TABLE OF CONTENTS

Technical Papers.................................................................................................................................................................. iv
Welcome from the General Chair .................................................................................................................................. xxvii
Welcome from the Technical Program Chair .............................................................................................................. xxviii
IFCS 2014 Organizing Committee .................................................................................................................................. xxix
IFCS 2014 Technical Program Committee ..................................................................................................................... xxxi
Special Thanks ............................................................................................................................................................... xxxiii
Organizers ....................................................................................................................................................................... xxxiv
Exhibitors......................................................................................................................................................................... xxxv
IFCS 2014 Awards .......................................................................................................................................................... xxxix
Student Paper Competition ................................................................................................................................................. xl
Future Symposia.............................................................................................................................................................. xlii
Tutorials ............................................................................................................................................................................. xliii
Plenary Session Invited Talk............................................................................................................................................. liii
Session: A1L-A: Time and Frequency Synchronization and Networking
Room: 101A
Session Chair: Shinn-Yan Lin, Chunghwa Telecom Co., Ltd.

Searching for Optimal Network Topology with Best Possible Synchronizability .......................................................... N/A
Guanrong Chen, University of Hong Kong, Hong Kong

Precise Latency Measurement of Unidirectional-Data-Flow Network Equipment ........................................................ 2
I-Chun Chao, National Taiwan University, Taiwan
Shinn-Yan Lin, Chunghwa Telecom Co., Ltd., Taiwan
Kang Lee, National Institute of Standards and Technology, United States
Frederick Proctor, National Institute of Standards and Technology, United States
Chien-Chung Shen, University of Delaware, United States
Fan-Ren Chang, National Taiwan University, Taiwan

Characterization of Coincident-Frequency Entangled Source in Quantum Synchronization Application .................. 5
Ruifang Dong, National Time Service Center / Chinese Academy of Sciences, China
Runai Quan, National Time Service Center / Chinese Academy of Sciences, China
Feiyan Hou, National Time Service Center / Chinese Academy of Sciences, China
Mengmeng Wang, National Time Service Center / Chinese Academy of Sciences, China
Zhaoyang Tai, National Time Service Center / Chinese Academy of Sciences, China
Tao Liu, National Time Service Center / Chinese Academy of Sciences, China
Shougang Zhang, National Time Service Center / Chinese Academy of Sciences, China

Performance Evaluation of NMSL’s Developed Calibration System for Timing Devices
with Seven-Segment LCD .................................................................................................................................................... 9
Ahmad Sahar Omar, SIRIM Berhad, Malaysia
Mohd Nasir Zainal Abidin, SIRIM Berhad, Malaysia
Mohd Fauzi Othman, Universiti Teknologi Malaysia, Malaysia
Erik Dierikx, VSL Dutch Metrology Institute, Netherlands
Roland van Bemmelen, VSL Dutch Metrology Institute, Netherlands
Peter van Otterloo, VSL Dutch Metrology Institute, Netherlands

Session: A1L-B: Bio and Chemical Sensing
Room: 101B
Session Chairs: Clemens Ruppel, EPCOS AG
Svenja Knappe, NIST

Shear-Horizontal Surface Acoustic Wave Biosensors for POCT .................................................................................. 12
Hiromi Yatsuda, Japan Radio Co. Ltd. / OJ-Bio Ltd., Japan
Takashi Kogai, Japan Radio Co. Ltd., Japan
Mikihiro Goto, Japan Radio Co. Ltd. / Shizuoka University, Japan
Naoyuki Yoshimura, Japan Radio Co. Ltd., Japan

380MHz SH-SAW Biosensors ............................................................................................................................................ 16
Mikihiro Goto, Japan Radio Co. Ltd. / Shizuoka University, Japan
Hiromi Yatsuda, Japan Radio Co. Ltd. / OJ-Bio Ltd., Japan
Jun Kondoh, Shizuoka University, Japan

Multi-Component Olfactory Display with a SAW Atomizer and Micropumps Controlled by a Tablet PC .................... 20
Takamichi Nakamoto, Tokyo Institute of Technology, Japan
Kazuki Hashimoto, Tokyo Institute of Technology, Japan
Tomoyuki Aizawa, Tokyo Institute of Technology, Japan
Yossiri Ariyakul, Tokyo Institute of Technology, Japan

High-Frequency SiC Microdisk Resonators Operating in Water with Responses to H2O2 and NH4OH .................. 24
Hao Jia, Case Western Reserve University, United States
Jaesung Lee, Case Western Reserve University, United States
Zenghui Wang, Case Western Reserve University, United States
Philip Feng, Case Western Reserve University, United States
In-Situ Monitor Electrochemical Processes in Batteries Using Vibrating Microcantilevers ........................................... 28
Jinho Yang, Wayne State University, United States
Jimmy Chen, Wayne State University, United States
Mark Ming-Cheng Cheng, Wayne State University, United States

Session: A1L-C: New Technologies
Room: 101CD
Session Chair: Mike Underhill, Underhill Research Limited

LGT Alternative Quartz Materials for Ultra-Stable Oscillators ........................................................................................... 32
Joël Imbaud, FEMTO-ST Institute, France
Jean Jacques Boy, FEMTO-ST Institute, France
Fabrice Sthal, FEMTO-ST Institute, France

High-Performance DSP-TCXO Using Twin-Crystal Oscillator ......................................................................................... 40
Koaru Kobayashi, Nihon Dempa Kogyo Co., Ltd., Japan
Yoshiaki Mori, Nihon Dempa Kogyo Co., Ltd., Japan
Tsukasa Kobata, Nihon Dempa Kogyo Co., Ltd., Japan
Manabu Ito, Nihon Dempa Kogyo Co., Ltd., Japan
Shigenori Watanabe, Nihon Dempa Kogyo Co., Ltd., Japan
Shinichi Sato, Nihon Dempa Kogyo Co., Ltd., Japan
Kazuo Akaike, Nihon Dempa Kogyo Co., Ltd., Japan

Spintronic Nano-Oscillators: Towards Nanoscale and Tunable Frequency Devices ............................................................. 44
Eva Grimaldi, Unité Mixte de Physique CNRS/Thales and Université Paris Sud 11, France
R. Lebrun, Unité Mixte de Physique CNRS/Thales and Université Paris Sud 11, France
A. Jenkins, Unité Mixte de Physique CNRS/Thales and Université Paris Sud 11, France
A. Dussaux, ETH Zurich, Switzerland
J. Grollier, Unité Mixte de Physique CNRS/Thales and Université Paris Sud 11, France
V. Cros, Unité Mixte de Physique CNRS/Thales and Université Paris Sud 11, France
A. Fert, Unité Mixte de Physique CNRS/Thales and Université Paris Sud 11, France
H. Kubota, National Institute of Advanced Industrial Science and Technology, Japan
K. Yakushiji, National Institute of Advanced Industrial Science and Technology, Japan
A. Fukushima, National Institute of Advanced Industrial Science and Technology, Japan
R. Matsumoto, National Institute of Advanced Industrial Science and Technology, Japan
S. Yuasa, National Institute of Advanced Industrial Science and Technology, Japan
G. Cibiel, Centre National d’Études Spatiales, France
P. Bortolotti, Unité Mixte de Physique CNRS/Thales and Université Paris Sud 11, France
G. Pillet, Thales Research and Technology, France

Bulk Acoustic Wave Resonator Thermal Noise Measurements ........................................................................................... 50
Maxim Goryachev, University of Western Australia, Australia
Eugene Ivanov, University of Western Australia, Australia
Stephen Parker, University of Western Australia, Australia
John Winterflood, University of Western Australia, Australia
Michael Tobar, University of Western Australia, Australia
Serge Galliou, FEMTO-ST Institute, France

Session: A2L-A: Combs and Stable Oscillators
Room: 101A
Session Chair: Long-Sheng Ma, East China Normal University

Novel Techniques for Low-Noise Microwave Generation and Transfer of Spectral Purity with Optical Frequency Combs ........................................................................................................... 53
Yann Le Coq, LNE-SYRTE, France

Long-Term Stable Balanced Optical-Microwave Phase Detector with Sub-Femtosecond Residual Timing Jitter Capability for Optical-to-RF Extraction ............................................................................. 54
Michael Y. Peng, Massachusetts Institute of Technology, United States
Franz Kärtner, Massachusetts Institute of Technology, United States
All-Optical Micro-Clock
Wei Liang, OEwaves Inc., United States
Danny Eliyahu, OEwaves Inc., United States
Vladimir Ilchenko, OEwaves Inc., United States
Anatoliy Savchenkov, OEwaves Inc., United States
Andrey Matsko, OEwaves Inc., United States
Lute Maleki, OEwaves Inc., United States

Hollow-Core Fibre Frequency Standard
Chris Perrella, University of Adelaide, Australia
James Anstie, University of Adelaide, Australia
Philip Light, University of Adelaide, Australia
Fetah Benabid, Université de Limoges, France
Andrew White, University of Queensland, Australia
Andre Luiten, University of Adelaide, Australia

Session: A2L-B: Time Scale and Satellite Time Transfer
Room: 101B
Session Chair: Wen-Hun Tseng, Chunghwa Telecom Co., Ltd.

A New Method for Generating Japan Standard Time by Using Distributed Atomic Clocks Connected via Satellites
Yuiko Hanado, National Institute of Information and Communications Technology, Japan

Method of Precise Common-View Frequency Transfer Based on BeiDou GEO Satellite
Yao Kong, National Time Service Center / Chinese Academy of Sciences, China
Xuhai Yang, National Time Service Center / Chinese Academy of Sciences, China
Hong Chang, National Time Service Center / Chinese Academy of Sciences, China
Weijin Qin, National Time Service Center / Chinese Academy of Sciences, China
Fen Cao, National Time Service Center / Chinese Academy of Sciences, China
Zhigang Li, National Time Service Center / Chinese Academy of Sciences, China
Baoqi Sun, National Time Service Center / Chinese Academy of Sciences, China

Mitigation of the TWSTFT Diurnal Effect Using Software-Defined Receivers
Yi-Jiun Huang, Chunghwa Telecom Co., Ltd., Taiwan
Wen-Hung Tseng, Chunghwa Telecom Co., Ltd., Taiwan

A Study of Antenna Multipath Instabilities in Two-Way Satellite Time and Frequency Transfer
Fang-Dar Chu, Chunghwa Telecom Co., Ltd., Taiwan
Wen-Hung Tseng, Chunghwa Telecom Co., Ltd., Taiwan
Wei-Chih Hsu, National Kaohsiung First University of Science and Technology, Taiwan
Pei-Yih Ting, National Taiwan Ocean University, Taiwan

Session: A2L-C: Quartz Crystals
Room: 101CD
Session Chair: Yook-Kong Yong, Rutgers University

A Perspective for the Quartz Crystal Devices Industry and Technologies in Taiwan and China
Min-Chiang Chao, TXC Corporation, Taiwan
Paul Jin-Bao Lin, TXC Corporation, Taiwan
Peter Wan-Shin Lin, TXC Corporation, Taiwan
Levi Shan-Shin Chen, TXC Corporation, Taiwan
Ren-Hung Larn, TXC Corporation, Taiwan
Ji Wang, NingBo University, China
Quartz-Based Vibrating MEMS Fabricated Using a Wafer-Bonding Process with Sealed Cavities .......................... 77
Sebastien Grousset, CEA-Leti, France
Pierre Lavenus, Office National d’Etudes et de Recherches Aérospatiales, France
Lamine Benaissa, CEA-Leti, France
Rachid Taïbi, Office National d’Etudes et de Recherches Aérospatiales, France
Emmanuel Augendre, CEA-Leti, France
Thomas Signamarcheix, CEA-Leti, France
Olivier Le Traon, Office National d’Etudes et de Recherches Aérospatiales, France
Sylvain Ballandras, FreC’N’Sys SAS, France

Wafer-Level Quartz Dry Etching Technology .................................................................................................................. 81
Atsushi Kamijo, Nihon Dempa Kogyo Co., Ltd., Japan
Shigeharu Monoe, Nihon Dempa Kogyo Co., Ltd., Japan
Norihiro Murayama, Nihon Dempa Kogyo Co., Ltd., Japan
Takefumi Saito, Nihon Dempa Kogyo Co., Ltd., Japan
Noritoshi Kimura, Nihon Dempa Kogyo Co., Ltd., Japan

A Miniature 12 MHz GT Cut Quartz Resonator Vibrating in a (m = 3, n = 1) Mode ...................................................... 85
Yusuke Yamagata, River Eletec Corporation, Japan
Katsuya Mizumoto, River Eletec Corporation, Japan

An Analysis of Frequency Temperature Characteristics of a Lamb Wave Type Quartz Acoustic Wave Device ....................................................................................................................................................... 89
Tasuku Kon, River Eletec Corporation, Japan
Katsuya Mizumoto, River Eletec Corporation, Japan
Yasutaka Saigusa, River Eletec Corporation, Japan

Session: A3P-D: Materials, Filters & Resonators I
Room: Poster Area
Session Chairs: Dan Stevens, Consultant
Ji Wang, Ningbo University

Thickness-Shear Frequencies of an Infinite Quartz Plate with Material Property Variation Along the Thickness .......................................................................................................................................... 95
Ji Wang, Ningbo University, China
Wenliang Zhang, Ningbo University, China
Dejin Huang, Ningbo University, China
Tingfeng Ma, Ningbo University, China
Jianke Du, Ningbo University, China

Long Term Stability and Quality Factors of Degenerately N-Type Doped Silicon Resonators ................................................. 100
Antti Jaakkola, VTT Technical Research Centre of Finland, Finland
Sergey Gorelick, VTT Technical Research Centre of Finland, Finland
Mika Prunnila, VTT Technical Research Centre of Finland, Finland
James Dekker, VTT Technical Research Centre of Finland, Finland
Tuomas Pensala, VTT Technical Research Centre of Finland, Finland
Panu Pekko, VTT Technical Research Centre of Finland, Finland

Micro Rb Atomic Vapor Cells for the Chip-Scale Atomic Clock .................................................................................. 105
Chang Zhang, Peking University, China
Shuangyou Zhang, Peking University, China
Dengzhu Guo, Peking University, China
Zhong Wang, Peking University, China
Jianye Zhao, Peking University, China

Piezoresistive Sensing in a Strongly-Coupled High Q Lamé Mode Silicon MEMS Resonator-Pair .............................. 108
Yuanjie Xu, City University of Hong Kong, Hong Kong
Haoshen Zhu, City University of Hong Kong, Hong Kong
Joshua Lee, City University of Hong Kong, Hong Kong
Measurement of Vibration Amplitude Distribution of Piezoelectric Devices by Speckle Interferometry with Pulsed Laser
Hajime Kobayashi, Nihon Dempa Kogyo Co., Ltd., Japan
Keita Mochizuki, Tokyo Metropolitan University, Japan
Yasuaki Watanabe, Tokyo Metropolitan University, Japan

Aluminum Nitride Lamb Wave Resonators with High Figure of Merit for Narrowband Filter Applications
Ji Liang, Tianjin University, China
Hongxiang Zhang, Tianjin University, China
Heng Xie, Tianjin University, China
Wei Pang, Tianjin University, China
Daihua Zhang, Tianjin University, China
Hao Zhang, Tianjin University, China

Second harmonic mode polarization inverted resonator consisting of PbTiO3 thin film
Katsuyoshi Katada, Nagoya Institute of Technology, Japan
Takahiko Yanagitani, Nagoya Institute of Technology, Japan
Masashi Suzuki, Nagoya Institute of Technology, Japan
Kiyotaka Wasa, Kyoto University, Japan

High Electromechanical Coupling in PZT Epitaxial Thick Film Resonators at 550 ºC
Takahiko Yanagitani, Nagoya Institute of Technology, Japan
Katsuyoshi Katada, Nagoya Institute of Technology, Japan
Masashi Suzuki, Nagoya Institute of Technology, Japan
Kiyotaka Wasa, Kyoto University, Japan

Length-Extension LGS Microresonators for FM-AFM: Microfabrication and Shear Effects Sensitivity
Therese Leblois, FEMTO-ST Institute, France
Etienne Herth, FEMTO-ST Institute, France
Fabien Henrot, FEMTO-ST Institute, France
Fabrice Sthal, FEMTO-ST Institute, France

Magnetic Field Influence on the Spectra of BAW Resonator with Ferrite Layers
Natalia Polzikova, Kotel'nikov Institute of Radio Engineering and Electronics, Russian Academy of Sciences, Russia
Sergey Alekseev, Kotel'nikov Institute of Radio Engineering and Electronics, Russian Academy of Sciences, Russia
Iosef Kotelyanskii, Kotel'nikov Institute of Radio Engineering and Electronics, Russian Academy of Sciences, Russia
Alexander Raevskiy, Kotel'nikov Institute of Radio Engineering and Electronics, Russian Academy of Sciences, Russia

Finite Element Analysis of Anchor Loss in AlN Lamb Wave Resonators
Yung-Yu Chen, Tatung University, Taiwan
Yen-Ting Lai, Tatung University, Taiwan
Chih-Ming Lin, University of California, Berkeley, United States

Low-Power Ovenization of Fused Silica Resonators for Temperature-Stable Oscillators
Zhengzheng Wu, University of Michigan, United States
Adam Peczalski, University of Michigan, United States
Mina Rais-Zadeh, University of Michigan, United States

Session: A3P-E: Oscillators, Synthesizers, Noise & Circuit Techniques I
Room: Poster Area
Session Chair: Fabrice Sthal, FEMTO-ST

Robust Colpitts and Hartley Oscillator Design
Chingyei Chung, Ming Hsin University of Science and Technology, Taiwan
Sou-Yen Chao, Ming Hsin University of Science and Technology, Taiwan
Detecting of Small Change of Temperature Using SAW Resonators ................................................. 174
Alexander Medved, Kotelnikov Institute of Radio Engineering and Electronics, Russian Academy of Sciences, Russia
Raisa Kryshtal, Kotelnikov Institute of Radio Engineering and Electronics, Russian Academy of Sciences, Russia

A CMOS CO2 Concentration to Frequency Converter with Calibration Circuits ........................................ 177
Cheng-Ta Chiang, National Chia Yi University, Taiwan
Ming-Yi Huang, National Chia Yi University, Taiwan
Michelle Chung, National Chia Yi University, Taiwan

Analysis of Impedance-Loaded Passive SAW Sensor ............................................................................... 182
Takuma Genji, Shizuoka University, Japan
Jun Kondoh, Shizuoka University, Japan

A Flexible Capacitive Pressure Sensor Array for Pulse Diagnosis .............................................................. 186
Jen-Yu Peng, National Tsing Hua University, Taiwan
Michael Lu, National Tsing Hua University, Taiwan

Capacitive Driving and Sensing of a Bi-Axial Scanning Micromirror for Projection Display ......................... 188
Sheng-Gang Fu, National Tsing Hua University, Taiwan
David Lin, Opus Microsystems Corporation, Taiwan
Harrison Lai, Opus Microsystems Corporation, Taiwan
Andrew Hung, Opus Microsystems Corporation, Taiwan
Michael Lu, National Tsing Hua University, Taiwan

Application of Kalmen Filter for Steering UTC(Lab) to UTC ...................................................................... 190
Ye Ren, National Time Service Center / Chinese Academy of Sciences, China
Xiaohui Li, National Time Service Center / Chinese Academy of Sciences, China
Yanrong Xue, National Time Service Center / Chinese Academy of Sciences, China
Ruifang Dong, National Time Service Center / Chinese Academy of Sciences, China

OFDM Technology Anti-Multipath Performance Analysis in China Mobile Multimedia Broadcasting (CMMB) System .............................................................. 193
Zhaopeng Hu, National Time Service Center / Chinese Academy of Sciences, China
Yu Hua, National Time Service Center / Chinese Academy of Sciences, China
Hong Chang, National Time Service Center / Chinese Academy of Sciences, China
Chaozhong Yang, National Time Service Center / Chinese Academy of Sciences, China
Jiangbin Yuan, National Time Service Center / Chinese Academy of Sciences, China

NTP Network Timing Technique Research for Android and iOS Mobile Platform ........................................ 196
Hong-Jiao Ma, National Time Service Center / Chinese Academy of Sciences, China
Meng Li, National Time Service Center / Chinese Academy of Sciences, China
Kang Wang, National Time Service Center / Chinese Academy of Sciences, China
Zhong Dou, National Time Service Center / Chinese Academy of Sciences, China
Haifeng Jiang, National Time Service Center / Chinese Academy of Sciences, China

Research on a New Method of Time Delay Measurement in Telephone Time Service ............................... 200
Xiaozhen Jin, National Time Service Center / Chinese Academy of Sciences, China
Yu Hua, National Time Service Center / Chinese Academy of Sciences, China
Yuanzhong Cao, Sichuan Spaceon Time & Frequency Tech. Co., Ltd, China
Experimental Study on Optical Frequency Transfer via Communication Fibers ...................................................... 203
Jie Liu, National Time Service Center / Chinese Academy of Sciences, China
Jing Gao, National Time Service Center / Chinese Academy of Sciences, China
Guanjun Xu, National Time Service Center / Chinese Academy of Sciences, China
Dongdong Jiao, National Time Service Center / Chinese Academy of Sciences, China
Long Chen, National Time Service Center / Chinese Academy of Sciences, China
Linbo Zhang, National Time Service Center / Chinese Academy of Sciences, China
Haifeng Jiang, National Time Service Center / Chinese Academy of Sciences, China
Ruifang Dong, National Time Service Center / Chinese Academy of Sciences, China
Tao Liu, National Time Service Center / Chinese Academy of Sciences, China
Shougang Zhang, National Time Service Center / Chinese Academy of Sciences, China

New Timekeeping System and its Time Link Calibration at Nim ................................................................................ 206
Kun Liang, National Institute of Metrology, China
Aimin Zhang, National Institute of Metrology, China
Weibo Wang, National Institute of Metrology, China
Dayu Ning, National Institute of Metrology, China
Yuan Gao, National Institute of Metrology, China
Zhiqiang Yang, National Institute of Metrology, China
Kejia Zhao, National Institute of Metrology, China
Yue Zhang, National Institute of Metrology, China
Kun Liu, National Institute of Metrology, China
Bo Long, Guizhou Institute of Metrology, China

A New Steering Strategy for UTC(NTSC) ....................................................................................................................... 210
Shuhong Zhao, National Time Service Center / Chinese Academy of Sciences, China
Dongshan Yin, National Time Service Center / Chinese Academy of Sciences, China
Shaowu Dong, National Time Service Center / Chinese Academy of Sciences, China
Haibo Yuan, National Time Service Center / Chinese Academy of Sciences, China
Lili Qu, National Time Service Center / Chinese Academy of Sciences, China
Jun Ruan, National Time Service Center / Chinese Academy of Sciences, China

Study of an Atomic Clock Steering Method Based on Least Square ................................................................................. 213
Yuwei Li, National Time Service Center / Chinese Academy of Sciences, China
Wenli Wang, National Time Service Center / Chinese Academy of Sciences, China
Liu Ya, National Time Service Center / Chinese Academy of Sciences, China
Xiaohui Li, National Time Service Center / Chinese Academy of Sciences, China
Ruifang Dong, National Time Service Center / Chinese Academy of Sciences, China
Yinhua Liu, National Time Service Center / Chinese Academy of Sciences, China

Calibration of GNSS Receivers ................................................................................................................................... N/A
Kun Liang, National Institute of Metrology, China
Aimin Zhang, National Institute of Metrology, China
Weibo Wang, National Institute of Metrology, China

Session: A3P-J: Optical Frequency Standards I
Room: Poster Area

Sub-Doppler Cooling with the 1S0-1P1 Line in Ytterbium .............................................................................................. 218
Nikita Kostylev, University of Western Australia, Australia
Eugene Ivanov, University of Western Australia, Australia
Michael Tobar, University of Western Australia, Australia
John McFerran, University of Western Australia, Australia

Population Inversion on 88Sr Atomic Beam for Active Optical Clock ................................................................................. 222
Xiaobo Xue, Peking University, China
Duo Pan, Peking University, China
Xiaogang Zhang, Peking University, China
Wei Zhuang, Peking University, China
Jingbiao Chen, Peking University, China
Piezoelectric Periodically Polled Resonators for Nonlinear-Optical Conversion of Laser Radiation .......................... 226
Oleg Ryabushkin, NTO IRE-Polus / Moscow Institute of Physics and Technology, Russia
Aleksy Konyashkin, NTO IRE-Polus / Moscow Institute of Physics and Technology, Russia

Improved Uncertainty of 171Yb Optical Lattice Clock at KRISS ............................................................................. 232
Chang-Yong Park, Korea Research Institute of Standards and Science, Korea, South
Dai-Hyuk Yu, Korea Research Institute of Standards and Science, Korea, South
Won-Kyu Lee, Korea Research Institute of Standards and Science, Korea, South
Sangkyung Lee, Korea Research Institute of Standards and Science, Korea, South
Sang Eon Park, Korea Research Institute of Standards and Science, Korea, South
Jongchul Mun, Korea Research Institute of Standards and Science, Korea, South
Sang-Bum Lee, Korea Research Institute of Standards and Science, Korea, South
Taeg Yong Kwon, Korea Research Institute of Standards and Science, Korea, South

Session: B1L-A: Optical Lattice Clocks
Room: 101A
Session Chair: Yann Le Coq, SYRTE

Frequency Comparison of Cryogenic Optical Lattice Clocks Between Riken and the University of Tokyo...................................................................................................................... N/A
Hidetoshi Katori, University of Tokyo, Japan
Ichiro Ushijima, University of Tokyo, Japan
Masao Takamoto, University of Tokyo / RIKEN, Japan

Optical Atomic Clock Measurements at the mHz Level ......................................................................................... 235
Nathan Hinkley, National Institute of Standards and Technology, United States
Kyle Beloy, National Institute of Standards and Technology, United States
Nate Phillips, National Institute of Standards and Technology, United States
Marco Schioppo, National Institute of Standards and Technology, United States
Jeffrey Sherman, National Institute of Standards and Technology, United States
Nate Phillips, National Institute of Standards and Technology, United States
Andrew Ludlow, National Institute of Standards and Technology, United States

Direct Frequency Comparison of Intercontinentally Separated Sr Lattice Clocks Using Carrier-Phase Two-Way Satellite Frequency Transfer ................................................................. 236
Tetsuya Ido, National Institute of Information and Communications Technology, Japan
Miho Fujieda, National Institute of Information and Communications Technology, Japan
Hidekazu Hachisu, National Institute of Information and Communications Technology, Japan
Shigeo Nagano, National Institute of Information and Communications Technology, Japan
Tadahiro Gotoh, National Institute of Information and Communications Technology, Japan
Stephan Falke, Physikalisch-Technische Bundesanstalt, Germany
Nils Huntemann, Physikalisch-Technische Bundesanstalt, Germany
Christian Grebing, Physikalisch-Technische Bundesanstalt, Germany
Burghard Lipphardt, Physikalisch-Technische Bundesanstalt, Germany
Christian Lisdat, Physikalisch-Technische Bundesanstalt, Germany
Dirk Piester, Physikalisch-Technische Bundesanstalt, Germany

Prospects for Frequency Stabilization Using Collective Effects of Strontium Atoms in an Optical Cavity ................................................................. 239
Bjarne Takashi Røjle Christensen, University of Copenhagen, Denmark
Martin Romme Henriksen, University of Copenhagen, Denmark
Philip Grabow Westergaard, Danish Fundamental Metrology, Denmark
Jun Ye, University of Colorado Boulder, United States
Jan Westenkær Thomsen, University of Copenhagen, Denmark

Lasing of Cesium Active Optical Clock with 459 nm Laser Pumping ................................................................. 242
Duo Pan, Peking University, China
Zhichao Xu, Peking University, China
Xiaobo Xue, Peking University, China
Wei Zhuang, Peking University, China
Jingbiao Chen, Peking University, China
Session: B1L-B: MEMS Oscillators
Room: 101B
Session Chairs: Wan-Thai Hsu, Micrel Inc
Clark Nguyen, Univ. of California at Berkeley

Wafer-Level Selective Transfer Method for FBAR-LSI Integration ............................................................................. 246
Kousuke Hikichi, Tohoku University, Japan
Kazushi Sekiyama, Asahi Kasei Microdevices Corporation, Japan
Masanori Ueda, Taiyo Yuden Co. Ltd., Japan
Shinji Taniguchi, Taiyo Yuden Co. Ltd., Japan
Ken-Ya Hashimoto, Chiba University, Japan
Masayoshi Esashi, Tohoku University, Japan
Shuji Tanaka, Tohoku University, Japan

Integrated MEMS Oscillator for Cellular Transceivers ........................................................................................................ 250
Greg Chance, Intel Mobile and Communications Group, Germany
Thorsten Meyer, Intel Mobile Communications, Germany
Stephan Stoeckl, Intel Mobile Communications, Germany
Burkhard Neurauter, Danube Mobile Communications Engineering, Austria
Giuseppe Patane, Danube Mobile Communications Engineering, Austria
Bernhard Neubauer, Danube Mobile Communications Engineering, Austria
Gerald Minichshofer, Danube Mobile Communications Engineering, Austria
Jan Kuypers, Sand 9, United States
Juergen Schoepf, Sand 9, United States
Reimund Rebel, Sand 9, United States
Darren Weninger, Sand 9, United States
Kim Chung, Sand 9, United States
Tung Shen Chew, Sand 9, United States
Oscar Mendoza, Sand 9, United States

Low Noise Chip Scale Atomic Clock (LNCSAC) ........................................................................................................... 253
Peter Cash, Microsemi Corporation, United States
Dan Boschen, Microsemi Corporation, United States
Ramesh Gandham, Microsemi Corporation, United States
David Mailoux, Microsemi Corporation, United States

A UHF SiGe Push-Pull Quartz MEMS Oscillator ........................................................................................................... 257
Harris Moyer, HRL Laboratories LLC, United States
Yeong Yoon, HRL Laboratories LLC, United States
Zhiwei Xu, HRL Laboratories LLC, United States
Robert Nagele, HRL Laboratories LLC, United States
Deborah Kirby, HRL Laboratories LLC, United States
Randall Kubena, HRL Laboratories LLC, United States
Richard Joyce, HRL Laboratories LLC, United States
R.L. Bowen, HRL Laboratories LLC, United States
David Chang, HRL Laboratories LLC, United States

A Low Noise, Wide Variable Range and High Linearity VCXO-IC Using Linearity Designable on-Chip Varactor Arrays for Fundamental AT-Cut Crystal Resonators ..................................................................... 261
Yutaka Takahashi, Nihon Dempa Kogyo Co., Ltd., Japan
Toshiyuki Shinotsuka, Nihon Dempa Kogyo Co., Ltd., Japan
Hiroyasu Kunitomo, Nihon Dempa Kogyo Co., Ltd., Japan
Takayuki Akutsu, Nihon Dempa Kogyo Co., Ltd., Japan
Chisato Ishimaru, Nihon Dempa Kogyo Co., Ltd., Japan
Shigeyoshi Murase, Nihon Dempa Kogyo Co., Ltd., Japan
Kazuo Akaike, Nihon Dempa Kogyo Co., Ltd., Japan
Magnetic Sensors Based on Micromechanical Oscillators
Mo Li, University of California, Davis, United States
Vashwar Rouf, University of California, Davis, United States
Soner Sonmezoglu, University of California, Davis, United States
David Horsley, University of California, Davis, United States

Ultra-Sensitive Magnetic Field Sensor Based on a Low-Noise Magnetoelectric MEMS-CMOS Oscillator
Yu Hui, Northeastern University, United States
Tianxiang Nan, Northeastern University, United States
Nianxiang Sun, Northeastern University, United States
Matteo Rinaldi, Northeastern University, United States

A Fully Integrated Wafer-Scale Sub-mm³ FBAR-Based Wireless Mass Sensor
Manohar Nagaraju, University of Washington, United States
Jingren Gu, University of Washington, United States
Andrew Lingley, University of Washington, United States
Fan Zhang, Marvell Semiconductor, United States
Martha Small, Avago Technologies, United States
Richard Ruby, Avago Technologies, United States
Brian Otis, University of Washington, United States

Response Signal Enhancement of Film Bulk Acoustic Resonator Mass Sensor with Bounded Hydrophobic Teflon Film
Menglun Zhang, Tianjin University, China
Weiwei Cui, Tianjin University, China
Daihua Zhang, Tianjin University, China
Wei Pang, Tianjin University, China
Hao Zhang, Tianjin University, China

Atomically-Thin MoS2 Resonators for Pressure Sensing
Jaesung Lee, Case Western Reserve University, United States
Philip Feng, Case Western Reserve University, United States

High Performance Compact Atomic Clock Based on Coherent Population Trapping
Stephane Guerandel, LNE-SYRTE, France
Jean-Marie Danet, LNE-SYRTE, France
Peter Yun, LNE-SYRTE, France
Emeric de Clercq, LNE-SYRTE, France

Pulsed Optically Pumped Rubidium Clock with Ultrahigh Resonance Contrast
Jianliao Deng, Shanghai Institute of Optics and Fine Mechanics / Chinese Academy of Sciences, China
Jinda Lin, Shanghai Institute of Optics and Fine Mechanics / Chinese Academy of Sciences, China
Jun Qian, Shanghai Institute of Optics and Fine Mechanics / Chinese Academy of Sciences, China
Gongxin Dong, Shanghai Institute of Optics and Fine Mechanics / Chinese Academy of Sciences, China
Huijuan He, Shanghai Institute of Optics and Fine Mechanics / Chinese Academy of Sciences, China
Yuzhu Wang, Shanghai Institute of Optics and Fine Mechanics / Chinese Academy of Sciences, China

Frequency Biases in a Cold-Atom Coherent Population Trapping Clock
Elizabeth Donley, National Institute of Standards and Technology, United States
Eric Blanshan, National Institute of Standards and Technology, United States
Francois-Xavier Esnault, Centre National d'Etudes Spatiales, France
John Kitching, National Institute of Standards and Technology, United States
Investigation on Light Shift in CPT-Ramsey Resonance for Compact Atomic Clocks ................................................. 297
Yuichiro Yano, Tokyo Metropolitan University, Japan
Wujie Gao, Tokyo Metropolitan University, Japan
Shigeyoshi Goka, Tokyo Metropolitan University, Japan
Masatoshi Kajita, National Institute of Information and Communications Technology, Japan

Session: B2L-B: Photonics and Microwave Oscillators
Room: 101B
Session Chair: Enrico Rubiola, FEMTO-ST

Current Limitations of Cryogenic Microwave Oscillator Frequency Stability ........................................................... 302
Stephen Parker, University of Western Australia, Australia
Eugene Ivanov, University of Western Australia, Australia
Michael Tobar, University of Western Australia, Australia
John Hartnett, University of Adelaide, Australia

Metamaterial Möbius Strips (MMS): Application in Resonators for Oscillators and Synthesizers ......................... 303
Ajay Poddar, Synergy Microwave Corporation, United States
Ulrich Rohde, Synergy Microwave Corporation / Brandenburgische Technische Universität, Germany

Ultra-High Stability Cryocooled Sapphire Microwave Oscillators ........................................................................... 312
Ashby Hilton, University of Western Australia, Australia
John Hartnett, University of Adelaide, Australia
Eugene Ivanov, University of Western Australia, Australia
Andre Luiten, University of Adelaide, Australia

Spectrally Pure and Stable Hyper-Parametric RF Photonic Oscillator ................................................................. 313
Lute Maleki, OEwaves Inc., United States
Wei Liang, OEwaves Inc., United States
Danny Eliyahu, OEwaves Inc., United States
Anatoly Savchenkov, OEwaves Inc., United States
Vladimir Ilchenko, OEwaves Inc., United States
David Seidel, OEwaves Inc., United States
Andrey Matsko, OEwaves Inc., United States

50 GHz Optical Frequency Comb Generation Based on an Optoelectronic Oscillator ........................................... 316
Xiaopeng Xie, Peking University, China
Huanfa Peng, Peking University, China
Tao Sun, Peking University, China
Cheng Zhang, Peking University, China
Peng Guo, Peking University, China
Lixin Zhu, Peking University, China
Weiwei Hu, Peking University, China
Zhangyuan Chen, Peking University, China

Session: B2L-C: Imaging and CMOS-MEMS Resonators
Room: 101CD
Session Chair: Gianluca Piazza, Carnegie Mellon University

Near-Field Microscopy: Is There an Alternative to Micro and Nano Resonating Cantilevers? ............................. 319
Lionel Buchailot, Université de Lille 1 / L'Institut d'Electronique, de Microélectronique et de Nanotechnologie, France
Estelle Mairiaux, Université de Lille 1 / L'Institut d'Electronique, de Microélectronique et de Nanotechnologie, France
Benjamin Walter, Université de Lille 1 / L'Institut d'Electronique, de Microélectronique et de Nanotechnologie, France
Zhuang Xiong, Université de Lille 1 / L'Institut d'Electronique, de Microélectronique et de Nanotechnologie, France
Marc Faucher, Université de Lille 1 / L'Institut d'Electronique, de Microélectronique et de Nanotechnologie, France
Bernard Legrand, Université de Lille 1 / L'Institut d'Electronique, de Microélectronique et de Nanotechnologie, France
Didier Theron, Université de Lille 1 / L'Institut d'Electronique, de Microélectronique et de Nanotechnologie, France
Emmanuelle Algré, ESIEE ESYCOM, France
Laser Probe System for 5 GHz SAW/BAW Devices ........................................................................................................... 321
Ken-Ya Hashimoto, Chiba University, Japan
Shunataro Kawachi, Chiba University, Japan
Akira Takahashi, Chiba University, Japan
Shinya Sakamoto, Chiba University, Japan
Tatsuya Omori, Chiba University, Japan

A CMOS-MEMS Arrayed RGFET ..................................................................................................................................... 325
Chi-Hang Chin, National Tsing Hua University, Taiwan
Sheng-Shian Li, National Tsing Hua University, Taiwan

An Experimental Investigation on the Q-Boosted CMOS-MEMS Flexural-Mode Resonator Circuits .............. 327
Ming-Huang Li, National Tsing Hua University, Taiwan
Chao-Yu Chen, National Tsing Hua University, Taiwan
Sheng-Shian Li, National Tsing Hua University, Taiwan

Exploring Parametric Resonance Effects in Bulk-Mode CMOS-MEMS Resonators .............................................. 329
Jaesung Lee, Case Western Reserve University, United States
Cheng-Syun Li, Case Western Reserve University, United States
Zenghui Wang, Case Western Reserve University, United States
Ming-Huang Li, National Tsing Hua University, Taiwan
Chi-Hang Chin, National Tsing Hua University, Taiwan
Sheng-Shian Li, National Tsing Hua University, Taiwan
Philip Feng, Case Western Reserve University, United States

Si MEMS Disk Resonator Supported by Double-Ended Tuning Fork Absorbers ........................................................ 332
Takahiro Ohtsuka, Nihon Dempo Kogyo Co., Ltd., Japan
Makiko Kageyama, Nihon Dempo Kogyo Co., Ltd., Japan
Yu Iwai, Nihon Dempo Kogyo Co., Ltd., Japan
Akihiko Tashiro, Nihon Dempo Kogyo Co., Ltd., Japan
Atsushi Kamijo, Nihon Dempo Kogyo Co., Ltd., Japan
Noritoshi Kimura, Nihon Dempo Kogyo Co., Ltd., Japan

Session: B3P-D: Materials, Filters & Resonators II
Room: Poster Area
Session Chairs: Ji Wang, Ningbo University
Dan Stevens, Consultant

Growth and Piezoelectric Properties of ReCa4O(BO3)3 (Re=Y,Sm) Crystals .......................................................... paper not available
Kainan Xiong, Shanghai Institute of Ceramics / Chinese Academy of Sciences, China
Yanqing Zheng, Shanghai Institute of Ceramics / Chinese Academy of Sciences, China
Xiaoniu Tu, Shanghai Institute of Ceramics / Chinese Academy of Sciences, China
Quanming Lin, Shanghai Institute of Ceramics / Chinese Academy of Sciences, China
Yaqiao Li, Shanghai Institute of Ceramics / Chinese Academy of Sciences, China
Erwei Shi, Shanghai Institute of Ceramics / Chinese Academy of Sciences, China

Electromagnetic Intermodulation Interference Using Quartz Oscillators ............................................................... 336
Wen-Teng Chang, National University of Kaohsiung, Taiwan
Kuei-Jie Tseng, National University of Kaohsiung, Taiwan
Su-Hao Lai, National University of Kaohsiung, Taiwan

Experimental Investigations of SC-Cut Resonators with B-Mode Reduction .......................................................... 341
Aleksei Lozhnikov, PJSC Omsky Nauchno Issledovatelskiy Institut Priborostr eveniya, Russia
Aleksandr Lepetaev, Omsk State Technical University, Russia

Analysis of Quality Factor of Quartz-Crystal Tuning Fork Fabricated by Etching Process ................................ 345
Hideaki Itoh, Shinshu University, Japan
Crystal Growth and High Temperature Applications of 3" Langatate ................................................................. 349
Xiaoniu Tu, Shanghai Institute of Ceramics / Chinese Academy of Sciences, China
Yanqing Zheng, Shanghai Institute of Ceramics / Chinese Academy of Sciences, China
Kainan Xiong, Shanghai Institute of Ceramics / Chinese Academy of Sciences, China
Quanming Lin, Shanghai Institute of Ceramics / Chinese Academy of Sciences, China
Yaqiao Li, Shanghai Institute of Ceramics / Chinese Academy of Sciences, China
Ying Shi, Shanghai University, China
Erwei Shi, Shanghai Institute of Ceramics / Chinese Academy of Sciences, China

Deposition of Highly C-Axis-Oriented ScAlN Thin Films by RF Magnetron Sputtering
Using a Sc-Al Alloy Target .............................................................................................................................................. 350
Satoshi Fujii, Chiba University, Japan
Shogo Shimizu, Chiba University, Japan
Masahiro Sumisaka, Chiba University, Japan
Yu Suzuki, Furuya Metal Company Ltd., Japan
Shouhei Otomo, Furuya Metal Company Ltd., Japan
Tatsuya Omori, Chiba University, Japan
Ken-Ya Hashimoto, Chiba University, Japan

Surface Acoustic Wave Resonator Using Layered Phononic Crystals .................................................................................. 354
Jia-Hong Sun, Chang Gung University, Taiwan
Jyun-Hua Jhou, Chang Gung University, Taiwan

A Study on Raising the Fundamental TS-Mode Resistance by Energy Trapping for 3rd Overtone Resonator Performance Enhancement .......................................................................................................................... 358
Shih-Yung Pao, TXC Corporation, Taiwan
Wen-Yuan Chang, TXC Corporation, China
Bi-Qing Hsu, TXC Corporation, China
Yen-Ting Lai, Tatung University, Taiwan
Yung-Yu Chen, Tatung University, Taiwan
Tao Lin, TXC Corporation, China
Min-Chiang Chao, TXC Corporation, China

Ultra-Sensitive Whispering Gallery Mode Spectroscopy of Low Loss Crystals at Cryogenic Temperatures .................................................................................................................................................................. 362
Maxim Goryachev, University of Western Australia, Australia
Warrick Farr, University of Western Australia, Australia
Natalia Carvalho, University of Western Australia, Australia
Daniel Creedon, University of Western Australia, Australia
Jean-Michel Le Floch, University of Western Australia, Australia
Karim Bennmessai, University of Western Australia, Australia
Pavel Bushev, Universität des Saarlandes, Germany
Michael Tobar, University of Western Australia, Australia

Equivalent Network Representation in Cylindrical Coordinates for Trapped-Energy Resonators Operating in Backward-Wave-Type Thickness Vibration Modes .......................................................................................................................... 365
Ken Yamada, Tohoku Gakuin University, Japan
Daisuke Suzuki, Tohoku Gakuin University, Japan
Yudai Kon, Tohoku Gakuin University, Japan

A Study for the Relationship Between Drive Level and the Activation Energy in Arrhenius Accelerated Aging Model for Small Size Quartz Resonators .......................................................................................................................... 368
Chun Nan Shen, TXC Corporation, China
Jun Jun Xu, TXC Corporation, China
Min-Chiang Chao, TXC Corporation, China

Anchor Loss Reduction in AlN Lamb Wave Resonators Using Phononic Crystal Strip Tethers .................................................................................................................................................................. 371
Chih-Ming Lin, University of California, Berkeley, United States
Jin-Chen Hsu, National Yunlin University of Science and Technology, Taiwan
Debbie Senesky, Stanford University, United States
Albert Pisano, University of California, San Diego, United States
Session: B3P-E: Oscillators, Synthesizers, Noise & Circuit Techniques II  
Room: Poster Area  
Session Chair: Fabrice Sthal, FEMTO-ST

Thermal Effect of the Microwave Mach-Zehnder Interferometric Switch ................................................................. 376  
Yu Zhang, Beijing Institute of Technology, China  
Kun Liu, National Institute of Metrology, China  
Fang Fang, National Institute of Metrology, China  
Nianfeng Liu, National Institute of Metrology, China  
Tianchu Li, National Institute of Metrology, China  

A Chip-Scale Atomic Resonator-Based Stabilization System for Optoelectronic Oscillator ............................................ 379  
Zheng Chen, Peking University, China  
Yaolin Zhang, Peking University, China  
Jianye Zhao, Peking University, China  

Spectral Properties of Dithered Nyquist-Rate Single-Bit Quantized Amplitude-Modulated Sinewaves ......................... 382  
Paul Sotiriadis, National Technical University of Athens, Greece  

Digitally Controlled Thermostat for a High-Stable Crystal Oscillator ........................................................................ 387  
Nikolay Vorobyev, FEMTO-ST Institute, France  
Joël Imbaud, FEMTO-ST Institute, France  
Philippe Abbe, FEMTO-ST Institute, France  
Fabrice Sthal, FEMTO-ST Institute, France  

Nonlinear Model of Crystal Resonator and its Application to Phase Noise Simulation of Oscillator .......................... 391  
Tsubasa Yasuda, Yokohama National University, Japan  
Shasika Shaminda Senanayaka, Yokohama National University, Japan  
Kohei Uchino, Yokohama National University, Japan  
Takehiko Adachi, Yokohama National University, Japan  

An Atomic Clock Based on Coherent Population Beating .......................................................................................... 394  
Dawei Li, Peking University, China  
Daiting Shi, Peking University, China  
Ermeng Hu, Peking University, China  
Yigen Wang, Peking University, China  
Lu Tian, Peking University, China  
Jianye Zhao, Peking University, China  
Zhong Wang, Peking University, China  

The Research of Control System for Cesium Atomic Fountain Clock ........................................................................ 397  
Dandan Liu, National Time Service Center / Chinese Academy of Sciences, China  
Xinliang Wang, National Time Service Center / Chinese Academy of Sciences, China  
Rui Lin, National Time Service Center / Chinese Academy of Sciences / University of Chinese Academy of Science, China  
Jiang Chen, National Time Service Center / Chinese Academy of Sciences, China  
Hui Zhang, National Time Service Center / Chinese Academy of Sciences, China  
Jun Ruan, National Time Service Center / Chinese Academy of Sciences, China  
Yong Guan, National Time Service Center / Chinese Academy of Sciences, China  
Fengxiang Yu, National Time Service Center / Chinese Academy of Sciences / University of Chinese Academy of Science, China  
Junru Shi, National Time Service Center / Chinese Academy of Sciences / University of Chinese Academy of Science, China  
Shougang Zhang, National Time Service Center / Chinese Academy of Sciences, China  

Effects of Polarization on Recoil-Induced Resonances of Rubidium Atoms in Diffuse Laser Light .......................... 401  
Wenli Wang, Shanghai Institute of Optics and Fine Mechanics / Chinese Academy of Sciences, China  
Jun Qian, Shanghai Institute of Optics and Fine Mechanics / Chinese Academy of Sciences, China  
Jianliao Deng, Shanghai Institute of Optics and Fine Mechanics / Chinese Academy of Sciences, China  
Yuzhu Wang, Shanghai Institute of Optics and Fine Mechanics / Chinese Academy of Sciences, China
Research on Modification of H-maser Drift .......................................................... 404
Aimin Zhang, National Institute of Metrology, China
Weibo Wang, National Institute of Metrology, China
Yuan Gao, National Institute of Metrology, China
Kun Liang, National Institute of Metrology, China
Zhiqiang Yang, National Institute of Metrology, China
Kun Liu, National Institute of Metrology, China

Researches of Local Oscillator Locking of Atomic Fountain Clock and its Frequency Shift ........................................ paper not available
Richang Dong, Shanghai Institute of Optics and Fine Mechanics / Chinese Academy of Sciences, China
Rong Wei, Shanghai Institute of Optics and Fine Mechanics / Chinese Academy of Sciences, China
Yuanbo Du, Shanghai Institute of Optics and Fine Mechanics / Chinese Academy of Sciences, China
Yuzhu Wang, Shanghai Institute of Optics and Fine Mechanics / Chinese Academy of Sciences, China

Progress in the Development of Commercial Optically Pumped Cesium Atomic Clock ............................................. 407
Yuanhong Cao, Chengdu Spaceon Electronics Co. Ltd., China
Xingwen Zhao, Chengdu Spaceon Electronics Co. Ltd., China
Lin Yang, Chengdu Spaceon Electronics Co. Ltd. / Sichuan Spaceon Time & Frequency Tech. Co., Ltd, China
Haijun Chen, CETC-12 institute, China
Shougang Zhang, National Time Service Center / Chinese Academy of Sciences, China

Low Power Chip-Scale CPT Atomic Clock with New Microwave Frequency Modulation Technique .................... 411
Cheng Xing, Peking University, China
Yaolin Zhang, Peking University, China
Jiutao Wu, Peking University, China
Jianye Zhao, Peking University, China

Laser Power Stabilization for the Detection of the Populations of the Atomic Double Levels in Cs Fountain Clock .......................................................... 414
Rui Lin, National Time Service Center / Chinese Academy of Sciences/University of Chinese Academy of Science, China
Dandan Liu, National Time Service Center / Chinese Academy of Sciences, China
Jun Ruan, National Time Service Center / Chinese Academy of Sciences, China
Wenyu Zhao, National Time Service Center / Chinese Academy of Sciences, China
Xinliang Wang, National Time Service Center / Chinese Academy of Sciences, China
Jiang Chen, National Time Service Center / Chinese Academy of Sciences, China
Yong Guan, National Time Service Center / Chinese Academy of Sciences, China
Hui Zhang, National Time Service Center / Chinese Academy of Sciences, China
Fengxiang Yu, National Time Service Center / Chinese Academy of Sciences/University of Chinese Academy of Science, China
Junru Shi, National Time Service Center / Chinese Academy of Sciences/University of Chinese Academy of Science, China
Shougang Zhang, National Time Service Center / Chinese Academy of Sciences, China

Session: B3P-H: Time & Frequency II
Room: Poster Area
Session Chair: Huang-Tien Lin, Chunghwa Telecom Co., Ltd.

GNSS System Time Offset Monitoring at NTSC ......................................................................................... 417
Huijun Zhang, National Time Service Center / Chinese Academy of Sciences, China
Lin Zhu, National Time Service Center / Chinese Academy of Sciences, China
Xiaohui Li, National Time Service Center / Chinese Academy of Sciences, China
Haifeng Jiang, National Time Service Center / Chinese Academy of Sciences, China
Xue Zhang, National Time Service Center / Chinese Academy of Sciences, China

The Research of Demarcating and Evaluating Method of System Error of Mobile Station ........................................ 422
Weijin Qin, National Time Service Center / Chinese Academy of Sciences, China
Pei Wei, National Time Service Center / Chinese Academy of Sciences, China
Xiaoqian Ren, National Time Service Center / Chinese Academy of Sciences, China
Xuhai Yang, National Time Service Center / Chinese Academy of Sciences, China
Hong Chang, National Time Service Center / Chinese Academy of Sciences, China
A New Method of Time Difference Calibration of TWSTFT Earth Station
Based on Two Portable Stations ................................................................. 426
Guoyong Wang, National Time Service Center / Chinese Academy of Sciences, China
Ya Liu, National Time Service Center / Chinese Academy of Sciences, China
Xiaohui Li, National Time Service Center / Chinese Academy of Sciences, China
Ruifang Dong, National Time Service Center / Chinese Academy of Sciences, China

Effect of Temperature on Precision of TWSTFT Clock Comparison in Chinese Area Positioning System ............................................................ 431
Fen Cao, National Time Service Center / Chinese Academy of Sciences, China
Xuhai Yang, National Time Service Center / Chinese Academy of Sciences, China
Tao Liu, National Time Service Center / Chinese Academy of Sciences, China
Zhigang Li, National Time Service Center / Chinese Academy of Sciences, China
Yao Kong, National Time Service Center / Chinese Academy of Sciences, China
Hui Lei, National Time Service Center / Chinese Academy of Sciences, China
Liang Chen, National Time Service Center / Chinese Academy of Sciences, China
Chugang Feng, Shanghai Astronomical Observatory, China

Juan Du, National Time Service Center / Chinese Academy of Sciences, China
Ji Guo, National Time Service Center / Chinese Academy of Sciences, China
Xiaochun Lu, National Time Service Center / Chinese Academy of Sciences, China
Xue Wang, National Time Service Center / Chinese Academy of Sciences, China
Lin Yang, Chengdu Spaceon Electronics Co. Ltd. / Sichuan Spaceon Time & Frequency Tech. Co., Ltd, China
Jun Ruan, National Time Service Center / Chinese Academy of Sciences, China

The TWSTFT Links Circling the World ................................................................. 440
Huang-Tien Lin, Chunghwa Telecom Co., Ltd., Taiwan
Yi-Jiun Huang, Chunghwa Telecom Co., Ltd., Taiwan
Wen-Hung Tseng, Chunghwa Telecom Co., Ltd., Taiwan
Chia-Shu Liao, Chunghwa Telecom Co., Ltd., Taiwan
Fang-Dar Chu, Chunghwa Telecom Co., Ltd., Taiwan

The Analysis of Differential Code Bias of BeiDou Satellite Navigation System ................................................................. 444
Yinhua Liu, National Time Service Center / Chinese Academy of Sciences, China
Xiaohui Li, National Time Service Center / Chinese Academy of Sciences, China
Jun Ruan, National Time Service Center / Chinese Academy of Sciences, China
Huijun Zhang, National Time Service Center / Chinese Academy of Sciences, China
Lin Yang, Chengdu Spaceon Electronics Co. Ltd. / Sichuan Spaceon Time & Frequency Tech. Co., Ltd, China

Session: B3P-J: Optical Frequency Standards II
Room: Poster Area
Session Chair: John McFerran, UWA

Alkali Pressure Shifts and Their Temperature Dependence: Measurements with the Rb Isoclinic Point ................................................................. 449
Nathan Wells, Aerospace Corporation, United States
Travis Driskell, Aerospace Corporation, United States
James Campano, Aerospace Corporation, United States

Mid-Infrared Frequency Comb Based on Highly-Efficient Optical Parametric Oscillator ................................................................. 450
Shigeo Nagano, National Institute of Information and Communications Technology, Japan
Hiroyuki Ito, National Institute of Information and Communications Technology, Japan
Motohiro Kumagai, National Institute of Information and Communications Technology, Japan
Masatoshi Kajita, National Institute of Information and Communications Technology, Japan
Yuko Hanado, National Institute of Information and Communications Technology, Japan
Coherence Transfer from 1064 nm to the Region of 700-1000 nm with an Optical Frequency Comb
Yanyi Jiang, East China Normal University, China
Haiqin Chen, East China Normal University, China
Su Fang, East China Normal University, China
Zhiyi Bi, East China Normal University, China
Long Sheng Ma, East China Normal University, China

Development of an Er:fiber-Based Femtosecond Laser at NTSC
Yanyan Zhang, National Time Service Center / Chinese Academy of Sciences, China
Wenyu Zhao, National Time Service Center / Chinese Academy of Sciences, China
Sen Meng, Xi'an Shiyou University, China
Lulu Yan, National Time Service Center / Chinese Academy of Sciences, China
Wenge Guo, Xi'an Shiyou University, China
Shougang Zhang, National Time Service Center / Chinese Academy of Sciences, China
Haifeng Jiang, National Time Service Center / Chinese Academy of Sciences, China

New Analytic Estimate of Thermal Noise in Spindle Optical Cavities
Guanjun Xu, National Time Service Center / Chinese Academy of Sciences, China
Linbo Zhang, National Time Service Center / Chinese Academy of Sciences, China
Jie Liu, National Time Service Center / Chinese Academy of Sciences, China
Jing Gao, National Time Service Center / Chinese Academy of Sciences, China
Dongdong Jiao, National Time Service Center / Chinese Academy of Sciences, China
Long Chen, National Time Service Center / Chinese Academy of Sciences, China
Ruiyang Dong, National Time Service Center / Chinese Academy of Sciences, China
Tao Liu, National Time Service Center / Chinese Academy of Sciences, China
Shougang Zhang, National Time Service Center / Chinese Academy of Sciences, China

Session: C1L-A: Atomic Fountains and Precision Measurements
Room: 101A
Session Chair: Andre Luiten, The University of Adelaide

Cold-Atom Clocks as Part of a Timing Ensemble
Christopher Ekstrom, United States Naval Observatory, United States
James Hanssen, United States Naval Observatory, United States
Thomas Swanson, United States Naval Observatory, United States
Jennifer Taylor, United States Naval Observatory, United States
Steven Peil, United States Naval Observatory, United States

Testing Speed of Light Isotropy Using Rotating Cryogenic Sapphire Microwave Oscillators
Stephen Parker, University of Western Australia, Australia
Moritz Nagel, Humboldt University of Berlin, Germany
Evgeny Kovalchuk, Humboldt University of Berlin, Germany
Paul Stanwix, University of Western Australia, Australia
Eugene Ivanov, University of Western Australia, Australia
John Hartnett, University of Adelaide, Australia
Achim Peters, Humboldt University of Berlin, Germany
Michael Tobar, University of Western Australia, Australia

Accuracy Evaluation of the KRISS-F1 Fountain Clock
Sang Eon Park, Korea Research Institute of Standards and Science, Korea, South
Myoung-Sun Heo, Korea Research Institute of Standards and Science, Korea, South
Taeg Yong Kwon, Korea Research Institute of Standards and Science, Korea, South
Kurt Gibble, Pennsylvania State University, United States
Sang-Bum Lee, Korea Research Institute of Standards and Science, Korea, South
Chang-Yong Park, Korea Research Institute of Standards and Science, Korea, South
Won-Kyu Lee, Korea Research Institute of Standards and Science, Korea, South
Dai-Hyuk Yu, Korea Research Institute of Standards and Science, Korea, South

PHARAO Flight Model : Integration and “On Ground” Performances Tests
Francois-Xavier Esnault, Centre National d'Etudes Spatiales, France
A High Performance Rb Atomic Clock ........................................................................................................................... 470
Lin Yang, Chengdu Spaceon Electronics Co. Ltd. / Sichuan Spaceon Time & Frequency Tech. Co., Ltd, China
Runchang Du, Chengdu Spaceon Electronics Co. Ltd., China
Yuanhong Cao, Chengdu Spaceon Electronics Co. Ltd., China
Qing He, Southwest China Research Institute of Electronic Equipment, China

Session: C1L-B: Modeling & Characterization of Sensors
Room: 101B
Session Chairs: Philip Feng, Case Western Reserve University
Svenja Knappe, NIST

Nonlinear Dynamics and All Mechanical Phonon Lasing in Electromechanical Resonators ........................................ 475
Hiroshi Yamaguchi, Nippon Telegraph and Telephone Corporation Basic Research Laboratories, Japan
Imran Mahboob, Nippon Telegraph and Telephone Corporation Basic Research Laboratories, Japan
Hajime Okamoto, Nippon Telegraph and Telephone Corporation Basic Research Laboratories, Japan

Multimode Characteristics of High-Frequency CMOS-MEMS Resonators ................................................................. 478
Jaesung Lee, Case Western Reserve University, United States
Cheng-Syun Li, Case Western Reserve University, United States
Ming-Huang Li, National Tsing Hua University, Taiwan
Chi-Hang Chin, National Tsing Hua University, Taiwan
Sheng-Shian Li, National Tsing Hua University, Taiwan
Philip Feng, Case Western Reserve University, United States

Modelling of Hysteresis and Creep in SAW Strain Sensors ............................................................................................ 481
Victor Kalinin, Transense Technologies PLC, United Kingdom

Packaging the SAW Torque Sensor with Teflon ........................................................................................................... 485
Yanping Fan, Shanghai Jiao Tong University, China
Xiaojun Ji, Shanghai Jiao Tong University, China
Ping Cai, Shanghai Jiao Tong University, China
Yulin Han, Shanghai Jiao Tong University, China

Fast Calibration of Wireless and Passive Temperature Sensors Based on SAW Resonators ....................................... 490
Yulin Han, Shanghai Jiao Tong University, China
Tao Han, Shanghai Jiao Tong University, China
Weibiao Wang, Shanghai Jiao Tong University, China

Session: C1L-C: Phononics and Non-Linear Phenomena
Room: 101CD
Session Chair: Jan Kuypers, Sand 9

Love Waves in a Quartz-Based Phononic Structure ...................................................................................................... 494
Tsung-Tsong Wu, National Taiwan University, Taiwan
Ting-Wei Liu, National Taiwan University, Taiwan
Yu-Ching Lin, Tohoku University, Japan
Yao-Chuan Tsai, Tohoku University, Japan
Takahito Ono, Tohoku University, Japan
Shuji Tanaka, Tohoku University, Japan

Phononic Crystals for Acoustic Confinement in CMOS-MEMS Resonators ................................................................. 497
Bichoy Bahr, Massachusetts Institute of Technology, United States
Radhika Marathe, Massachusetts Institute of Technology, United States
Dana Weinstein, Massachusetts Institute of Technology, United States

Orientation Dependence of Nonlinearity and TCF in High-Q Shear-Modes of Silicon MEMS Resonators ............... 501
Haoshen Zhu, City University of Hong Kong, Hong Kong
Joshua Lee, City University of Hong Kong, Hong Kong
Special Amplitude-Frequency Effects in VHF Quartz Resonators ................................................................. 505
Randall Kubena, HRL Laboratories LLC, United States
Richard Joyce, HRL Laboratories LLC, United States
Brian Rose, Consultant, United States
Yook-Kong Yong, Rutgers University, United States

High-Q and Low TCF HBAR Based on LiTaO3 Substrate .................................................................................. 511
Thomas Baron, FEMTO-ST Institute, France
Gilles Martin, FEMTO-ST Institute, France
Nicolas Chrétien, FEMTO-ST Institute, France
Valérie Petrini, FEMTO-ST Institute, France
Guilame Combe, FEMTO-ST Institute, France
Fabien Henrot, FEMTO-ST Institute, France
Florent Bassignot, FEMTO-ST Institute, France
Alexandre Reinhardt, CEA-Leti, France
Pierre-Patrick Lassagne, CEA-Leti, France
Jean-Marc Lesage, DGA Information Superiority, France
David Rabus, SENSeOR, France
Luc Chommeloux, SENSeOR, France
Sylvain Ballandras, FreC’N’Sys SAS, France

Phononic SAW Transducers with Complete Frequency Bandgap Characteristics .................................................. 515
Ventsislav Yantchev, Uppsala University, Sweden
Victor Plessky, GVR Trade SA, Switzerland

Session: C2L-A: Optical Frequency Transfer
Room: 101A
Session Chair: Kwangyun Jung, KAIST
James Cahill, US Army Research Laboratory

Optimization of Modulation Techniques for Suppression of GEMRS in Frequency Transfer Systems ............... 517
James Cahill, US Army Research Laboratory, United States
Olukayode Okusaga, US Army Research Laboratory, United States
Weimin Zhou, US Army Research Laboratory, United States
Curtis Menyuk, University of Maryland Baltimore County, United States
Gary Carter, University of Maryland Baltimore County, United States

Laser-to-Laser Remote Transfer and Synchronization with Sub-Fs Precision Over a 3.5 km Fiber Link ........... 520
Kemal Safak, Deutsches Elektronen-Synchrotron / University of Hamburg, Germany
Ming Xin, Deutsches Elektronen-Synchrotron, Germany
Michael Y. Peng, Massachusetts Institute of Technology, United States
Patrick T. Callahan, Massachusetts Institute of Technology, United States
Franz X. Kärntner, CFEL-DESY / Massachusetts Institute of Technology / University of Hamburg, Germany

Optical Frequency Transfer via 1840 km Fiber Link with Superior Stability ....................................................... 525
Stefan Droste, Max Planck Institute of Quantum Optics, Germany
Filip Ozimek, Physikalisch-Technische Bundesanstalt, Germany
Thomas Udem, Max Planck Institute of Quantum Optics, Germany
Katharina Predehl, Max Planck Institute of Quantum Optics, Germany
Theodor W. Hänsch, Max Planck Institute of Quantum Optics, Germany
Harald Schnatz, Physikalisch-Technische Bundesanstalt, Germany
Gesine Grosche, Physikalisch-Technische Bundesanstalt, Germany
Ronald Holzwarth, Max Planck Institute of Quantum Optics, Germany

Characterization of a 450-km-Baseline GPS Carrier-Phase Link Using an Optical Fiber Link ....................... 527
Stefan Droste, Max Planck Institute of Quantum Optics, Germany
Christian Grebing, Physikalisch-Technische Bundesanstalt, Germany
Julia Leute, Physikalisch-Technische Bundesanstalt, Germany
Sebastian Raupach, Physikalisch-Technische Bundesanstalt, Germany
Andreas Bauch, Physikalisch-Technische Bundesanstalt, Germany
Gesine Grosche, Physikalisch-Technische Bundesanstalt, Germany
Ronald Holzwarth, Max Planck Institute of Quantum Optics, Germany
Microwave Transfer Through Optical Frequency Comb Toward 10-19 Instability Using Fiber-Loop Optical-Microwave Phase Detectors ................................................................. 529
Kwangyun Jung, Korea Advanced Institute of Science and Technology, Korea, South
Junho Shin, Korea Advanced Institute of Science and Technology, Korea, South
Jinho Kang, Korea Advanced Institute of Science and Technology, Korea, South
Jungwon Kim, Korea Advanced Institute of Science and Technology, Korea, South
Stephan Hunziker, Paul Scherrer Institute, Switzerland
Chang-Ki Min, Pohang Accelerator Laboratory, Korea, South

Session: C2L-B: Digital Electronics and Noise
Room: 101B
Session Chair: Aaron Partridge, SiTime

Phase Noise and Jitter in Digital Electronic Components ............................................................. 532
Claudio Calosso, Istituto Nazionale di Ricerca Metrologica, Italy
Enrico Rubiola, FEMTO-ST Institute, France

All Digital Frequency Synthesis Based on Pulse Direct Digital Synthesizer with Spurs
Free Output and Improved Noise Floor ................................................................................. 535
Paul Sotiriadis, National Technical University of Athens, Greece

Delta-Sigma Modulation Techniques to Reduce Noise and Spurs in All-Digital RF Transmitters .......... 540
Kostas Galanopoulos, National Technical University of Athens, Greece
Charis Basetas, National Technical University of Athens, Greece
Paul Sotiriadis, National Technical University of Athens, Greece

On the Generation of Random Dithering Sequences with Specified Both Power
Spectral Density and Probability Density Function ........................................................................... 543
Paul Sotiriadis, National Technical University of Athens, Greece

Session: C2L-C: High Frequency Piezoelectric Resonators
Room: 101CD
Session Chair: Randy Kubena, HRL Laboratories

Piezoelectric Acoustic Wave Devices Based on Heterogeneous Integration Technology ..................... 548
Shuji Tanaka, Tohoku University, Japan

Residual Noise Reduction in AlN Resonators by Prolonged RF Excitation ....................................... 552
Nancy Saldanha, Carnegie Melon University, United States
Usama Zaghoul, Carnegie Melon University, United States
Gianluca Piazza, Carnegie Melon University, United States

Phase Change Material Programmable Vias for Switching and Reconfiguration of
Aluminum Nitride Piezoelectric MEMS Resonators ......................................................................... 556
Gwendolyn Hummel, Northeastern University, United States
Yu Hui, Northeastern University, United States
Matteo Rinaldi, Northeastern University, United States

L-Band Lamb Mode Resonators in Gallium Nitride MMIC Technology .............................................. 559
Laura Popa, Massachusetts Institute of Technology, United States
Dana Weinstein, Massachusetts Institute of Technology, United States

Low TCF Lithium Tantalate Contour Mode Resonators ..................................................................... 563
Renyuan Wang, Cornell University, United States
Sunil A. Bhave, Cornell University, United States
Kushal Bhattacharjee, RF Micro Devices, Inc., United States
A High-Accuracy Mobile Al+ Optical Clock
S M Brewer, National Institute of Standards and Technology / Massachusetts Institute of Technology, United States
J S Chen, National Institute of Standards and Technology, United States
D R Leibrandt, National Institute of Standards and Technology, United States
Chin-Wen Chou, National Institute of Standards and Technology, United States
D J Wineland, National Institute of Standards and Technology, United States
J C Bergquist, National Institute of Standards and Technology, United States
T Rosenband, National Institute of Standards and Technology / Harvard University, United States

The Comparison of the 40Ca+ Ion Clocks with the Improvement of the Clock Laser Stability
Yao Huang, Wuhan Institute of Physics and Mathematics / Chinese Academy of Sciences, China
Peiliang Liu, Wuhan Institute of Physics and Mathematics / Chinese Academy of Sciences, China
Wu Bian, Wuhan Institute of Physics and Mathematics / Chinese Academy of Sciences, China
Hua Guan, Wuhan Institute of Physics and Mathematics / Chinese Academy of Sciences, China
Kelin Gao, Wuhan Institute of Physics and Mathematics / Chinese Academy of Sciences, China

Miniature Microwave Frequency Standard with Trapped 171Yb+
Yuan-Yu Jau, Sandia National Laboratories, United States
Peter D.D. Schwindt, Sandia National Laboratories, United States
Adrian Casias, Sandia National Laboratories, United States
Darwin Serkland, Sandia National Laboratories, United States
Ron Manginell, Sandia National Laboratories, United States
Mathew Moorman, Sandia National Laboratories, United States
Robert Boye, Sandia National Laboratories, United States
Aaron Ison, Sandia National Laboratories, United States
Ted Winrow, Sandia National Laboratories, United States
Andrew McCants, Sandia National Laboratories, United States
John Prestage, Jet Propulsion Laboratory, United States
Nan Yu, Jet Propulsion Laboratory, United States
James Kellogg, Jet Propulsion Laboratory, United States
Igor Kosvin, Microsemi Corporation, United States

Improvement of the Signal-to-Noise Ratio of the Clock Signal for the Frequency Standard Based on 113Cd+ Ions
Kai Miao, Tsinghua University, China
Jianwei Zhang, Tsinghua University, China
Shiguang Wang, Tsinghua University, China
Zhengbo Wang, Tsinghua University, China
Lijun Wang, Tsinghua University, China

The Pursuit for Low Cost and Low Phase Noise Synthesized Signal Sources: Theory & Optimization
Ajay Poddar, Synergy Microwave Corporation, United States
Ulrich Rohde, Synergy Microwave Corporation / Brandenburgische Technische Universität, Germany

Correlation Measurements Between PM and AM Noise in Oscillators
Archita Hati, National Institute of Standards and Technology, United States
Craig Nelson, National Institute of Standards and Technology, United States
David Howe, National Institute of Standards and Technology, United States

Modeling Spectral Description of Lock Phenomena in Harmonic Oscillator
Kia Hock Tan, Universiti Tunku Abdul Rahman, Malaysia
Eng Hock Lim, Universiti Tunku Abdul Rahman, Malaysia
Fook Loong Lo, Universiti Tunku Abdul Rahman, Malaysia
Collapse of the Cross-Spectral Function
Craig Nelson, National Institute of Standards and Technology, United States
Archita Hati, National Institute of Standards and Technology, United States
Dave Howe, National Institute of Standards and Technology, United States

Oscillator Phase Noise Reduction Using Self-Injection Locked and Phase Locked Loop (SILPLL)
Li Zhang, Drexel University, United States
Afshin Daryoush, Drexel University, United States
Ajay Poddar, Synergy Microwave Corporation, United States
Ulrich Rohde, Synergy Microwave Corporation / Brandenburgische Technische Universität, United States

Coupling Theory for Fluctuating Spurs in Oscillators
Michael Underhill, Underhill Research Limited, United Kingdom

Session: C3L-C: Micromechanical Filters and MEMS Resonators
Room: 101CD
Session Chair: Sheng-Shian Li, National Tsing Hua University

A Passband-Corrected High Rejection Channel-Select Micromechanical Disk Filter
Mehmet Akgul, University of California, Berkeley, United States
Clark Nguyen, University of California, Berkeley, United States

A Protocol for Automated Passband Correction of High-Order Microelectromechanical Filters
Henry Barrow, University of California, Berkeley, United States
Clark Nguyen, University of California, Berkeley, United States

Active Q-Control for Improved Insertion Loss Micromechanical Filters
Thura Lin Naing, University of California, Berkeley, United States
Jalal Naghsh Nilchi, University of California, Berkeley, United States
Ruonan Liu, University of California, Berkeley, United States
Tristan Rocheleau, University of California, Berkeley, United States
Clark Nguyen, University of California, Berkeley, United States

Temperature Dependence of Torsional and Flexural Modes in 6H-SiC Microdisk Resonators
Rui Yang, Case Western Reserve University, United States
Zenghui Wang, Case Western Reserve University, United States
Jaesung Lee, Case Western Reserve University, United States
Kalyan Ladhane, University of Utah, United States
Darrin Young, University of Utah, United States
Philip Feng, Case Western Reserve University, United States

A Temperature-Stable Clock Using Multiple Temperature-Compensated Micro-Resonators
Vikram A. Thakar, University of Michigan, United States
Cesar Figueroa, University of Michigan, United States
Zhengzheng Wu, University of Michigan, United States
Mina Rais-Zadeh, University of Michigan, United States

Author Index