

# PRELIMINARY TECHNICAL PROGRAM

**2020**

SOLID-STATE SENSORS, ACTUATORS AND MICROSYSTEMS WORKSHOP

**HILTON HEAD**

Sonesta Resort ★ Hilton Head, South Carolina

May 31–June 4, 2020

[www.HH2020.org](http://www.HH2020.org)

Sponsored by



The Workshop Executive Committee reserves the right to amend the program if necessary.

# Sunday, May 31

## Short Course - Microsystems Frontiers in the IoT Era

Course Chair: Matteo Rinaldi, *Northeastern University, USA*

The course will discuss examples of enabling microsystems technologies for Internet-of-Things (IoT) and their commercialization efforts, including:

- near zero power
- event-driven
- sensors and RF devices
- low-power chip-scale piezoelectric ultrasonic platforms for sensing and imaging

Visit [website](#) for additional details.

**8:30 am**    **Short Course Registration**

**9:00 am**    **SESSION 1 - ULTRASONIC TIME OF FLIGHT SENSING FOR THE IOT**

David Horsley

*University of California, Davis, USA and TDK/Chirp Microsystems, USA*

**10:00 am**    **Break**

**10:15 am**    **SESSION 2 - GIGAHERTZ ULTRASONICS FOR THE IOT**

Amit Lal

*Cornell University, USA and Geegah, USA*

**11:15 am**    **Break**

**11:30 am**    **SESSION 3 - NEAR ZERO-POWER MICROSYSTEMS FOR THE IOT**

Matteo Rinaldi

*Northeastern University, USA*

**12:30 pm**    **Lunch on Own**

*Afternoon Panel Presentation and Panel Discussion are open to all workshop attendees.*

**2:00 pm**    **Panel Presentation and Perspective from Government and Industry**

Benjamin Griffin, *Defense Advanced Research Projects Agency (DARPA), USA*

Tanbir Haque, *InterDigital, Inc., USA*

David Howard, *TowerJazz, USA*

Arjun Kumar Kantimahanti, *SilTerra, MALAYSIA*

Ronald Polcawich, *Defense Advanced Research Projects Agency (DARPA), USA*

Keith Rebello, *Defense Advanced Research Projects Agency (DARPA), USA*

**3:30 pm**    **Break**

**4:00 pm - 5:30 pm**    **Panel Discussion**

# Sunday, May 31

6:00 pm - 9:00 pm **Registration and Welcome Reception**

# Monday, June 1

7:00 am **Registration and Breakfast**

7:45 am **Welcome**

**Workshop Chair** - Mina Rais-Zadeh, *NASA Jet Propulsion Laboratory, USA*

**Program Chair** - Reza Ghodssi, *University of Maryland, College Park, USA*

## Plenary Presentation I

Session Chair: Carol Livermore, *Northeastern University, USA*

8:15 am **FUNCTIONAL ULTRASOUND (FUS) IMAGING: A NEW WHOLE BRAIN  
NEUROIMAGING MODALITY FROM BENCH TO BEDSIDE**

[Mickael Tanter, Ph.D.](#)

*ESPCI, FRANCE*

## Session 1 - Microsystems for Cell Biology

Session Chair: A. Faith Sarioglu, *Georgia Institute of Technology, USA*

8:55 am **A HYBRID BIOMONITORING SYSTEM FOR GUT-NEURON COMMUNICATION**

Ashley Chapin, Jinjing Han, Tawen Ho, Jens Herberholz, and Reza Ghodssi

*University of Maryland, College Park, USA*

9:15 am **MULTI-LAYER MICRO-NANOFLUIDIC DEVICE FOR ISOLATION AND  
CAPTURE OF LIPOSARCOMA EXTRACELLULAR VESICLES**

Prashanth Mohana Sundaram, Gonzalo Lopez, Danielle Braggio,

Gita Balakirsky, Lucia Casadei, Raphael Pollock, and Shaurya Prakash

*Ohio State University, USA*

9:35 am **3D PROJECTION ELECTROPHORESIS FOR HIGH-DENSITY SINGLE-CELL  
IMMUNOBLOTTING**

Samantha Grist, Andoni Mourdoukoutas, and Amy Herr

*University of California, Berkeley, USA*

9:55 am **APPLYING HIGH STRAIN TO SINGLE CELLS VIA MEMS ACTUATOR**

Jennifer Walker<sup>1</sup>, Luke Patterson<sup>1</sup>, Evelyn Rodriguez-Mesa<sup>2</sup>, Kevin Shields<sup>2</sup>,  
John Foster<sup>2</sup>, Megan Valentine<sup>1</sup>, Adele Doyle<sup>1</sup>, and Kimberly Foster<sup>1,3</sup>

<sup>1</sup>University of California, Santa Barbara, USA, <sup>2</sup>Owl Biomedical, USA, and

<sup>3</sup>Tulane University, USA

10:15 am **Break and Table Top Exhibits**

10:44 am **Wen Ko Leadership Award Announcement**

### Invited Presentation I

Session Chair: Sam Emaminejad, *University of California, Los Angeles, USA*

10:45 am **PRECISION MEDICINE IS ADVANCED BY PRECISION MICROSYSTEMS**  
[Amy Herr, Ph.D.](#)  
*University of California, Berkeley, USA*

### Session 2 - Personal Biomonitoring

Session Chair: Alireza Modafe, *Nevro Inc., USA*

11:15 am **A FULLY INTEGRATED ELECTRONICALLY-PROGRAMMABLE EPIDERMAL MICROFLUIDIC VALVING ARRAY FOR WEARABLE BIOFLUID MANAGEMENT**  
Jiawei Tan, Haisong Lin, Shuyu Lin, Wenzhuo Yu, Jialun Zhu, Yichao Zhao, Xuanbing Cheng, Siyang Yang, Eric Tang, and Sam Emaminejad  
*University of California, Los Angeles, USA*

11:35 am **ELECTRONIC IMMUNOAFFINITY ASSAY FOR DIFFERENTIAL LEUKOCYTE COUNTS**  
Ruxiu Liu, AKM Arifuzzman, Ningquan Wang, Ozgun Civelekoglu, and A. Fatih Sarioglu  
*Georgia Institute of Technology, USA*

11:55 am **A WEARABLE MICROFLUIDIC SYSTEM FOR HIGH SIGNAL-TO-NOISE RATIO SWEAT RATE SENSING VIA PROGRAMMABLE MICROBUBBLE GENERATION AND TRACKING**  
Haisong Lin, Shuyu Lin, Jorge Suarez, Harish Athavan, Yibo Wang, Wenzhuo Yu, and Sam Emaminejad  
*University of California, Los Angeles, USA*

12:15 pm **Poster Preview Session 1**  
Session Chair: John Foster, *Advano, USA*

12:45 pm **Networking Lunch**

### Poster Session 1

Session Chair: Zhengzheng Wu, *Qualcomm, USA*

2:15 pm **Contributed and Late News**  
See page 12 for listing of poster presentations

4:45 pm **Adjourn for the Day**

## Tuesday, June 2

7:30 am **Breakfast**

8:10 am **Announcements**

### Plenary Presentation II

Session Chair: Roya Maboudian, *University of California, Berkeley, USA*

8:15 am **INNOVATION IN THE ERA OF VALUE BASED HEALTHCARE**

[Catherine Mohr, M.D.](#)

*Intuitive Foundation, USA*

### Session 3 - Advanced Manufacturing

Session Chair: Jenna F. Chan, *General Technical Services, LLC, USA*

8:55 am **COMBINING MICRO FABRICATION AND ADDITIVE MANUFACTURING FOR MICROROBOTIC MECHANISMS**

Camilo Velez<sup>1</sup>, Dinesh Patel<sup>1</sup>, Sukjun Kim<sup>1</sup>, Mahnoush Babaei<sup>1</sup>, Cory Knick<sup>2</sup>, Gabriel Smith<sup>2</sup>, and Sarah Bergbreiter<sup>1</sup>

<sup>1</sup>*Carnegie Mellon University, USA* and <sup>2</sup>*Army Research Laboratory (ARL), USA*

9:15 am **COMPLEMENTARY CAPILLARY SYSTEM INTEGRATED MICRONEEDLES FOR AUTONOMOUSLY LOCALIZED THERAPEUTICS LOADING**

Sangwook Chu, Nikhil Uplekar, Sanwei Liu, and Reza Ghodssi

*University of Maryland, College Park, USA*

9:35 am **THIN-FILM, MULTI-MATERIAL STRUCTURES: A FLEXIBLE 3D PRINTING APPROACH USING ELECTROHYDRODYNAMIC JET PRINTING**

Zahra Afkhami<sup>1</sup>, Brian Lezzi<sup>1</sup>, David Hoelzle<sup>2</sup>, Max Shtein<sup>1</sup>, and Kira Barton<sup>1</sup>

<sup>1</sup>*University of Michigan, USA* and <sup>2</sup>*Ohio State University, USA*

9:55 am **Break and Table Top Exhibits**

10:24 am **Denice Denton Mentoring Award Announcement**

### Invited Presentation II

Session Chair: Mehrnaz Motiee, *Apple, USA*

10:25 am **TINY LEAPS FOR ROBOT-KIND: MICROSYSTEMS-ENABLED ROBOTICS**

[Sarah Bergbreiter, Ph.D.](#)

*Carnegie Mellon University, USA*

## Session 4 - RF Microsystems

Session Chair: Roozbeh Tabrizian, *University of Florida, Gainesville, USA*

- 10:55 am PARAFFIN-BASED RECONFIGURABLE ANTENNAS OPERATING AT 100 GHZ**  
Behnam Ghassemiparvin and Nima Ghalichechian  
*Ohio State University, USA*
- 11:15 am LITHIUM NIOBATE-ON-SILICON ACOUSTOELECTRIC TRANSVERSAL FILTERS WITH MORE THAN 20-DB NONRECIPROCAL TRANSMISSION RATIO**  
Hakhamanesh Mansoorzare and Reza Abdolvand  
*University of Central Florida, USA*
- 11:35 am SILOCON-DOPED GAN BASED SAW RESONATORS FOR EXTREME ENVIRONMENT APPLICATIONS**  
Afzaal Qamar<sup>1</sup>, Savannah R. Benbrook<sup>2</sup>, Debbie G. Senesky<sup>2</sup>,  
and Mina Rais-Zadeh<sup>1,3</sup>  
<sup>1</sup>*University of Michigan, USA*, <sup>2</sup>*Stanford University, USA*, and  
<sup>3</sup>*NASA Jet Propulsion Laboratory, USA*
- 11:55 pm – 1:30 pm Networking Lunch**

## Early Career Faculty Development Session

Chair/Moderator: Svetlana Tatic-Lucic, *Lehigh University, USA*

**2:00 pm - 4:00 pm** This session is open to all workshop attendees.

This session, targeting senior graduate students, postdocs, and junior faculty members in our community, aims to offer relevant guidance and advice for new faculty as well as those who aspire to become faculty members. Visit [website](#) for additional details.

Shubhra Gangopadhyay, *National Science Foundation (NSF), USA*  
Ron Polcawich, *Defense Advanced Research Projects Agency (DARPA), USA*  
Stephen D. Senturia, *Massachusetts Institute of Technology (Emeritus), USA*  
Usha Varshney, *National Science Foundation (NSF), USA*  
Michael Wolfson, *National Institutes of Health, USA*

**6:00 pm - 7:00 pm Graduate Student Networking Event**

**7:00 pm - 10:00 pm Workshop Banquet**

## Wednesday, June 3

7:30 am **Breakfast**

8:10 am **Announcements**

### Plenary Presentation III

Session Chair: Behraad Bahreyni, *Simon Fraser University, CANADA*

8:15 am **PROBLEMS AND PROSPECTS FOR HEALTH EQUALITY**

[Thomas LaVeist, Ph.D.](#)

*Tulane University, USA*

### Session 5 - Physical Microsystems for Energy Applications

Session Chair: Jason Gorman, *National Institute of Standards and Technology (NIST), USA*

8:55 am **FABRICATION AND DEMONSTRATION OF A SELF-ADAPTIVE MICROVALVE ARRAY FOR DISTRIBUTED LIQUID COOLING IN MICROELECTRONIC INTERPOSERS**

Amrid Amnache<sup>1</sup>, Gerard Laguna<sup>2</sup>, Étienne Léveillé<sup>1</sup>, Rajesh Pandiyan<sup>1</sup>, Louis-Michel Collin<sup>1</sup>, Montse Villarubiz<sup>2</sup>, Simon Hamel<sup>3</sup>, Jérôme Barrau<sup>2</sup>, and Luc Fréchette<sup>1</sup>

<sup>1</sup>*Université de Sherbrooke, CANADA*, <sup>2</sup>*Universidad de Lleida, SPAIN*, and <sup>3</sup>*Teledyne DALSA, CANADA*

9:15 am **DEMONSTRATION OF ATMOSPHERIC-PRESSURE RADIOMETER WITH NANOCARDBOARD VANES**

Mohsen Azadi<sup>1</sup>, Zhipeng Lu<sup>1</sup>, George Popov<sup>1</sup>, Christopher Stanczak<sup>1</sup>, John Cortes<sup>2</sup>, Andy Eskenazi<sup>1</sup>, Pratik Ponnarassery<sup>1</sup>, Matthew Campbell<sup>1</sup>, and Igor Bargatin<sup>1</sup>

<sup>1</sup>*University of Pennsylvania, USA* and <sup>2</sup>*Lawrence Livermore National Laboratory, USA*

9:35 am **MOISTURE-RESPONSIVE PAPER ROBOTS**

Jihyun Ryu, Mehdi Tahernia, Maedeh Mohammadifar, and Seokheun Choi  
*State University of New York, Binghamton, USA*

9:55 am **ZERO POWER CROP WATER-STRESS DETECTOR BASED ON A SHORTWAVE-INFRARED MICROMECHANICAL PHOTOSWITCH**

Antea Risso, Vageeswar Rajaram, Sungho Kang, Sila Calisgan, Zhenyun Quian, and Matteo Rinaldi  
*Northeastern University, USA*

10:15 am **Break and Table Top Exhibits**

10:44 am **Mark Shannon Grand Challenges Award Announcement**

### **Invited Presentation III**

Session Chair: Kristen Dorsey, *Smith College, USA*

10:45 am **USING TECHNOLOGY AND EVERYTHING WE HAVE LEARNED TO ADDRESS THE CLIMATE GRAND CHALLENGE**

[Leslie Field, Ph.D.](#)

*Ice911 Research, USA and SmallTech Consulting, LLC, USA*

### **Session 6 - Micro-Acoustic Devices & Systems**

Session Chair: Sarah Bedair, *Army Research Laboratory (ARL), USA*

11:15 am **NOVEL HIGH BANDWIDTH LITHIUM NIOBATE BASED PIEZOELECTRIC MICROMACHINED ULTRASONIC TRANSDUCER**

Flavius Pop, Bernard Herrera, and Matteo Rinaldi

*Northeastern University, USA*

11:35 am **FREQUENCY TUNABLE SURFACE ACOUSTIC WAVE ACTUATORS FOR ADJUSTABLE PITCH DIFFRACTION GRATING**

Clifford F. Frez, Valerie J. Scott, Mustafa B. Coskun, and Mina Rais Zadeh

*NASA Jet Propulsion Laboratory, USA*

11:55 am **BOTTLE-BEAM TRANSDUCER WITH LONG DEPTH-OF-FOCUS AND MULTIPLE TRAPPING ZONES BASED ON RING-FOCUSING FRESNEL ACOUSTIC LENS**

Yongkui Tang and Eun Sok Kim

*University of Southern California, USA*

12:15 pm **Poster Preview Session 2**

Session Chair: Raviv Perahia, *HRL Laboratory, USA*

1:00 pm **Networking Lunch**

### **Poster Presentations - Session 2**

Session Chair: Nicole Nastaran Hashemi, *Iowa State University, USA*

2:30 pm – 5:00 pm **Contributed and Late News**

See page 18 for listing of poster presentations



## Poster Presentations - Session 3 and Reception

Session Chairs: Debbie Senesky, *Stanford University, USA*  
Alba Avila, *University at Los Andes, COLOMBIA*

**5:30 pm -7:00 pm**      **Commercial and Open Posters**

## Rump Session

Session Chair: Christian Zorman, *Case Western Reserve University, USA*

**7:30 pm**      **What's Wrong with this Picture? Making Microsystems Pictures:  
A Practical Guide to Presenting Your Work**

Felice Frankel

*Massachusetts Institute of Technology, USA*

This year's Rump Session topic tackles one of the most important aspects of publishing in our field: Creating compelling images and graphics that showcase your work while clearly conveying the maximum amount of information to the target audience. Felice Frankel, a renowned expert on scientific imaging, will present tips and techniques to create cover-worthy images of your research. In rump session tradition, attendees will then have an opportunity to apply their hand at these skills, with the results being shared to the Hilton Head community. Visit [website](#) for additional details.

**10:00 pm**      **Adjourn for the Day**

## Thursday, January 4

7:30 am **Breakfast**

8:10 am **Announcements**

### Plenary Presentation IV

Session Chair: Chris Roberts, *University of Texas, El Paso, USA*

8:15 am **BEYOND DIGESTION: HOW THE GUT IS THE GATEWAY TO HEALTH AND WHAT CAN WE DO TO HARNESS ITS POTENTIAL**

[Pankaj Jay Pasricha, M.D.](#)

*Johns Hopkins University, USA*

### Session 7 - Physical Microsystems for Healthcare

Session Chair: Matthew Hopcroft, *University of California, Santa Barbara, USA*

8:55 am **HYBRID AND PASSIVE TISSUE-ANCHORING MECHANISM FOR INGESTIBLE RESIDENT DEVICES**

Sanwei Liu, Sangwook Chu, Luke Beardslee, and Reza Ghodssi  
*University of Maryland, College Park, USA*

9:15 am **PIEZOELECTRIC MICROMACHINED ULTRASONIC TRANSDUCERS FOR BLOOD VESSEL MOTION TRACKING**

Xiaoyue (Joy) Jiang, Mei-Lin Chan, Bala Govind, and Peter Hartwell  
*TDK InvenSense, USA*

9:35 am **TOWARD 3D NANOPRINTED MICROCAPSULES FOR CONTROLLED DRUG DELIVERY**

Ruben Acevedo<sup>1</sup>, Michael Restaino<sup>1</sup>, Dongyue Yu<sup>2</sup>, Stephen Hoag<sup>2</sup>, Sharon Flank<sup>3</sup>, and Ryan Sochol<sup>1</sup>  
<sup>1</sup>*University of Maryland, College Park, USA,*  
<sup>2</sup>*University of Maryland, Baltimore, USA, and* <sup>3</sup>*InfraTrac, USA*

9:55 am **Break and Table Top Exhibits**

## Invited Presentation IV

Session Chair: Luke Beardslee, *Georgia Institute of Technology, USA*

**10:25 am** **MINIATURE ELECTRONICS ENABLING INGESTIBLES FOR ADVANCED MONITORING OF THE GASTRO-INTESTINAL SYSTEM**

[Nick Van Helleputte, Ph.D.](#)

*imec, BELGIUM*

## Session 8 - Late News

Session Chair: Ryan Sochol, *University of Maryland, College Park, USA*

**10:55 am** **Late News Presentations**

**11:55 am** **Award Ceremony**

Chair: Nima Ghalichechian, *Ohio State University, USA*

**12:30 pm** **Networking Lunch**

**2:00 pm** **Workshop Adjourns**

# Poster Presentations – Session 1

Contributed and Late News Posters

Monday, June 1

2:15 pm - 4:45 pm

## Bio/Chemical and Biomedical Sensors

- MP-01**     **A MINIATURIZED EHT PLATFORM FOR ACCURATE MEASUREMENTS OF TISSUE CONTRACTILE PROPERTIES**  
Milica Dostanic<sup>1</sup>, Laura Windtz<sup>2</sup>, Jeroen Stein<sup>2</sup>, Berend van Meer<sup>2</sup>,  
Massimo Mastrangeli<sup>1</sup>, Christine Mummery<sup>2</sup>, and Pasqualina Sarro<sup>1</sup>  
*<sup>1</sup>Delft University of Technology, NETHERLANDS and*  
*<sup>2</sup>Leiden University Medical Center, NETHERLANDS*
- MP-02**     **CHARACTERIZATION AND CLINICAL SERUM TEST OF A MOLECULAR IMPRINTED POLYMER (MIP)-BASED CARDIAC TROPONIN T SENSING ELECTRODE FOR PATIENT MONITORING APPLICATIONS**  
Pei-S. Chen, Yu-T. Lin, Yu-T. Cheng, Chih-K. Lee, and Hsiao-E. Tsai  
*National Chiao Tung University, TAIWAN*
- MP-03**     **ENHANCING MICROSCALE MASS SENSING VIA INTEGRATING BISTABLE CIRCUITRY NETWORK AND CANTILEVER-BASED RESONANT SENSORS**  
Jinki Kim, Félicie Le Hir de Fallois, and Adam Bryant  
*Georgia Southern University, USA*
- MP-04**     **GRAPHENE ISFET SENSOR WITH POROUS ANODIC ALUMINUM OXIDE SUBSTRATE FOR NITRATE DETECTION**  
Jungyoon Kim<sup>1</sup>, Qingyuan Liu<sup>2</sup>, and Tianhong Cui<sup>1</sup>  
*<sup>1</sup>University of Minnesota, USA and <sup>2</sup>Tsinghua University, CHINA*
- MP-05**     **LABEL-FREE IMPEDIMETRIC SENSING OF CORTISOL IN HUMAN SERUM BASED ON NANOWELL ARRAY ELECTRODES**  
Seyed Reza Mahmoodi<sup>1</sup>, Pengfei Xie<sup>1</sup>, Daniel Zachs<sup>2</sup>, Erik Peterson<sup>2</sup>,  
Hubert Lim<sup>2</sup>, Mark Allen<sup>3</sup>, and Mehdi Javanmard<sup>1</sup>  
*<sup>1</sup>Rutgers University, USA, <sup>2</sup>University of Minnesota, USA, and*  
*<sup>3</sup>University of Pennsylvania, USA*
- MP-06**     **MICROMECHANICAL SWITCH BASED VOC DETECTORS FOR PLANT HEALTH MONITORING WITH ZERO STANDBY POWER**  
Sila Deniz Calisgan, Vageeswar Rajaram, Sungho Kang, Antea Risso,  
Xuanhang Wu, Zhenyun Qian, and Matteo Rinaldi  
*Northeastern University, USA*

**MP-07 WIRELESS SENSOR-INTEGRATED PLATFORM FOR LOCALIZED DISSOLVED OXYGEN SENSING IN BIOREACTORS**  
Justin Stine, Luke Beardslee, Sangwook Chu, Sanwei Liu, Dana Motabar, William Bentley, and Reza Ghodssi  
*University of Maryland, College Park, USA*

## **Biomedical Systems**

**MP-08 A CERAMIC PZT-BASED PMUT ARRAY FOR ENDOSCOPIC PHOTOACOUSTIC IMAGING**  
Haoran Wang<sup>1</sup>, Zhenfang Chen<sup>2</sup>, Hao Yang<sup>3</sup>, Huabei Jiang<sup>3</sup>, and Huikai Xie<sup>1</sup>  
*<sup>1</sup>University of Florida, USA, <sup>2</sup>MEMS Materials and Engineering Inc., USA, and <sup>3</sup>University of South Florida, USA*

**MP-09 A FOULING-RESISTIVE VOLTAMMETRIC SENSING SYSTEM FOR WEARABLE ELECTROACTIVE BIOMARKER MONITORING**  
Shuyu Lin, Bo Wang, Wenzhuo Yu, Diana Ly, and Sam Emaminejad  
*University of California, Los Angeles, USA*

**MP-10 A PAPER-BASED FLEXIBLE TACTILE SENSOR ARRAY FOR LOW-COST WEARABLE HUMAN HEALTH MONITORING**  
Weijie Luo and Darrin Young  
*University of Utah, USA*

**MP-11 BIO-INSPIRED SOFT-TO-HARD INTEGRATION OF WEARABLE ELECTROCHEMICAL SENSING ELECTRONICS**  
Yichao Zhao, Bo Wang, Hannaneh Hojaiji, Zhaoqing Wang, Shuyu Lin, Xuanbing Cheng, Haisong Lin, and Sam Emaminejad  
*University of California, Los Angeles, USA*

**MP-12 COMPACT OPTICS ENGINE MODULE FOR OPTICAL COHERENCE TOMOGRAPHY (OCT)**  
Flavio Pardo<sup>1</sup>, Michael Eggleston<sup>1</sup>, Cristian Bolle<sup>1</sup>, Mark Earnshaw<sup>1</sup>, Rose Kopf<sup>1</sup>, Mark Cappuzzo<sup>1</sup>, Corey Pollock<sup>2</sup>, and David Bishop<sup>2</sup>  
*<sup>1</sup>Nokia Bell Labs, USA and <sup>2</sup>Boston University, USA*

**MP-13 MEMS HEATER FOR CONTROLLED EVAPORATION OF LIQUIDS FOR PERSONALIZED DRUG DELIVERY TO THE LUNGS**  
Frank Goldschmidtboeing<sup>1</sup>, Uwe Pelz<sup>1</sup>, Muhannad Ghanam<sup>1</sup>, Thomas Bilger<sup>1</sup>, Armin Jamali<sup>1</sup>, Mohammadreza Saberi<sup>1</sup>, Eiko Baeumker<sup>1</sup>, Jan Jaklin<sup>2</sup>, Marc Kessler<sup>2</sup>, Rene Schmidt<sup>2</sup>, David Schadow<sup>3</sup>, Patrick Scheunemann<sup>3</sup>, and Peter Woias<sup>1</sup>  
*<sup>1</sup>University Freiburg, GERMANY, <sup>2</sup>Hauni Maschinenbau GmbH, GERMANY, and <sup>3</sup>South Westphalia University of Applied Sciences, GERMANY*

**MP-14 PRINTED ELECTROCEUTICAL DRESSINGS FOR THE ERADICATION OF BIOFILMS AND TREATMENT OF CHRONIC WOUNDS**  
Rachel Heald, Molly Bennett, Vish Subramaniam, Devendra Dusane,  
Varun Lochab, Prashanth Mohana Sundaram, Sarah Salyer, Paul Stoodley,  
and Shaurya Prakash  
*Ohio State University, USA*

### **Characterization, Fabrication and Materials**

**MP-15 A SCALABLE, HIERARCHICAL RIB DESIGN FOR LARGER-AREA, HIGHER-POROSITY NANOPOROUS MEMBRANES FOR THE IMPLANTABLE BIO-ARTIFICIAL KIDNEY**  
Benjamin Chui, Nathan Wright, Jimmy Ly, David Maginnis, Tariq Haniff,  
Charles Blaha, and Shuvo Roy  
*University of California, San Francisco, USA*

**MP-16 ANCHOR DESIGN AFFECTS DOMINANT ENERGY LOSS MECHANISM IN A LAMÉ MODE MEMS RESONATOR**  
Gabrielle Vukasin<sup>1</sup>, Veronica Sanchez<sup>1</sup>, Janna Rodriguez<sup>1</sup>, Hyun-Keun Kwon<sup>1</sup>,  
Nicholas Bousse<sup>1</sup>, David Heinz<sup>1</sup>, Dongsuk Shin<sup>1</sup>, Ernest Yen<sup>2</sup>,  
and Thomas Kenny<sup>1</sup>  
*<sup>1</sup>Stanford University, USA and <sup>2</sup>Texas Instruments, USA*

**MP-17 DETERMINATION OF ELASTIC MODULUS OF SILICON CARBIDE (SiC) THIN DIAPHRAGMS VIA MODE-DEPENDENT DUFFING NONLINEAR RESONANCES**  
Hailong Chen<sup>1</sup>, Hao Jia<sup>1</sup>, Christian Zorman<sup>1</sup>, and Philip Feng<sup>2</sup>  
*<sup>1</sup>Case Western Reserve University, USA and <sup>2</sup>University of Florida, USA*

**MP-18 DLP 3D PRINTED "INTELLIGENT" MICRONEEDLE ARRAY (µNA) FOR STIMULI RESPONSIVE RELEASE OF DRUGS AND ITS IN VITRO AND EX VIVO CHARACTERIZATION**  
Parker Arnett<sup>1</sup>, Avra Kundu<sup>1</sup>, Arvind Bagde<sup>2</sup>, Nilab Azim<sup>1</sup>, Mandip Sachdeva<sup>2</sup>,  
and Swaminathan Rajaraman<sup>1</sup>  
*<sup>1</sup>University of Central Florida, USA and <sup>2</sup>Florida A&M University, USA*

**MP-19 FABRICATION OF INJECTABLE MICRO-SCALE OPTO-ELECTRONICALLY TRANSDUCED ELECTRODES (MOTES) FOR PHYSIOLOGICAL MONITORING**  
Sunwoo Lee, Alejandro Cortese, Aaron Mok, Chunyan Wu, Ju Uhn Park,  
Conrad Smart, Shahaboddin Ghajari, Devesh Khilwani, Sanaz Sadeghi,  
Yanxin Ji, Jesse Goldberg, Chris Xu, Paul McEuen, and Alyosha Molnar  
*Cornell University, USA*

- MP-20 IMPROVING PRECISION OF FUSED DEPOSITION MODELING BY IN-SITU MONITORING AND PREDICTING 3D GEOMETRIC DEVIATION USING CONDITIONAL ADVERSARIAL NETWORKS**  
Ling Li, Ryan McGuan, Robert Isaac, Pirouz Kavehpour, and Robert Candler  
*University of California, Los Angeles, USA*
- MP-21 SEEDEZ(TM) INTERDIGITATED ELECTRODES AND MULTIFUNCTIONAL LAYERED BIOSENSOR COMPOSITES (MLBCS): A PARADIGM SHIFT IN THE DEVELOPMENT OF IN VITRO BIOMICROSYSTEMS**  
Charles Didier<sup>1</sup>, Avra Kundu<sup>1</sup>, James Shoemaker<sup>2</sup>, Jelena Vukasinovic<sup>2</sup>, and Swaminathan Rajaraman<sup>1</sup>  
*<sup>1</sup>University of Central Florida, USA and <sup>2</sup>Lena Biosciences, USA*
- MP-22 TUNABLE FBAR WITH FERROELECTRIC BEHAVIOR BASED ON SPUTTERED SCALN THIN-FILM**  
Jialin Wang<sup>1</sup>, Mingyo Park<sup>1</sup>, Stefan Martin<sup>2</sup>, Tuomas Pensala<sup>2</sup>, Farrokh Ayazi<sup>1</sup>, and Azadeh Ansari<sup>1</sup>  
*<sup>1</sup>Georgia Institute of Technology, USA and <sup>2</sup>VTT Technical Research Centre of Finland, FINLAND*

## Microfluidics

- MP-23 3D NANOPRINTING-ENABLED MULTI-TIERED MICROFLUIDICS**  
Abdullah Alsharhan<sup>1</sup>, Anthony Stair<sup>1</sup>, Ryan Utz<sup>1</sup>, Ruben Acevedo<sup>1</sup>, Talha Razau<sup>2</sup>, Roseanne Warren<sup>2</sup>, and Ryan Sochol<sup>1</sup>  
*<sup>1</sup>University of Maryland, College Park, USA and <sup>2</sup>University of Utah, USA*
- MP-24 DIRECTIONAL DROPLET TRANSPORT AND CONDENSATION COLLECTION ON TEXTURE SURFACE**  
Di Sun and Karl Böhringer  
*University of Washington, USA*
- MP-25 MICROFLUIDIC GASKETLESS INTERCONNECT SEALED BY SUPERHYDROPHOBIC SURFACES**  
Xiaoxiao Zhao<sup>1</sup>, Daniel Park<sup>1</sup>, Steven Soper<sup>2</sup>, and Michael Murphy<sup>1</sup>  
*<sup>1</sup>Louisiana State University, USA and <sup>2</sup>University of Kansas, USA*

## Physical and Optical Sensors and Actuators

- MP-26 A FLUSH-MOUNTED DUAL-AXIS WALL SHEAR STRESS SENSOR**  
Brett Freidkes<sup>1</sup>, David Mills<sup>2</sup>, William Patterson<sup>2</sup>, and Mark Sheplak<sup>1</sup>  
*<sup>1</sup>University of Florida, USA and <sup>2</sup>Interdisciplinary Consulting Corporation, USA*

- MP-27**     **A MONOLITHIC FORWARD-VIEW MEMS LASER SCANNER WITH DECOUPLED RASTER SCANNING FOR MICRO LIDAR APPLICATIONS**  
Dingkang Wang, Sanjeev Koppal, and Huikai Xie  
*University of Florida, USA*
- MP-28**     **BI-STABLE ALUMINUM NITRIDE BASED PIEZOELECTRIC MICROMACHINED ULTRASONIC TRANSDUCER (PMUT)**  
Michael Schneider, Manuel Dorfmeister, Philipp Moll, Manfred Kaltenbacher, and Ulrich SchmidSchneider  
*Vienna University of Technology, AUSTRIA*
- MP-29**     **ELECTROLYSIS-DRIVEN REVERSIBLE ACTUATION USING PATTERNED PH-SENSITIVE HYDROGEL**  
Rebecca Campbell<sup>1</sup>, Diane Buton<sup>1</sup>, Seung Song<sup>2</sup>, and Albert Kim<sup>1</sup>  
*<sup>1</sup>Temple University, USA and <sup>2</sup>Sook Myung Women's University, KOREA*
- MP-30**     **INCREASING THE WORK EFFICIENCY OF NITI UNIMORPH ACTUATORS**  
Mahnoush Babaei, Sukjun Kim, Camilo Velez, Dinesh Patel, and Sarah Bergbreiter  
*Carnegie Mellon University, USA*
- MP-31**     **POLYSILICON GRATING SWITCHES FOR LIDAR**  
Eugene Cook, Steven Spector, Michael Moebius, Frederick Baruffi, Mirela Bancu, Lucas Benney, Steven Byrnes, Jordan Chesin, Sarah Geiger, Daniel Goldman, Alva Hare, Benjamin Lane, William D. Sawyer, and Chris R. Bessette  
*Charles Stark Draper Laboratory, USA*
- MP-32**     **WHISPERING-GALLERY-MODE OPTICAL MICROSHELL RESONATOR INFRARED DETECTOR.**  
Vedant Sumaria and Srinivas Tadigadapa  
*Northeastern University, USA*

## **Resonant Devices**

- MP-33**     **A RADAR FOR LOCALIZATION ON INTERNET OF THINGS BASED ON MAGNET-FREE MICRO-ACOUSTIC CIRCULATORS**  
Yao Yu, Amit Sangwan, Giuseppe Michetti, and Matteo Rinaldi  
*Northeastern University, USA*
- MP-34**     **AFM MICROcantilever WITH A COLLOCATED ALN SENSOR-ACTUATOR PAIR: ENABLING EFFICIENT Q-CONTROL FOR DYNAMIC IMAGING**  
Mohammad Mahdavi, Nastaran Nikooienejad, and Reza Moheimani  
*University of Texas, Dallas, USA*



- MP-35**      **ENGINEERING EFFICIENT ACOUSTIC POWER TRANSFER IN HBARS AND OTHER COMPOSITE RESONATORS**  
Vikrant Gokhale, Brian Downey, D. Scott Katzer, Matthew Hardy, Neeraj Nepal, and David Meyer  
*U.S. Naval Research Laboratory, USA*
- MP-36**      **HIGH SNR PHOTOACOUSTIC DETECTION OF BIOANALYTES USING A NOVEL MICROMECHANICAL ACOUSTIC TRANSDUCER**  
Imran Latif, Masaya Toda, and Takahito Ono  
*Tohoku University, JAPAN*
- MP-37**      **MINIATURIZED PMUT-BASED RECEIVER FOR UNDERWATER ACOUSTIC NETWORKING**  
Bernard Herrera, Flavius Pop, and Matteo Rinaldi  
*Northeastern University, USA*
- MP-38**      **NEGATIVE NONLINEAR DISSIPATION IN MICROELECTROMECHANICAL BEAMS**  
Nicholas Bousse, James Miller, Anne Alter, Hyun-Keun Kwon, Gabrielle Vukasin, and Thomas Kenny  
*Stanford University, USA*

## Poster Presentations – Session 2

Contributed and Late News Posters

Wednesday, June 3

2:30 pm – 5:00 pm

### Bio/Chemical and Biomedical Sensors

- WP-01**     **A SELF-POWERED BIODEGRADABLE DISSOLVED OXYGEN MICROSENSOR**  
Didi She and Mark Allen  
*University of Pennsylvania, USA*
- WP-02**     **ENHANCED CAPTURE OF AEROSOL PARTICLES ON RESONATOR-BASED AIR-MICROFLUIDIC PM MASS SENSORS USING STAGGERED ARRAYS OF MICRO-PILLARS**  
Mandana Hajizadehmotlagh, Anuj Singhal, and Igor Paprotny  
*University of Illinois, Chicago, USA*
- WP-03**     **FAST SELECTIVE SENSING OF NITROGEN BASED GASES UTILIZING  $\delta$ -MnO<sub>2</sub> -EPITAXIAL GRAPHENE-SILICON CARBIDE HETEROSTRUCTURES FOR ROOM TEMPERATURE GAS SENSING**  
Michael Pedowitz<sup>1</sup>, Soaram Kim<sup>1</sup>, Daniel Lewis<sup>1</sup>, Balaadithya Uppalapati<sup>2</sup>, Digangana Khan<sup>2</sup>, Ferhat Bayram<sup>2</sup>, Goutam Koley<sup>2</sup>, and Kevin Daniels<sup>1</sup>  
*<sup>1</sup>University of Maryland, College Park, USA and <sup>2</sup>Clemson University, USA*
- WP-04**     **INKJET PRINTED HYDROGEN PEROXIDE SENSOR WITH SENSITIVITY ENHANCED BY PLASMA ACTIVABLE INORGANIC METAL SALT INKS**  
Yongkun Sui, Allison Hess-Dunning, R. Sankaran, and Christian Zorman  
*Case Western Reserve University, USA*
- WP-05**     **MICRO-SENSORS IN ICY ENVIRONMENTS TO DETECT MICROBIAL ACTIVITIES**  
Matthew McGlennen, Michael Neubauer, Matthew Driesler, Markus Dieser, Christine Foreman, and Stephan Warnat  
*Montana State University, USA*
- WP-06**     **TEMPERATURE COMPENSATION OF THERMALLY ACTUATED, IN-PLANE RESONANT GAS SENSOR USING EMBEDDED OXIDE-FILLED TRENCHES**  
Steven Schwartz<sup>1</sup>, Oliver Brand<sup>1</sup>, and Luke Beardslee<sup>2</sup>  
*<sup>1</sup>Georgia Institute of Technology, USA and <sup>2</sup>Naval Submarine Medical Research Laboratory, USA*

## Biomedical Systems

- WP-07**     **A 512-CHANNEL MULTI-LAYER POLYMER-BASED NEURAL PROBE ARRAY**  
Kee Scholten, Christopher Larson, Huijing Xu, Dong Song, and Ellis Meng  
*University of Southern California, USA*
- WP-08**     **A DESIGN METHODOLOGY FOR WEARABLE ELECTROACTIVE PHARMACEUTICAL DRUG MONITORING**  
Shuyu Lin, Bo Wang, Wenzhuo Yu, Kait Castillo, and Sam Emaminejad  
*University of California, Los Angeles, USA*
- WP-09**     **A HYBRID-FLEX MONOLITHIC WEARABLE SYSTEM DESIGN METHODOLOGY FOR PHYSIOLOGICAL ACTUATION AND ELECTROCHEMICAL SENSING**  
Hannaneh Hojaiji, Yichao Zhao, Shuyu Lin, Mudith Mallajosyula, Max Gong, Jiawei Tan, Haisong Lin, Xuanbing Cheng, Asad Madni, and Sam Emaminejad  
*University of California, Los Angeles, USA*
- WP-10**     **A SENSOR-INTEGRATED MICROPHYSIOLOGICAL BLOOD-BRAIN-BARRIER BASED ON PDMS-FREE MICROFLUIDICS AND INDUCED PLURIPOTENT STEM CELLS**  
Thomas Winkler<sup>1</sup>, Isabelle Matthiesen<sup>1</sup>, Dimitrios Voulgaris<sup>1</sup>, Polyxeni Nikolakopoulou<sup>2</sup>, and Anna Herland<sup>1,2</sup>  
*<sup>1</sup>KTH Royal Institute of Technology, SWEDEN and <sup>2</sup>Karolinska Institute, SWEDEN*
- WP-11**     **AN IMPLANTABLE MICRODEVICE FOR IN SITU CHEMOTHERAPY DRUG SYNTHESIS**  
Albert Kim<sup>1</sup> and Seung Hyun Song<sup>2</sup>  
*<sup>1</sup>Temple University, USA and <sup>2</sup>Sook Myung Women's University, KOREA*
- WP-12**     **INTEGRATED SYSTEM FOR MONITORING AND ELIMINATING BACTERIAL BIOFILMS ON INDWELLING URINARY CATHETERS**  
Ryan Huiszoon, Sangwook Chu, Luke Beardslee, and Reza Ghodssi  
*University of Maryland, College Park, USA*
- WP-13**     **MICROGASKETS FOR HIGH-CHANNEL-DENSITY RECONNECTABLE IMPLANTABLE PACKAGING**  
Paritosh Rustogi and Jack Judy  
*University of Florida, USA*

## Characterization, Fabrication and Materials

- WP-14**     **A 1-D YARN-BASED BIOBATTERY FOR SCALABLE POWER GENERATION IN 2-D AND 3-D STRUCTURED TEXTILES**  
Jihyun Ryu, Yang Gao, Jong Hyun Cho, and Seokheun Choi  
*State University of New York, Binghamton, USA*
- WP-15**     **ADDITIVE MANUFACTURING OF LIVING ELECTRODES**  
Yang Gao<sup>1</sup>, Shuai Feng<sup>1</sup>, Jeonghwan Kim<sup>2</sup>, and Seokheun Choi<sup>1</sup>  
*<sup>1</sup>State University of New York, Binghamton, USA and*  
*<sup>2</sup>State University of New York, Alfred State College, USA*
- WP-16**     **DEMONSTRATION OF TANTALUM AS A NEW MEMS STRUCTURAL MATERIAL**  
Longchang Ni, Ryan Pocratsky, and Maarten de Boer  
*Carnegie Mellon University, USA*
- WP-17**     **DIELECTRIC TRANSFER PROCESS FOR 3D PRINTED METAL MICROSYSTEMS**  
Bhushan Lohani, Sheikh Dobir Hossain, and Robert Roberts  
*University of Texas, El Paso, USA*
- WP-18**     **FABRICATION OF A MEMS MICROMIRROR BASED ON BULK SILICON MICROMACHINING COMBINED WITH GRAYSCALE LITHOGRAPHY**  
Inês Garcia<sup>1</sup>, Carlos Ferreira<sup>1</sup>, Joana Santos<sup>1</sup>, Marco Martins<sup>1</sup>, Rosana Dias<sup>1</sup>, Diogo Aguiam<sup>1</sup>, Jorge Cabral<sup>2</sup>, and João Gaspar<sup>1</sup>  
*<sup>1</sup>International Iberian Nanotechnology Laboratory (INL), PORTUGAL and*  
*<sup>2</sup>University of Minho, PORTUGAL*
- WP-19**     **HIGH POWER DENSITY ELECTROHYDRODYNAMIC JET ARRAYS USING FOLDED LASER MICROFABRICATED ELECTRODES**  
Daniel Drew and Sean Follmer  
*Stanford University, USA*
- WP-20**     **NANOSTRUCTURED SPACERS FOR THERMIONIC AND THERMOPHOTOVOLTAIC ENERGY CONVERTERS**  
Matthew Campbell<sup>1</sup>, Mohsen Azadi<sup>1</sup>, Zhipeng Lu<sup>1</sup>, Andy Eskenazi<sup>1</sup>, Akshat Jain<sup>1</sup>, Jiwon Bang<sup>1</sup>, Samuel Nicaise<sup>1</sup>, Kyana Von Houten<sup>2</sup>, Felix Schmitt<sup>2</sup>, Jared Schwede<sup>2</sup>, and Igor Bargatin<sup>1</sup>  
*<sup>1</sup>University of Pennsylvania, USA and <sup>2</sup>Spark Thermionics, USA*
- WP-21**     **SIDEWALL METALLIZATION ON CMOS MEMS BY PLATINUM ALD PATTERNING**  
Yi-Chung Lin  
*Carnegie Mellon University, USA*

## Microfluidics

- WP-22 3D MICROFLUIDIC LOGIC GATES FOR COMPLEX FLUIDS MICROANALYSIS**  
Nazek El-Atab<sup>1</sup>, Javier Canas<sup>1</sup>, and Muhammad Hussain<sup>1,2</sup>  
*<sup>1</sup>King Abdullah University of Science and Technology, SAUDI ARABIA and  
<sup>2</sup>University of California, Berkeley, USA*
- WP-23 A MICROFLUIDIC PLATFORM INCORPORATING PLASMA SEPARATION AND ACTIVE MIXING FOR BIOMARKER ANALYSIS IN MICROLITER SAMPLE OF WHOLE BLOOD**  
Alan Gonzalez-Suarez, Yong-Duk Han, William Carey, Gulnaz Stybayeva, and Alexander Revzin  
*Mayo Clinic, USA*
- WP-24 HIGH-THROUGHPUT CANCER CELL MECHANOPHENOTYPING VIA ELECTRONIC MULTIPLEXED CYTOMETRY**  
Norh Asmare, AKM Arifuzzman, Ningquan Wang, Mert Boya, Ruxiu Liu, and A. Fatih Sarioglu  
*Georgia Institute of Technology, USA*

## Physical and Optical Sensors and Actuators

- WP-25 A CUSTOMIZABLE DNA AND MICROSPHERE-BASED, MAGNETICALLY ACTUATED MICROSWIMMER**  
Ian Harmatz, Matthew Travers, and Rebecca Taylor  
*Carnegie Mellon University, USA*
- WP-26 A MEMS-BASED FAST-RESPONSE MINIATURE FIVE-HOLE PROBE WITH OPTICAL PRESSURE TRANSDUCERS**  
Haocheng Zhou and Mark Shelplak  
*University of Florida, USA*
- WP-27 ACCURATE 3-DOF LIGHTHOUSE LOCALIZATION OF A LOW-POWER CRYSTAL-FREE SINGLE CHIP MOTE**  
Brian Kilberg, Felipe M. R. Campos, Filip Maksimovic, and Kristofer Pister  
*University of California, Berkeley, USA*
- WP-28 ELECTRO-OPTOMECHANICAL DESIGN OF NONRECIPROCAL ACOUSTO-OPTIC MODULATORS**  
Donggyu Sohn, Soonwook Kim, and Gaurav Bahl  
*University of Illinois, Urbana Champaign, USA*

- WP-29 FLOW VELOCITY GRADIENT MEASUREMENT USING A SINGLE CURVED BISTABLE MICROBEAM AS A SENSING ELEMENT**  
Yoav Kessler, Alex Liberzon, and Slava Krylov  
*Tel Aviv University, ISRAEL*
- WP-30 LOW OFFSET AND REDUCED NOISE FLOOR IN HIGH BIASED GAN 2DEG HALL-EFFECT PLATES INVESTIGATED WITH INFRARED MICROSCOPY**  
Karen Dowling<sup>1</sup>, Tanya Dowling<sup>2</sup>, Hannah Alpertz<sup>2</sup>, Caitlin Chapin<sup>1</sup>, Savannah Benbrook<sup>2</sup>, Ananth Saran Yalamarthy<sup>3</sup>, Peter Satterthwaite<sup>4</sup>, Helmut Koeck<sup>5</sup>, Udo Ausserlechner<sup>5</sup>, Mehdi Asheghi<sup>2</sup>, Kenneth Goodson<sup>2</sup>, and Debbie Senesky<sup>2</sup>  
*<sup>1</sup>Lawrence Livermore National Laboratory, USA, <sup>2</sup>Stanford University, USA, <sup>3</sup>Fore Systems, USA, <sup>4</sup>Massachusetts Institute of Technology, USA, and <sup>5</sup>Infineon Technologies, AUSTRIA*
- WP-31 SURFACE TEXTURE DETECTION WITH A NEW SUB-MM RESOLUTION FLEXIBLE TACTILE CAPACITIVE SENSOR ARRAY FOR MULTIMODAL ARTIFICIAL FINGER**  
Edoardo Sotgiu, Diogo Aguiam, Filipe Alves, Carlos Calaza, Bernardo Pires, Eurico Moreira, Helder Fonseca, José Fernandes, José Rodrigues, Rosana Dias, Sofia Martins, and João Gaspar  
*International Iberian Nanotechnology Laboratory (INL), PORTUGAL*

## **Resonant Devices**

- WP-32 1-PORT PIEZOELECTRIC RESONATORS WITH 100 V/V GAIN**  
Mary Galanko Klemash, Sarah Bedair, Ryan Rudy, Victor Farm-Guoo Tseng, Jeffrey Pulskamp, and Iain Kierzewski  
*U.S. Army Research Laboratory, USA*
- WP-33 ACTIVE NOISE CANCELLATION WITH MEMS RESONANT MICROPHONE ARRAY**  
Hai Liu, Song Liu, Anton Shkel, and Eun Sok Kim  
*University of Southern California, USA*
- WP-34 DEMONSTRATION OF ANOMALOUS FREQUENCY FLUCTUATIONS IN ENCAPSULATED MICROELECTROMECHANICAL RESONATORS**  
James Miller, Nicholas Bousse, Hyun-Keun Kwon, Gabrielle Vukasin, and Thomas Kenny  
*Stanford University, USA*

- WP-35 FULLY DIFFERENTIAL ACTUATION AND SENSING IN PIEZOELECTRIC DIAPHRAGM RESONATORS FOR HIGH SNR RESONANT SENSING**  
Sudhanshu Tiwari, Randhir Kumar, Saurabh Chandorkar, and Rudra Pratap  
*Indian Institute of Science, Bangalore, INDIA*
- WP-36 MICROSCALE 3D FUSED QUARTZ DUAL-SHELL RESONATOR INSTRUMENTED AS A RATE GYROSCOPE**  
Mohammad Asadian, Danmeng Wang, and Andrei Shkel  
*University of California, Irvine, USA*
- WP-37 NEAR CARRIER PHASE-NOISE ENHANCEMENT IN AN OVENIZED QUASI THICKNESS-LAMÉ THIN-FILM PIEZOELECTRIC-ON-SILICON OSCILLATOR**  
Yasaman Majd, Sarah Shahraini, Garrete Goodale, Heather Hofstee, and Reza Abdolvand  
*University of Central Florida, USA*
- WP-38 TIME-DOMAIN ANALYSIS OF A NOVEL-CO-RESONANT CANTILEVER MEMS SENSOR AND DERIVATION OF A NEW MEASUREMENT CONCEPT BASED ON BEATING**  
Gerrit Bücken<sup>1</sup> and Julia Körner<sup>2</sup>  
*<sup>1</sup>Dresden University of Technology, GERMANY and*  
*<sup>2</sup>Leibniz Universität Hannover, GERMANY*

# Poster Presentations – Session 3

Commercial and Open Posters

Wednesday, June 3

5:30 pm – 7:00 pm

## Commercial Posters

**WCP-01 CUSTOMIZED MEMS SOLUTIONS FROM PROTOTYPE TO PRODUCTION VOLUMES**

James Walker<sup>1</sup>, Arne Leinse<sup>2</sup>, Douwe Geuzebroek<sup>2</sup>

*<sup>1</sup>LioniX International, USA and <sup>2</sup>LioniX International, NETHERLANDS*