



European Materials Research Society

Spring Meeting 2022

May 30 | June 3
Virtual Conference

SYMPOSIUM M

Novel materials for radiation detectors

Symposium Organizers :

Jinsong HUANG, University of North Carolina

Laura BASIRICO, University of Bologna

Paul SELLIN, University of Surrey



frontiers

| Frontiers in Physics

Monday may 30

- 14:45 **Welcome and Introduction to the Symposium**
- 1 : Paul Sellin**
- 15:00 **INV Perovskite - a wonder material for X-ray detection** **M 1.1**
Shengzhong (Frank) Liu
1Dalian National Laboratory for Clean Energy, Dalian Institute of Chemical Physics, Chinese Academy of Sciences, Dalian 116023, P.R. China 2Key Laboratory of Applied Surface and Colloid Chemistry, Ministry of Education, Shaanxi Key Laboratory for Advanced Energy Devices, Shaanxi Engineering Lab for Advanced Energy Technology, School of Materials Science & Engineering, Shaanxi Normal University, Xi'an 710119, P.R. China
- 15:30 **INV Developing Advanced Materials for X-ray Imaging and Sensing** **M 1.2**
Xiaogang Liu
National University of Singapore
- 16:00 **Heterojunction Structures for Reduced Noise in Large Area, Stable and Sensitive Perovskite X-ray Detectors** **M 1.3**
Ying Zhou, Liang Zhao, Zhenyi Ni, Shuang Xu, Jingjing Zhao, Xun Xiao and Jinsong Huang
Department of Applied Physical Science, University of North Carolina at Chapel Hill, Chapel Hill, NC 27599, USA
- 16:15 **Discussion**
- 2 : Laura Basiricò**
- 16:30 **INV Solution-processed perovskites for medical flat panel X-ray detectors** **M 2.1**
Eric Gros-Daillon
CEA-Leti, Université Grenoble Alpes, F-38000 Grenoble, France
- 17:00 **INV High resolution and high sensitivity X-ray detectors with soft-sintered organometal halide perovskites** **M 2.2**
Dr. Sandro F. Tedde, Judith Hürdler, Sarah Deumel, and Dr. Oliver Schmidt
Siemens Healthineers, Technology Excellence, Erlangen, 91058, Germany.
- 17:30 **High Sensitivity CsPbBr₃ X-ray Detectors Fabricated Using Scalable Field Assisted Sintering Technology** **M 2.3**
Justin Reiss, Stephanie Bennett, Suad Alghamdi, Dr. Carol Crean, Prof. Paul Sellin, and Prof. Douglas Wolfe
Justin Reiss Applied Research Laboratory, The Pennsylvania State University, USA, Stephanie Bennett Department of Physics, University of Surrey, UK, Suad Alghamdi Department of Physics, University of Surrey, UK, Carol Crean Department of Chemistry, University of Surrey, UK, Paul Sellin Department of Physics, University of Surrey, UK, Douglas Wolfe Applied Research Laboratory, The Pennsylvania State University, USA,
- 17:45 **All-inorganic Cs₂AgBiBr₆ double perovskite single crystals for X-Ray detectors** **M 2.4**
Nazire Simay Sahsuvar *(1), Valeria Murgulov (1), Catherine Schweinle (2), Michael Daub (1) (2), Harald Hillebrecht (1) (2), Michael Fiederle (1).
(1) Freiburg Materials Research Center, Albert-Ludwigs-Universität Freiburg, Stefan-Meier-Str. 21, 79104 Freiburg im Breisgau, Germany, valeria.murgulov@fmf.uni-freiburg.de (V.M.), michael.daub@ac.uni-freiburg.de (M.D.), harald.hillebrecht@ac.uni-freiburg.de (H.H.), michael.fiederle@fmf.uni-freiburg.de (M.F.). (2) Institute of Inorganic and Analytical Chemistry, Faculty of Chemistry and Pharmacy, Albert-Ludwigs-Universität Freiburg, Albert Str. 21, 79104 Freiburg im Breisgau, Germany, C-Schweinle@web.de (C.S.). * simay.sahsuvar@fmf.uni-freiburg.de
- 18:00 **Discussion**

Tuesday may 31

- 14:50 **Welcome to Day 2**
- 3 : Paul Sellin**
- 15:00 **INV Organic and Hybrid films as platform for Large-area and Flexible Direct Detection of Ionizing Radiation** **M 3.1**
Andrea Ciavatti
Department of Physics and Astronomy, University of Bologna, Italy
- 15:30 **INV RADIATION DETECTORS based on Organic Field-Effect Transistors (RAD-OFETs)** **M 3.2**
Oana D. Jurchescu
Oana D. Jurchescu, Department of Physics and Center for Functional Materials, Wake Forest University, Winston Salem, NC 27109, USA
- 16:00 **CsPbCl₃ inorganic perovskite thin film detectors under high energy proton beams** **M 3.3**
Mara Bruzzi^{1,2}, Nicola Calisi³, Carlo Civinini², Enrico Verroi⁴, Anna Vinattieri^{1,2}
¹Dipartimento di Fisica e Astronomia, Università degli Studi di Firenze, Via G. Sansone 1, 50019 Sesto Fiorentino (FI) Italy, ² I.N.F.N. Sezione di Firenze Via G. Sansone 1, 50019 Sesto Fiorentino (FI) Italy, ³ Dipartimento di Ingegneria Industriale, Università degli Studi di Firenze, Via S. Marta, 50139 Firenze Italy, ⁴ TIFPA, Trento Italy ⁴ TIFPA, Trento Italy
- 16:15 **Discussion**
- 4 : Laura Basiricò**
- 16:30 **INV Organic semiconductors for ionising radiation dosimetry in medical applications** **M 3.4**
Matthew J. Large,¹ Jessie A. Posar,¹ Attila J. Mozer,² Saree Alnaghy,¹ Martin Carolan,^{1, 3, 4}, P.J. Sellin⁶, Justin Davies,⁷ Zeljko Pastuovic,⁷ Michael L. F. Lerch,¹ Anatoly B. Rosenfeld,¹ Matthew J. Griffith,⁵ and Marco Petasecca¹
¹Centre for Medical Radiation Physics (CMRP), University of Wollongong, Wollongong, NSW, 2522, Australia, ²ARC Centre of Excellence for Electromaterials Science (ACES), Intelligent Polymer Research Institute (IPRI), University of Wollongong, Wollongong, NSW, 2522, Australia, ³Illawarra Cancer Care Centre, Wollongong Hospital, Wollongong, NSW, 2500, Australia, ⁴Illawarra Health and Medical Research Institute (IHMRI), University of Wollongong, Wollongong, NSW, 2522, Australia, ⁵School of Aerospace, Mechanical and Mechatronic Engineering, University of Sydney, Camperdown, NSW, 2006, Australia, ⁶Department of Physics, University of Surrey, Guildford, Surrey GU2 7XH UK, ⁷Australian Nuclear Science and Technology Organisation, New Illawarra Rd, Lucas Heights NSW 2234, Australia.
- 17:00 **INV Hadronic radiation detection using solid state organic devices** **M 4.2**
Adrian Bevan
(1) Department of Physics and Astronomy, Queen Mary University of London, UK
(2) Alan Turing Institute, UK
- 17:30 **Stable near-to-ideal performance of a solution-grown single-crystal perovskite X-ray detector** **M 4.3**
Kostiantyn Sakhatskyi, Bekir Turedi, Gebhard Matt, Muhammad Lintangpradipto, Rounak Naphade, Omar Mohammed, Sergii Yakunin, Osman Bakr, Maksym Kovalenko
Kostiantyn Sakhatskyi - ETH Zurich, Bekir Turedi - King Abdullah University of Science and Technology, Gebhard Matt - ETH Zurich, Muhammad Lintangpradipto - King Abdullah University of Science and Technology, Rounak Naphade - King Abdullah University of Science and Technology, Omar Mohammed - King Abdullah University of Science and Technology, Sergii Yakunin - ETH Zurich, Osman Bakr - King Abdullah University of Science and Technology, Maksym Kovalenko - ETH Zurich
- 17:45 **High performance, high yield solution-grown FACsPbBr₃ single crystals for gamma-ray spectroscopy** **M 4.4**
Liang Zhao, Ying Zhou, Zhifang Shi, Zhenyi Ni, Jinsong Huang
Department of Applied Physical Sciences, University of North Carolina at Chapel Hill, USA
- 18:00 **Discussion**

Wednesday June 1

14:50 Welcome to Day 3

5 : Jinsong Huang

15:00 **INV High-resolution room temperature gamma-ray detection with CsPbBr₃ perovskite** M 5.1
 Mercuri G Kanatzidis
 Department of Chemistry, Northwestern University, Evanston, IL 60208, USA

15:30 **INV Investigation on CsPbBr₃ Detectors: from Leakage Current and Charge Transport Behaviors to Contact and Configuration** M 5.2
 Yadong Xu 1,2*, Yingying Hao1, Xin Zhang1, Fangpei Li1, Ruichen Bai1, Qihao Sun1, Menghua Zhu1, Wanq Jie1,2
 1MIIT Key Laboratory of Radiation Detection Materials and Devices, and 2State Key Laboratory of Solidification Processing, Northwestern Polytechnical University, Xi'an 710072, China

16:00 **Extreme γ -ray radiation hardness and high scintillation yield in perovskite nanocrystals** M 5.3
 Matteo L. Zaffalon, Francesca Cova, Mingming Liu, Alessia Cemmi, Ilaria Di Sarcina, Carmelita Rodà, Mauro Fasoli, Francesco Meinardi, Liang Li, Anna Vedda, Sergio Brovelli
 1. Dipartimento di Scienza dei Materiali, Università degli Studi Milano - Bicocca, via R. Cozzi 55, IT-20125 Milano, Italy & Istituto Nazionale di Fisica Nucleare (INFN), Sezione di Milano – Bicocca, Milano, Italy, 2. Dipartimento di Scienza dei Materiali, Università degli Studi Milano - Bicocca, via R. Cozzi 55, IT-20125 Milano, Italy & Istituto Nazionale di Fisica Nucleare (INFN), Sezione di Milano – Bicocca, Milano, Italy, 3. School of Environmental Science and Engineering, Shanghai Jiao Tong University, 800 Dongchuan Road, 200240 Shanghai, P.R. China, 4. ENEA Fusion and technology for nuclear safety and security department, Casaccia R.C., Via Anguillarese 301, 00123 Rome, Italy, 5. ENEA Fusion and technology for nuclear safety and security department, Casaccia R.C., Via Anguillarese 301, 00123 Rome, Italy, 6. Dipartimento di Scienza dei Materiali, Università degli Studi Milano - Bicocca, via R. Cozzi 55, IT-20125 Milano, Italy, 7. Dipartimento di Scienza dei Materiali, Università degli Studi Milano - Bicocca, via R. Cozzi 55, IT-20125 Milano, Italy & Istituto Nazionale di Fisica Nucleare (INFN), Sezione di Milano – Bicocca, Milano, Italy, 8. Dipartimento di Scienza dei Materiali, Università degli Studi Milano - Bicocca, via R. Cozzi 55, IT-20125 Milano, Italy, 9. School of Environmental Science and Engineering, Shanghai Jiao Tong University, 800 Dongchuan Road, 200240 Shanghai, P.R. China, 10. Dipartimento di Scienza dei Materiali, Università degli Studi Milano - Bicocca, via R. Cozzi 55, IT-20125 Milano, Italy & Istituto Nazionale di Fisica Nucleare (INFN), Sezione di Milano – Bicocca, Milano, Italy, 11. Dipartimento di Scienza dei Materiali, Università degli Studi Milano - Bicocca, via R. Cozzi 55, IT-20125 Milano, Italy & Istituto Nazionale di Fisica Nucleare (INFN), Sezione di Milano – Bicocca, Milano, Italy,

16:15 Discussion

Section 6 : Jinsong Huang

16:30 **INV Understanding and manipulating of radiation induced triplet states for efficient X-ray scintillation and imaging.** M 6.1
 Yang Yang (Michael)
 State Key Laboratory of Modern Optical Instrumentation, College of Optical Science and Engineering, Zhejiang University, Hangzhou, Zhejiang 310027, China.

17:00 Discussion

7: Poster session : Paul Sellin

17:10 **Orthorhombic Cesium Plumbiodide for Sensitive High-Resolution X-ray Detectors** M 7.1
 Makhud I. Saidaminov
 University of Victoria, Canada

17:10 **Growth and Characterization of Large Single-Crystal Lead Halide Perovskites for X-ray Detector Development** M 7.2
 M. Niraula, Y. Nakashima, Y. Takagi, R. Okumura, and K. Yasuda
 Dept. Electrical and Mechanical Engineering, Graduate School of Engineering, Nagoya Institute of Technology, Gokiso, Showa, Nagoya 466-8555, Japan

17:10 **Synthesis of morphology controlled Hf-halide double perovskite and Lu-hydroxy-halide luminescent nano/micro-particles** M 7.3
 Madeleine Fellner, Alessandro Lauria
 ETH Zurich, Department of Materials, Laboratory of Multifunctional Materials, Vladimir-Prelog-Weg 5, 8093 Zurich

17:10 **MAPb(Br_{1-x}Cl_x)₃ perovskite materials and influence of environment during crystal growth for direct X-ray detection** M 7.4
 Javier Mayén Guillén, Giovanni Armaroli, Ferdinand Lédée, Oriane Baussens, Marian Chapran, Jean-Marie Verilhac, Eric Gros D'Aillon, Alain Ibanez, Julien Zaccaro
 Javier Mayén Guillén – Grenoble Alpes University, CEA, LITEN, DTNM, F38000 Grenoble, France Giovanni Armaroli – Department of Physics and Astronomy, University of Bologna, 40127 Bologna, Italy Ferdinand Lédée – Grenoble Alpes University, CEA, LETI, DOPT, F38000 Grenoble, France Oriane Baussens – Grenoble Alpes University, CEA, LETI, DOPT, F38000 Grenoble, France Marian Chapran – Grenoble Alpes University, CEA, LETI, DOPT, F38000 Grenoble, France Jean-Marie Verilhac – Grenoble Alpes University, CEA, LITEN, DTNM, F38000 Grenoble, France Eric Gros D'Aillon – Grenoble Alpes University, CEA, LETI, DOPT, F38000 Grenoble, France Alain Ibanez – Grenoble Alpes University, CNRS, Grenoble INP, Institut Néel, F38042 Grenoble, France Julien Zaccaro – Grenoble Alpes University, CNRS, Grenoble INP, Institut Néel, F38042 Grenoble, France

17:10 **Novel sustainable and flexible composite neutron detector based on fully enriched lithium tetraborate.** M 7.5
 Jessica Delgado, Felix Pino, Sara Maria Carturan, Giorgia Mantovani, Matteo Polo, Daniela Fabris, and Sandra Moretto.
 Dipartimento di Fisica e Scienze della Terra, University of Ferrara, Ferrara, 44122, Italy, Department of Physics and Astronomy "Galilei", University of Padova, Padova, 35121, Italy, INFN-Laboratori Nazionali di Legnaro, Legnaro, 35020, Italy, INFN-Padova Section, Padova, 35131, Italy.

17:10 **Organic additives for stabilizing low-dimensional hybrid perovskites incorporated in sensor and related devices** M 7.7
 Anna Ioannou, A.I.* (1), Ufuk Yilmaz, U.Y. (2), Georg Ramer, G.R. (2), Bernhard Ledl, B.L. (2), Ioannis Koutselas, I.K. (1)
 (1) Department of Materials Science, University of Patras, Greece (2) Institute of Chemical Technologies and Analytics, Technische Universität Wien, Austria

17:10 **Development and understanding of highly efficient MOF composite scintillators** M 7.8
 Hayden Salway * (1), Elena Avila (1), Samuel Stranks (1), David Fairen-Jimenez (1), Miguel Anaya (1).
 (1) Department of Chemical Engineering and Biotechnology, University of Cambridge, Philippa Fawcett Drive, Cambridge, CB3 0AS UK * Lead presenter

17:10 **Bias-modulated spectral-selective perovskite/organic hybrid photodetector** M 7.9
 Suen Chun Wai, Cai Linfeng, Zhu Furong
 Department of Physics, Research Centre of Excellence for Organic Electronics, and Institute of Advanced Materials, Hong Kong Baptist University

17:10 **Direct Detection of 5-MeV protons by Flexible Thin-Film devices based on Organic Semiconductors** M 7.10
 Ilaria Fratelli (1)(2), Andrea Ciavatti (1)(2), Enrico Zanazzi (3)(4), Laura Basiricò (1) (2), Massimo Chiani (5), Laura Fabbri (1)(2), John E. Anthony (6), Alberto Quaranta (3)(4) and Beatrice Fraboni (1)(2)
 1) Department of Physics and Astronomy, University of Bologna, Bologna, Italy, 2) National Institute of Nuclear Physics (INFN), Section of Bologna, Bologna, Italy, 3) Department of Industrial Engineering, University of Trento, Via Sommarive 9, I-38123 Povo, Trento, Italy, 4) INFN-TIFPA, Via Sommarive 14, I-38123 Povo, Trento, Italy, 5) INFN-Florence, Via G. Sansone 1, 50019 Sesto Fiorentino, Florence, Italy, 6) Department of Chemistry and Center for Applied Energy Research, University of Kentucky, Lexington, KY 40506, USA.

17:10 **Lead Bromide Perovskite thin films and single crystals based devices** M 7.11
 Marianna Testa, Luisa De Marco, Matthias Auf der Maur, Fabio Matteocci, Ilenia Viola, Silvio Morganti, Chiara Rovelli, Antonio De Santis, Silvia Rizzato, Leonardo Lo Presti
 Marianna Testa LNF-INFN, Luisa De Maro CNR-Nanotec, Matthias Auf der Maur Electronic Engineering Department Tor Vergata University, Fabio Matteocci Electronic Engineering Department Tor Vergata University, Ilenia Viola CNR-Nanotec, Silvio Morganti Roma1-INFN, Chiara Rovelli Roma1-INFN, Antonio De Santis LNF-INFN, Silvia Rizzato Department of Chemistry Università degli Studi di Milano, Leonardo Lo Presti Department of Chemistry Università degli Studi di Milano

17:10	Unconventional two-dimensional CsPb2Br5 perovskite single crystals for enabling radiation detection Saqr Alshogheathri, Da Cao, Bryant Kanies, Ge Yang Department of Nuclear Engineering, North Carolina State University 2500 Stinson Drive, Raleigh, NC 27695-7909, USA Contact Emails: Ge Yang (gyang9@ncsu.edu), Saqr Alshogheathri (salshog@ncsu.edu)	M 7.12
17:10	Synthesis and characterisation of lead-free double perovskite scintillators for nanocomposite applications Joseph O'Neill, Suad Alghamdi, Stephanie Bennett, Isabel Braddock, Carol Crean, Joydip Ghosh, Caroline Shenton-Taylor, Paul Sellin [1], Sion Richards, Matthew Wilson [2] [1] University of Surrey, [2] Rutherford Appleton Laboratory	M 7.13
17:10	A perovskite-enhanced photogating type X-ray detector. Guan-Hua Dun1,2,*, Ken Qin1,2,*, Xiang-Shun Geng1,2, Yuan-Yuan Li1,2, Dan Xie1,2,*, He Tian1,2,*, Yi Yang1,2,* and Tian-Ling Ren1,2,* . #These authors contributed equally to this work. *Email: RenTL@tsinghua.edu.cn, yiyang@tsinghua.edu.cn, tianhe88@tsinghua.edu.cn, xiedan@tsinghua.edu.cn 1 School of Integrated Circuits, Tsinghua University, Beijing 100084, China. 2 Beijing National Research Center for Information Science and Technology (BNRist), Tsinghua University, Beijing 100084, China.	M 7.14
17:10	Basic properties of point defects in halide perovskites derived from analysis of the corresponding binary metal halides A.I. Popov (1), E.A. Kotomin (1,2), J. Maier (2) (1) Institute of Solid State Physics, University of Latvia, Riga, Latvia, (2) Max Planck Institute for Solid State Research, Stuttgart, Germany	M 7.15
17:10	Solution Processed Lead-Free Double Perovskite Single crystal for X-ray Detection Naveen Kumar Tailor1, Joydip Ghosh2, Mohammad Adil Afroz1, Paul Sellin2, Soumitra Satapathi1 1Department of Physics, Indian Institute of Technology Roorkee, Roorkee, 247667, India 2Department of Physics, University of Surrey, Guildford GU2 7XH, United Kingdom	M 7.16
17:10	Polarized photodetectors based on oriented organic semiconductors: Fabrication, dark-current suppression and applications Aleksandr Perevedentsev1,2, Hadhemi Mejri1,2, Luis A. Ruiz-Preciado1,2, Tomasz Marszalek3, Uli Lemmer1,4, Paul W. M. Blom3, Gerardo Hernandez-Sosa1,2,4 1. Light Technology Institute, Karlsruhe Institute of Technology, 76131 Karlsruhe, Germany, 2. InnovationLab, 69115 Heidelberg, Germany, 3. Max Planck Institute for Polymer Research, 55128 Mainz, Germany, 4. Institute of Microstructure Technology, Karlsruhe Institute of Technology, 76344 Eggenstein-Leopoldshafen, Germany	M 7.17

Thursday June 2

14:50 Welcome to Day 4

8 : Laura Basiricò

15:00 **INV Exploration of metal halides for indirect and direct X-ray detection** M 8.1
Jiang Tang, Guangda Niu
Huazhong University of Science and Technology

15:30 **INV Benefits and challenges of charge transport in halide perovskites** M 8.2
Artem Musienko
Helmholtz-Zentrum Berlin für Materialien und Energie GmbH, Institut für Silizium Photovoltaik

16:00 **Impact of X-ray irradiation on the excitonic properties of lead halide perovskite single crystals** M 8.3
Giovanni Armaroli (1), Laura Ferlauto (1,2), Ferdinand Lédée (1,2), Matilde Lini (1), Andrea Ciavatti (1), Alessandro Kovtun (3), Francesco Borgatti (4), Gabriele Calabrese (5), Silvia Milita (5), Beatrice Fraboni (1), and Daniela Cavalcoli (1)
1: Department of Physics and Astronomy, University of Bologna, Viale Bertini Pichat 6/2, 40127, Bologna, Italy, 2: Interdepartmental Center for Industrial Research of the University of Bologna (CIRI-MAM), Viale Risorgimento 2, 40136, Bologna, Italy, 3: Institute of Organic Synthesis and Photoreactivity - (CNR-ISOF), Via Gobetti 101, 40129, Bologna, Italy, 4: Institute for Nanostructured Material Study (CNR – ISMN), Via Piero Gobetti 101, 40129, Bologna, Italy, 5: Institute for Microelectronics and Microsystems (CNR – IMM), Via Piero Gobetti 101, 40129, Bologna, Italy

16:15 Discussion

9 : Jinsong Huang

16:30 **INV Recent progress in metal halide perovskite radiation detectors** M 9.1
Eric Lukosi1-2, Ryan Tan1-2, Jessica Charest1-2, Bogdan Dryzhakov2-3, Chris Busch1-2, Lance Drouet1-2, Owen Johnson1-2, Jeonghee Yang2-3, Zachary Dancoes4, Praneeth Kandlakunta4, Lei Cao4, Bin Hu2-3, Mahshid Ahmadi2-3
[1] Department of Nuclear Engineering, University of Tennessee, Knoxville, TN 37996, [2] Institute of Advanced Materials and Manufacturing, University of Tennessee, Knoxville, TN, 37996, [3] Department of Materials Science Engineering, University of Tennessee, Knoxville, TN 37996, [4] Nuclear Engineering, Department of Mechanical and Aerospace Engineering, The Ohio State University, Columbus, OH 43210

17:00 **INV Recent progress of lead-free perovskite radiation detectors** M 9.2
Xiangshun Geng, Yu-Ang Chen, Guan-Hua Dun, Yuan-Yuan Li, Dan Xie, Tian-Ling Ren
School of Integrated Circuit & Beijing National Research Center for Information Science and Technology (BNRist), Tsinghua University, Beijing 100084, China

17:30 **Ultra-Stable and Robust Response to X-Rays in 2D Layered Perovskite Micro-Crystalline Films Directly Deposited on Flexible Subst** M 9.3
Ferdinand Lédée (1), Matteo Verdi* (1,2), Andrea Ciavatti (1,2), Laura Basiricò (1,2), and Beatrice Fraboni (1,2)
(1) Department of Physics and Astronomy, University of Bologna, Bologna, Italy (2) National Institute for Nuclear Physics-INFN section of Bologna, Bologna, Italy

17:45 **Two-dimensional (2D) Perovskite Single Crystals for Efficient and Stable X-Ray Detection** M 9.4
Yukta1, Joydip Ghosh2, Mohammad Adil Afroz1, Paul Sellin2, Soumitra Satapathi1
1Department of Physics, Indian Institute of Technology Roorkee, Roorkee, Haridwar, Uttarakhand, 247667, India 2 Department of Physics, University of Surrey, Guildford GU2 7XH, United Kingdom

18:00 Discussion and Closing with award of student prizes