



The Solar Energy Society

International Solar Energy Society UK National Section (UK-ISES)

13th Photovoltaic Science, Applications & Technology

Conference C99

PVSAT-13

Bangor University

Bangor, Wales

Wednesday 5th to Friday 7th April 2017

PROGRAMME

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EXHIBITORS





PRINCIPAL GUEST SPEAKER



Prof Christophe Ballif is the Director of the PV laboratory at Ecole Polytechnique Fédérale de Lausanne (EPFL) and Director of PV Development at Centre Suisse d' Electronique et de Microtechnique (CSEM) in Neuchâtel. Christophe won the Becquerel Prize in 2016 for scientific, technical or managerial accomplishments in the development of solar energy.

GUEST SPEAKERS

Prof Hongwei Han is based at Huazhong University of Science & Technology and Wuhan National Laboratory for Optoelectronics, China. In 2015 his group fabricated a 7m² fully printable mesoscopic perovskite solar module. He will present a key-note lecture at the Sêr Solar workshop on Printed Photovoltaics.



Dr Karsten Walzer is the Senior Research Scientist and Project Manager at Heliatek GmbH, a company that is commercialising the roll-to-roll production of solar cells based on organic oligomers. Karsten will talk on the success and challenges of OPV technology scale-up from the laboratory to industrial production.

Dr Jeff Kettle based at the School of Electronic Engineering at the Bangor University. His research interests cover semiconductor device fabrication, characterisation and modelling. Jeff will give the host lecture and present aspects of PV research at Bangor University.



Dr Marco Raugei is a Senior Research Fellow in the Department of Mechanical Engineering and Mathematical Sciences at Oxford Brookes University and currently Visiting Scientist at the Centre of Life Cycle Analysis at Columbia University (USA). Marco will present his work on the Energy Return on Investment Analysis (EROI) for PV Systems.

Dr Ian Forbes is a Reader in Photovoltaic in the Department of Physics and Electrical Engineering Research at Northumbria University. Ian will present the latest developments, performance and prospects for the CZTS family of solar cells.



Prof Paul Meredith is the new Sêr Cymru Chair in Sustainable Advanced Materials at Swansea University. He holds an Honorary Professorship at the University of Queensland in Australia where he was Director of the UQ Solar Initiative and an Australian Research Council Discovery Outstanding Researcher Award Professorial Fellow. His talk will describe recent research on the scaling physics of next generation thin film solar cells such as organic semiconductor and organohalide perovskite technologies.



DYDD MERCHER / WEDNESDAY

- 09:00 Visit to Dinorwig pumped hydro storage power station (pre-registration required)
- 12:00 Lunch PJ Hall
- 13:00 Opening Session, Main Arts Lecture Theatre (MALT)
Chair: Nigel Mason, PV Consulting Ltd

Welcome	Vice Chancellor – John Hughes <i>Bangor University</i>	Welcome to Bangor University
	Nigel Mason <i>PV Consulting</i>	Conference Chair welcome
	Alex Cole <i>Centre for Process Innovation</i>	Programme Chair welcome and notices
Invited	Jeff Kettle <i>Bangor University</i>	Stability of Organic PVs
Invited	Marco Raugei <i>Oxford Brookes University</i>	Net Energy Analysis of Photovoltaics: potential, limits and ideas for improvement

14:30 Poster Session A Chair: Ian Forbes, Northumbria University PJ Hall

15:30 Coffee break PJ Hall

16:00 Session 1 Chair: Ken Durose, University of Liverpool MALT

Invited	Karsten Walzer Heliatek GmbH	Organic solar films: From the lab to vacuum roll-to-roll manufacturing for building-integrated photovoltaics
Contributory	Simone Meroni Swansea University	Novel deposition method to print binder-free inks on large scale perovskite solar cell modules
	Silvia Mariotti Liverpool University	Reversible water catalysed CsPbI ₂ Br perovskite phase change and device performances
	Exhibitors and Sponsors	Exhibitor and Sponsor Presentations

17:05 Short Break

17:20 Session 2 Chair: Jeff Kettle, Bangor University MALT

Contributory	Tom Baines Liverpool University	Use of CdS:O and CdSe as Window Layers for CdTe Photovoltaics
	Lewis Wright Loughborough University	Fabrication of CZTS thin films via ultrasonic spray deposition
	James McGettrick Swansea University	Understanding the Photoelectron Spectroscopy of Perovskites for Photovoltaics
	Michael Owen-Bellini Loughborough University	Thermo-mechanical stresses of Silicon Photovoltaic Modules

18:25 Time to check-in at your accommodation

19:30 Welcome Drinks followed by Dinner, Bar Uno, Ffiddoedd Village, Bangor University



DYDD IAU / THURSDAY

09:00 Session 3 Chair: Trystan Watson, Swansea University MALT

Contributory	Adam Pockett Swansea University	Perovskite-silicon tandem cells utilizing a semitransparent silver nanowire composite electrode
	Souray Khanna Exeter University	Optimization of PV-PCM systems for South-West UK climate
	Laurie Phillips University of Liverpool	CuSCN interlayer for high efficiency CdTe solar cells with improved back-contacts
	Stuart Irvine Swansea University	New mechanism in proton irradiated CdTe solar cells revealed by SCAPS modelling
	Husyira Alhusna Loughborough University	Influence of Spectral Variations on Photovoltaic Module Energy Rating
	Arunima Sethi Trinity College Dublin	Synthesis of single crystalline Au and Ag nanorods for plasmonic luminescent devices in PV application

10:30 Coffee Break PJ Hall

11:00 Session 4 Chair: Alex Cole, Centre for Process Innovation MALT

Contributory	Dan Lamb Swansea University	First Flight Test of a Thin Film Cadmium Telluride Solar Cell on Cover Glass in Space
	Steve Ransome SCRL	Optimum Use of The Loss Factors Model (LFM) for Improved PV Performance Modelling
	John Hodgkinson University of Salford	Highly Effective TiO _{2-x} Electron Transport Layers via Atmospheric Pressure Plasma Enhanced CVD
	Katherine Hooper Swansea University	Characterisation and optimisation of processing time for perovskite solar cells
	Chris Kershaw Bangor University	Understanding and controlling electron transfer between sensitizer and electrolyte

12:15 Lunch PJ Hall

13:15 Poster Session B Chair: Rob Treharne, University of Liverpool PJ Hall

14:15 Session 5 Chair: Dame Mary Archer, UK-ISES MALT

Invited	Ian Forbes Northumbria University	The Status of Kesterite Thin Film PV
Contributory	Phoebe Pearce Imperial College London	SiGeSn as a 1.0eV component sub-cell in III-V multi-junction solar cells
	Liyang Yue Bangor University	Light absorption in perovskite solar cell: Fundamentals and plasmonic enhancement of infrared band absorption
	Rolf Crook University of Leeds	Impact of stratospheric aerosol geoengineering on PV and CPV output

15:30 Coffee Break PJ Hall



DYDD IAU / THURSDAY

Sêr Solar Symposium – Printed Photovoltaics

16:00 Session 6 Chair: Stuart Irvine, Swansea University MALT

Invited	Hongwei Han Huazhang University	Stable fully printable mesoscopic perovskite solar cells
	Paul Meredith University of Queensland	Scaling Physics of Thin Film Solar Cells
Contributory	Trystan Watson Swansea University	Designing the fabrication route for perovskite solar cells: From spin-coating to slot die
	James Bishop Sheffield University	Spray-cast multilayer perovskite solar cells with an active-area of 1.5 cm ²
	Matt Klug University of Oxford	Tailoring Metal Halide Perovskites through Partial Metal Substitution

CONFERENCE AWARDS DINNER

Chateau Rhianfa, Anglesey

- 18:45 Coaches leave from Bangor University Halls and Management Centre for Anglesey
- 19:15 Drinks Reception, Chateau Rhianfa, Anglesey
- 20:00 Conference Awards Dinner, Chateau Rhianfa
- 22.00 Trio Canig, Anglesey Male Voice Trio Performance
- 23:00 Coaches depart for return to Bangor University





DYDD GWENER / FRIDAY

09:00 Session 7 Chair: Rolf Crook, Leeds University MALT

Contributory	George Koutsourakis Loughborough University	Uncertainty Contributions in Photocurrent Linearity Measurements of PV Devices using a Flash Solar Simulator
	PJ Yates University of Liverpool	Antimony Selenide – Microstructure and Photovoltaic Devices
	Xinya Xu Northumbria University	Flexible $\text{Cu}_2\text{ZnSn}(\text{S,Se})_4$ solar cells made from nanoparticle inks
	Elana Koubli Loughborough University	Remote monitoring and failure detection for distributed small-scale PV systems
	Joel Troughton Swansea University	Very high humidity fabrication of planar perovskite solar cells and modules

10:30 Coffee Break

11:00 Session8 Chair: Steve Ransome, SRCL MALT

Invited	Christophe Ballif CSEM, EPFL	On sea, in the air and on land: when will everything become solar?
Contributory	Diane Palmer Loughborough University	Satellite or Ground-based Irradiation Data: Which is closer to reality?
	Phoebe Pearce Imperial College London	Agent-based modelling of the effect of government policy on the adoption of domestic photovoltaic systems in Great Britain
	Giray Kartopu Swansea University	Development of ZnO/CdS/CdTe core-shell nanorod-based solar cells with an extremely thin absorber
	Ross Hatton University of Warwick	Enhanced Efficiency and Stability in Tin Perovskite Photovoltaics

13:00 Closing Remarks

13:15 Lunch

14:00 Conference Close



POSTER SESSION A



Wednesday 5th April 13:30 – 14:30 Chair: Ian Forbes, Northumbria University PJ Hall

Ref. No	Paper Title	Authors	Affiliation
D1-1	MOCVD of SnS with large grains and stoichiometry control for thin film photovoltaics	A. J. Clayton, Stuart J. C. Irvine, P. Siderfin and C. M. E. Charbonneau	Swansea University
D1-2	Degradation mechanisms of perovskite solar cells based on a triple all-printable mesoporous stack	F. De Rossi, J. Baker, K. Hooper and T.M. Watson	Swansea University
D1-3	A Simple Optical Setup for Current Mapping of Small Area PV Devices Using Different Sampling Strategies	G. Koutsourakis, M. Cashmore, S. R. G. Hall and R. Gottschalg	Loughborough University
D1-4	A comparison of selenisation configurations for solution processed Cu(In,Ga)(S,Se) ₂ solar cells	S. Uličná, P. Arnou, C. S. Cooper, L. D. Wright, A. V. Malkov, J. M. Walls and J. W. Bowers	Loughborough University
D1-5	Accelerated weathering test study of series of different “encapsulants on steel substrate” and their potential application in building integrated PV	S. Ghosh, V. Stoickov, L. Haponow, J. Kettle, A. L. Martínez, D. Gómez and P. Sánchez	Bangor University
D1-6	Sr ₄ Al ₁₄ O ₂₅ : Eu, Dy as a potential downconverter for crystalline-silicon solar cells	J. Day, S. Senthilarasu and T. K. Mallick	University of Exeter
D1-7	The effect of annealing time and ambient pressure on the formation of Cu ₂ ZnSnS ₄ (CZTS) thin films based on mixed powder precursors	M. Mokhtarimehr, I. Forbes and N. Pearsall	Northumbria University
D1-8	Water Vapour Transmission Rate of Ethylene Vinyl Acetate (EVA) Encapsulant with different Curing Levels	J. Zhu, C. Ng, D. Montiel-Chicharro, T. R. Betts and R. Gottschalg	Loughborough University
D1-9	Outdoor degradation, performance analysis and software modelling of Organic Photovoltaics (OPVs) fixed to a building prototype	V. Stoichkov, J. Kettle, T. Sweet and E. Katz	Bangor University
D1-10	Dye sensitized Schottky barrier devices on steel	N. Ryall, R. Crook and J. Weinstein	University of Leeds
D1-11	Evaluation of Charge Carrier Lifetime of Thin Film Solar Cells using Transient Photovoltage Decay Measurements	V. Tsai, G. Koutsourakis, M. Bliss, T.R. Betts and R. Gottschalg	Loughborough University



POSTER SESSION B



Thursday 6th April 13:15 – 14:15

Chair: Rob Treharne, University of Liverpool

PJ Hall:

Ref. No	Paper Title	Authors	Affiliation
D2-1	Analysis of Luminescent Solar Concentrator Performance Using a Ray Tracing Algorithm: Modelling, Optimization and Validation	M. Rafiee, S. Chandra, H. Ahmed and S. J. McCormack	Trinity College Dublin
D2-2	Triple-Junction Concentrator Photovoltaic-Thermoelectric Hybrid Receivers: Robustness, Validation and Preliminary Reliability Studies	M. Rolley, T. Sweet, V. Stoichkov, J. Kettle and G. Min	Cardiff University
D2-3	Influence of the S amount on the Cu ₂ ZnSnS ₄ absorber on thin film solar cells	S. Mazzamuto, S. Dale, L.M. Peter, N.M. Pearsall and I. Forbes	Northumbria University
D2-4	In-situ metrology of solar cell processing and lifetime	P. J. Holliman, L. Furnell, R. Anthony, A. Connell, E. W. Jones and C. P. Kershaw	Bangor University
D2-5	Degradation analysis of Perovskite Absorber Layers and Solar Cells using Spectral Filtration, Encapsulation and Concentrated Sunlight	V. Stoichkov, J. Kettle, A. Ambrose, I. Visoly-Fisher and E. Katz	Bangor University
D2-6	U-value calculation of CdTe thin film PV glazing using indoor characterization	H. Alrashidi, A. Gosh, W. Issa, N. Sellamil, S. Senthilarasu, S. Townley and T. Mallick	University of Exeter
D2-7	Mixed dimensions silver nanowire thin, flexible, transparent and conducting electrodes with improved optical and physical properties	D. Kumar, V. Stoichkov, S. Ghosh, G.C. Smith and J. Kettle	Bangor University
D2-8	Spray coated zinc oxide for solar cell applications	T. C. Gomes, N. Alves and J. Kettle	Bangor University
D2-9	Large Area Deposition of CH ₃ NH ₃ PbI ₃ Films in a Single-Step Using Aerosol-Assisted Chemical Vapour Deposition	H. M. Yates and M. Afzaal	University of Salford
D2-10	Plasmon-active silver nanohole films as light-catching electrodes for organic photovoltaics	J. Lee and R. A. Hatton	University of Warwick
D2-11	Process Development of Sublimated Cu-free CdTe Solar Cells	C. Potamialis, F. Lisco, B. Maniscalco, M. Togay, J. W. Bowers and J. M. Walls	Loughborough University
Late News 1	Low-T crystalline TiO ₂ nano-structured materials for the fabrication of lead-halide perovskite solar device	A. Yasin, A. Lewis, E. Jewell, J. McGettrick, J. Searle, J. Troughton, T. Watson, D. Worsley and C Charbonneau	Swansea University
Late News 2	A Conceptual Strategy to Control the Cell Temperature in a Concentrating Photovoltaic/Thermal Roof-top System	W. Li, H. Baig, M.C. Paul, T. K Mallick and A. R. Knox	University of Glasgow/Exeter
Late News 3	Optimised organometal halide perovskite solar cell fabrication through control of nanoparticle crystal patterning	D. K. Mohamad, B. G. Freestone, R. Masters, M. Reinhardt, S. Canning, C. Rodenburg and D.G. Lidzey	Sheffield University
Late News 4	Improving the Efficiency and Stability of Fully-Printed Carbon-based Mesoporous Perovskite Solar Cells by Solvent Engineering	D. Williams, J. Baker, F. de Rossi, S. Meroni and T. Watson	Swansea University
Late News 5	Electrical Characterisation of Solution Processed Cu(In,Ga)Se ₂ Thin Film Solar Cells	M. Togay, A. Eeles, P. Arnou, S. Ulinchna, J.M. Walls and J. W. Bowers	Loughborough University



DELEGATE LIST (as registered by 24 March 2017)

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Heather Yates, University of Salford
Liyang Yue, Bangor University
Jiang Zhu, Loughborough University



OVERVIEW

WEDNESDAY	
09:00	Dinorwig Power
09:15	Station visit
09:30	
09:45	
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11:45	
12:00	lunch
12:15	
12:30	
12:45	
13:00	Opening Session
13:15	
13:30	
13:45	
14:00	
14:15	
14:30	Poster Session A
14:45	
15:00	
15:15	
15:30	coffee break
15:45	
16:00	Session 1
16:15	
16:30	
16:45	
17:00	
17:05	Short Break
17:20	
17:20	Session 2
18:00	
18:15	
18:25	accommodation
18:45	check-in
19:00	
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19:30	Reception Drinks
19:45	
20:00	Dinner
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THURSDAY	
09:00	Session 3
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10:30	coffee break
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11:00	Session 4
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12:00	
12:15	lunch
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12:45	
13:00	
13:15	Poster Session B
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14:15	Session 5
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15:15	
15:30	coffee break
15:45	
16:00	Session 6
16:15	Ser Solar
16:30	Printed PV
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18:15	
18:30	Coaches to Chateau
18:45	Rhianfa
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19:15	Reception Drinks
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20:00	Awards Dinner
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22:00	Trio Canig
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23:00	Coaches return to University

FRIDAY	
09:00	Session 7
09:15	
09:30	
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10:30	coffee break
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11:00	Session 8
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11:30	
11:45	
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12:45	closing remarks
13:00	lunch
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13:45	
14:00	CONFERENCE CLOSE