Alexandre Reinhardt[1]
[1]CEA-Leti, Université Grenoble Alpes, France; [2]Frec'n'sys, France; [3]Soitec, France

Thin-Film Lithium Niobate Acoustic Resonator with High Q of 237 and k^2 of 5.1% at 50.74 GHz

Jack Kramer[2], Vakhtang Chulukhadze[2], Kenny Huynh[1], Omar Barrera[2], Michael Liao[1], Sinwoo Cho[2], Lezli Matto[1], Mark Goorsky[1], Ruochen Lu[2]
[1]University of California, Los Angeles, United States; [2]University of Texas at Austin, United States

LN Membrane Suspended on Pedestals as a Waveguide

Victor Plessky
Huawei Technologies Oy Finland Co. Ltd, Finland

Suppression of Transverse Mode on LiNbO3/ Quartz Hetero Acoustic Layer Surface Acoustic Wave Resonator by Zigzag Shape Apodization

Yong Guo, Michio Kadota, Shuji Tanaka
Tohoku University, Japan

SAW Resonators on 15°YX-LiNbO3/SiO2/Sapphire Substrate with Excellent Electromechanical Coupling

Jinbo Wu, Yang Chen, Lipng Zhang, Pengcheng Zheng, Hulin Yao, Xiaoli Fang, Kai Huang, Shibin Zhang, Xin Ou
Shanghai institute of Microsystem and Information Technology Chinese Academy of Sciences, China

12:30 – 14:00
Lunch Break
Room: Crowne Plaza

14:00 – 15:50
Ion Clocks
Room: Main Hall
Chair: Jerome Lodewyck (LNE-SYRTE)

INVITED: Development of Room Temperature and Cryogenic Strontium Ion Clocks with Low Uncertainties
Pierre Dubé[1], Kosuke Kato[1], Scott Smale[2], Amar Vutha[2]
[1]National Research Council Canada, Canada; [2]University of Toronto, Canada

Frequency Ratios Involving the $^{171}Yb^{+}$ Ion Optical Clock at NPL
Alexandra Tofful[1], Billy Robertson[1], Adam Parsons[1], Anne Curtis[1], Jacob Tunesi[2], An Tran[1], Matthew Johnson[1], Chen-Hao Feng[1], Marco Schioppo[1], Rachel Godun[1], Ian Hill[1], Helen Margolis[2]
[1]National Physical Laboratory, United Kingdom; [2]NPL Management Ltd, National Physical Laboratory, United Kingdom

High-Uptime Operation of Yb^{+} Optical Clocks at PTB
Melina Filzinger, Martin Steinel, Jian Jiang, Richard Lange, Ekkehard Peik, Nils Huntemann
Physikalisch-Technische Bundesanstalt, Germany

High-Accuracy Optical Clock Based on $^{115}In^{+}$ / $^{172}Yb^{+}$ Mixed-Species Coulomb Crystals
Jonas Keller, Tabea Nordmann, Hartmut Nimród Hausser, Nishant M. Bhatt, Ingrid M. Dippel, Moritz von Boehn, Tanja E. Mehlstäubler
Physikalisch-Technische Bundesanstalt, Germany

Laser Spectroscopy of Triply Charged Thorium Ions Towards a Nuclear Clock
Atsushi Yamaguchi[2], Yudai Shigekawa[2], Hiromitsu Haba[2], Michiharu Wada[1], Hidetoshi Katori[3]
[1]High Energy Accelerator Research Organization / RIKEN, Japan; [2]RIKEN, Japan; [3]University of Tokyo, RIKEN, Japan

14:00 – 15:50
Vapor Cell Clocks
Room: Lecture Hall 2
Chair: Sota Kagami (NEC Corporation)

INVITED: Recent Results on a Rb Pulsed Optically Pumped Clock for Space Applications
Salvatore Micalizio[1], Michele Gozzelino[1], Claudio Eligio Calosso[1], Filippo Levi[1], Jacopo Belfi[2]
[1]INRiM Istituto Nazionale di Ricerca Metrologica, Italy; [2]Leonardo SpA, Italy

A Ramsey-Based Microcell CPT Clock with Fractional Frequency Stability in the Low 10^{-12} Range at 10^{5} s
Clément Carlé[1], Moustafa Abdel Hafiz[1], Shervin Keshavarzi[1], Rémy Vicarini[1], Nicolas Passilly[2], Rodolphe Boudot[2]
[1]FEMTO-ST Institute, France; [2]FEMTO-ST Institute, CNRS, University of Bourgogne Franche-Comté, France

Constructive, Destructive and Differential Detection of Coherent Population Trapping Resonance
Peter Yun[3], Tenghui Yang[3], Rodolphe Boudot[1], Emeric de Clercq[2]
[1]FEMTO-ST Institute, CNRS, University of Bourgogne Franche-Comté, France; [2]LNE-SYRTE Laboratoire, France; [3]National Time Service Center, Chinese Academy of Sciences, China

Polarization Modulated CPT and Population Distributions Among Ground-State Zeeman Sublevels
Zachary Warren, Hunter Kettering, Andrew Householder, James Camparo
Aerospace Corporation, United States

An Integrated Pulsed Optically Pumped Rb Clock
Qiang Hao, Shaojie Yang, Peter Yun, Shuai Nie, Jun Ruan, Shougang Zhang
National Time Service Center, Chinese Academy of Sciences, China

14:00 – 15:50
GNSS & TWSTFT
Room: Lecture Hall 3
Chair: Miho Fujieda (NICT)

INVITED: A Realization of QZSS Time Synchronized with UTC(NICT)
Shigeki Murakami, Kazunori Someya, Motoyuki Miyoshi, Erika Myojin, Akihiro Matsumoto
Japan Aerospace Exploration Agency, Japan

Characterization of GPS PPP-AR Frequency Transfer
Bin Jian, Marina Gertsvolf
National Research Council Canada, Canada

Advanced Time Transfer Comparison GNSS Versus Fiber Over a 3 km Long Baseline
Vincent Voisin[3], Lucille Mellet[3], Stefano Russo[3], Mathieu Guigue[3], Boris Popov[3], Baptiste Chupin[2], Caroline B. Lim[2], Olivier Chiu[2], Philip Tuckey[2], Paul-Éric Pottie[2], Pierre Uhrich[1], Michel Abgrall[2]
[1]LNE-SYRTE Laboratoire, France; [2]LNE-SYRTE Observatoire de Paris, Université PSL, CNRS, Sorbonne Université, France; [3]LPNHE - CNRS - Sorbonne Université/Université Paris Cité, France

The 6-Year Long Term Total Delay Variations Investigation of Tl GPS Stations – According to a Virtual Ensemble Receiver
Shinn-Yan Lin[2], Ta-Kang Yeh[1], Tzu-Yi Lien[1]
[1]National Taipei University, Taiwan; [2]Telecommunication Laboratories, Chunghwa Telecom Co., Ltd., Taiwan

Development of an Opensource, Openhardware, Software-Defined Radio Platform for Two-Way Satellite Time and Frequency Transfer
Jean-Michel Friedt[1], Michel Lours[2], Gwenaël Goavec-Merou[1], Maxime Dupont[2], Baptiste Chupin[2], Olivier Chiu[2], Eric Meyer[1], Francois Meyer[1], Joseph Achkar[2]
[1]LNE-LTFB, FEMTO-ST Institute, Observatoire de Besançon, France; [2]LNE-SYRTE Observatoire de Paris, Université PSL, CNRS, Sorbonne Université, Germany; [2]LNE-SYRTE Observatoire de Paris, Université PSL, CNRS, Sorbonne Université, France

14:00 – 15:50
Digital Techniques for Time and Frequency Control
Room: Lecture Hall 4
Chair: Craig Nelson (NIST)

INVITED: The Digital Revolution, Also for Time Scales
Claudio Eligio Calosso
INRiM Istituto Nazionale di Ricerca Metrologica, Italy

Terahertz Frequency Synthesizer with 10 MHz Resolution
Brendan Heffernan[2], Takashi Hori[2], James Greenberg[2], Rubab Amin[2], Tatsuya Tanigawa[2], Antoine Rolland[1]
[1]Boulder Research Labs., IMRA America, Inc., United States; [2]IMRA America, Inc., Japan; [2]IMRA America, Inc., United States

Multi-Layer Neural Network for the Stabilization of Ultra-Stable Oscillators
Olukayode Okusaga, John Hamilton, Samuel Reynolds, Eduard Pulaha, Jeffrey Garstecki, Stephen Mitchell, Gregory Weaver
Johns Hopkins Applied Physics Laboratory, United States

A Miniature Oven-Controlled Crystal Oscillator (OCXO) with PPT Stability Over Temperature Using High-Order Polynomial Temperature Control

Shuenn-Jyh Chang, Wen-Cheng Wang, Sheng-Hsiang Kao, Wan-Lin Hsieh
TXC Corporation, Taiwan

The High Short-Term Frequency Stability Digitally Controlled X'Tal Oscillator with Small Size and Low Power Consumption

Kotaro Hayashi, Yuichi Yokozeki, Hiroyasu Kunitomo, Takashi Matsumoto, Kazuo Akaike, Shunichi Wakamatsu
Nihon Dempa Kogyo Co., Ltd., Japan

15:50 – 16:10
Coffee Break

16:10 – 18:00
Transportable and Compact Systems
Room: Main Hall
Chair: Laura Sinclair (NIST)

INVITED: Towards Compact Optical References on a Chip

William Loh[2], Dave Kharas[2], Ryan Maxson[2], Alexander Medeiros[2], Gavin West[1], Robert McConnell[2]
[1]Massachusetts Institute of Technology, United States; [2]MIT Lincoln Laboratory, United States

Towards a High-Stability Cs-Microcell Stabilized Laser with Dual-Frequency Sub-Doppler Spectroscopy

Anthony Gusching[1], Jacques Millo[3], Rémy Vicarini[1], Moustafa Abdel Hafiz[1], Nicolas Passilly[2], Rodolphe Boudot[2]
[1]FEMTO-ST Institute, France; [2]FEMTO-ST Institute, CNRS, University of Bourgogne Franche-Comté, France; [3]FEMTO-ST Institute, CNRS, University of Bourgogne Franche-Comté, ENSMM, France

Field Testing NIST's First Generation Portable Yb Optical Lattice Clock

Tobias Bothwell[1], Wesley Brand[2], Robert Fasano[2], Richard Fox[1], Andrew Ludlow[3]
[1]National Institute of Standards and Technology, United States; [2]NIST Boulder and University of Colorado, Boulder, United States; [3]NIST Boulder, University of Colorado at Boulder, United States

A Laser-Cooled Optical Beam Clock for Portable Applications

Rachel Offer[1], Ashby Hilton[1], Nicolas Bourbeau-Hébert[1], Elizaveta Klantsataya[1], Andre Luiten[2]
[1]University of Adelaide, Australia; [2]University of Adelaide, QuantXLabs, Australia

Portable Optical Atomic Clock Based on a Dichroic Two-Photon Transition in Rubidium

Clayton Locke[2], Sarah Scholten[1], Sebastian Ng[2], Emily Ahern[1], Martin O'connor[2], Jordan Scarabel[2], Nicolas Bourbeau-Hébert[1], Christopher Perrella[2], Andre Luiten[2]
[1]University of Adelaide, Australia; [2]University of Adelaide, QuantXLabs, Australia

16:10 – 18:00
Fiber Time Transfer
Room: Lecture Hall 2
Chair: Qi Shen (University of Science and Technology of China)

INVITED: Ultra-Accurate Time Dissemination in a Hybrid Fiberoptic System with Frequency-Synchronized Lasers and λ-Swapping

Łukasz Śliwczyński, Przemysław Krehlik, Łukasz Buczek
AGH University of Science and Technology, Poland

Proof-of-Concept of a Fiber-Optic Timing Transmission for a Synthesis Radio Telescope

Miho Fujieda[1], Tadahiro Gotoh[2], Hitoshi Kiuchi[1]
[1]National Astronomical Observatory of Japan, Japan; [2]National Institute of Information and Communications Technology, Japan

Optical Frequency and Timing Distribution System for ESA Deep Space Tracking Stations

Kemal Şafak[1], Anan Dai[1], Michael Hagemann[1], Daniel Petters[1], Franz X. Kärtner[2], Benjamin Rudin[6], Florian Emaury[6], Oliver Lange[5], Werner Lange[5], Wolfgang Klische[4], Franklin G. Ascarrunz[7], Bernardino Quaranta[3], Sinda Mejri[3]
[1]Cycle GmbH, Germany; [2]Deutsches Elektronen-Synchrotron, Hamburg University, Cycle GmbH, Germany; [3]ESA-ESOC European Space Agency-European Space Operations Centre, Germany; [4]KplusK Messtechnik GmbH, Germany; [5]Lange-Electronic GmbH, Germany; [6]Menhir Photonics AG, Switzerland; [7]SpectraDynamics, Inc., United States

Quantum Network Node Synchronization Over 128 km

Ya-Shian Li-Baboud[3], Wayne McKenzie[1], Thomas Gerrits[3], Mark Morris[1], Gerry Baumgartner[1], Anouar Rahmouni[3], Paulina Kuo[3], Oliver Slattery[3], Bruce Crabill[2], Mheni Merzouki[3], Abdella Battou[3]
[1]Laboratory for Telecommunication Sciences, United States; [2]Mid-Atlantic Crossroads, United States; [3]National Institute of Standards and Technology, United States

Calibration of Fiber-Optic Time Synchronization System Over 800km

Jiameng Dong[1], Zhaohui Wang[1], Rui Zhang[1], Song Yu[3], Bin Luo[3], Hong Guo[2]
[1]Beijing University of Posts and Telecommunications, China; [2]State Key Laboratory of Advanced Optical Communication Systems and Networks, Peking University, China; [3]State Key Laboratory of Information Photonics and Optical Communications, Beijing University of Post, China

16:10 – 18:00
Sensors for Structural Health Monitoring
Room: Lecture Hall 3
Chair: Shyam Trivedi (Institute of Microeletronics, Agency for Science, Technology and Research)

INVITED: Piezoelectric MEMS for Frequency Control and Sensing

Yao Zhu, Bhattacharya Shashwat, Wenjia Yang, Li Chen, Ying Zhang, Chen Liu
Institute of Microelectronics, Agency for Science, Technology and Research, Singapore

PZT-Based Multi-Mode Cantilever for Viscosity Sensing

Javed Nadindla[1], Priyanka Singh[1], Sudhanshu Tiwari[2], Pavitra Jain[1], Kongbrailatpam Sandeep Sharma[1], Rudra Pratap[1], Gayathri Pillai[1]
[1]Indian Institute of Science, India; [2]Purdue University, United States

TinyML-Enabled Unsupervised Ultrasonic Guided Wave SHM Under Varying Thermal Conditions

Pankhi Kashyap, Kajal Shivgan, Sheetal Patil, Sagar Mahajan, Sauvik Banerjee, Siddharth Tallur
Indian Institute of Technology Bombay, India

An Embedded SHM System for Monitoring of Pipelines Using Torsional Guided Wave Ultrasonics

Sheetal Patil, Sagar Mahajan, Sauvik Banerjee, Siddharth Tallur
Indian Institute of Technology Bombay, India

A Study of New Environmental SAW Sensors Based on Innovative Poi Substrates in a Cascade Impactor

Ghida Fawaz[1], Meddy Vanotti[1], Fatima-Ezzahraa Dbibih[1], Valérie Soumann[2], Virginie Blondeau-Patissier[1]
[1]FEMTO-ST Institute, France; [2]FEMTO-ST Institute, CNRS, University of Bourgogne Franche-Comté, France

16:10 – 18:00

Tools and Techniques for Phase and Frequency Noise Measurement

Room: Lecture Hall 4

Chair: Archita Hati (NIST)

INVITED: The Power Spectral Density Is Not What You Think It Is - on the Fourier Transform of Power Limited Signals

Attila Kinali
CISPA Helmholtz Center for Information Security, Germany

A Simple Optimization Technique for IQ-Based Armstrong Modulators

Craig Nelson, Archita Hati
National Institute of Standards and Technology, United States

Novel Open-Loop Phase Noise Measurement Technique for GHz Resonators

Yao Yu, Jeronimo Segovia-Fernandez, Ernest Ting-Ta Yen, Bichoy Bahr, Swaminathan Sankaran
Texas Instruments, United States

Improving Frequency Measurement Accuracy of Fully Digital Phase Detection Quartz Crystal Microbalance Based on Multi-Channel ADC

Tatsuki Tamaoki, Shouta Kanno, Takeshi Imaike
Nihon University, Japan

Integrated Frequency Counter for Multidimensional Seismometric System

Paweł Kwiatkowski[3], Dominik Sondej[3], Ryszard Szplet[3], Marcin Chodnicki[1], Jerzy Kowalski[2], Henryk A. Kowalski[2]
[1]Air Force Institute of Technology, Poland; [2]Independent Researcher, Poland; [3]Military University of Technology, Poland

10:30 – 10:40
Poster Session 1
Poster Areas: 1F Deli, 3F North, 3F South

10:40 – 12:30
Novel Concepts
Room: Lecture Hall 3
Chair: Elizabeth Donley (NIST)

INVITED: Advancing the Sensitivity of Rydberg Atom Based Electrometry
Nikunjkumar Prajapati, Alexandra Artusio-Glimpse, Andrew Rotunno, Samuel Berweger, Maitreyi Jayseelan, Kaleb Campbell, Christopher Holloway
National Institute of Standards and Technology, United States

A Chip-Scale Atomic Beam Clock
Alexander Staron[3], Gabriela Martinez[4], Chao Li[1], John Kitching[2], Chandra Raman[1], William McGehee[2]
[1]Georgia Institute of Technology, United States; [2]NIST Boulder, United States; [3]NIST Boulder, Joint Institute for Laboratory Astrophysics, University of Colorado Boulder, United States; [4]NIST Boulder, University of Colorado at Boulder, United States

Performance of a 3 cc Yb^+ Trap as a Microwave Clock After 10 Years
Daniel Thrasher, Peter Schwindt, Erik Skogen, Seth Fortuna, Charles Alford, Michael Smith, Ganapathi Subramania, Joshua Mondragon, Haylie Orozco, Eduardo Garcia, Anthony Rice, Yuan-Yu Jau
Sandia National Laboratories, United States

Terahertz Microcomb Oscillator Stabilized by Molecular Rotation
James Greenberg[2], Brendan Heffernan[2], Antoine Rolland[1]
[1]Boulder Research Labs., IMRA America, Inc., United States; [2]IMRA America, Inc., United States

Fundamental Physics Tests with Cryogenic Mechanical Resonators
William Campbell[2], Maxim Goryachev[1], Michael Tobar[1]
[1]Quantum Technologies and Dark Matter Labs, University of Western Australia, Australia; [2]University of Western Australia, Australia

10:40 – 12:30
Optical Timescales and TAI Contributions
Room: Main Hall
Chair: Tara Fortier (NIST)

INVITED: Robust Optical Clocks for International Timescales (ROCIT)
Helen Margolis
NPL Management Ltd, National Physical Laboratory, United Kingdom

Frequency Steering of Local and Global Time Scales with NPL's Optical Clocks
Jacob Tunesi[2], An Tran[1], Adam Parsons[1], Alexandra Tofful[1], Billy Robertson[1], Matthew Johnson[1], Chen-Hao Feng[1], Marco Schioppo[1], Anne Curtis[1], Ian Hill[1], Rachel Godun[1], Helen Margolis[2]
[1]National Physical Laboratory, United Kingdom; [2]NPL Management Ltd, National Physical Laboratory, United Kingdom

Practical and Fundamental Properties of a Definition of the SI Second Based on Several Optical Transitions
Jérôme Lodewyck
LNE-SYRTE Laboratoire, France

IT-Yb1 Optical Lattice Clock: Absolute Frequency Measurement at the Cs Fountain Uncertainty Level
Irene Goti[2], Stefano Condio[2], Cecilia Clivati[1], Matias Risaro[1], Michele Gozzelino[1], Giovanni A. Costanzo[2], Filippo Levi[1], Davide Calonico[1], Marco Pizzocaro[1]
[1]INRiM Istituto Nazionale di Ricerca Metrologica, Italy; [2]INRiM Istituto Nazionale di Ricerca Metrologica, Politecnico di Torino, Italy

Characterization Setup of a Molecular Iodine Based Optical Clock
Ludwig Blümel[1], Thomas Zechel[1], Tobias D. Schmidt[1], Pia Kindl[1], Thomas Schilling[1], Johann Furthner[1], Markus Oswald[1], Thilo Schuldt[1], Claus Braxmaier[1], Klaus Döringshoff[2], Evgeny Kovalchuk[2], Achim Peters[2], Martin Gohlke[1]
[1]Deutsches Zentrum für Luft- und Raumfahrt e.V., German Aerospace Center, Germany; [2]Ferdinand-Braun-Institut, Leibniz-Institut für Höchstfrequenztechnik, Germany

10:40 – 12:30
Piezoelectric MEMS/NEMS resonators (Joint Group 1 & 4 Session)
Room: Lecture Hall 2
Chair: Jun Kondoh (Shizuoka University)

INVITED: An Ising Tag with a LiNbO3 Resonator for Temperature Threshold Sensing
Nicolas Casilli[2], Hussein Hussein[1], Ryan Tetro[2], Tahmid Kaisar[3], Philip X.-L. Feng[3], Luca Colombo[2], Cristian Cassella[2]
[1]Northeastern University, United States; [2]SMART Center, Northeastern University, United States; [3]University of Florida, United States

Near-Zero TCF SH0 Plate Acoustic Wave Resonators Using 36°YX-LiTaO3/SiO2 Film
Shuxian Wu[2], Zonglin Wu[2], Hangyu Qian[2], Feihong Bao[2], Gongbin Tang[3], Feng Xu[1], Jie Zou[2]
[1]Fudan University, China; [2]Key Laboratory for Information Science of Electromagnetic Waves, Fudan University, China; [3]New Generation semiconductor Materials Research Institute, Shandong University, China

Impact of Asymmetric Piezoelectricity of 100 nm Al0.7Sc0.3N Thin Film on Ferroelectrically Switchable Multi-Layer Bulk Acoustic Wave Resonators
Li Chen, Wenjia Yang, Chen Liu, Minghua Li, Nan Wang, Yao Zhu
Institute of Microelectronics, Agency for Science, Technology and Research, Singapore

Tuning Strain and Quality Factor of 2D MoS2 NEMS Resonators Using Annealing and Electrostatic Gating
Pengcheng Zhang, Yueyang Jia, Zuheng Liu, Rui Yang
Shanghai Jiao Tong University, China

High Overtone Bulk Acoustic Resonator Based on 32.8°Y-LiNbO3 Thin Film Grown by DLI-CVD
Sondes Boujnah[2], Quentin Micard[2], Lilia Arapan[2], Mihaela Ivan[2], Valérie Soumann[2], Mario Costanza[2], Samuel Margueron[2], Vincent Astié[1], Jean-Manuel Decams[1], Ausrine Bartasyte[2]
[1]Annealsys, France; [2]FEMTO-ST Institute, CNRS, University of Bourgogne Franche-Comté, France

12:30 – 14:00
Lunch Break
Room: Crowne Plaza

14:00 – 15:50
Neutral Atom and Nuclear Clocks
Room: Main Hall
Chair: Nils Nemitz (NICT)

Improving ^{171}Yb Optical Lattice Clock Performance with Coherent Delocalization

Jacob Siegel[2], William McGrew[1], Chun-Chia Chen[2], Youssef Hassan[2], Xiaogang Zhang[2], Tanner Grogan[2], Benjamin Hunt[2], Kyle Beloy[2], Andrew Ludlow[3]
[1]JILA Joint Institute for Laboratory Astrophysics, University of Colorado Boulder, United States; [2]National Institute of Standards and Technology, United States; [3]NIST Boulder, University of Colorado at Boulder, United States

Towards a Systematic Accuracy Evaluation of the JILA Sr1 Optical Lattice Clock

Alexander Aeppli, Kyungtae Kim, William Warfield, Jun Ye
JILA Joint Institute for Laboratory Astrophysics, University of Colorado Boulder, United States

Optical Ramsey Spectroscopy with Superradiance Enhanced Readout

Eliot Bohr, Sofus Laguna Kristensen, Stefan Alaric Schäffer, Julian Robinson-Tait, Jörg Helge Müller
Niels Bohr Institute, University of Copenhagen, Denmark

Vacuum Ultraviolet Search from Thorium-229 Isomer in Crystal Toward Solid-State Nuclear Clock

Sayuri Takatori[4], Yuta Fukunaga[4], Ming Guan[4], Takahiro Hiraki[4], Takahiko Masuda[4], R. Ogake[4], Koichi Okai[4], Noboru Sasao[4], K. Shimizu[4], Satoshi Uetake[4], Akihiro Yoshimi[4], Koji Yoshimura[4], Motohiko Yoshimura[4], Kjeld Beeks[8], Fabian Schaden[8], Thorsten Schumm[8], Hiroyuki Fujimoto[3], Makoto Watanabe[3], Hiromitsu Haba[6], Yudai Shigekawa[6], Atsushi Yamaguchi[6], Kenji Tamasaku[6], Yoshitaka Kasamatsu[5], Yuki Yasuda[5], S. Kitao[2], M. Seto[2], K. Konashi[7], M. Watanabe[7], N. Nagasawa[1], Y. Yoda[1]
[1]Japan Synchrotron Radiation Research Institute, Japan; [2]Kyoto University, Japan; [3]National Institute of Advanced Industrial Science and Technology, Japan; [4]Okayama University, Japan; [5]Osaka University, Japan; [6]RIKEN, Japan; [7]Tohoku University, Japan; [8]Vienna University of Technology, Austria

Status and Perspectives of INRIM Sr Cavity-Enhanced Optical Clock

Matteo Barbiero[1], Gianluca Bertaina[1], Davide Calonico[1], Filippo Levi[1], Juan Pablo Salvatierra[2], Marco Giacinto Tarallo[1]
[1]INRiM Istituto Nazionale di Ricerca Metrologica, Italy; [2]Politecnico di Torino, Italy

14:00 – 15:50
MEMS and BAW resonators
Room: Lecture Hall 3
Chair: Marie Bousquet (Cea Leti)

INVITED: BAW Advantages for Low Power IoT Applications

Danielle Griffith
Texas Instruments, United States

A Self-Sustained Phononic Comb MEMS Oscillator with Loop Phase Tuning

Chin-Yu Chang, Chun-You Liu, Sheng-Shian Li
National Tsing Hua University, Taiwan

Spurious-Free Lithium Niobate Bulk Acoustic Resonator for Piezoelectric Power Conversion

Kristi Nguyen[3], Eric Stolt[1], Weston Braun[1], Vakhtang Chulukhadze[3], Jeronimo Segovia-Fernandez[2], Sombuddha Chakraborty[2], Juan Rivas-Davila[1], Ruochen Lu[3]
[1]Stanford University, United States; [2]Texas Instruments, United States; [3]University of Texas, Austin, United States

A MEMS-Boosted Over-the-Air RF Energy Harvester for IoT Receivers

Luca Colombo[2], Giuseppe Michetti[2], Gabriel Giribaldi[2], Nicolas Casilli[2], Ankit Mittal[2], Guodong Zhang[1], Patrick Cabrol[1], Aatmesh Shrivastava[2], Cristian Cassella[2], Matteo Rinaldi[2]
[1]INTERDIGITAL, INC., United States; [2]SMART Center, Northeastern University, United States

Push-Pull Resoswitch Communication Receiver

Qiutong Jin, Kevin Zheng, Clark Nguyen
University of California, Berkeley, United States

14:00 – 15:50
Timescales
Room: Lecture Hall 2
Chair: Marina Gertsvolf (NRC Canada)

An Algorithm for the Generation of Optical Time Scales

Ilaria Sesia[1], Valerio Formichella[1], Giovanna Signorile[1], Tung Than Thai[1], Lorenzo Galleani[3], Marco Pizzocaro[1], Irene Goti[2], Stefano Condio[2], Cecilia Clivati[1], Matias Risaro[1], Davide Calonico[1], Filippo Levi[1]
[1]INRiM Istituto Nazionale di Ricerca Metrologica, Italy; [2]INRiM Istituto Nazionale di Ricerca Metrologica, Politecnico di Torino, Italy; [3]Politecnico di Torino, Italy

Traceable Time and Frequency Signals for UK Innovation

Huw Owen[2], Conway Langham[2], Ali Ashkhasi[2], Hannah Collingwood[1], John Davis[2], Belinda Eglin[2], Robert Foot[2], Jacob Tunesi[2], Peter Whibberley[2], Helen Margolis[2]
[1]NPL Management Ltd, United Kingdom; [2]NPL Management Ltd, National Physical Laboratory, United Kingdom

Performance of a Real-Time Ensemble Time Scale Steered to KRISS-PSFS

Ho Seong Lee, Taeg Yong Kwon, Sang Eon Park, Young Kyu Lee, Sung-Hoon Yang, Dai-Hyuk Yu, Myoung-Sun Heo, Huidong Kim, Chang Yong Park, Won-Kyu Lee
Korea Research Institute of Standards and Science, Korea

State Estimation of Atomic Clocks by Kalman Filter Using Time-Delayed Observation

Takahiro Kawaguchi[1], Yuto Kakinuma[1], Takayuki Ishizaki[3], Yuichiro Yano[2], Yuko Hanado[2]
[1]Gunma University, Japan; [2]National Institute of Information and Communications Technology, Japan; [3]Tokyo Institute of Technology, Japan

High-Performance Limits of an Atomic Fountain Clock Based Time Scale

Josh Whale[1], Richard Hendricks[1], Krzysztof Szymaniec[1], Andrew Wilson[1], Peter Whibberley[2], Conway Langham[2]
[1]National Physical Laboratory, United Kingdom; [2]NPL Management Ltd, National Physical Laboratory, United Kingdom

8:50 – 10:40
Sensing and Space
Room: Main Hall
Chair: Jérome Delporte (Centre National d'Etudes Spatiales)

INVITED: Transforming Seafloor Cables Into Environmental Sensor Arrays for Earth Monitoring on a Global Scale

Giuseppe Marra[4], David Fairweather[6], Valey Kamalov[2], P. Gaynor[4], Mattia Cantono[2], Sean Mulholland[4], Brian Baptie[1], Jorge Castellanos[2], George Vagenas[4], Jacques-Olivier Gaudron[4], Jochen Kronjäger[5], Ian Hill[4], Marco Schioppo[4], Irene Barbeito Edreira[4], Kathryn Burrows[4], Cecilia Clivati[3], Davide Calonico[3], Andrew Curtis[6]
[1]British geological Survey, United Kingdom; [2]Google Inc, United States; [3]INRiM Istituto Nazionale di Ricerca Metrologica, Italy; [4]National Physical Laboratory, United States; [4]National Physical Laboratory, United Kingdom; [5]Physikalisch-Technische Bundesanstalt, National Physical Laboratory, United Kingdom; [6]University of Edinburgh, United Kingdom

Low-Frequency Seismic Wave Sensing Using Coherent Optical Fiber Networks for Metrology

Mads Tønnes[3], Maxime Mazouth-Laurol[3], Hendrix Montalvan-Leyva[2], Benjamin Pointard[3], Héctor Álvarez Martínez[4], Rodolphe Le Targat[3], Paul-Éric Pottie[3], Étienne Cantin[1], Olivier Lopez[1], Christian Chardonnet[1], Anne Amy-Klein[1]
[1]Laboratoire de Physique des Lasers, Université Sorbonne Paris Nord, CNRS, France; [2]LNE-SYRTE Laboratoire, France; [3]LNE-SYRTE Observatoire de Paris, Université PSL, CNRS, Sorbonne Université, France; [4]LNE-SYRTE Observatoire de Paris, Université PSL, CNRS, Sorbonne Université, ROA, France

Searching for Large Dark Matter Clumps Using Galileo Satellites Clocks

Bruno Bertrand[5], Julien Chabé[6], Clément Courde[6], Pascale Defraigne[5], Florian Dilssner[3], Aurélien Hees[4], Luis Mendes[2], Erik Schoenemann[3], Javier Ventura-Traveset[1], Pacôme Delva[4]
[1]ESA European Space Agency-Centre Spatial de Toulouse, France; [2]ESA-ESAC European Space Agency-European Space Astronomy Centre, Spain; [3]ESA-ESOC European Space Agency-European Space Operations Centre, Germany; [4]LNE-SYRTE Observatoire de Paris, Université PSL, CNRS, Sorbonne Université, France; [5]Royal Observatory of Belgium, Belgium; [6]Université Côte d'Azur, CNRS, Observatoire de la Côte d'Azur, IRD, Géoazur, France

Calibration of the Optical Time Transfer and Ranging System of the CubeSat Laser Infrared CrosslinK (CLICK) Mission

Hannah Tomio[2], Paul Serra[2], William Kammerer[2], Peter Grenfell[2], Nicholas Belsten[2], Kerri Cahoy[2], Myles Clark[4], Danielle Coogan[4], Joseph Conroy[4], John Conklin[4], Jan Stupl[3], David Mayer[3], John Hanson[1]
[1]Crosstrac Engineering, United States; [2]Massachusetts Institute of Technology, United States; [3]NASA Ames Research Center, United States; [4]University of Florida, United States

Experimental Study on VLBI Time Transfer Based on GEO Satellite Observation

Jia Liu[1], Zhe Zhang[1], Xuhai Yang[2], Baoqi Sun[1], Yuanxin Wang[1], Hui Lei[1], Yuanwei Wu[1], Langming Ma[1], Xishun Li[1], Kai Nan[1], Shougang Zhang[1]
[1]National Time Service Center, Chinese Academy of Sciences, China; [2]National Time Service Center, Chinese Academy of Sciences, University of Chinese Academy of Sciences, China

8:50 – 10:40
Combs and Photonic Microwave Generation
Room: Lecture Hall 2
Chair: Ronald Holzwarth (Menlo**)**

INVITED: An Er/Yb:Glass Frequency Comb for Precision Optical and Microwave Synthesis
Nicholas Nardelli[1], Holly Leopardi[1], Thomas Schibli[2], Tara Fortier[1]
[1]National Institute of Standards and Technology, United States; [2]University of Colorado Boulder, United States

Ultrastable Low-Noise Optical Frequency Synthesizer
Stefan Kundermann[1], Lauriane Karlen[1], Emmanuel Onillon[1], Sylvain Karlen[1], Steve Lecomte[1], Brian Shortt[2]
[1]CSEM SA, Switzerland; [2]ESA-ESTEC European Space Agency-European Space Research and Technology Centre, Netherlands

10 GHz Output Signal from an Optical Clockwork Supporting 10^{-20}-Level Stability in 1000 s
Michele Giunta, Martin Wolferstetter, Andreas Fricke, Benjamin Rauf, Dag Schmidt, Marc Fischer, Ronald Holzwarth
Menlo Systems GmbH, Germany

Low-Phase-Noise Microwave Generated by an Optical Frequency Comb Locked to an On-Chip Interferometer
James Cahill[1], Tanvir Mahmood[1], Patrick Sykes[2], Curtis Menyuk[2], Weimin Zhou[1]
[1]DEVCOM Army Research Laboratory, United States; [2]University of Maryland, Baltimore County, United States

Ultrabroadband Frequency Comb with Sub-3 kHz Free-Running Linewidths
Rafał Wilk[1], Ali Seer[1], Robert Herda[1], Christoph Tresp[1], Sarah Hutter[2], Tilman König[2], Daniel Hertzsch[2], Hannes Kempf[2], Alfred Leitenstorfer[2]
[1]TOPTICA Photonics AG, Germany; [2]University of Konstanz, Germany

8:50 – 10:40
Piezoelectric and mm-wave resonators
Room: Lecture Hall 3
Chair: Ming-Huang Li (Tsingua Uni)

INVITED: Aluminum Scandium Nitride for mm-Wave Acoustic Filtering: Challenges and Outlook
Azadeh Ansari
Georgia Institute of Technology, United States

An Experimental Approach to Optimize Quality Factor and Power Linearity in 30% Scandium Aluminum Nitride CLMRs Operating Above 6 GHz
Gabriel Giribaldi, Luca Colombo, Matteo Rinaldi
SMART Center, Northeastern University, United States

Laterally Coupled BST/Sapphire High Overtone Bulk Acoustic Resonators Exhibiting DC Tunable Comb Filter Response with High Q.f Product
Sandeep Sharma Kongbrailatpam[1], Akhil Raman T S[2], Chandrashekar L N[1], James Raju K C[2], Gayathri Pillai[1]
[1]Indian Institute of Science, India; [2]University of Hyderabad, India

Effect of Polarity of LiTaO3 and Quartz on Hetro Acoustic Layer Surface Acoustic Wave Properties
Michio Kadota, Shuji Tanaka
Tohoku University, Japan

Analysis of 5–10 GHz Higher-Order Lamb Acoustic Waves in Thin-Film Scandium Aluminum Nitride

Sinwoo Cho[2], Jack Guida[1], Jack Kramer[2], Omar Barrera[2], Vakhtang Chulukhadze[2], Can Cui[2], Siddhartha Ghosh[1], Ruochen Lu[2]
[1]Northeastern University, United States; [2]University of Texas at Austin, United States

10:40 – 11:00
Coffee Break

11:00 – 12:30
Keynote 2: John M. Doyle
Cold and ultra-cold polyatomic molecules for quantum science
Room: Main Hall
Chair: Filippo Levi (INRIM) and Ashwin A. Seshia (Cambridge University)

12:30 – 14:00
Lunch Break
Room: Crowne Plaza

14:00 – 15:50
Free-space Optical Links
Room: Main Hall
Chair: Anne Amy-Klein (Université Sorbonne Paris Nord)

INVITED: Towards Ground-to-Space Laser Links for Precision Metrology

David Gozzard, Benjamin Dix-Matthews, Shane Walsh, Skevos Karpathakis, Ayden McCann, Alex Frost, Sascha Schediwy
University of Western Australia, Australia

Ultra-Low Power Time Transfer: 300 Attosecond Synchronization with 300 Fw Over 300 km of Air

Emily Caldwell[1], Jean-Daniel Deschenes[2], Jennifer Ellis[1], William Swann[1], Benjamin Stuhl[3], Hugo Bergeron[2], Nathan Newbury[1], Laura Sinclair[1]
[1]National Institute of Standards and Technology, United States; [2]Octosig Consulting, Canada; [3]Space Dynamics Laboratory, National Institute of Standards and Technology, United States

Optical Ranging and Synchronization for Distributed Sensing with Small Satellite Formations

Christopher Flood[3], Emily Caldwell[1], Laura Sinclair[1], Nathan Newbury[1], Jean-Daniel Deschenes[2], William Swann[1], Ian Coddington[1], Fabrizio Giorgetta[1]
[1]National Institute of Standards and Technology, United States; [2]Octosig Consulting, Canada; [3]University of Colorado Boulder, United States

A Two-Way Free-Space Link for Optical Frequency Comparisons

Jingxian Ji[1], Alexander Kuhl[1], Jochen Kronjäger[2], Sebastian Koke[1]
[1]Physikalisch-Technische Bundesanstalt, Germany; [2]Physikalisch-Technische Bundesanstalt, National Physical Laboratory, Germany

Effect of Wind in Free-Space Time and Frequency Transfer

Jan Geršl
Czech Metrology Institute, Czech Rep.

14:00 – 15:50
Ultrastable Cavities and Laser Systems
Room: Lecture Hall 2
Chair: Ladan Arissian (NIST)

INVITED: First Measurements of Spectral Hole Line Shifts at Dilution Temperatures for Laser Stabilization
Michael Hartman[3], Xiuji Lin[3], Benjamin Pointard[4], Rodolphe Le Targat[4], Philippe Goldner[1], Signe Seidelin[2], Bess Fang[3], Yann Le Coq[3]
[1]Chimie ParisTech, Chemistry Research Institute of Paris, France; [2]Institut Neel, CNRS, France; [3]LNE-SYRTE Laboratoire, France; [4]LNE-SYRTE Observatoire de Paris, Université PSL, CNRS, Sorbonne Université, France

Photo-Modified Birefringence in AlGaAs Coatings
Thomas Legero[2], Chun Yu Ma[2], Jialiang Yu[2], Steffen Sauer[2], Daniele Nicolodi[2], Mona Kempkes[2], Sofia Herbers[2], Fritz Riehle[2], Uwe Sterr[2], Dhruv Kedar[1], John Robinson[1], Jun Ye[1]
[1]JILA Joint Institute for Laboratory Astrophysics, University of Colorado Boulder, United States; [2]Physikalisch-Technische Bundesanstalt, Germany

Hollow Core Fibre Based Fabry-Perot Resonators with Q Factor Over 90 Billion
Meng Ding, Zitong Feng, Eric Numkam Fokoua, Gregory Jasion, Francesco Poletti, David J Richardson, Radan Slavík
University of Southampton, United Kingdom

Vacuum-Gap, 2 mL-Volume Optical Reference Cavity with a Microfabricated Mirror
Charles McLemore[2], Naijun Jin[3], Megan Kelleher[2], David Mason[3], Yizhi Luo[3], Dahyeon Lee[2], Peter Rakich[3], Scott Diddams[2], Franklyn Quinlan[1]
[1]National Institute of Standards and Technology, United States; [2]University of Colorado Boulder, United States; [3]Yale University, United States

Ultra-Low Noise Dual Polarization Brillouin Fiber Laser
Jacob Lampen[2], Peng Li[2], Jie Jiang[2], Martin Fermann[2], Antoine Rolland[1]
[1]Boulder Research Labs., IMRA America, Inc., United States; [2]IMRA America, Inc., United States

14:00 – 15:50
Fountain and Cold Atom Clock
Room: Lecture Hall 3
Chair: James Camparo (Aerospace)

INVITED: Compact and Miniature Atomic Clocks Using Hot and Cold Rubidium Atomic Vapors
Gaetano Mileti
Université de Neuchâtel - Laboratoire Temps - Fréquence, Switzerland

Progress Towards the Reevaluation of the NRC-FCs2 Fountain Clock at the National Research Council Canada
Scott Beattie, Bin Jian, Marina Gertsvolf
National Research Council Canada, Canada

Cesium Fountain Primary Frequency Standard NMIJ-F2 with Uncertainty Evaluated
Akifumi Takamizawa[1], Shinya Yanagimachi[2], Ken Hagimoto[1]
[1]National Metrology Institute of Japan, Advanced Industrial Science and Technology, Japan; [2]NMIJ, National Institute of Advanced Industrial Science and Technology, Japan

Progress Towards a Compact Cold-Atom Microwave Clock
Martin Knapp[3], Sam Walby[2], Mohsin Haji[1], Chris Foot[3], Patrick Gill[1]
[1]National Physical Laboratory, United Kingdom; [2]National Physical Laboratory, University of Oxford, United Kingdom; [3]University of Oxford, United Kingdom

Development of a Continuous Rb Fountain Clock with a Standard Frequency Output
Kun Liu, Weiliang Chen, Fasong Zheng, Shaoyang Dai, Yani Zuo, Shiying Cao, Fang Fang
National Institute of Metrology of China, China

16:00 – 17:40
Poster Session 2
Poster Areas: 1F Deli, 3F North, 3F South

Technical Program for Friday, May 19

8:50 – 10:40
Compact Optical/Microwave Clocks (Joint Group 3 & 6 Session)
Room: Main Hall
Chair: Gregory Hoth (NIST)

INVITED: Next Generation Chip-Scale Atomic Clocks
John Kitching
NIST Boulder, United States

Measurements of Frequency Shifts in a High-Performance CPT-Based Cesium Cell Atomic Clock
Juliette Breurec[1], Moustafa Abdel Hafiz[1], Rémy Vicarini[1], Claudio Eligio Calosso[3], Oriane Lelièvre[4], Rodolphe Boudot[2]
[1]FEMTO-ST Institute, France; [2]FEMTO-ST Institute, CNRS, University of Bourgogne Franche-Comté, France; [3]INRiM Istituto Nazionale di Ricerca Metrologica, Italy; [4]THALES AVS-MIS, France

Progress on Ion Microwave Frequency Standards at Tsinghua University
Haoran Qin[2], Ying Zheng[2], Nongchao Xin[1], Shengnan Miao[1], Yiting Chen[1], Wenxin Shi[1], Jize Han[1], Jianwei Zhang[1], Lijun Wang[1]
[1]State Key Laboratory of Precision Measurement, Tsinghua University, China; [2]Tsinghua University, China

Suppression of the AC Stark Shift in a Two-Photon Rubidium Optical Frequency Standard
Yorick Andeweg[1], John Kitching[2], Matthew Hummon[1]
[1]National Institute of Standards and Technology, United States; [2]NIST Boulder, United States

Deployed Optical Atomic Clocks and Time-Transfer
Jonathan Roslund, Arman Cingoz, Abijith Kowligy, William Lunden, Guthrie Partridge, Micah Ledbetter, Dan Sheredy, Frank Roller, Gunnar Skulason, Andrew Dowd, Akash Rakholia, Jamil Abo-Shaeer, Martin Boyd
Vector Atomic, United States

8:50 – 10:40
Time Distribution
Room: Lecture Hall 2
Chair: Kun Liang (Beijing Jiaotong University)

INVITED: Free-Space Dissemination of Time and Frequency with 10^{-19} Instability Over 113 km
Qi Shen, Jian-Yu Guan, Ji-Gang Ren, Ting Zeng, Lei Hou, Min Li, Hai-Feng Jiang, Qiang Zhang, Jian-Wei Pan
University of Science and Technology of China, China

Autonomous Synchronization of Satellite Constellations via Optical Inter-Satellite Links
Christian Trainotti[1], Manuele Dassié[1], Gabriele Giorgi[1], Amir Khodabandeh[3], Christoph Günther[2]
[1]German Aerospace Center, Germany; [2]German Aerospace Center, Technical University of Munich, Germany; [3]University of Melbourne, Australia

Performance of Real-Time PPP for UTC(k) Time Transfer
Harald Hauglin[2], Ole Petter Rønningen[1], Tor Melgård[1]
[1]Fugro Satellite Positioning, Norway; [2]Justervesenet - Norwegian Metrology Service, Norway

Extension of REFIMEVE with a White Rabbit Network

Caroline B. Lim[2], Florian Frank[2], Baptiste Chupin[2], Olivier Chiu[2], Michel Abgrall[2], Philip Tuckey[2], Paul-Éric Pottie[2], Étienne Cantin[1], Christian Chardonnet[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

A Quantum Key Encrypted Time Distribution Experiment

Thomas Zechel[2], Pablo Dominguez[3], Davide Orsucci[3], Amita Shrestha[3], Florian Moll[3], Tobias D. Schmidt[2], Luca Calderaro[4], Francesco Vedovato[5], Francesco Picciariello[5], Marco Avesani[4], Paolo Villoresi[5], Giuseppe Vallone[5], Matteo Padovan[1]
[1]Centro di Ateneo di Studi e Attivita Spaziali, Università degli Studi di Padova, Italy; [2]Deutsches Zentrum für Luft- und Raumfahrt e.V., German Aerospace Center, Germany; [3]German Aerospace Center, Germany; [4]ThinkQuantum srl, Italy; [5]Università degli Studi di Padova, Italy

8:50 – 10:40
Photonic and Microwave Oscillators
Room: Lecture Hall 3
Chair: Michele Giunta (Menlo Systems)

INVITED: Improving a Trapped-Ion Quantum Computer with a Cryogenic Sapphire Oscillator

Ting Rei Tan, Tomas Navickas, Christophe Valahu, Julian Jee, Arjun Rao, Maverick Millican, Michael Biercuk
University of Sydney, Australia

Low Noise Photonic Microwave Oscillator Based on a Novel Repetition Rate Stabilization

Erwin Cano Vargas[3], Kemal Şafak[2], Anan Dai[2], Marvin Edelmann[3], Florian Emaury[5], Benjamin Rudin[5], Philip Battle[1], Tony Roberts[1], Todd Hawthorne[1], Franz X. Kärtner[4]
[1]AdvR Inc, United States; [2]Cycle GmbH, Germany; [3]Deutsches Elektronen-Synchrotron, Hamburg University, Germany; [4]Deutsches Elektronen-Synchrotron, Hamburg University, Cycle GmbH, Germany; [5]Menhir Photonics AG, Switzerland

Technology Readiness of the Cryogenic Sapphire Oscillator

Christophe Fluhr[1], Benoît Dubois[1], Julien Paris[4], Guillaume Le Tetû[1], Valérie Soumann[2], Enrico Rubiola[1], Vincent Giordano[3]
[1]FEMTO-ST Institute, France; [2]FEMTO-ST Institute, CNRS, University of Bourgogne Franche-Comté, France; [3]FEMTO-ST Institute, CNRS, University of Bourgogne Franche-Comté, ENSMM, France; [4]My Cryo Firm, France

Frequency Noise in Cryogenic Silicon Cavities with Semiconductor Crystalline Coatings

Dhruv Kedar[1], Jialiang Yu[3], Eric Oelker[1], Alexander Staron[2], William Milner[1], John Robinson[1], Thomas Legero[3], Fritz Riehle[3], Uwe Sterr[3], Jun Ye[1]
[1]JILA Joint Institute for Laboratory Astrophysics, University of Colorado Boulder, United States; [2]NIST Boulder, Joint Institute for Laboratory Astrophysics, University of Colorado Boulder, United States; [3]Physikalisch-Technische Bundesanstalt, Germany

10:40 – 11:00
Coffee Break

11:00 – 11:30
Special Session: H. Katori (University of Tokyo, RIKEN, Japan)
Making Optical Lattice Clocks Compact and Useful for Real-World Applications
Room: Lecture Hall 3
Chair: Laura Sinclair (NIST)

11:30 – 12:35
Awards Ceremony
Room: Main Hall
Chair: Ashwin A. Seshia (Cambridge University) and Tetsuya Ido (NICT)

12:35 – 14:00
Lunch Break
Room: TICC Foyer

Friday, May 19

14:00 – 15:45
Session 1
Room: Main Hall
Chair: Ho Seong Lee (KRISS)

Frequency Scaling Millimeter Wave Acoustic Resonators Using Ion Beam Trimmed Lithium Niobate
V. Chulukhadze[2], K. Huynh[1], J. Kramer[2], M. Liao[1], S. Cho[2], L. Matto[1], O. Barrera[2], C. Cui[2], M. Goorsky[1], R. Lu[2]
[1]University of California, Los Angeles, United States; [2]University of Texas at Austin, United States

Light Shift Detection Using a Multiple Photodetection Method Suitable for a Chip-Scale Atomic Clock
M. Fukuoka, S. Goka
Tokyo Metropolitan University, Japan

Towards Coherent Population Trapping Clock Based on Compact Cold Atom Physical Package
J. Duan[2], Z. Yu[2], J. Qu[2], Y. Zhu[1], S. Wei[1], M. Yao[1], X. Liu[1]
[1]Innovation Academy for Precision Measurement Science and Technology, Chinese Academy of Sciences, China; [2]National Institute of Metrology of China, China

Few NV Center Nanodiamonds Enable High-Speed and High-Resolution Sensing of Paramagnetic Species
A. Modak, A. Majumder, M. Parashar, S. Tallur, K. Saha
Indian Institute of Technology Bombay, India

Improvement of the Ensemble Atomic Timescale Using Hydrogen Masers in NICT
H. Ito, T. Ido, Y. Hanado
National Institute of Information and Communications Technology, Japan

15:45 – 16:05
Coffee Break

16:05 – 17:30
Session 2
Room: Main Hall
Chair: Masami Yasuda (NMIJ)

UTC(NICT) Referenced to a Timescale Based on the Optical Clock NICT-Sr1
H. Hachisu, H. Ito, N. Nemitz, N. Ohtsubo, Y. Miyauchi, M. Morikawa, K. Matsubara, T. Ido
National Institute of Information and Communications Technology, Japan

Frequency Locking and Power Enhancement by Coherent Addition of a Clock Laser for a Portable Multi-$^{40}Ca^{+}$ Optical Clock
A. Nagano[2], U. Tanaka[2], K. Hayasaka[1]
[1]National Institute of Information and Communications Technology, Osaka University, Japan; [2]Osaka University, National Institute of Information and Communications Technology, Japan

Status Report of the ^{171}Yb Optical Lattice Clock KRISS-Yb1
H. Kim, W. Lee, C. Park, D. Yu, M. Heo
Korea Research Institute of Standards and Science, Korea

An Improved Transportable Strontium Lattice Clock

I. Nosske, C. Vishwakarma, T. Lücke, S. Herbers, C. Lisdat
Physikalisch-Technische Bundesanstalt, Germany

Poster Sessions

Poster Session 1 - Wednesday, May 17

8:50 – 10:30
Poster Session 1a
Room: 3F North

Asynchronous Optical Sampling (ASOPS) to Detect Small Oscillations in Silicon Membranes
Kenichi Hitachi[2], Atsushi Ishizawa[1], Kenji Ishikawa[3], Haruki Sanada[2], Katsuya Oguri[2]
[1]Nihon University, Japan; [2]NTT Basic Research Laboratories, Japan; [3]NTT Communication Science Laboratories, Japan

Frequency Separation Between $^3P_0$ and $^3P_1$ Levels in ^{171}Yb and Intercombination Line Frequencies
Daniel Jones, Frank van Kann, John McFerran
University of Western Australia, Australia

Measuring the Cavity-Pulling Coefficient of Active Optical Clock via Pump Laser Modulation
Jianxiang Miao, Jia Zhang, Tiantian Shi, Jingbiao Chen
Peking University, China

Detection of 776 nm Fluorescence in Two-Photon Rubidium Clock with Multi-Pixel Photon Counter
River Beard[2], Kyle Martin[2], John Elgin[1], Brian Kasch[1], Sean Krzyzewski[1]
[1]Air Force Research Laboratory, United States; [2]BLUEHALO, United States

Ultra Low Phase Noise VCXO with Crystal Filter Array
Yu-Liang Chen, Chi-Lun Yu, Shu-Ling Yeh, Chih-Hsun Chen, Sheng-Hsiang Kao
TXC Corporation, Taiwan

Cryogenic Ultra-Stable Laser at 1.9×10^{-16} Based on a Sapphire Cavity
Jingxuan Zhang[1], Leilei He[1], Zhiyuan Wang[1], Jialu Chang[1], Qiyue Wu[1], Qiang Wei[1], Zehuang Lu[2], Jie Zhang[1]
[1]Huazhong University of Science and Technology, China; [2]MOE Key Laboratory of Fundamental Quantities Measurement, HUST, China

Status Report of the ^{171}Yb Optical Lattice Clock KRISS-Yb1
Huidong Kim, Won-Kyu Lee, Chang Yong Park, Dai-Hyuk Yu, Myoung-Sun Heo
Korea Research Institute of Standards and Science, Korea

Optically-Based Low Noise Microwave Phase-Locked to a H-Maser for the SYRTE Atomic Fountains
Benjamin Pointard[2], Michel Lours[2], Luca Lorini[1], Yann Le Coq[1], Michel Abgrall[2], Rodolphe Le Targat[2]
[1]LNE-SYRTE Laboratoire, France; [2]LNE-SYRTE Observatoire de Paris, Université PSL, CNRS, Sorbonne Université, France

Atomic Beam Distribution in Calcium Beam Optical Clock
Lei Han[1], Xiaobo Xue[1], Hui Zhu[2], Qianqian Ji[1], Yu Chen[1], Shengkang Zhang[1]
[1]Beijing Institute of Radio Metrology and Measurement, China; [2]Institute of Semiconductors, Chinese Academy of Sciences, China

Ultra-Stable and Tunable Fabry-Perot Cavity for an Ytterbium Based Superradiant Laser
Martin Hauden, Martina Matusko, Jana El Badawi, Yann Kersalé, Francisco Sebastian Ponciano-Ojeda, Marion Delehaye
FEMTO-ST Institute, CNRS, University of Bourgogne Franche-Comté, ENSMM, France

High Precision Laser Synchronization System Based on AOM and Frequency-to-Voltage Converter

Shangsu Ding[1], Mingwen Zhu[1], Jianming Shang[2], Song Yu[2], Bin Luo[2]
[1]IPOC, Beijing University of Posts and Telecommunications, China; [2]State Key Laboratory of Information Photonics and Optical Communications, Beijing University of Post, China

Dual-Wavelength Ultra-Stable Optical Cavity

Adam Linek, Rodolfo Muñoz-Rodriguez, Michał Zawada, Marcin Witkowski
Institute of Physics, Nicolaus Copernicus University, Poland

Development of Two Single-Ion Spectroscopy Systems for the 2S1/2 – 2D5/2 Transition in Ytterbium Ions Towards Measurement of Isotope Shifts

Keisuke Yoshida[1], Mitsuharu Katagiri[1], Hwasun Jo[1], Yusuke Ueno[1], Takayuki Morimoto[1], Kazuhiko Sugiyama[1], Yasutaka Imai[2]
[1]Kyoto University, Japan; [2]Okayama University, Japan

A Frequency Shifting Scheme for On-Chip Optical Frequency Transfer

Ziang Qiu, Liang Hu, Jianping Chen, Guiling Wu
Shanghai Jiao Tong University, China

NPL-Sr1 Optical Lattice Clock Towards Redefinition of the Si Second

Chen-Hao Feng[2], Matthew Johnson[2], Filip Butuc-Mayer[2], Richard Hobson[1], William Bowden[2], Alvise Vianello[1], Marco Schioppo[2], Helen Margolis[3], Ian Hill[2]
[1]Imperial College London, National Physical Laboratory, United Kingdom; [2]National Physical Laboratory, United Kingdom; [3]NPL Management Ltd, National Physical Laboratory, United Kingdom

Towards a Continuous and Passive Strontium Optical Frequency Standard to Beat the Hydrogen Maser

Julian Robinson-Tait[1], Camila Beli Silva[2], Sofus Laguna Kristensen[1], Eliot Bohr[1], Stefan Alaric Schäffer[1], Jörg Helge Müller[1]
[1]Niels Bohr Institute, University of Copenhagen, Denmark; [2]University of Amsterdam, Netherlands

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

Modelling Convex-Concave Ultra-Stable Optical Cavity

Omid Vartehparvar[2], Marcin Bober[2], Mateusz Narożnik[2], Michał Zawada[1]
[1]Institute of Physics, Nicolaus Copernicus University, Poland; [2]Nicolaus Copernicus University, Poland

A Cryogenic Sapphire Oscillator with 10^{-16} Mid-Term ADEV

Christophe Fluhr[1], Benoît Dubois[1], Claudio Eligio Calosso[3], François Vernotte[1], Enrico Rubiola[1], Vincent Giordano[2]
[1]FEMTO-ST Institute, France; [2]FEMTO-ST Institute, CNRS, University of Bourgogne Franche-Comté, ENSMM, France; [3]INRiM Istituto Nazionale di Ricerca Metrologica, Italy

Excitation of a Microwave Cavity Resonators Using an Interferometric Wire Dipole Probe

Michael Hatzon[2], Eugene Ivanov[2], Jeremy Bourhill[2], Maxim Goryachev[1], Michael Tobar[1]
[1]Quantum Technologies and Dark Matter Labs, University of Western Australia, Australia; [2]University of Western Australia, Australia

Mode Number Determination of Optical Cavities for Next Generations of Gravity Missions

Timm Wegehaupt[4], Sariga Sachit[3], Vitali Müller[3], Gerhard Heinzel[3], Claus Braxmaier[2], Jens Grosse[1]
[1]Center of Applied Space Technology and Microgravity, Universität Bremen, Germany; [2]Deutsches Zentrum für Luft- und Raumfahrt e.V., German Aerospace Center, Germany; [3]Max-Planck-Institut für Gravitationsphysik, Albert-Einstein-Institut, Germany; [4]University of Bremen, Center of Applied Space Technology and Microgravity ZARM, Germany

A Robust Narrow-Line Frequency Comb

Christoph Tresp, Thomas Puppe, Sebastian Müller, Ali Seer, Pierre Thoumany, Rafał Wilk
TOPTICA Photonics AG, Germany

Frequency Locking and Power Enhancement by Coherent Addition of a Clock Laser for a Portable Multi-$^{40}Ca^+$ Optical Clock

Akira Nagano[2], Utako Tanaka[2], Kazuhiro Hayasaka[1]
[1]National Institute of Information and Communications Technology, Osaka University, Japan; [2]Osaka University, National Institute of Information and Communications Technology, Japan

Laser Power Stabilization with a Cesium FADOF

Hangbo Shi[2], Xiaolei Guan[1], Zhiyang Wang[2], Zijie Liu[2], Xiaomin Qin[2], Zhihong Gao[2], Tiantian Shi[2], Jingbiao Chen[2]
[1]Beijing University of Posts and Telecommunications, Peking University, SEIEE, China; [2]Peking University, China

Saturation Spectroscopy of $H^{13}C^{14}N$ Absorption Lines

Martin Hosek, Jan Hrabina, Šimon Řeřucha, Martin Čížek, Lenka Pravdova, Ondřej Číp
Institute of Scientific Instruments of the Czech Academy of Sciences, Czech Rep.

Development of a Sub-Kelvin Silicon Cavity

Joannès Barbarat[1], Jonathan Gillot[1], Jacques Millo[1], Clément Lacroûte[1], Vincent Giordano[1], Yann Kersalé[1], Thomas Legero[2]
[1]FEMTO-ST Institute, CNRS, University of Bourgogne Franche-Comté, ENSMM, France; [2]Physikalisch-Technische Bundesanstalt, Germany

Progress Toward the Transportable Strontium Optical Lattice Clock

Yuheng Huyan, Jordan Wayland, Yogeshwar Kale, Abhilash Jha, Yeshpal Singh
University of Birmingham, United Kingdom

Cryogenic High-Finesse Sapphire Cavity to Improve the Stability of Ytterbium Optical Lattice Clocks

Tanner Grogan[1], Chun-Chia Chen[1], Daniele Nicolodi[3], Youssef Hassan[1], Tobias Bothwell[1], Jacob Siegel[1], Benjamin Hunt[1], Andrew Ludlow[2]
[1]National Institute of Standards and Technology, United States; [2]NIST Boulder, University of Colorado at Boulder, United States; [3]Physikalisch-Technische Bundesanstalt, Germany

Development of an Ultra-Stable Cryogenic Silicon Optical Cavity

Jonathan Gillot[2], Yara Hariri[1], Joannès Barbarat[2], Clément Lacroûte[2], Jacques Millo[2], Yann Kersalé[2]
[1]FEMTO-ST Institute, France; [2]FEMTO-ST Institute, CNRS, University of Bourgogne Franche-Comté, ENSMM, France

Demonstration of a Field-Deployable Ytterbium Cell Clock

Ashby Hilton[1], Rachel Offer[1], Nicolas Bourbeau-Hébert[1], Christopher Billington[1], Elizaveta Klantsataya[1], Sarah Scholten[1], Ben White[1], Montana Nelligan[1], Jack Allison[1], Andre Luiten[2]
[1]University of Adelaide, Australia; [2]University of Adelaide, QuantXLabs, Australia

Multi-Mode Heterodyne Spectroscopy of Eu:YSO Based on Software Defined Radio

Bess Fang[3], Xiuji Lin[3], Michael Hartman[3], Rodolphe Le Targat[4], Philippe Goldner[1], Signe Seidelin[2], Yann Le Coq[3]
[1]Chimie ParisTech, Chemistry Research Institute of Paris, France; [2]Institut Neel, CNRS, France; [3]LNE-SYRTE Laboratoire, France; [4]LNE-SYRTE Observatoire de Paris, Université PSL, CNRS, Sorbonne Université, France

Alignment Sensing and Control of KAGRA

Chiaki Hirose[2], Kenta Tanaka[1], Osamu Miyakawa[1], Takamasa Suzuki[2]
[1]Institute for Cosmic Ray Research, University of Tokyo, Japan; [2]Niigata University, Japan

Towards a Sr Optical Lattice Clock at ROA - First Implementations

Héctor Álvarez Martínez[2], Antonio Estarellas Perales[3], Ignacio Cortés Delgado[3], Jesús Romero González[3], José Manuel Suárez Ramírez deArellano[3], Verónica Bazán Suárez[3], Juan Manuel González Sánchez[3], Jaime Cafranga Bohórquez[3], Carmen Vélez López[3], Rodolphe Le Targat[1], Héctor Esteban Pinillos[3]
[1]LNE-SYRTE Observatoire de Paris, Université PSL, CNRS, Sorbonne Université, France; [2]LNE-SYRTE Observatoire de Paris, Université PSL, CNRS, Sorbonne Université, ROA, Spain; [3]Real Instituto y Observatorio de la Armada, Spain

Ultra-Stable Rack-Integrated DFG Frequency Comb System for Quantum Technologies

Ali Seer, Christoph Tresp, Thomas Puppe, Jae-Ihn Kim, Ralf Bickleder, Thomas Trummer, Christoph Stihler, Matthias Scholz, Rafał Wilk
TOPTICA Photonics AG, Germany

New Physics Package for a Strontium Optical Lattice Clock

Jérôme Lodewyck[1], Miguel Cifuentes[1], Haosen Shang[1], Rodolphe Le Targat[2]
[1]LNE-SYRTE Laboratoire, France; [2]LNE-SYRTE Observatoire de Paris, Université PSL, CNRS, Sorbonne Université, France

8:50 – 10:30
Poster Session 1b
Room: 3F South

MEMS-Based Technologies for Ultraminiaturization and Cost Reduction of Atomic Clocks

Motoaki Hara, Yuichiro Yano, Tetsuya Ido
National Institute of Information and Communications Technology, Japan

Towards Coherent Population Trapping Clock Based on Compact Cold Atom Physical Package

Junyi Duan[2], Zhilong Yu[2], Jifeng Qu[2], Yumeng Zhu[1], Shiming Wei[1], Minghao Yao[1], Xiaochi Liu[1]
[1]Innovation Academy for Precision Measurement Science and Technology, Chinese Academy of Sciences, China; [2]National Institute of Metrology of China, China

Mitigation of He Permeation in Microfabricated Vapor Cells with Alumino-Silicate Glass and Al2O3 Coatings

Clément Carlé[2], Shervin Keshavarzi[2], Andrei Mursa[2], Petri Karvinen[4], Ravinder Chutani[1], Sylwester Bargiel[2], Rémy Vicarini[2], Philippe Abbé[2], Moustafa Abdel Hafiz[2], V. Maurice[1], Rodolphe Boudot[3], Nicolas Passilly[3]
[1]École Centrale de Lille, Institute of Electronics, Microelectronics and Nanotechnology, France; [2]FEMTO-ST Institute, France; [3]FEMTO-ST Institute, CNRS, University of Bourgogne Franche-Comté, France; [4]University Eastern Finland, Finland

Characterization of Short-Term Ultra-Stable Radiofrequency Sources Generated from Cavity Based Optical Reference Systems

Pablo Dominguez[2], Thomas Zechel[1], Ludwig Blümel[1], Tobias D. Schmidt[1]
[1]Deutsches Zentrum für Luft- und Raumfahrt e.V., German Aerospace Center, Germany; [2]German Aerospace Center, Germany

Derivation of CPT Resonance Signals from Density-Matrix Equations with All Relevant Sublevels of Cs Atoms and Confirmation of Experimental Results

Kenta Matsumoto[2], Sota Kagami[2], Takahiro Fujisaku[2], Shinya Yanagimachi[3], Takeshi Ikegami[1], Atsuo Morinaga[1]
[1]Micromachine Center, Japan; [2]NEC Corporation, Japan; [3]NMIJ, National Institute of Advanced Industrial Science and Technology, Japan

Light Shift of CPT-Ramsey Resonance in Dilute Cs Vapor Cells

Sota Kagami[2], Takahiro Fujisaku[2], Kenta Matsumoto[2], Shinya Yanagimachi[3], Atsuo Morinaga[1]
[1]Micromachine Center, Japan; [2]NEC Corporation, Japan; [3]NMIJ, National Institute of Advanced Industrial Science and Technology, Japan

Two Methods About C-Field Evaluation in Beam Clock
Yuanhao Li, Chen Liu, Sifei Chen, Lifeng Fan, Yanhui Wang
Peking University, China

Investigation of Conical Magneto-Optical Trap as a Source of Slow Atoms
Ekaterina Aleinikova, Ekaterina Ivanchenko, Dmitrii Kupalov, Olga Kupalova
VNIIFTRI, Russia

Laser Frequency Offset Stabilization Using Modulation Transfer Spectroscopy
Georgii Osipenko, Mikhail Aleynikov, Yulia Pashkova
VNIIFTRI, Russia

Passively-Pumped Vacuum System for a Laser-Cooled Yb^+ Microwave Clock
Sean Mulholland, Geoffrey Barwood, Guilong Huang, Hugh Klein, Patrick Gill
National Physical Laboratory, United Kingdom

Preliminary Study of TA1000: Performance and Time-Keeping Application
Hongqiang Du, Jianjun Gong, Wenjun Wu, Shao-Wu Dong, Shougang Zhang
National Time Service Center, Chinese Academy of Sciences, China

Current Status of REFIMEVE Fiber Network in Paris Urban Area
Étienne Cantin[2], Olivier Lopez[2], Christian Chardonnet[2], Anne Amy-Klein[2], Martin Rabault[1], Grégoire Coget[1], Peter Rosenbusch[1], Vincent Ménoret[1], Nicolas Quintin[4], Mads Tønnes[3], Maxime Mazouth-Laurol[3], Benjamin Pointard[3], Maxime Laiguillon[3], Pascal Blondé[3], Michel Abgrall[3], Rodolphe Le Targat[3], Paul-Éric Pottie[3]
[1]exail Quantum Sensors, 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]RENATER, France

Time Synchronization Performance of an Eloran Station to UTC(KRIS) by GPS Common View
Young Kyu Lee, Sung-Hoon Yang, Ho Seong Lee, Jong Koo Lee, Sang-Wook Hwang, Joon Hyo Rhee, Juhyun Lee
Korea Research Institute of Standards and Science, Korea

Correction Algorithm of Doppler Effect on the Comb-Based FSO-TWTFT for Satellite Application
Long Wang[2], Wenhai Jiao[1], Liang Hu[2], Jianping Chen[2], Guiling Wu[2]
[1]Beijing Institute of Tracking and Telecommunication Technology, China; [2]Shanghai Jiao Tong University, China

Polarization Control for Continuous Optical Frequency Transfer
Przemysław Krehlik[1], Łukasz Buczek[1], Łukasz Śliwczyński[1], Krzysztof Turza[2]
[1]AGH University of Science and Technology, Poland; [2]Poznań Supercomputing and Networking Center, Poland

Coherent Optical Frequency Transfer via Aerial Fiber Link with 10^{-19} of Instability
Qian Zhou, Xiang Zhang, Qi Zang, Xue Deng, Mengfan Wu, Jie Liu, Dan Wang, Ruifang Dong, Tao Liu, Shougang Zhang
National Time Service Center, Chinese Academy of Sciences, China

Applications of a TWSTFT Modem for a Fiber-Optic Timing Transfer
Miho Fujieda[1], Motohiro Kumagai[2]
[1]National Astronomical Observatory of Japan, Japan; [2]National Institute of Information and Communications Technology, Japan

Data Assimilation Using Instantaneous Frequency Information for Time Estimation of Compact Atomic Clock
Yuichiro Yano, Tetsuya Ido, Motoaki Hara
National Institute of Information and Communications Technology, Japan

UTC(NICT) Referenced to a Timescale Based on the Optical Clock NICT-Sr1

Hidekazu Hachisu, Hiroyuki Ito, Nils Nemitz, Nozomi Ohtsubo, Yuka Miyauchi, Masaki Morikawa, Kensuke Matsubara, Tetsuya Ido
National Institute of Information and Communications Technology, Japan

Improvement of the Ensemble Atomic Timescale Using Hydrogen Masers in NICT

Hiroyuki Ito, Tetsuya Ido, Yuko Hanado
National Institute of Information and Communications Technology, Japan

Frequency Transfer Using Link Combination for the Distribution of Hydrogen Maser Signals

Carsten Rieck, Sven-Christian Ebenhag, Per Olof Hedekvist, Kenneth Jaldehag
RISE Research Institutes of Sweden, Sweden

Environmental Effects and Control Systems for GPS-Disciplined Clocks (GPSDC)

Andrew Novick[2], Demetrios Matsakis[1], John Clark[1]
[1]Masterclock, Inc, United States; [2]National Institute of Standards and Technology, United States

Precise Measurement Module for Laser Two Frequency Gyroscope-Based Seismometer

Ryszard Szplet[3], Dominik Sondej[3], Paweł Kwiatkowski[3], Marcin Chodnicki[1], Jerzy Kowalski[2], Henryk A. Kowalski[2]
[1]Air Force Institute of Technology, Poland; [2]Independent Researcher, Poland; [3]Military University of Technology, Poland

Over-the-Air Jamming and Spoofing Tests of GNSS Timing Devices

Harald Hauglin[1], Thomas Rødningen[1], Anders Rødningsby[2]
[1]Justervesenet - Norwegian Metrology Service, Norway; [2]Norwegian Defence Research Establishment FFI, Norway

8:50 – 10:30
Poster Session 1c
Room: 1F Deli

Investigations of Rydberg-Atom Based THz-Wave Electric Field Sensor

Motohiro Kumagai, Shigeo Nagano, Shin'Ichiro Hayashi, Norihiko Sekine
National Institute of Information and Communications Technology, Japan

Optically Pumped Cesium Beam Clock Using Monochromatic Light

Chen Liu, Yuanhao Li, Sifei Chen, Lifeng Fan, Yanhui Wang
Peking University, China

Long-Haul Fiber-Optic Time and Frequency Synchronization

Yufeng Chen, Hongfei Dai, Bo Wang
Tsinghua University, China

Time Shifting Deviation Method Enhanced Laser Interferometer for Traffic Monitoring

Bo Wang, Zhongwang Pang, Guan Wang
Tsinghua University, China

Experimental Demonstration of Surface Acoustic Wave Propagation on α-GeO2 for Wireless, Passive Sensor Design

William Daniau[1], Roland Salut[1], Jean-Michel Friedt[5], Alexandra Peña[4], Jérôme Debray[4], Bertrand Menaert[4], Pascale Armand[2], Philippe Papet[2], Annick Penarier[3], Philippe Nouvel[3]
[1]FEMTO-ST Institute, France; [2]Institut Charles Gerhardt Montpellier, Université de Montpellier, France; [3]Institut d'Electronique et des Systèmes, Université de Montpellier, France; [4]Institut Neel, CNRS, France; [5]LNE-LTFB, FEMTO-ST Institute, Observatoire de Besançon, France

Piezoelectric Micromachined Ultrasonic Transducer Integrated with Field Effect Transistor for Acoustic Sensing

Jennyfer Vivas Gomez[2], Luke Minks[2], Hakhamanesh Mansoorzare[2], Reza Abdolvand[2], Sarah Shahraini[1], Ruth Vidana Morales[1], Anushka Bhardwaj[1], Jason Mix[1], Matthew Dobre[1]
[1]Intel Corporation, United States; [2]University of Central Florida, United States

Towards a Ba^{+}-Li Atom-Ion System for Investigating Collisional Shifts in Ion-Based Optical Clocks

Naoto Mizukami[2], Lucia Duca[1], Gabriele Gatta[3], Carlo Sias[1]
[1]INRiM Istituto Nazionale di Ricerca Metrologica, LENS, Italy; [2]INRiM Istituto Nazionale di Ricerca Metrologica, Politecnico di Torino, LENS, Italy; [3]University of Florence and LENS, Italy

Development of a Compact Optical Clock for Small Satellite Applications

Emily Ahern[1], Sarah Scholten[1], Clayton Locke[2], Nicolas Bourbeau-Hébert[1], Christopher Perrella[2], Andre Luiten[2]
[1]University of Adelaide, Australia; [2]University of Adelaide, QuantXLabs, Australia

Poster Session 2 - Thursday, May 18

16:00 – 17:40
Poster Session 2a
Room: 3F North

Evaluation of an $^{27}Al^{+}$ Ion Optical Clock Systematic Uncertainty with a Value of 2×10^{-18}

Liren Pang, Zhiyu Ma, Wenzhe Wei, Peng Hao, Biao Wang, Hongli Liu, Wenhao Yuan, Ke Deng, Zehuang Lu
MOE Key Laboratory of Fundamental Quantities Measurement, HUST, China

Development of Next-Generation Strontium Ion Optical Clocks at the NRC

Kosuke Kato[1], Pierre Dubé[1], Scott Smale[2], Amar Vutha[2]
[1]National Research Council Canada, Canada; [2]University of Toronto, Canada

High-Performance 459-nm Cs Cell Optical Frequency Standard with a Predicted Frequency Stability of 10^{-14}

Jia Zhang, Jianxiang Miao, Tiantian Shi, Jingbiao Chen
Peking University, China

Characterization of a Surface Electrode Paul Trap for Frequency Metrology

Josipa Madunic[1], Moustafa Abdel Hafiz[1], Yann Kersalé[2], Clément Lacroûte[2]
[1]FEMTO-ST Institute, France; [2]FEMTO-ST Institute, CNRS, University of Bourgogne Franche-Comté, ENSMM, France

Thermal-Noise-Limited Transportable Ultra-Stable Laser

Weinan Zhao[1], Ming Dong[2], Hanxu Wu[1], Yang Fu[1], Jun Ge[1], Shengkang Zhang[1], Honglei Yang[1]
[1]Beijing Institute of Radio Metrology and Measurement, China; [2]Beijing Institute of Tracking and Telecommunications Technology, China

Broadband Characterization of an Ultrastable Optical Cavity with Crystalline Mirrors Using an Optical Frequency Comb

Marcin Bober[1], Dominik Charczun[1], Mateusz Narożnik[1], Maximilian Prinz[3], Piotr Morzyński[1], Garrett Cole[2], Gar-Wing Truong[2], Oliver Heckl[3], Piotr Masłowski[1]
[1]Nicolaus Copernicus University, Poland; [2]Thorlabs Crystalline Solutions, United States; [3]University of Vienna, Austria

Kerr Soliton Comb's Repetition Rate Stabilization via Auxiliary Mode Thermal Compensation and Rapid PZT Servo

Mingfei Qu[2], Kangqi Liu[1], Chenhong Li[2], Weihang Zhu[2], Yuan Wei[2], Pengfei Wang[2], Songbai Kang[2]
[1]Innovation Academy for Precision Measurement Science &Technology, UCAS, Chinese Academy of Sciences, China; [2]Innovation Academy for Precision Measurement Science and Technology, Chinese Academy of Sciences, China

A Space-Borne Ultra-Stable Laser Prototype for Space Gravitational Wave Detection

Jialu Chang[1], Zhiyuan Wang[1], Qiyue Wu[1], Jingxuan Zhang[1], Leilei He[1], Qiang Wei[1], Zehuang Lu[2], Jie Zhang[1]
[1]Huazhong University of Science and Technology, China; [2]MOE Key Laboratory of Fundamental Quantities Measurement, HUST, China

Isotope Shift Measurement of Ytterbium Atoms Towards a Search for New Physics

Tetsushi Takano[1], Koki Ono[1], Taiki Ishiyama[1], Ayaki Sunaga[1], Yosuke Takasu[1], Yasuhiro Yamamoto[2], Minoru Tanaka[3], Yoshiro Takahashi[1]
[1]Kyoto University, Japan; [2]National Centre for Theoretical Physics, Taiwan; [3]Osaka University, Japan

Contribution to TAI Calibration by NMIJ-Yb1 and Development of a New Ultra-Stable Laser

Akiko Nishiyama[1], Takumi Kobayashi[1], Sho Okubo[1], Daisuke Akamatsu[2], Kazumoto Hosaka[1], Yusuke Hisai[2], 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, Advanced Industrial Science and Technology, Japan; [2]Yokohama National University, Japan

A Dual-Interrogation Way for Light-Shift Suppression of Rb 778nm Two-Photon Transition Optical Frequency Reference

Dou Li[3], Kangqi Liu[1], Pengfei Wang[2], Songbai Kang[2]
[1]Innovation Academy for Precision Measurement Science &Technology, UCAS, Chinese Academy of Sciences, China; [2]Innovation Academy for Precision Measurement Science and Technology, Chinese Academy of Sciences, China; [3]University of Chinese Academy of Sciences, China

Progress on a ^{171}Yb-Based Active Optical Atomic Clock

Francisco Sebastian Ponciano-Ojeda, Jana El Badawi, Martin Hauden, Martina Matusko, Marion Delehaye
FEMTO-ST Institute, CNRS, University of Bourgogne Franche-Comté, ENSMM, France

Status Report on the Third Yb Optical Lattice Clock of KRISS and Evaluation of Blackbody Radiation Shift

Chang Yong Park, Myoung-Sun Heo, Huidong Kim, Dai-Hyuk Yu, Won-Kyu Lee
Korea Research Institute of Standards and Science, Korea

Collective Behaviour of a Continuous Thermal Beam of ^{88}Sr Atoms Coupled to a Single Mode Optical Cavity

Francesca Famà[1], Benedikt Heizenreder[1], Camila Beli Silva[1], Sheng Zhou[1], Mikkel Tang[2], Shayne Bennetts[1], Stefan Alaric Schäffer[1], Florian Schreck[1]
[1]University of Amsterdam, Netherlands; [2]University of Copenhagen, Netherlands

Autonomous Frequency Stabilization in Cold Atom Experiments

Mehrdad Zarei[2], Ivo Knottnerus[3], Alex Urech[3], Florian Schreck[3], Michał Zawada[1], Piotr Morzyński[2]
[1]Institute of Physics, Nicolaus Copernicus University, Poland; [2]Nicolaus Copernicus University, Poland; [3]University of Amsterdam, Netherlands

Precision Dual-Comb Spectroscopy Using Wavelength-Converted Er:Fiber Combs in the Visible-Wavelength Region

Yohei Sugiyama, Tsubasa Kashimura, Daisuke Akamatsu, Feng-Lei Hong
Yokohama National University, Japan

Iodine-Stabilized Lasers Using a 2-m-Long Cell
Shogo Matsunaga, Mayuko Yoshiki, Riho Amaki, Daisuke Akamatsu, Feng-Lei Hong
Yokohama National University, Japan

Digital Automatic Relocking Method and Implementation of Ultra-Stable Laser
Weinan Zhao[1], Ming Dong[2], Hanxu Wu[1], Yang Fu[1], Jun Ge[1], Shengkang Zhang[1], Honglei Yang[1]
[1]Beijing Institute of Radio Metrology and Measurement, China; [2]Beijing Institute of Tracking and Telecommunications Technology, China

Simple Vibration Insensitive Support of a Rectangular Optical Cavity with Instability of < 10^{-15} for Transportable Optical Atomic Clocks
Noriaki Ohmae[1], Hidetoshi Katori[2]
[1]Fukuoka University, Japan; [2]University of Tokyo, RIKEN, Japan

Investigation of Continuously Repumped Superradiance in ^{88}Sr
Sofus Laguna Kristensen, Eliot Bohr, Julian Robinson-Tait, Stefan Alaric Schäffer, Jörg Helge Müller
Niels Bohr Institute, University of Copenhagen, Denmark

Oscillator Synchronization Measurements Campaign for Network Radar Systems
Darren Griffiths, Mohammed Jahangir, Gwynfor Donlan, Jithin Kannanthara, Michail Antoniou, Chris Baker, Yeshpal Singh
University of Birmingham, United Kingdom

Integrating Optical-Clock Technology Into an Operational Timescale
Joseph Whalen[1], Thomas Akin[2], Bryan Hemingway[2], Steven Peil[2]
[1]Computational Physics Inc., United States; [2]United States Naval Observatory, United States

Ultrastable Optical Cavity as a Gravitational Waves Bar Detector
Mateusz Narożnik[2], Marcin Bober[2], Michał Zawada[1]
[1]Institute of Physics, Nicolaus Copernicus University, Poland; [2]Nicolaus Copernicus University, Poland

Transportable Industrial Ultra-Stable Laser with Instability < 6E-16 @ 1 S
Filippo Bregolin, Manuel Schiefer, Pierre Thoumany, Dewni Pathegama, Thomas Puppe, Rafał Wilk
TOPTICA Photonics AG, Germany

Development of KRISS-Yb2 for the Uncertainty at the 10^{-18} Level
Won-Kyu Lee, Huidong Kim, Myoung-Sun Heo, Dai-Hyuk Yu, Chang Yong Park
Korea Research Institute of Standards and Science, Korea

Development and Evaluation of a Narrow Linewidth Laser System for $^{171}Yb^{+}$ E2 Transition
Yani Zuo, Shiying Cao, Shaoyang Dai, Yige Lin, Tao Yang, Baike Lin, Weiliang Chen, Kun Liu, Fasong Zheng, Fang Fang
National Institute of Metrology of China, Chile; National Institute of Metrology of China, China

Testing Novel High-Reflectivity Mirror Technologies from Room-Temperature to 4 K
Mona Kempkes, Thomas Legero, Uwe Sterr, Daniele Nicolodi
Physikalisch-Technische Bundesanstalt, Germany

Compact Field-Deployable Sr Optical Lattice Clock
Jordan Wayland, Yuheng Huyan, Yogeshwar Kale, Abhilash Jha, Yeshpal Singh
University of Birmingham, United Kingdom

Evaluation of an Indium Ion Clock at the 10^{-18}-Level

Hartmut Nimród Hausser, Jonas Keller, Tabea Nordmann, Nishant M. Bhatt, Ingrid M. Dippel, Moritz von Boehn, Tanja E. Mehlstäubler
Physikalisch-Technische Bundesanstalt, Germany

Chip-Scale Optical Clock Scheme Based on Dual-Wavelength Modulation Transfer Spectroscopy

Jie Miao[1], Qiaohui Yang[1], Jiqing Lian[2], Tianyu Liu[1], Duo Pan[1], Jingbiao Chen[1]
[1]Peking University, China; [2]Xidian University, China

Searching for Dark Matter with a Cryogenic Silicon Fabry-Pérot Cavity

Jonathan Gillot[2], Jacob Puhalo-Smith[1], Yara Hariri[1], Joannès Barbarat[2], Clément Lacroûte[2], Jacques Millo[2], Yann Kersalé[2]
[1]FEMTO-ST Institute, France; [2]FEMTO-ST Institute, CNRS, University of Bourgogne Franche-Comté, ENSMM, France

An Improved Transportable Strontium Lattice Clock

Ingo Nosske, Chetan Vishwakarma, Tim Lücke, Sofia Herbers, Christian Lisdat
Physikalisch-Technische Bundesanstalt, Germany

Chip-Scale Optical Clock Based on Modulation Transfer Spectroscopy

Qiaohui Yang, Tianyu Liu, Jie Miao, Duo Pan, Jingbiao Chen
Peking University, China

Design of Compact Vacuum Setup for Al^+ and Ca^+ Ion Trapping with Homogeneous Magnetic Field

Jakub Grim[1], Ivan Vlček[1], Petr Jedlička[1], Minh Tuan Pham[1], Šimon Řeřucha[1], Martin Čížek[1], Artem Kovalenko[2], Lukáš Slodička[2], Ondřej Číp[1]
[1]Institute of Scientific Instruments of the Czech Academy of Sciences, Czech Rep.; [2]Palacky University, Czech Rep.

Active Optical Clock Using Optical Conveyor in the Ring Cavity: Simulation and Optimization of Loading the Atoms

Swadheen Dubey[1], Sheng Zhou[2], Georgy Kazakov[1], Shayne Bennetts[2], Benedikt Heizenreder[2], Camila Beli Silva[2], Florian Schreck[2], Francesca Famà[2], Stefan Alaric Schäffer[2]
[1]Atominstitut, Vienna University of Technology, Austria; [2]University of Amsterdam, Netherlands

Experimental and Theoretical Study of Dynamic Polarizabilities in the 5S1/2-5D5/2 Clock Transition in Rb-87 and Determination of E1 Matrix Elements

Rhona Hamilton[3], Benjamin Roberts[4], Sarah Scholten[1], Clayton Locke[2], Andre Luiten[2], Jacinda Ginges[4], Christopher Perrella[2]
[1]University of Adelaide, Australia; [2]University of Adelaide, QuantXLabs, Australia; [3]University of Adelaide, University of Tokyo, Australia; [4]University of Queensland, Australia

16:00 – 17:40
Poster Session 2b
Room: 3F South

Long-Term Stability of GPS Time Transfer Link

Zhe Gao, Jihai Zhang, Weixiong Wang, Wenjun Wu, Shao-Wu Dong
National Time Service Center, Chinese Academy of Sciences, China

Coherent Optical Frequency Transfer Over 100 km Fiber Link Using Bidirectional Active Optics

Hanxu Wu[1], Xiaoming Zhang[2], Weinan Zhao[1], Yang Fu[1], Xinyi Chen[1], Sitong Jia[1], Wenzhe Yang[1], Jun Ge[1], Shengkang Zhang[1], Honglei Yang[1]
[1]Beijing Institute of Radio Metrology and Measurement, China; [2]Tsinghua University, China

Simulation of Residual Dispersion on Stability of Optical Fiber Frequency Transfer System

Hao Gao[1], Zhuoze Zhao[1], Jiahui Cheng[1], Bin Luo[3], Song Yu[3], Hong Guo[2]
[1]Beijing University of Posts and Telecommunications, China; [2]State Key Laboratory of Advanced Optical Communication Systems and Networks, Peking University, China; [3]State Key Laboratory of Information Photonics and Optical Communications, Beijing University of Post, China

Prediction of Common-View Based Time Differences to Build a Resilient Dissemination System

Shilpa Manandhar[1], Yu Song Meng[2]
[1]Agency for Science Technology and Research, Singapore; [2]National Metrology Centre, Agency for Science, Technology and Research, Singapore

Evaluation of Stability Performance of a Simple Time and Frequency Transfer System

Yung Chuen Tan, Yu Song Meng, Chin Yi Liaw
National Metrology Centre, Agency for Science, Technology and Research, Singapore

Time Transfer Calibration and Measurement Data Exchange in Multi-Domain Fiber Optic Networks

Krzysztof Turza, Wojbor Bogacki
Poznań Supercomputing and Networking Center, Poland

National Multiring Time and Frequency Disemination Network with Improved Reliability

Wojbor Bogacki, Krzysztof Turza, Artur Binczewski
Poznań Supercomputing and Networking Center, Poland

Dissemination of Optical Frequency for Future Telecom Networks and Applications

Lakshmi Rajagopal[1], Andrew Lord[1], Mike Gilson[1], Yeshpal Singh[2]
[1]British Telecommunications PLC, United Kingdom; [2]University of Birmingham, United Kingdom

An BDS Spoofing Interference Detection and Identification Method Using the Radio Determination Satellite Service

Zhengkun Chen, Jing Li, Qizhen Weng, Fan Feng, Du Li, Xuelin Yuan, Xiangwei Zhu
Sun Yat-sen University, China

Coherent Optical Frequency Dissemination with Passive Phase Noise Cancellation

Xiang Zhang, Qian Zhou, Xue Deng, Qi Zang, Mengfan Wu, Jie Liu, Dan Wang, Ruifang Dong, Tao Liu, Shougang Zhang
National Time Service Center, Chinese Academy of Sciences, China

A Resilient Secondary Realization of UTC(PTB) Using a Passive Hydrogen Maser

Florian Heimbach, Egle Staliuniene, Dirk Piester, Andreas Bauch, Ekkehard Peik
Physikalisch-Technische Bundesanstalt, Germany

Nearly Real Time GNSS Time Transfer Using MADOCA-PPP

Tadahiro Gotoh[2], Tatsuya Fujimoto[1], Ryuichi Ichikawa[2], Tetsuya Ido[2]
[1]Hokkaido University, Japan; [2]National Institute of Information and Communications Technology, Japan

Study on Measurement Methods for GNSS Antenna Cable Delay

Tian Yu, Kun Liang, Baoying Wei
Beijing Jiaotong University, China

Controllable Asymmetric Attack Against Practical Round-Trip Fiber Time Synchronization System
Xuesong Xu[1], Yiming Bian[1], Jinlong Hu[2], Jiayi Dou[1], Yang Li[2], Bingjie Xu[2], Yichen Zhang[1], Song Yu[4], Hong Guo[3]
[1]Beijing University of Posts and Telecommunications, China; [2]Science and Technology on Communication Security Laboratory, Institute of Southwestern Communication, China; [3]State Key Laboratory of Advanced Optical Communication Systems and Networks, Peking University, China; [4]State Key Laboratory of Information Photonics and Optical Communications, Beijing University of Post, China

Evaluation of GNSS Timing Performance in China and Belarus
Feng Zhu, Huijun Zhang, Ya Liu
National Time Service Center, Chinese Academy of Sciences, China

Simulation and Evaluation of Time Synchronization Performance Based on NTP and PTP
Baoying Wei, Kun Liang, Tian Yu
Beijing Jiaotong University, China

Design and Development of a New Resilient Time Scale Infrastructure for the UK's UTC(NPL)
Setnam Shemar[1], John Davis[2], Ben Everett[1], Richard Hendricks[1], Huw Owen[2], Peter Whibberley[2], Belinda Eglin[2], Robert Foot[2], Krzysztof Szymaniec[1], Conway Langham[2], Mayokun Aikomo[1], Ali Ashkhasi[2], Douglas Jones[1], Rebecca Lewis[1], Adam Sheppard[1], Annora Sundararajan[1], Daniela Weston[1], Josh Whale[1], Andrew Wilson[1], Charles Wilson[1], Sam Walby[1], Helen Margolis[2]
[1]National Physical Laboratory, United Kingdom; [2]NPL Management Ltd, National Physical Laboratory, United Kingdom

Real-Time Timestamp Decoder for Data and Time Transfer on the CubeSat Laser Infrared CrosslinK (CLICK) Mission
Paul Serra[2], Hannah Tomio[2], William Kammerer[2], Peter Grenfell[2], Nicholas Belsten[2], Kerri Cahoy[2], Myles Clark[4], Danielle Coogan[4], Joseph Conroy[4], John Conklin[4], Jan Stupl[3], David Mayer[3], John Hanson[1]
[1]Crosstrac Engineering, United States; [2]Massachusetts Institute of Technology, United States; [3]NASA Ames Research Center, United States; [4]University of Florida, United States

A Lithium-Tantalate Based Acoustic Reflective Delay Line for Chemical Sensing in Water
Jean-Michel Friedt[3], David Rabus[1], Lilia Arapan[2], Vincent Luzet[1], Frederic Chérioux[1], Nathalie Nief[4], Sebastien Dehez[4], John-Richard Ordonez-Varela[4]
[1]FEMTO-ST Institute, France; [2]FEMTO-ST Institute, CNRS, University of Bourgogne Franche-Comté, France; [3]LNE-LTFB, FEMTO-ST Institute, Observatoire de Besançon, France; [4]TotalEnergies, France

Low-Noise Crystal Oscillator with AT-Cut Fundamental Resonator
Xianhe Huang, Wei Fu
University of Electronic Science and Technology of China, China

Layered SiO2 / LiNbO3 / Si SH-SAW Biological Sensor for Operation in Water
Caique Veras, Issam Ouerghi, Elisa Soulat, Marie Bousquet, Alexandre Reinhardt, Thomas Alava, Pascal Mailley
CEA-Leti, Université Grenoble Alpes, France

Long-Term Operation of a 12-M Perimeter Passive Resonant Gyroscope
Xiaohua Feng[1], Kui Liu[1], Yuxuan Chen[1], Haobo Zhang[1], Yuhong Zhong[1], Jinpei Yao[1], Yawen Liu[1], Zehuang Lu[2], Jie Zhang[1]
[1]Huazhong University of Science and Technology, China; [2]MOE Key Laboratory of Fundamental Quantities Measurement, HUST, China

The Cool-Physics Oscillator Model with Asymptotes to Predict Noise, Jitter and Size Limitations
Michael Underhill
Underhll Research Limited, United Kingdom

Evaluation of Undamaged and Damaged “Fixed Beams at Both Ends” Using Surface Acoustic Wave Device with Vibration Sensor and Machine Learning
Shinji Baba, Jun Kondoh
Shizuoka University, Japan

Few NV Center Nanodiamonds Enable High-Speed and High-Resolution Sensing of Paramagnetic Species
Aparajita Modak, Ayan Majumder, Madhur Parashar, Siddharth Tallur, Kasturi Saha
Indian Institute of Technology Bombay, India

Passive Excitation of 10 MHz Quartz Resonator with Direct Digital Synthesizer
Philippe De Visme, Joel Imbaud, Fabrice Sthal
FEMTO-ST Institute, France

16:00 – 17:40
Poster Session 2c
Room: 1F Deli

Reducing Impact of Stress on Coupling Coefficient in 30% Scandium Aluminum Nitride Films
Sergey Mishin[1], Yury Oshmyansky[2]
[1]Advanced Modular Systems, Inc., United States; [2]AMS, Inc., United States

Epitaxial LiNbO3 on Al2O3 for Surface Acoustic Wave Devices
I. Pershukov[2], J. Richy[1], E. Soulat[3], M. Bousquet[3], F. Dupont[1], B. Vilquin[4]
[1]CEA-Leti, France; [2]CEA-Leti, Ecole Centrale de Lyon, France; [3]CEA-Leti, Université Grenoble Alpes, France; [4]Université Lyon, INSA Lyon, CNRS, Ecole Centrale de Lyon, Université Claude Bernard Lyon 1, CPE Lyon, Franc

Analysis of Rayleigh Waves in Piezoelectric Solids with Metal Coatings by the Rayleigh-Ritz Method
Jinghui Wu[1], Ji Wang[1], Erasmo Carrera[2]
[1]Ningbo University, China; [2]Politecnico di Turino, Italy

Spurious Free SAW Resonators on LiNbO3/SiO2/ Quartz Substrate for Wideband Application
Yang Chen, Jinbo Wu, Xiaomeng Zhao, Xinjian Ke, Shibin Zhang, Pengcheng Zheng, Kai Huang, Xin Ou
Shanghai institute of Microsystem and Information Technology Chinese Academy of Sciences, China

Analysis of Leaky Surface Acoustic Waves and Thermal Conduction on LiTaO3/SiC/Si Structure
N. Watanabe, S. Kakio
University of Yamanashi, Japan

A Two-Step ALN Thin Film for Energy Harvesting and Acoustic MEMS Resonators
A. Sebastian, S. Chandorkar
Indian Institute of Science, India

RF Complex Permittivity Characterization of ScAlN Thin Films
Aurelio Venditti[2], Luca Colombo[3], Pietro Simeoni[1], Matteo Rinaldi[3]
[1]Northeastern University, United States; [2]Politecnico di Torino, United States; [3]SMART Center, Northeastern University, United States

ANOVA Investigation of Neural Network Guided Spurious Modes Reduction in Lithium Niobate MEMS Resonators
Ryan Tetro[1], Luca Colombo[1], Mary Beth Galanko-Klemash[2], Sarah S. Bedair[2], Ryan Rudy[2], Matteo Rinaldi[1]
[1]SMART Center, Northeastern University, United States; [2]US Army Research Lab, United States

Parametric Studies of Modal Characteristics for Phononic Frequency Comb Generation

Y. Yong[3], W. Wall[2], D. Kirby[2], R. Kubena[1]
[1]ENVIETA STAFFING LLC, United States; [2]HRL Laboratories, United States; [3]Rutgers University, United States

Analysis of Quality Factor of the Quartz Crystal Resonator with N-M Asymmetric Electrodes

Jianguo Hu, Jing Chen, Xiaoming Wu, Tian-Ling Ren
Tsinghua University, China

Optimizing Hollow Core Fibers for Stable Interferometry

Bo Shi, Ian Davidson, Ghafour Mahdiraji, Jaroslaw Rzegocki, Eric Numkam Fokoua, Mohammad Mousavi, Zitong Feng, Meng Ding, Francesco Poletti, David J Richardson, Radan Slavík
University of Southampton, United Kingdom

A 5.5 GHz S3 Mode Plate Acoustic Wave Resonator Using Lithium Tantalate Thin Film

Zonglin Wu[1], Shuxian Wu[1], Hangyu Qian[1], Feihong Bao[1], Gongbin Tang[2], Jie Zou[1], Guomin Yang[1]
[1]Key Laboratory for Information Science of Electromagnetic Waves, Fudan University, China; [2]New Generation semiconductor Materials Research Institute, Shandong University, China

Development of a Quartz-MEMS Resonator

Baptiste Fischer-Kaszuba[3], Pierre Lavenus[3], Raphael Levy[3], Paul Chapellier[3], Thomas Baron[2], Nicoals Vorobyev[1]
[1]CNES Centre national d'études spatiales, France; [2]FEMTO-ST Institute, France; [3]ONERA Office National d'Etudes et de Recherches Aérospatiales, France

Frequency Scaling Millimeter Wave Acoustic Resonators Using Ion Beam Trimmed Lithium Niobate

Vakhtang Chulukhadze[2], Kenny Huynh[1], Jack Kramer[2], Michael Liao[1], Sinwoo Cho[2], Lezli Matto[1], Omar Barrera[2], Can Cui[2], Mark Goorsky[1], Ruochen Lu[2]
[1]University of California, Los Angeles, United States; [2]University of Texas at Austin, United States

Shear Guided SAW Resonator Without Bragg Grating Mirror

T. Baron[2], S. Oliveri[2], T. Richard[2], V. Soumann[3], D. Belharet[2], L. Robert[2], M. Raschetti[2], R. Salut[2], J. Lesage[1], E. Courjon[4], T. Laroche[4], F. Bernard[4], A. Clairet[4], S. Ballandras[4]
[1]DGA Direction générale de l’armement, France; [2]FEMTO-ST Institute, France; [3]FEMTO-ST Institute, CNRS, University of Bourgogne Franche-Comté, France; [4]Frec’n’sys, France

Enchanced Moving Boundary Effects in High-Overtone Bulk Acoustic Resonators

L. Connolly, J. Gorman
National Institute of Standards and Technology, United States

Hydrogen Maser Magnetron Cavity with Sub-kHz/°C Frequency-Temperature Coefficient

E. Van der Beken, D. Léonard, T. Bastin
University of Liege, Belgium

Second-Order Doppler Frequency Shifts of Trapped Ions in a Linear Paul Trap

S. Miao[1], J. Zhang[1], Y. Zheng[2], H. Qin[2], N. Xin[1], Y. Chen[1], J. Han[1], W. Shi[1], T. Zhao[1], L. Wang[1]
[1]State Key Laboratory of Precision Measurement, Tsinghua University, China; [2]Tsinghua University, China

Long-Term Stability and Performance Analysis of the Refreshed 5071A Cesium Primary Frequency Reference

D. Chandler, C. Liessner, P. Cash, M. Trainoff
Microchip Technology, United States

A Control System for Atomic Fountain Clock Based on Field- Programmable Gate Array

Dandan Liu, Jun Ruan, Sichen Fan, Hui Zhang, Yang Bai, Xinliang Wang, Junru Shi, Yong Guan, Shougang Zhang
National Time Service Center, Chinese Academy of Sciences, China

Light Shift Detection Using a Multiple Photodetection Method Suitable for a Chip-Scale Atomic Clock
Masahiro Fukuoka, Shigeyoshi Goka
Tokyo Metropolitan University, Japan

Calibration of Video Cameras Frame Rate Based on Onsets Tracking Technique
Chung Fai Au Yeung, Shing Lung Yang, Kin Wah Chen, Hin Fai Tsang
Standards and Calibration Laboratory, Hong Kong

Progress Toward a Raman-Ramsey Clock Based on a Transverse Cooled Rubidium Beam
Pei-Qiang Yan, Wei-Chen Jia, Yan-Ying Feng
Tsinghua University, China

Design and Manufacture of a New Microwave Cavity Assembly for Use in Cesium Fountains at NIST
G. Hoth[1], K. Gibble[2], V. Gerginov[3]
[1]National Institute of Standards and Technology, United States; [2]National Institute of Standards and Technology, Pennsylvania State University, United States; [3]NIST Boulder and University of Colorado, Boulder, United States

Analytical Expression of Higher-Order Allan Variance for Atomic Clock Models
T. Ishizaki[3], T. Ichimura[3], T. Kawaguchi[1], Y. Yano[2], Y. Hanado[2]
[1]Gunma University, Japan; [2]National Institute of Information and Communications Technology, Japan; [3]Tokyo Institute of Technology, Japan

External Cavity Laser for Chip-Scale Atomic Clock
Jie Miao[1], Jiqing Lian[2], Tianyu Liu[1], Duo Pan[1], Jingbiao Chen[1]
[1]Peking University, China; [2]Xidian University, China

Virtual Poster Session

On-Demand
Virtual Poster Session

Cooling and Crystallization of Trapped Single $^{171}Yb^{+}$ Ion for Optical Frequency Standard
Jize Han[2], Ying Zheng[3], Shengnan Miao[2], Yiting Chen[2], Jianwei Zhang[2], Lijun Wang[2], Lei Han[1], Xing Chen[1], Xiaobo Xue[1], Shengkang Zhang[1]
[1]Beijing Institute of Radio Metrology and Measurement, China; [2]State Key Laboratory of Precision Measurement, Tsinghua University, China; [3]Tsinghua University, China

A Voigt Laser Operating on Cs 852 nm Transition
Zheyi Ge[2], Xiaolei Guan[1], Zhiyang Wang[2], Zijie Liu[2], Tiantian Shi[2], Anhong Dang[2], Jingbiao Chen[2]
[1]Beijing University of Posts and Telecommunications, Peking University, SEIEE, China; [2]Peking University, China

Preliminary Studies of Rb Microfabricated Cells for a Two-Photon Rb Optical Frequency Reference
Martin Callejo[1], Rémy Vicarini[1], Philippe Abbé[1], Nicolas Passilly[2], Rodolphe Boudot[2]
[1]FEMTO-ST Institute, France; [2]FEMTO-ST Institute, CNRS, University of Bourgogne Franche-Comté, France

A Voigt Anomalous Dispersion Optical Filter Immune to the Cell Temperature Fluctuation
Zijie Liu[2], Xiaolei Guan[1], Tiantian Shi[2], Anhong Dang[2], Jingbiao Chen[2]
[1]Beijing University of Posts and Telecommunications, Peking University, SEIEE, China; [2]Peking University, China

Frequency Stabilization for the Faraday Laser Operating on Rb 780 nm Transition
Zijie Liu, Xiaomin Qin, Tiantian Shi, Anhong Dang, Jingbiao Chen
Peking University, China

A 780 nm Dual-Frequency Faraday Laser
Xiaomin Qin, Zijie Liu, Tiantian Shi, Jingbiao Chen
Peking University, China

A Scheme of 852 nm Faraday Laser with Kilometer Level Cavity Length
Zhiyang Wang, Hangbo Shi, Zijie Liu, Xiaomin Qin, Zhihong Gao, Tiantian Shi, Jingbiao Chen
Peking University, China

Optimization of Faraday Laser's Performance by Adjusting Incident Light Intensity
Zhiyang Wang, Huifang Hou, Hangbo Shi, Zijie Liu, Xiaomin Qin, Zhihong Gao, Tiantian Shi, Jingbiao Chen
Peking University, China

Fiber Noise Suppression System with Additional Linewidth of mHz-Level for Ultra-Stable Lasers
Lulu Yan, Pan Zhang, Mingkun Li, Bingjie Rao, Ru Yuan, Xiguang Yang, Xin Chen, Wenge Guo, Shougang Zhang
National Time Service Center, Chinese Academy of Sciences, China

Ultranarrow Bandwidth Optical Filter Based on Laser Cooled ^{87}Rb Atoms
Xiaolei Guan[1], Wei Zhuang[2], Tiantian Shi[3], Jianxiang Miao[3], Jia Zhang[3], Jingbiao Chen[3], Bin Luo[4]
[1]Beijing University of Posts and Telecommunications, Peking University, SEIEE, China; [2]National Institute of Metrology of China, China; [3]Peking University, China; [4]State Key Laboratory of Information Photonics and Optical Communications, Beijing University of Post, China

A Power Efficient Faraday Laser at 780nm Rb Transition
Zhihong Gao, Jingbiao Chen
Peking University, China

Atmospheric Traces Sensor Based on Visible Dual-Comb Spectroscopy Using Ti:sapphire Mode-Locked Lasers
Zhaolong Li[2], Haitao Wu[2], Sibo Gui[2], Hao Xu[1], Haoyuan Lu[3], Tao Bi[2], Peng Zuo[2], Jianye Zhao[2]
[1]Aerospace Information Research Institute, Chinese Academy of Sciences, China; [2]Peking University, China; [3]Shanghai Academy of Spaceflight Technology, China

Frequency Combs for $^{88}Sr^{+}$ Clock Comparison with Cs Fountain Clock at the NRC
Claude Marceau, Scott Beattie, Wojciech Pakulski, Marina Gertsvolf
National Research Council Canada, Canada

Sensitivity to Dark Matter Couplings from Frequency Measurements of Acetylene Optical Clocks
Florin Lucian Constantin
CNES Centre national d'études spatiales, France

A Simple Digital Satellite TV Timing Method and its Timing Accuracy Analysis
Shanhe Wang, Yu Hua, Fen Cao, Yu Xiang
National Time Service Center, Chinese Academy of Sciences, China

Laser Frequency-Offset Locking Over a 1577 km Fiber Link Based on LSTM Neural Network
Mingwen Zhu[1], Shangsu Ding[1], Chenglong Wu[3], Jianming Shang[3], Song Yu[3], Bin Luo[3], Hong Guo[2]
[1]IPOC, Beijing University of Posts and Telecommunications, China; [2]State Key Laboratory of Advanced Optical Communication Systems and Networks, Peking University, China; [3]State Key Laboratory of Information Photonics and Optical Communications, Beijing University of Post, China

High-Precision Fiber-Optic Time Transfer System Based on Bidirectional FDM and Correlation Processing
Kunfeng Xie, Liang Hu, Jianping Chen, Guiling Wu
Shanghai Jiao Tong University, China

Analysis of the Asymmetry of Erbium-Doped Fiber Length in Fiber RF Transmission

Jinze Lu[1], Hao Gao[1], Zhuoze Zhao[1], Jiahui Cheng[1], Bin Luo[3], Song Yu[3], Hong Guo[2]
[1]Beijing University of Posts and Telecommunications, China; [2]State Key Laboratory of Advanced Optical Communication Systems and Networks, Peking University, China; [3]State Key Laboratory of Information Photonics and Optical Communications, Beijing University of Post, China

Introduction of GNSS Up-Sampled All-in-View Time Transfers

Wen-Hung Tseng, Shinn-Yan Lin
Telecommunication Laboratories, Chunghwa Telecom Co., Ltd., Taiwan

Missing Data Prediction Using LSTM for Radio Frequency Transfer System

Jiahui Cheng[1], Hao Gao[1], Chenxia Liu[2], Zhuoze Zhao[1], Yaojun Qiao[1], Bin Luo[4], Song Yu[4], Hong Guo[3]
[1]Beijing University of Posts and Telecommunications, China; [2]North China Electric Power University, China; [3]State Key Laboratory of Advanced Optical Communication Systems and Networks, Peking University, China; [4]State Key Laboratory of Information Photonics and Optical Communications, Beijing University of Post, China

Real-Time Synchronization of Clocks at Femtosecond Level Through a 113 km-Free-Space Link

Min Li, Qi Shen, Jian-Yu Guan, Ji-Gang Ren, Ting Zeng, Lei Hou, Yuan Cao, Jin-Jian Han, Meng-Zhe Lian, Yan-Wei Chen, Meng Yang, Xin-Xin Peng, Shao-Mao Wang, Dan-Yang Zhu, Yu-Xiang Cheng, Sheng-Kai Liao, Juan Yin, Cheng-Zhi Peng, Hai-Feng Jiang, Qiang Zhang, Jian-Wei Pan
University of Science and Technology of China, China

Optic Frequency Transfer via Fiber Based on Digital Phase Unwrap Technology

Dan Wang, Xue Deng, Jie Liu, Qi Zang, Xiang Zhang, Qian Zhou, Ruifang Dong, Tao Liu
National Time Service Center, Chinese Academy of Sciences, China

Reducing the Effects of Correlation Between Multiple Clocks on Clock Ensemble Time Scale

Qian Xu[1], Yu Chen[2], Yuzhou Wang[1], Zhengsen Jia[1], Aimin Zhang[1]
[1]National Institute of Metrology of China, China; [2]National Intellectual Property Administration, China

Wide Range and High-Precision 1PPS Time Interval Measurement Method

Ruilin Zhang[2], Zhiqi Li[2], Haifeng Wang[1], Jian Chang[2], Zhixin Cao[2], Xiangyang Wei[2], Zhe Tan[2]
[1]Beijing Institute of Radio Metrology and Measurement, China; [2]Xidian University, China

A Method of High Resolution Digital Linear Phase Comparison

Zhe Tan, Zhiqi Li, Xiangyang Wei, Ruilin Zhang, Min Fan, Wei Zhou
Xidian University, China

Synchronising Datacenters

Ullas Kumar Cs
Rakon Ltd, Singapore

Time Transfer Experiments Based on BDS Code Observations

Weijin Qin[1], Jia Liu[1], Xuhai Yang[2]
[1]National Time Service Center, Chinese Academy of Sciences, China; [2]National Time Service Center, Chinese Academy of Sciences, University of Chinese Academy of Sciences, China

Development of a Precise Timescale for Research and Training Purposes

Dylan Meyer, Adam Hauser, Patrick LeClair, Thejesh Bandi
University of Alabama, United States

Time Transfer Scheme in Power Line Based on Narrow Electric Pulse

Ze Li, Peng Zhang, Guangkun Guo, Ke Liu, Dong Hou
University of Electronic Science and Technology of China, China

High-Precision Time Transfer Based on Power Line Communication
Peng Zhang, Ze Li, Guangkun Guo, Ke Liu, Dong Hou
University of Electronic Science and Technology of China, China

A UTC(NTSC) Steering Algorithm Based on an Atomic Clock Ensemble Scale
Shuhong Zhao, Shao-Wu Dong, Shanshan Bai, Wenjun Wu, Lili Qu, Sufang Liu
National Time Service Center, Chinese Academy of Sciences, China

Characterization of GNSS Receivers for Timing Applications with Inaccurate External Reference Clock or with Internal Reference
Tung Than Thai[1], Elena Cantoni[1], Giancarlo Cerretto[1], Franco Fiasca[1], Andrea Perucca[1], Marco Sellone[1], Giovanni Daniele Rovera[2], Ilaria Sesia[1]
[1]INRiM Istituto Nazionale di Ricerca Metrologica, Italy; [2]TFSol - Time and Frequency Solutions, France

First Long-Haul Dissemination of High Accuracy Timescales Using White Rabbit in Switzerland
Antoine Jallageas[1], Dominik Husmann[1], Jacques Morel[1], Fabian Mauchle[2]
[1]Swiss Federal Institute of Metrology METAS, Switzerland; [2]SWITCH, Switzerland

Towards Simultaneous Time and Frequency Dissemination Over Optical Fibre Networks Using a Single Stabilized Optical Carrier
Dominik Husmann, Jacques Morel
Swiss Federal Institute of Metrology METAS, Switzerland

Free-Space Optical Frequency Transfer Based on Moveable Platform
Lei Liu, Zhou Tong, Jialiang Wang, Qian Cao, Zhicheng Jin, Zhiyuan Xu, Youzhen Gui
Shanghai Institute of Optics and Fine Mechanics, Chinese Academy of Sciences, China

Fast Synchronization Algorithm of High-Stability Oscillators to GNSS Signals
Paweł Kubczak, Mieczysław Jessa, Michał Kasznia
Poznan University of Technology, Poland

Searching for Dark Matter Clumps Using the Pulsar Signal Dispersion Measurements
Bruno Bertrand, Pascale Defraigne
Royal Observatory of Belgium, Belgium

Probing Material Properties via a Pair of Piezoelectric Micromachined Ultrasound Transducers
Hamad Raheem[2], Ashwin Seshia[2], Bernadette Craster[1]
[1]TWI Ltd., United Kingdom; [2]University of Cambridge, United Kingdom

Light Shift Suppression of CPT Resonances in Alkali Metal Vapors Irradiated by the Field of Counterpropagating Light Beams
Denis Brazhnikov, Stepan Ignatovich, Mikhail Skvortsov
Institute of Laser Physics SB RAS, Russia

Deep Silicon Vapor Cells for Quantum Technology
Sean Dyer[2], Paul Griffin[2], Aidan Arnold[2], Dave Burt[1], Erling Riis[2], James McGilligan[2]
[1]Kelvin Nanotechnology, United Kingdom; [2]University of Strathclyde, United Kingdom

The Miniaturized Integrating Sphere Cold Atom Clock Based on Fiber Mirrors
Xiumei Wang[1], Danyang Wang[1], Yifei Wang[1], Wenming Wang[1], Bohan Deng[1], Shiguang Li[1], Yunjia Wang[1], Weili Wang[1], Liang Wang[1], Jin He[3], Jingbiao Chen[2]
[1]Beijing Institute of Radio Metrology and Measurement, China; [2]Peking University, China; [3]PKU-HKUST Shenzhen-Hong Kong Institution, China

Ramsey CPT Signal Observation with a Miniature Clock Bench and a Dual-Frequency Optical Generator

Ghaya Baili[2], Jérémie Cotxet[2], François Gutty[2], Loic Morvan[2], Daniel Dolfi[2], Stéphane Guérandel[1], David Holleville[1]

[1]LNE-SYRTE Observatoire de Paris, Université PSL, CNRS, Sorbonne Université, France; [2]THALES Research and Technology, France

A Cs Rydberg Atomic Microwave Oscillator for Electric Field Sensing

He Wang, David Rosser, Michael Mazon, Gabe Iyanu
Aerospace Corporation, United States

The Optical to Electrical Conversion of a Frequency Comb and Related Applications

Po-Cheng Chang[2], Tien-Kuan Tseng[1]

[1]Telecommunication Laboratories, Taiwan; [2]Telecommunication Laboratories, Chunghwa Telecom Co., Ltd., Taiwan

A Novel Scheme for Noise Suppression of CPT Resonance

Qinglin Li[2], Tenghui Yang[1], Peter Yun[1]

[1]National Time Service Center, Chinese Academy of Sciences, China; [2]National Time Service Center, Chinese Academy of Sciences, University of Chinese Academy of Science, China

A Self-Driving Rb-Xe Spin Oscillator

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Dark-State Resonances in Elliptically Polarized Field for Alkali Vapors in a Buffer-Gas Cell: Theory and Experiment

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Wafer Level Fabrication of Alkali Vapor Cells for Microwave Atomic Clocks

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A Curved Four-Conductor Assembly with Larger Uniform Region

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Kyumin Kwon, David Wentzloff
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