

NES Workshop Bath May 2011

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June 8, 2011 (HE59). The latest in a series of workshops on Nanoscience and Engineering in Superconductivity (NES) funded by the European Science Foundation was held at the Bath Spa Hotel in Bath, U.K. from 3-7th May 2011. The 3-day Workshop was planned close to the centenary of the discovery of superconductivity by Heike Kamerlingh Onnes in 1911 and incorporated events to celebrate this anniversary. The workshop opened with a fascinating talk by Peter Kes who has been undertaking detailed research into Kamerlingh Onnes original laboratory notebooks. Attendees were relieved to learn that the discovery is noted in Onnes' own notebook and

suggestions that Onnes was anything other than the driving force behind the discovery are not supported by the original source material. After Peter's talk the audience was left with renewed respect for the inventiveness of and challenges face by our predecessors.

As with previous workshops in this series the themes of Mesoscopic Superconductivity and Vortex imaging were interpreted broadly to provide a lively and interesting program of talks and posters. The conference opened with a talk by Joffre Guitierrez of the Catholic University of Leuven concerning the effect of the multiband nature of MgB₂ on its vortex physics. After an interesting talk a lively debate ensued which revealed that there is little consensus in the community on whether or not "Type 1.5" superconductivity is a distinct vortex state.



Figure 1 The Fe-pnictides were one of the main topics discussed at the meeting.

Vortex imaging was, as before, strongly represented. One highlight was work from the Weizman institute presented by Eli Zeldov who reported the successful creation of a nanometer scale SQUID on a quartz crystal tip. Interesting new techniques discussed included a method for analysing scanning tunnelling spectroscopy (STS) data to allow indirect magnetic imaging to be performed by Jose Rodrigo. In case attendees had forgotten, Ted Forgan treated them to a comprehensive overview of how neutron scattering remains one of the most powerful techniques for studying the structure of the Flux Line Lattice. Ted also described his group's new side

access high field cryostat which leads a peripatetic life between beamlines across Europe, when not being used to levitate fine wine!

Recent developments in understanding of the Fe-pnictides superconductors were discussed. Tony Carrington from the University of Bristol provided a comprehensive introduction to the complex "fermiology" of these materials. Other speakers spanned the whole field from the pure physics of fermiology through vortex dynamics, vortex imaging all the way to a discussion of how properties of vortices at grain boundaries will affect potential practical applications of the pnictides. It was clear that the field of pnictides continues to develop at a fast pace with the understanding of vortices key to the potential development of these materials into practical applications.

Cuprate superconductors, while perhaps less in the limelight since the discovery of the pnictides, were well represented at the meeting. One strong theme was the power of micro and nano-fabrication in allowing innovative experiments. Results were reported on the movement of heat pulses in nanoscale current tracks in YBCO, the microwave properties of the vortex lattice in YBCO and Non-Ohmic resistivity and Hall conductivity in the pseudogap regime in underdoped YBCO.



Figure 2 The Bath Spa Hotel provided a sumptuous setting for the meeting

A new and highly active field covered was that of spin triplet superconductivity. Mark Blamire showed recent results on triplet supercurrents in Nb/Co/Nb tunnel junctions. The addition of a conical magnet, holmium, at the interfaces appears to allow long range triplet supercurrents to flow. Jan Aarts also reported persistent triplet supercurrents in the half metal CrO₂. Steve Lee then showed how neutron and muon scattering experiments can be used to probe the physics of superconductor/ferromagnetic systems, especially at buried interfaces.

The conference wrapped up with two sessions on superconducting devices. The first focussed on Josephson junctions. Notably Sergey Savel'ev explained how Josephson junctions can be used as a meta-material where electromagnetic response is controllable by quantum elements. In the final session the discussion covered the use of Josephson junctions and flux vortices to overcome the so-called "THz gap" in our ability to create and detect electromagnetic radiation. In a context of a meeting which featured a talk from a representative of the UK national research council on the importance of research impact it was encouraging to learn how vortex physics can respond to technological needs in the area of THz radiation.

In addition to a packed oral program the conference featured a busy poster session with a wide range of presentations covering the whole range of conference topics. The posters were of a very high quality making the decision of the poster prize judges very difficult. In the end the poster prize, funded by the IOP Superconductivity group, was awarded to André Müller of the University of Bath for his work on Micromagnetometry of electrodeposited core-shell crystals with three runners up receiving prizes and commendations.

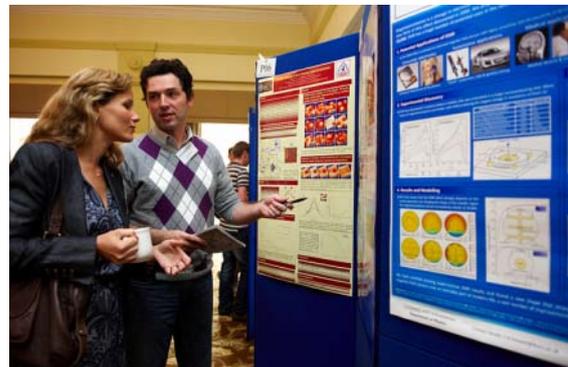


Figure 3 The poster prize committee deep in discussion.

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We provide the [Final Programme](#) and the [Abstract Book](#) of the Workshop.



Figure 4 The participants before the conference dinner