SUPA Annual Gathering 2018

Early Career Researcher Presentation Report

Our star and solar flares

Dr Natasha Jeffrey, University of Glasgow

Natasha is a Research Associate in the Astronomy and Astrophysics Group in the School of Physics and Astronomy at the University of Glasgow, conducting research on solar flares. She received her Ph.D. from Glasgow in 2014 and is an elected member of the UK Solar Physics Council. She was recently awarded both the European Geophysical Union (EGU) Solar-Terrestrial (2018) and European Physical Society (EPS) Solar Physics Division (ESPD) (2017) Early Career Researcher Prizes for her part in the "warm-target" model, a model that finally helps us to constrain the properties of flare-accelerated electrons after fifty years.

Natasha's talk described her studies on solar flares, large releases of energy in the Sun's atmosphere and a key component of space weather which affects human activity. She explained that our Sun is a small "G-type" star with a magnetic activity that makes it very interesting. Solar flares are the dramatic product of magnetic energy release and conversion via magnetic reconnection. A medium solar flare releases about 1032 erg (where 1 megaton of TNT = 4x1022 erg). Turbulence plays a vital role in transferring energy from magnetic fields, and X-rays are a prime and direct diagnostic tool of flare-accelerated electrons. Natasha informed the Gathering of the Parker Solar Probe that will be launched from Florida on the 31st July 2018 on a Delta IV rocket. This mission will travel to within 4 million miles of the Sun, facing heat and radiation like no spacecraft has before…

Natasha is involved in several different outreach activities having talked about solar physics at different local astronomy groups including Airdrie, Troon and Inverclyde Sky Watchers, as well as supporting the Institute of Physics (IOP) Girls in Physics events.

High-dimensional entanglement: a personal journey

Dr Lucia Caspani, University of Strathclyde

Lucia has held a joint appointment with the Institute of Photonics at the University of Strathclyde and the Fraunhofer Centre for Applied Photonics since 2017, as a research fellow first and then as a Chancellor's Fellow and Lecturer in the Department of Physics from June 2018. She received her Bachelor, Master and PhD Degree (2010) in Physics from Insubria University (Como, Italy), where she theoretically investigated the spatiotemporal structure of entanglement in second-order nonlinear optical media. She then spent 3 years as a postdoctoral fellow at INRS-EMT in Canada where she switched to experimental research on entanglement for applications to quantum communication and computing. From 2014 she held a Marie Curie Fellowship at Heriot-Watt University

Lucia's talk tracked her own transition from theorist to lab scientist. She now exploits integrated optics developed for the telecom industry, making use of the availability of a large choice of devices and components, and the frequency degree of freedom already widely exploited for optical communications. She first explained the difference between classical and quantum correlations with spin ½ particles and demonstrated the opportunities of quantum technologies for future applications

in computing, secure communications and metrology using light. The use of photons offers low decoherence, widely available components, optical fibres for distribution networks and entanglement via nonlinear optical interactions. Her current research is developing compact sources of quantum states of light for quantum metrology and quantum information including on-chip high-dimensional frequency entangled states involving lasers and fibre ring resonators utilizing the variables of space, time, frequency and optical angular momentum.

From MeV to TeV: event simulation and model-fitting at the LHC and beyond

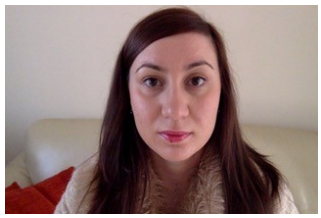
Dr Andy Buckley, University of Glasgow

Andy is a Lecturer in particle physics in the School of Physics and Astronomy at the University of Glasgow, and holder of a Royal Society (London) University Research Fellowship carrying out modelling of large hadron collider (LHC) experiments at CERN. Originally from Belfast, he completed both his undergraduate and PhD degrees at the University of Cambridge - the latter on preparations for the LHCb collider physics experiment at CERN. Switching direction, his first postdoctoral work was in Durham on Monte Carlo simulation of collider events, during which he first developed tools and methods widely used at the LHC. This was followed by a SUPA Advanced Fellowship at the University of Edinburgh on event simulation and measurement of QCD and Higgs boson phenomena, and by 2 years at CERN in charge of event modelling for the ATLAS experiment.

Since moving to the University of Glasgow, Andy has been leading LHC measurements of b-quark dynamics, and working on "synoptic" reinterpretations of LHC data in frameworks of physics beyond the Standard Model.

Optical sensing and manipulation for physico-chemical and biomedical applications

Dr Stella Corsetti, University of St Andrews



Stella is a Research Fellow in the Optical Manipulation Group in the School of Physics and Astronomy at the University of St Andrews, working on the development and application of optical and spectroscopic techniques for physicochemical and biomedical applications. She graduate from the University of Rome 'La Sapienza' with a BSc in Biomedical Engineering and MSc in Bio-Nanotechnology Engineering and gained a PhD in 2016 in Chemical Engineering at the University of Aberdeen in a project involving the use of single particle manipulation and spectroscopic techniques to study hydrocarbon phase transitions. She subsequently carried out research in the College of Life Sciences at the University of Dundee and at Lancaster University before moving to St Andrews.

Stella's talk demonstrated the wide applicability of optical and photonic techniques in a range of applications areas. The presentation exemplified the opportunities of interdisciplinary research by working within different disciplinary environments with a common thread of applying and combining clever optical techniques such as optical trapping and manipulation, Raman spectroscopy, fluorescence, and the shaping of light beams. Her research has progressed through studies of aerosols and hydrocarbon droplets for petroleum applications to medical applications involving DNA molecules, prostate cancer cells and intracellular drug detection, and recently employing light sheet fluorescence spectroscopy for histopathology.

Soft materials for energy applications

Dr Job Thijssen, University of Edinburgh

Job has been conducting postdoctoral research in the School of Physics and Astronomy at the University of Edinburgh since 2007 and was awarded a Chancellor's Fellowship in 2014 starting his own group focussing on energy applications and coatings. Job completed his PhD in the Netherlands, at Utrecht University, on the characterization of photonic colloidal crystals. He moved to the Edinburgh Soft Matter Physics group in 2007 as a PDRA. He was awarded a Royal Society of Edinburgh / BP Trust Personal Research Fellowship in 2010, to start exploring the use of soft materials in energy-storage applications. He currently leads the Edinburgh effort in the EPSRC networking centre "Multiscale Tuning of Interfaces and Surfaces for Energy Applications".

Job described soft matter as anything “squidgy or gooey”. Soft materials (plastics, opals, tooth paste…) can often be liquid-like or solid-like depending on the time scale probed. Advances in batteries and fuel cells are needed for many applications in the modern world including the switch to electric cars. Job’s research involves optimisation of structures, morphologies and compositions at interfaces for applications in batteries and fuel cells. This provides another great example of interdisciplinary research with his work being conducted in collaboration with chemists at St Andrews, Oxford and other universities. Job’s advice to PhD students and PDRAs is (a) consider more than one career path, (b) consider a career stage abroad, (c) accept and learn from failures, (d) ask for application feedback, and (e) take advantage of career stage CPD.