

## E\PCOS 2018 – TIMETABLE: Monday September 24

7:30-8:30 **REGISTRATION + COFFEE**

8:30-8:45 **OPENING REMARKS**

8:45-9:15 Ovsinsky Lecture Award 2018: **Marco Bernasconi** -University of Milano-Bicocca, Italy p. 3  
*Large Scale Atomistic Simulations of Phase Change Materials*

### SESSION-1 PRAM (Thermal)

September 24 2018 Monday 9:15 – 10:35 AM

9:15-9:40 **Invited: Feng Rao** -Shenzhen University, China p. 9  
*Phase Change Materials for High-Speed Working Memory Applications*

9:40-9:55 **Huai-Yu Cheng** -IBM/Macronix PCRAM Joint Project, Macronix International, Taiwan, ROC p. 10  
*Doped  $Ge_xSb_yTe_z$  Phase-Change Material for Storage Class Memory (SCM) Application*

9:55-10:10 **Elisabetta Palumbo** -Technology R&D, STMicroelectronics, Italy p. 12  
*Heating mechanisms in Ge-rich PCM cells*

10:10-10:35 **Invited: Eric Pop** -Stanford University, CA, USA p. 14  
*Thermometry, Interfaces, Scaling and Energy Limits of Phase-Change Memory*

10:35-11:00 **COFFEE BREAK**

### SESSION-2 PRAM + Neuromorphic

September 24 2018 Monday 11:00 – 12:35 AM

11:00-11:15 **Phoebe Yeoh** -Carnegie Mellon University, Pittsburgh, PA, USA p. 20  
*Experimental evidence for solid state thermodiffusion in  $Ge_2Sb_2Te_5$  Phase Change Memory cells*

11:15-11:30 **Eilam Yalon** -Stanford University, CA, USA p. 22  
*Improving PCM Energy-Efficiency by Reducing Pulse Widths*

11:30-11:55 **Invited: Mattia Boniardi** -Micron Semiconductor Italia, p. 24  
*Highlights on the current memory arena and overview of Phase Change Memory breakthroughs*

11:55-12:20 **Invited: Stefano Ambrogio** -IBM Research-Almaden, San Jose, CA, USA p. 29  
*Equivalent-Accuracy Neural Network Training with Analog Non-Volatile Memory*

12:20-12:35 **Irem Boybat** -IBM Research – Zurich, Switzerland p. 35  
*Multi-PCM synapses for spiking neural networks*

## E\PCOS 2018 – TIMETABLE: Monday September 24

12:35-12:45 **GROUP PHOTO**  
12:45-2:45 **LUNCH BREAK + POSTERS**

### SESSION-3 Neuromorphic + Meta Materials

September 24 2018 Monday 2:45 – 4:20 PM

- 2:45-3:10 **Invited: Abu Sebastian** -IBM Research – Zurich, Switzerland p. 37  
*Precise computation using computational phase-change memory*
- 3:10-3:35 **Invited: Min Gu** -RMIT University, Melbourne, Australia p. 38  
*Toward 3D optical nanoprinting of memristors by photoreduction of graphene oxides*
- 3:35-3:50 **Syed Ghazi Sarwat** -University of Oxford, UK p. 39  
*Strong Light Matter Interaction in Phase Change Materials*
- 3:50-4:05 **Li Lu** -Singapore University of Technology and Design (SUTD), Singapore p. 41  
*Wide band gap phase change material tuned nanoantenna arrays in the visible and near infrared spectrum*
- 4:05-4:20 **Emilija Petronijevic** -Department S.B.A.I., Sapienza University of Rome, Italy p. 43  
*Dielectric metamaterials with thin phase change layers for telecom switching*

4:20-4:45 **COFFEE BREAK**

### SESSION-4 (Diverse) Theory

September 24 2018 Monday 4:45 – 6:10 PM

- 4:45-5:00 **Emanuele Gemo** -University of Exeter, UK p. 45  
*Modelling phase-change integrated photonic devices*
- 5:00-5:15 **Jose C. Martinez** -Singapore University of Technology and Design (SUTD), Singapore p. 47  
*Dielectric functions of crystalline and amorphous phase-change materials*
- 5:15-5:30 **Stephen Elliott** -University of Cambridge, UK p. 49  
*Radiation resilience of the PCRAM material,  $Ge_2Sb_2Te_5$*
- 5:30-5:55 **Invited: Wei Zhang** -Xi'an Jiaotong University, China p. 51  
*Tuning the nucleation rate of phase-change materials via ab initio materials design*
- 5:55-6:10 **Daniele Dragoni** -University of Milano-Bicocca, Italy p. 52  
*An artificial Neural Network potential for Sb*

7:30 - **SOCIAL DINNER**

## E\PCOS 2018 – TIMETABLE: Tuesday September 25

8:30-9:00 AM **REGISTRATION + COFFEE**

### SESSION-5 Epitaxy, superlattices & bilayer defects

September 25 2018 Tuesday 9:00 – 11:00 AM

- 9:00-9:25 **Invited: Andriy Lotnyk** -Leibniz Institute of Surface Engineering (IOM), Leipzig, Germany p. 54  
*Epitaxial GeSbTe-based thin films and heterostructures: growth, microstructure and optical properties*
- 9:25-9:50 **Invited: Jamo Momand** -University of Groningen, the Netherlands p. 60  
*Tailoring the texture of GeTe/Sb<sub>2</sub>Te<sub>3</sub> thin films and superlattices using Si surface termination*
- 9:50-10:05 **Fabrizio Arciprete** -Università di Roma Tor Vergata, Italy p. 66  
*Molecular Beam Epitaxy of GeSbTe alloys on InAs: van der Waals epitaxy in presence of low-mismatched substrates*
- 10:05-10:30 **Invited: Yuta Saito** -National Institute AIST, Tsukuba, Japan p. 68  
*Understanding the crystalline and electronic structure of GeTe/Sb<sub>2</sub>Te<sub>3</sub> chalcogenide superlattices*
- 10:30-10:45 **Alex V. Kolobov** -National Institute AIST, Tsukuba, Japan p. 72  
*Reconfiguration of the SbTe-terminated van der Waals gap as a switching mechanism in GeTe-Sb<sub>2</sub>Te<sub>3</sub> superlattices*
- 10:45-11:00 **Torben Dankwort** -Inst. for Materials Science, Univ. of Kiel, Germany p. 74  
*In situ TEM investigation of the phase change mechanism of Ge<sub>6</sub>Sn<sub>2</sub>Sb<sub>2</sub>Te<sub>11</sub>*

11:00-11:25 AM **COFFEE BREAK**

### SESSION-6 Superlattices (thermal, strain, electrical)

September 25 2018 Tuesday 11:25 AM – 1:00 PM

- 11:25-11:50 **Invited: Kye Okabe** -Stanford University, CA, USA p. 76  
*Thermal, Electrical, and Process Analysis of Interfacial Phase Change Memory*
- 11:50-12:15 **Invited: Raffaella Calarco** -PDI für Festkörperelektronik, Berlin, Germany p. 82  
*Phase Change Materials: Strain Engineering*
- 12:15-12:30 **Paul A. Vermeulen** -University of Groningen, The Netherlands p. 87  
*Strain engineering of van-der-Waals heterostructures*
- 12:30-12:45 **Stefano Cecchi** -PDI für Festkörperelektronik, Berlin, Germany p. 89  
*Structural and electrical properties of epitaxial Sb<sub>2+x</sub>Te<sub>3</sub> films on Si(111) substrates*

## E\PCOS 2018 – TIMETABLE: Tuesday September 25

12:45-1:00 **Kirill V. Mitrofanov** -National Institute AIST, Tsukuba, Japan p. 91  
*Switching effects in iPCM beyond standard operation*

1:00-2:00 PM **LUNCH BREAK**

### SESSION-7 OTS, GeSe & GeTe

September 25 2018 Tuesday 2:00 – 4:05 PM

2:00-2:25 **Invited: Karl Opsomer** -Imec, Heverlee, Belgium p. 93  
*Thermal stability and material properties of  $Ge_xSe_{1-x}$  for selector device applications*

2:25-2:40 **Anthonin Verdy** -Université Grenoble Alpes, CEA-LETI, France p. 94  
*New insight on the threshold switching in amorphous chalcogenide films used in state-of-the-art OTS selector devices*

2:40-2:55 **John Robertson** -University of Cambridge, UK p. 96  
*Materials and Non-linearity Mechanism for Chalcogenide Selectors*

2:55-3:10 **Xian-Bin Li** -Jilin University, China p. 98  
*Directional Forces by Momentumless Excitation and Rhombohedral-to-Cubic Transition in GeTe*

3:10-3:35 **Invited: Matteo Cagnoni** -RWTH Aachen University, Germany p.100  
*Superior thermoelectric performance of crystalline IV-VI compounds: a chemical-bonding perspective*

3:35-4:05 PM **COFFEE BREAK**

### SESSION-8 Advances

September 25 2018 Tuesday 4:05 – 5:15 PM

4:05-4:30 **Invited: Harish Bhaskaran** -University of Oxford, UK p.106  
*Pulse-width modulation for integrated non-volatile photonic memories and logic applications*

4:30-4:45 **Junji Tominaga** -National Institute AIST, Tsukuba, Japan p.108  
*Topological phase-transition switching in  $GeTe/Sb_2Te_3$  superlattice by external stimulus -A method to increase the ferroelectric phase-*

4:45-5:00 **Matthias Wuttig** -RWTH Aachen University, Germany p.110  
*Taming Bond No. 6 to design Phase Change Materials and Thermoelectrics*

5:00-5:15 **CLOSING + AWARD CEREMONY**

## E\PCOS 2018 – POSTER SESSION

|       |                                                                                                                                                                                                                 |       |
|-------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------|
| PC-01 | <b>Ping Ma</b> -Huazhong University of Science and Technology, Wuhan, China<br><i>Variations of Local Motifs around Ge Atoms in Amorphous Ultrathin Films of Phase Change Materials</i>                         | p.113 |
| PC-02 | <b>Ming Xu</b> -Huazhong University of Science and Technology, Wuhan, China<br><i>Local structure of phase change materials revisited by atomic cluster alignment (ACA) method</i>                              | p.115 |
| PC-03 | <b>Yongwoo Kwon</b> -Hongik University, Seoul, Republic of Korea<br><i>Computational Study of Phase-change Synapse Devices for Gradual Switching</i>                                                            | p.117 |
| PC-04 | <b>Lingjun Zhou</b> -Huazhong Univ. of Science and Technology, Wuhan, China<br><i>Resistance drift suppression utilizing superlattice-like chalcogenide phase change material</i>                               | p.119 |
| PC-05 | <b>Takara Suzuki</b> -University of Tsukuba, Japan<br><i>Ultrafast Measurement of Folded Longitudinal Acoustic Phonon in Topological Chalcogenide Superlattices</i>                                             | p.121 |
| PC-06 | <b>Liam Trimby</b> -University of Exeter, UK<br><i>Tunable Band-Pass Filters Using Phase-Change Materials</i>                                                                                                   | p.123 |
| PC-07 | <b>Hiroaki Nohara</b> -Graduate School of Engineering, Nagoya University, Japan<br><i>Effect of Ge-Te exchange on resistance state of superlattice GeTe/Sb<sub>2</sub>Te<sub>3</sub></i>                        | p.125 |
| PC-08 | <b>Andrea N.D. Kolb</b> -Univ. Grenoble Alpes, CEA-INAC, Grenoble, France<br><i>On the origin of the effect of surface oxidation on the crystallization mechanism of GeTe thin films</i>                        | p.127 |
| PC-09 | <b>Carlota Ruiz de Galarreta</b> -CEMPS, University of Exeter, UK<br><i>Phase-change reflective meta-optics with enhanced efficiency</i>                                                                        | p.129 |
| PC-10 | <b>Shogo Hatayama</b> -Tohoku University, Sendai, Japan<br><i>Crystallization Kinetics of Inverse Resistance Change Cr<sub>2</sub>Ge<sub>2</sub>Te<sub>6</sub></i>                                              | p.131 |
| PC-11 | <b>Gianmario Cesarini</b> -Sapienza Università di Roma, Italy<br><i>Characterization of the phase transition of vanadium dioxide film on a silicon substrate through radiative emission in the mid-infrared</i> | p.133 |
| PC-12 | <b>Kotaro Makino</b> -National Institute AIST, Tsukuba, Japan<br><i>Terahertz spectroscopic characterization of Ge<sub>2</sub>Sb<sub>2</sub>Te<sub>3</sub> phase change material</i>                            | p.135 |
| PC-13 | <b>Peter C. Schmitz</b> -RWTH Aachen University, Germany<br><i>Massive topological Dirac Semimetals from GeSbTe van-der-Waals Heterostructures</i>                                                              | p.137 |

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|-------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------|
| PC-14 | <b>Matthias Dück</b> -RWTH Aachen University, Germany<br><i>Disorder Control in Crystalline GeSb<sub>2</sub>Te<sub>4</sub> Thin Films and its Impact on Characteristic Length Scales</i>    | p.139 |
| PC-15 | <b>Johannes Reindl</b> -RWTH Aachen University, Germany<br><i>Electrical transport in the bad-metal regime for Sn<sub>1</sub>Sb<sub>2</sub>Te<sub>4</sub></i>                               | p.141 |
| PC-16 | <b>Yi Shuang</b> -Tohoku University, Sendai, Japan<br><i>Phase Change Behavior of Non-bulk Resistance Change N-doped Cr<sub>2</sub>Ge<sub>2</sub>Te<sub>6</sub> Phase Change Material</i>   | p.143 |
| PC-17 | <b>Stefania M. S. Privitera</b> -CNR-IMM HQ, Catania, Italy<br><i>Ion beam irradiation of crystalline GeTe thin film</i>                                                                    | p.145 |
| PC-18 | <b>Jean-Yves Raty</b> -Université Grenoble Alpes, CEA-LETI, France<br><i>Ab initio simulation of amorphous GeTe on Si<sub>3</sub>N<sub>4</sub> and effect of oxidation</i>                  | p.147 |
| PC-19 | <b>Stefan Maier</b> -RWTH Aachen University, Germany<br><i>Distinctive bond breaking in crystalline phase-change materials and fingerprints for metavalent bonding</i>                      | p.149 |
| PC-20 | <b>Bart J. Kooi</b> -University of Groningen, the Netherlands<br><i>Crystallization kinetics of GeTe phase-change nanoparticles studied by ultrafast calorimetry</i>                        | p.151 |
| PC-21 | <b>Yasir J. Noori</b> -University of Southampton, UK<br><i>Resistive Switching in Electrodeposited GeSbTe</i>                                                                               | p.153 |
| PC-22 | <b>Suresh Durai</b> -Indian Institute of Technology Indore, Madhya Pradesh, India<br><i>Understanding the impact of Heavy-Ion Induced Single Event Upsets in Phase Change Memory</i>        | p.155 |
| PC-23 | <b>Henning Hollermann</b> -RWTH Aachen University, Germany<br><i>Structural characteristics of chalcogenide superlattices and stoichiometry determination by means of X-ray diffraction</i> | p.158 |
| PC-24 | <b>Enrico Piccinini</b> -Università di Bologna, Italy<br><i>Band Transport and localized states in modeling electric conduction of Ovonic materials</i>                                     | p.160 |
| PC-25 | <b>Jiang-Jing Wang</b> -Xi'an Jiaotong University (XJTU), Xi'an, China<br><i>Atomic imaging and modelling of hexagonal GST</i>                                                              | p.162 |
| PC-26 | <b>Alessandro Meli</b> -CNR-IMM HQ, Catania, Italy<br><i>CW laser induced stress field during phases transition in Ge<sub>2</sub>Sb<sub>2</sub>Te<sub>5</sub></i>                           | p.163 |

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|-------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------|
| PC-27 | <b>Mariaroberta Russo</b> -CNR-IMM HQ, Catania, Italy<br><i>Monitoring of mechanical properties modification from crystalline to amorphous Ge<sub>2</sub>Sb<sub>2</sub>Te<sub>5</sub> induced by ion irradiation</i> | p.165 |
| PC-28 | <b>Antonella Sciuto</b> -CNR-IMM HQ, Catania, Italy<br><i>Nano-scaled Graphene Contacts in a Planar Phase Change Memory Structures</i>                                                                               | p.167 |
| PC-29 | <b>Raimondo Cecchini</b> -CNR-IMM, Agrate Brianza, Italy<br><i>MOCVD grown, fast switching phase change In-doped Sb nanowires</i>                                                                                    | p.169 |
| PC-30 | <b>Mario Scuderi</b> -CNR-IMM HQ, Catania, Italy<br><i>Study of Ge rich GeSbTe thin films by means of STEM EELS</i>                                                                                                  | p.171 |
| PC-31 | <b>Olesya Yarema</b> -ETH Zurich, Switzerland<br><i>Colloidal Phase-Change Materials: Synthesis of Monodisperse GeTe Nanoparticles and Size-Dependent Crystallization</i>                                            | p.173 |
| PC-32 | <b>Richarj Mondal</b> -University of Tsukuba, Japan<br><i>Femtosecond magneto-optical response in chalcogenide superlattices</i>                                                                                     | p.174 |
| PC-33 | <b>Ann-Katrin U. Michel</b> -ETH Zurich, Switzerland<br><i>Towards three-dimensionally programmable metasurfaces</i>                                                                                                 | p.176 |
| PC-34 | <b>Vladimir Yu. Kolosov</b> -Ural Federal University, Ekaterinburg, Russia<br><i>Microstructure and transrotational nuclei revealed by TEM in crystallizing Sb thin films</i>                                        | p.179 |