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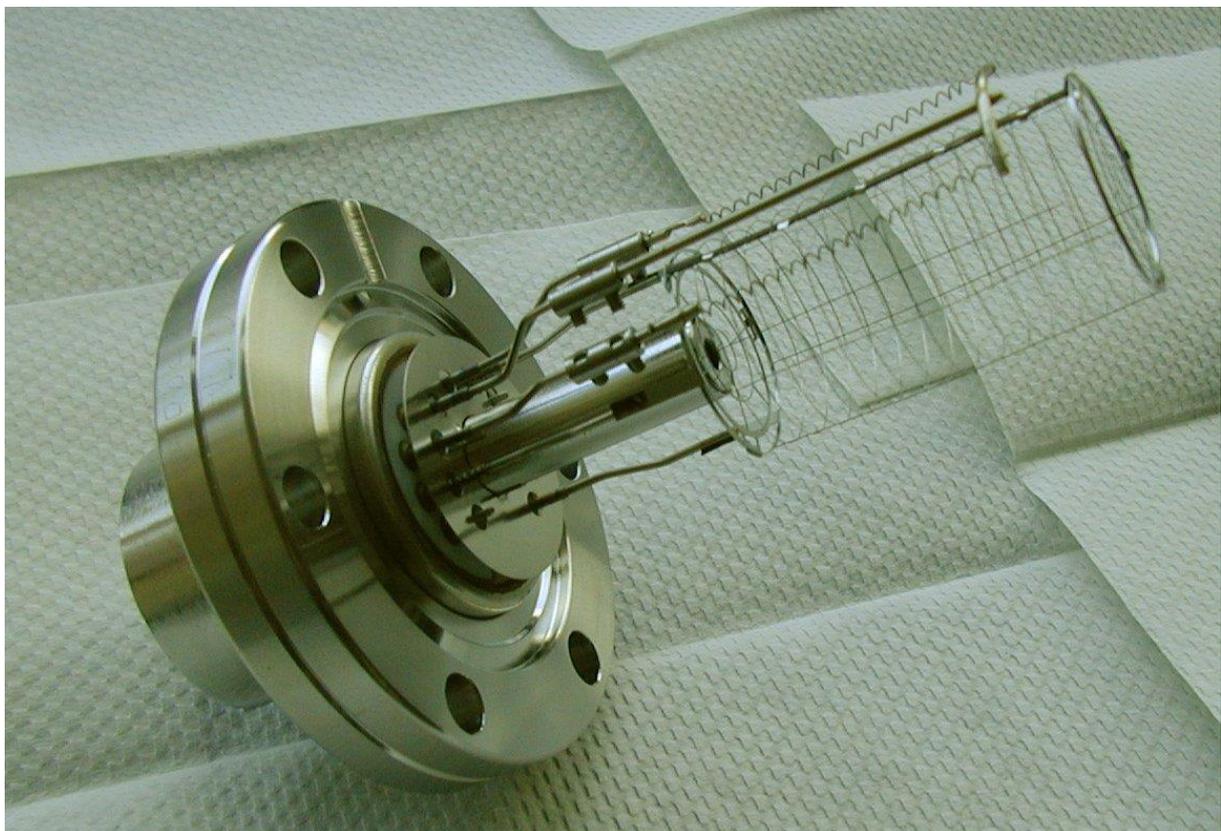
**IOP** | Institute of Physics  
**Vacuum Group**

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**NEWSLETTER**

**2017**

**Issue no. 17/1**



**Contents**

The Vacuum Group .....	3
Chair's Report 2017 .....	3
Group Meetings .....	4
VS7: Vacuum Quality in Vacuum Process Engineering – does it matter?.....	4
IPSI Annual Meeting: The Plasmas Surfaces and Thin Films Early Career Researchers' Meeting.....	5
Vacuum Symposium UK .....	8
The Harry Leck Memorial Medal .....	9
The British Vacuum Council.....	10
British Vacuum Council Report.....	10
Vacuum Roadshow 2017 .....	11
Vacuum Expo 2017 .....	12
Report to IOP Vacuum Group and Early Career Researchers Fund .....	12
VACUUM Japan .....	14
Forthcoming events .....	15
Committee 2017-2018 .....	15
Join the Vacuum Group .....	17

## The Vacuum Group

The Vacuum Group endeavours to appeal to as many people as possible in academe, industry and research by arranging meetings covering the widest possible range of subjects for which vacuum is important.

The composition of the Group Committee reflects the broad coverage of the subject aimed at by the Group, encompassing academics, representatives of vacuum manufacturers and vacuum users in government and industrial laboratories. The Group has been successful in bringing together those engaged in the production and improvement of vacuum equipment with those concerned with its application in such diverse areas as medical physics, large machines for research in the physical sciences, industrial process control and the electronics and semiconductor industries.

The Vacuum Group takes an active interest in education for those working with vacuum technology. The Group maintains close links with the British Vacuum Council ([BVC](#)), the International Union for Vacuum Science Technique and Applications ([IUVSTA](#)) and Vacuum Symposium UK.

The Group has organised a wide programme of half-day and full-day meetings, some of which have taken the form of workshops or included mini-exhibitions. The group has also actively participated in the Vacuum Symposium UK series of conferences.

## Chair's Report 2017

In many ways, the year reported on has been one of some frustration. Group meetings on various interesting topics have been discussed by your Committee, but for one reason or another they have had to be deferred or not proceeded with – usually because the relevant people were not able to carry them forward. I guess this is a symptom of the society in which we live – people are just so busy and very rightly giving priority to the work which provides their bread and butter, which leaves little time for the rather more peripheral stuff, no matter how interesting it might be.

Nevertheless, members of the Group have been engaged in various other bodies and meetings and the reports in this newsletter will give you a flavour of what they are doing in the world of vacuum.

One thing we are very much hoping to get off the ground in 2018 is a new training course in vacuum. It is anticipated that this will last a few

days and be at an intermediate level, pitched between the basic courses held at Vacuum Symposium in Coventry and the higher-level courses aimed at specialists, such as those run by vacuum companies and the CERN Accelerator Schools in Vacuum. If this is of interest – watch the website!

Although the Vacuum Group is not directly involved in organising a meeting within VS7 in October this year, it very much supports the meeting. In particular, the RGA Users' Group meeting will be of very much interest to many of our members. We will also be sponsoring a Poster Prize.

*Ron Reid*

## **Group Meetings**

### **VS7: Vacuum Quality in Vacuum Process Engineering – does it matter?**

*Ricoh Stadium, Coventry, 12th October 2016*

#### **Vacuum Quality in Vacuum Process Engineering – Does it matter?**

Vacuum Symposium 7 | 12<sup>th</sup> October 2016 | Ricoh Arena, Coventry

By simply pumping to base pressure thereby achieving ultimate quantity, may not be sufficient, as what is in the residual gas, the quality, is really what is important. Hence this aim of this meeting was to bring together both industry and academia to discuss the importance of vacuum quality.

This half a day meeting was sponsored by the follow IoP groups:

- Vacuum
- Ion & Plasma Surface Interaction Group
- Thin Films and Surface

The standard of the talks was excellent, these included Dr Hugo Sheirs who gave a great overview of why vacuum quality was important at Diamond. Dr Alan Webb who spoke about semiconductor etch, Dr David Pearson (Oxford Instruments) on ion beam processes and Jonathan Leslie (MKS Instruments) who spoke about extending the limits of detection into the PPT range with a Quadrupole Mass Spectrometer.

If a similar meeting was to be held next year the meeting committee acknowledge that the program must be released earlier in attempt to increase the number of attendees.

We would like to thank all at Vacuum Symposium and Xmark Media Ltd for enabling us to offer a free meeting to the vacuum community.



*Hayley Brown*

## **IPSI Annual Meeting: The Plasmas Surfaces and Thin Films Early Career Researchers' Meeting**

The meeting was organised by The Ion and Plasma Surface Interactions, (IPSI) Group and co-sponsored by the Vacuum and Thin Films & Surfaces Groups of the IoP.

It was held on the 22<sup>nd</sup> June 2017 at Loughborough University in the Schofield Building

This meeting at Loughborough has taken over from the former Plasma Surfaces and Thin Films Meeting, which had been held in London for many years. The reason for the change being the unavailability of suitable rooms at the Institute during the refurbishment move and that the new format has been highly successful.

This meeting proved no exception with good invited talks, good participation in the audience and a good show of posters. The standard of posters proved to be as high as ever, as testified by the two judges, which made the winner difficult to identify.

The established format was followed, with the meeting starting with invited speakers, 'setting the scene' and then followed by contributed talks and a good array of posters.

**The Programme :***Invited talks by established Researchers*

10-30 Christian Bradley, Tokamak Energy, UK, Plasma Challenges and Glow Discharge Vessel Conditioning in the Tokamak Energy ST40

11-00 Chris Walker, Diamond Hard Surfaces Ltd, Diamond Hard Surfaces; Successful technology implementation; from idea to commercial success

11-30 Ben Beake Micromaterials, Improved characterisation of DLC coatings for automotive applications

12-00 Konstantza Lambrinou, SCK-SEN, Belgium, Radiation damage to materials and developments towards next generation of nuclear reactors

12-30 Houzheng Wu, Department of Materials Loughborough University, Microstructure and mechanical property characterisation of zirconium nitride, carbide and boride after heavy ion irradiation

13-00 Lunch, poster session and AGM of the Ion and Plasma Surface Interactions Group of the Institute of Physics

**Young Researcher talks**

14-10 David Shaw University of York, Modelling deposition removal from fusion optics

14-25 David Meehan University of York, Laser Ablation of metal and metal-oxide targets, and applications towards Plasma Enhanced-Pulsed Laser Deposition

14-40 Aisyah Zanai University of Surrey and Plasma Quest Ltd., An introduction to Hiatus Technology with application to Multilayer depositions

15-55 Tea break and poster prize winner announcement

15-15 Sibel Yilmaz CREST, Loughborough, The microstructure of CdS/CdTe solar cells fabricated using magnetron sputtering.

15-30 Gerald Womack CREST, Loughborough, The design, performance and durability of broadband anti-reflection coatings for solar modules deposited using magnetron sputtering.

15-45 Mateus Tunes University of Huddersfield, Ion beam sputter-deposition of high-entropy alloy thin films on zircaloy-4 for potential use in accident-tolerant fuel systems

16-00 Adam Bennett Cranfield University Atmospheric pressure

plasma technology for ultra-precision engineering of optics for applications in aerospace, defence and science

16-15 Jingcheng Guan Department of Materials, Loughborough University, Atomistic modelling of zinc oxide thin film growth by different deposition techniques

16-30 Close

## POSTER PRESENTATIONS

1. Stuart Robertson, Loughborough University, Structure and mechanical performance characterisation of zirconium nitride after heavy ion irradiation
2. Chris Chalmers Loughborough University, Modelling the dewetting of inkjet printed drops
3. Carmen Alonso Herr Oxford University, Deposition of organic layers by roll-to-roll coating in vacuum
4. Benjamin Maertz Loughborough, Microstructure of Isostatic Pressure-Moulded Graphite (Iso-Graphite)
5. Amal- Al Harbi, Mathematical Sciences, Loughborough University, Radiation damage in glasses
6. Michael Watts, Understanding CdTe/CdS solar thin film structures through ab initio modeling
7. Faraz H. Montazersadgha, Space Averaged Mathematical Model of Pulse Powered Atmospheric Pressure Air Plasma
8. Juliet Ojiako, First steps in modelling plasma interactions with liquids
9. O. Ogunyinka, Loughborough University, Enhancement of mass transfer rate of plasma reactive species in gas-liquid phases with a Microfluidic plasma reactor
10. S. Kurdi, Cambridge University, Fe<sub>2</sub>-xMn<sub>1+x</sub>Al Heusler films showing a large exchange bias shift
11. Alec Wright, Loughborough University, Development and Comparison of Ozone Measurement Techniques
12. M. Shaban Loughborough University, Plasma liquid interface using a microfluidic plasma device
13. Doga Billcan, Barcelona Synthesis of Porous BiFeO<sub>3</sub> films with Ferromagnetic-like Behaviour by Electrodeposition followed by Heat Treatment
14. Wilhelm Huettenes, Cambridge, Sustainable magnetostrictive thin film alloys

The poster prize winner was announced after the afternoon tea break and the prize presented by the Group Chair Glen West



The Plasmas Surfaces and Thin Films format may revert to that originally conceived once the move to the new IoP building has taken place. However, there is still clearly a need for a Young Researchers' Meeting, as identified again this year, by the enthusiastic response and the high quality of the presentations.

IPSI organisers :

Roger Smith and Alan Webb

## **Vacuum Symposium UK**



Vacuum Symposium UK was formed to embrace all of the UK vacuum community. Its aim is to bring together academics, industrialists, engineers, manufacturers and anyone using vacuum to promote UK pre-eminence in the subject.

Vacuum is a key enabling technology for a wide variety of applications that are of growing importance in the 21<sup>st</sup> Century. Whilst there is an abundance of information on the Internet we believe that the annual event organised by Vacuum Symposium UK provides a unique opportunity for networking and education, in addition to topical meetings of interest to vacuum users.

The meetings within Vacuum Symposium UK are free to attend. We welcome anyone with experience and contacts to organise a vacuum related meeting that will attract and interest the diverse spectrum of vacuum users. See our website [www.vacuum-uk.org](http://www.vacuum-uk.org) for more details.

The Vacuum Symposium event is co-located with Vacuum Expo – the UK's premier exhibition of vacuum equipment – all on one site, under one roof. Attendees are welcome on one or both days of the

Vacuum Symposium UK is an independent organisation (Registered Charity No. 1137989). Our roots were based in the RGA User Group but nowadays we seek to encompass all aspects of vacuum with a view to establishing a UK annual event worthy of hosting an International vacuum conference.

*Steve Shannon, SS Scientific Limited*

## The Harry Leck Memorial Medal

Each year the organising committee of Vacuum Symposium UK seeks nominations for the Harry Leck Memorial Medal. The Medal is awarded for distinguished contributions to British scientific research and/or related scientific/technical communities, in the field of Vacuum Science and Technology.



The medal has been established to honour the memory of **Professor John Henry Leck**, known to his friends as 'Harry'. Harry was a former Chair of the IoP Vacuum Group.

The award for 2017 will be made to Prof John S Colligon at VS7 on the 11<sup>th</sup> October. John has over many years been active in the Vacuum Group and is a past Chair.

The inaugural medal awarded at VS6 in 2015 was to Dr Austin Chambers.

The 2016 medal was awarded to Dr Ron Reid.

Further details and nomination forms are available at

<http://www.vacuum-uk.org/about/harry-leck-memorial-medal/>

## The British Vacuum Council



The Institute of Physics is a member of the British Vacuum Council and nominates members of the Council.

The web site contains the BVC mission statement, remit, activities, events, members, the current committee, and a whole lot more! There is a leaflet to download, explaining the purpose of the BVC, that can be folded into a third the size of A4 and can be used at conferences and meetings for delegates to read. Additionally, there is a PowerPoint™ presentation of 'What the BVC is and what it does'. This can be further used as an educational tool to give a brief introduction to the history and 'workings' of the BVC.

The BVC offers two prizes annually; The British Vacuum Council Senior Prize (with associated John Yarwood Memorial Medal) and the British Vacuum Council Junior prize (which comprises the BVC Medal and C.R. Burch Award). Within the web-site there are lists of former recipients and details of how to nominate a candidate for a current prize. Nomination is always open which means that, if the deadline is missed one year, the nomination can be submitted the following year for consideration by the Committee. See it all here <http://www.british-vacuum-council.org.uk/>

Please consider making a nomination.

The BVC is your link to IUVSTA (The International Union for Vacuum Science, Technique and Applications), and the web-site is an ideal way to trace this link. The site can directly link you electronically to the IUVSTA web site. The IUVSTA Divisional Representatives can be found, who are your link to IUVSTA activities within your field, via the web-site <http://iuvsta.org/>

*Alan Webb*

## British Vacuum Council Report

There were again no nominations for the junior prize this year, but several for the senior.

This was won by Prof Morgan Alexander of the University of Nottingham for his work on the ground-breaking development of high throughput surface characterisation which has created a new era of high throughput biomaterials discovery. This seminal research has led to the discovery of a new class of materials with superior properties that resist bacterial cell

attachment and biofilm formation and novel materials for the control of pluripotent stem cell expansion and differentiation.

The award will be presented at the AVS in Tampa in early November 2017.

## **Vacuum Roadshow 2017**

The BVC visited the Vacuum Roadshow 2017 on Wednesday 14h June 2017 at the Technology and Innovation Centre, part of The University of Strathclyde, Glasgow

Alan Webb reports:

The centre at which the roadshow was staged is just two years old and is well equipped with exhibition space, meeting rooms and quiet areas away from the exhibition for discussion. It is situated a short walk from George Square in the heart of the Glasgow city centre.

This is 'strictly' The Photonex and Vacuum Road show. The Photonex show, as with that at the Ricoh, has been running longer than the combined event.

The Scottish event has been running 4 years, changing each year between east and west - Edinburgh and Glasgow and, only the second year, the event has been combined. Thus, this is the first time the Vacuum meeting has been staged in Glasgow, so a direct comparison just with last year may be applicable.

I learnt that there were about 240 preregistered attendees, which exceeded the entire attendance for the whole day in Edinburgh last year.

Besides the 34 exhibitors (optics and vacuum), there were three 'technical' programmes that started around lunch time and went on through the afternoon.

Last year the afternoon was busier than the morning, possibly due to the presentations. The optics and vacuum programmes were mainly, but not exclusively, presentations by the exhibitors. The third was an all-afternoon session organised by Fraunhofer UK.

There were just seven exclusive vacuum companies, eight other companies suggested they had a foot in both photonics and vacuum technologies. Unlike at the Ricoh, where the Vacuum and Photonics stands are roughly grouped together, in Glasgow they were intermingled.

I arrived just after 10 am and speaking with the vacuum company suppliers, they already had more visitors than at the entire show at Heriot Watt last year. Through the morning the attendance swelled

considerably.

I spoke with Laurence Devereux, the event director, and although disappointed by last year's attendance, was very 'upbeat' at Glasgow. Although not official, he said that the show next year may well be 'in the centre' of Edinburgh.

Representing the BVC, I asked if I could leave some of our leaflets on 'the literature table', having no designated stand at this show, to which he agreed. This prompted him to look at his exhibitors' plan for the Ricoh Exhibition. Although he could not designate a stand to the BVC at present, as he had paying 'customers' still coming in, he did say that he would include us on the Exhibitors' List on the web site, such that we could start planning for the event. By doing this, it is understood that we, the BVC, should start inviting visitors to the exhibition.

My 30-40 BVC leaflets on the literature table had dwindled to less than 10 by the time I left just after 2pm to go and catch my flight.

For some of the exhibitors, it was their first time at the Glasgow exhibition, and they were saying that they liked Glasgow better than last year – not a surprising conclusion, as they had more enquiries and potential customers. Although a one day show, the exhibitors stay overnight either before and or after the event, making the event venue a bit more important to them, rather than just the numbers attending.

Although the attendance numbers were low at both the Roadshow in Edinburgh and at Vacuum Expo in Coventry last year, the exhibitors thought that, on the showing in Glasgow, potential contacts and hence orders could be on the up.

We, as the BVC, should still monitor the roadshow, and now, due to the visit, we have a stand at the Ricoh this year.

My 4 hours spent at the exhibition-show represented a 16 hour day, something that demanded a good deal of planning

## **Vacuum Expo 2017**

The BVC will again have a stand at Vacuum Expo 2017, taking place on Wednesday 11<sup>th</sup> and Thursday 12<sup>th</sup> October. The stand will have information on the running of the BVC with leaflets and contact cards, together with information on the Prizes and how to nominate potential candidates. There will also be copies of 'Vacuum Focus', the supplement within Physics World, only available in 'hard copy'.

## **Report to IOP Vacuum Group and Early Career**

## Researchers Fund

Dr Saim Memon



Event: CISBAT 2017 (Internal Conference on Future Buildings & Districts-Energy Efficiency from Nano to Urban Scale)

Place: EPFL, Lausanne, Switzerland

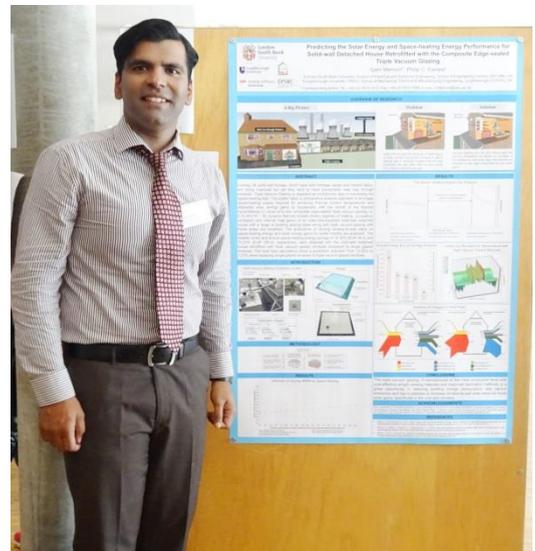
Date: 6-8 September 2017

Outcome: Saim Memon, Philip C. Eames, Predicting the solar energy and space-heating energy performance for solid-wall detached house retrofitted with the composite edge-sealed triple vacuum glazing, Energy Procedia, Volume 122, September 2017, Pages 565-570, ISSN 1876-6102, <https://doi.org/10.1016/j.egypro.2017.07.419>.

<http://www.sciencedirect.com/science/article/pii/S1876610217332253>)

Keywords: Vacuum glazing; Solar Energy; Building; Thermal Modelling; Energy Savings

This international research conference was focussed on energy efficiency and the use of solar energy in the built environment in which the smart vacuum based window technology for the sustainable building envelope is of particular interest and a conference paper presented on 'Predicting the Solar Energy and Space-heating Energy Performance for Solid-wall Detached House Retrofitted with the Composite Edge-sealed Triple Vacuum Glazing' is authored by Dr Saim Memon from London South Bank University and



Prof Philip C Eames from Loughborough University. The research presented on Triple-Vacuum-Glazing which is regarded as evolutionary step in minimising the space-heating loss. This paper took a comparative analysis approach to envisage space-heating supply required for achieving thermal-comfort temperatures and attainable solar energy gains to households with retrofit of composite edge-sealed triple-vacuum-glazing. Predictions of varying window-to-wall ratios on space-heating energy and solar energy gains for winter months were analysed.

The notable winter and annual space-heating energy savings of 14.58% and 15.31%, respectively, were obtained with solid-wall detached-house retrofitted with triple-vacuum-glazed windows compared to single-glazed-windows. The heat-loss calculations show a prominent reduction from 12.92% to 2.69% when replacing single-glazed windows to triple-vacuum-glazed windows.

This conference was hosted by Prof Jean-Louis Scartezzini from Solar Energy and Building Physics Laboratory, EPFL, Lausanne, Switzerland. The scientific partners are Cambridge University UK, MIT USA, IBPSA Swiss Chapter and Swiss Competence Centre for Energy Research 'Future Buildings and Districts'. This conference offered a dynamic international platform for scientific exchange in fields ranging from nanostructured materials for renewable energy applications to urban energy systems. It was designed as a platform for interdisciplinary dialog and presentations of innovative research and development in the field of sustainability in the built environment, the conference covered a wide range of subjects from solar nanotechnologies to the metabolism of urban districts.

There was a special workshop and round table discussions on 'Science Meets Industry' where I had an opportunity of learning from outstanding scientists such as: Prof. Mathias Sulzer, Head SCCER FEEB&D, University of Geneva, on Future Energy Efficient Buildings and Districts; Dr Andreas Schueler, EPFL, on Efficient Building Envelopes and his group scientific achievement from an idea to large scale industry product (TRL 1 to TRL 9).

After the workshops I had an opportunity to visit scientific laboratories and site tours such as Building Integrated PV-Urban Hub and Solar Nanotech & Urban Microclimate laboratories where specifically I learned the latest research on electrochromic smart glazing technologies, micro-mirror based glazing technologies and multi-coloured nano glazing coating technologies.

This research conference is a great success with attendees from all over the world where I met many experts working on vacuum coating and glazing technologies and have already started developing ideas for future collaboration.

IOP Vacuum Group logo and its support are acknowledged on the poster and during presentation.

## **VACUUM Japan**

Andrew Chew reports:

The 39th Vacuum Technology Exhibition VACUUM 2017, took place in Yokohama, Japan from 6th to 8th September. This annual event is organised by the Japan Vacuum Industry Association and the Vacuum Society of Japan. With ~ 50 exhibitors the major global vacuum equipment manufacturers were represented as were a range of other regional suppliers mainly from Japan, China, Taiwan and South Korea. Additionally a range of interesting 'non-vacuum' exhibitors participated including 3D printers.

A relatively large 'Education Area and Fun Zone' had information on the International Linear Collider and 'promotion' for the proposal of its location in the Kitakami Mountains area of Japan.

A small number of posters included submissions from some of the large research institutes in Japan including KEK, CNT, SLIT-J and NIMS. Others specifically discussed NEG pumps.

Information and communication was primarily in Japanese and secondly English. Talks were well attended (70 persons) and given in Japanese though AC gave a translated presentation on Evolution of vacuum pump requirements in Analytical Instrumentation Applications and Large Scale High Energy Physics Facilities.

A very well organised and interesting event – well worth attending

## **Forthcoming events**

Vacuum Based Components for Built Environments, half day meeting on 15<sup>th</sup> November 2017, London (date and venue to be confirmed).

## **Committee 2017-2018**

### **Chair**

Dr Ronald Reid CEng CPhys FInstP

### **Secretary**

Mr Robert Livesey CPhys FInstP

### **Treasurer**

Dr Gianfranco Claudio CPhys MInstP, University of Loughborough

### **Ordinary Members**

Dr Alan Webb, CPhys FInstP

Dr Hazel Assender CPhys MInstP, University of Oxford

Dr Oleg Malyshev, MInstP, STFC Daresbury Laboratory

Dr Yueping Fang, MInstP, University of Ulster

Dr Andrew Chew, MInstP, Edwards Ltd

Dr Saim Memon MInstP, London South Bank University

**Coopted Members**

Mr Robin Hathaway, SS Scientific Ltd

Dr Gordon Jones, MInstP, Waters Corporation

## Join the Vacuum Group

The Group welcomes new members.

If you are already a member of the IoP, then go to your MyIOP page and simply sign up. **It will not cost you anything extra!** Alternatively follow the instructions on [http://www.iop.org/activity/groups/page\\_38363.html](http://www.iop.org/activity/groups/page_38363.html)

If you are not yet a member of the IoP then go to <http://www.iop.org/membership/index.html> and follow the links there to get full information.

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This newsletter is also available on the web and in larger print sizes

The contents of this newsletter do not necessarily represent the views or policies of the Institute of Physics, except where explicitly stated.

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