

MPS Research Update

January - March 2019

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Staff have had mentions in the following press

BBC News

Professor Peter Kruger was quoted on the BBC News webpage in an article discussing quantum sensing. <https://www.bbc.co.uk/news/business-47294704>

Scientific American

Antony Lewis provided commentary on the article discussing the “Best-Yet Measurements Deepen Cosmological Crisis”. <https://www.scientificamerican.com/article/best-yet-measurements-deepen-cosmological-crisis/>

Sky News

Dr Alessia Pasquazi and colleagues from the Emergent Photonics Lab (EPic Lab) were featured on the Sky News webpage. The article discusses the breakthrough in developing atomic clocks, which could replace the GPS and Galileo systems and mean accessing a satellite signal would be unnecessary. <https://news.sky.com/story/british-scientists-make-breakthrough-in-gps-and-galileo-replacement-11663018>

University of Sussex

A press release regarding Konstantin Blyuss’ recently published paper in the *Frontiers in Plant Science*. <https://www.sussex.ac.uk/news/media-centre/press-releases/id/48552>

Awards and Recognitions

Dr Lily Asquith has been selected to join the Royal Society Science Policy Expert Advisory Committee (SPEAC). SPEAC is responsible for the overall direction of the Royal Society’s policy work and contributes to horizon scanning, scoping new projects, and sharpening its impact on science policy.

Professor Jacob Dunningham, Head of Department, has been appointed to the Institute of Physics Council's Awards Committee.

Jose Verdu Galiana. A DSTL PhD studentship for the development of "microwave quantum illumination with trapped electrons." The award is a contribution of £ 118,471 from DSTL plus an extra contribution of £ 40000 from Leonardo MW Ltd.

Professor Peter Kruger has been awarded an Innovate UK with their existing industrial project partner CD02 Ltd. Although the Sussex participation is only £35,406, they have managed to include several new companies and Strathclyde University in this collaboration.

Marco, Alessia and Juan have been awarded with the ERC – Proof of Concept.

Simon Peeters. The EPP group (PI Simon Peeters) has been awarded the STFC Consolidated Grant of £1.7M. This award provides the main funding for the group of 11 academics for the next three years. This award represents the same amount of money per year as was awarded previously. In the current funding climate, this is viewed as a great success and a recognition of the high-quality research output by the group.

Areas of Knowledge Exchange

Max Jensen and Spyros Skarvelis-Kazakos (Sussex Engineering) had a stand at the Rushlight show on discussing the results of the Innovate UK project to industry:

<https://www.rushlightevents.com/rushlight-show/>

(30.01.19).

Max Jensen gave a presentation to an R&D team of EDF Energy on optimal control for energy storage (22.01.19).

Talks delivered

"Cosmology with primordial black holes"

Invited talk by Chris Byrnes at the Sesto cosmology workshop in Italy.

"Discover the Sky by Longest Wavelength with Small Satellite Constellation"

Invited lecture by Anastasia Fialkov at the "Discover the Sky by Longest Wavelength with Small Satellite Constellation" meeting, International Space Science Institute Beijing, China, January 2019.

"Dynamical Systems Applied to Biology and Natural Sciences"

Invited talk by Yulia Kyrychko at 10th International Conference, Naples, 3 - 6 February 2019 and at Complex Systems Seminar Series, Queen Mary University of London, 29 January 2019.

"Dynamic Programming for Finite Ensembles of Nanomagnetic Particles"

Presentation given at OCIP by Max Jensen.

"Numerical Methods for Optimal Control and Inverse Problems"

Workshop given by Max Jensen, 11 – 13 March, 2019.

"Special Functions and Orthogonal Polynomials: Some Spectral-Geometric Problems Pertaining to Lie Groups and their Symmetric Spaces"

Ali Taheri was a plenary speaker at the International Conference on Orthogonal Polynomials, Special Functions and Computer Algebra, 5-7 March 2019, Jaipur, Rajasthan, India.

"Cosmology with primordial black holes"

Invited talk given by Christian Byrnes at the Sesto cosmology workshop in Italy, March.

"Primordial black holes and how to produce them"

Christian Byrnes PhD student Pippa Cole gave an invited seminar talk at ICG, Portsmouth (March) and Imperial College London (March).

Yulia Kyrychko - Invited seminar talk at the University of Portsmouth, April 2019

Anastasia Fialkov has given talks at seminars located in Beijing, QMUL, The Geneva Observatory and at a Collaborative meeting in Cambridge (REACH).

Kathy Romer - IoP talk at Surrey University

Antony Lewis - Talk given at MSSL seminar and invited speaker at the Gradnet meeting Southampton

Seb Oliver - SoC for Monsters of the Universe the most extreme star factories. 4-8 Feb, Leiden, Netherlands; SoC for Machine Learning and Artificial Intelligence applied to Astronomy RAS meeting at Royal Society 8th March

Illian Iliev - SoC for Machine Learning and Artificial Intelligence applied to Astronomy RAS meeting at Royal Society 8th March

Anastasia Fialkov has given talks at:

- Cosmology on Safari 2019, KwaZulu-Natal, South Africa, March, 2019
- Strasbourg University, Seminar, March 2019 (France)
- GRAPPA Seminar, the Center of Excellence in Gravitation and Astroparticle Physics at the University of Amsterdam, March 2019 (Netherlands)
- University College London, Seminar, March 2019 (UK)

Impact

Seb Oliver. DISCUS approved; DISCUS are main partners in two projects that have been funded by STFC Food Network:

- FACYNation: SIM Farm 2030 Led by Jake Bishop at University of Reading
- "Remote sensing led monitoring and forecasting of global banana production" Led by Dan Bebber at University of Exeter

Significant Research Outcomes

Dr Andrea Banfi and collaborators have provided the first ever determination of the coupling of strong interaction where calculable theory uncertainties are less than those due to the poorly understood phenomenon of hadronisation (<https://arxiv.org/abs/1902.08158>).

SNO+ has published their first two physics papers. After a long development and installation period, converting the Sudbury Neutrino Observatory (SNO) to the new SNO+ experiment, SNO+ has published their first two physics papers (<https://snolab.ca/news/2019-01-14-sno-release-new-results>).

Sussex scientists one step closer to clock that could replace GPS and Galileo

Researchers in the Emergent Photonics Lab (EPic Lab) have made a breakthrough to a crucial element of an atomic clock – devices which could reduce our reliance on satellite mapping in the future – using cutting-edge laser beam technology. Their development greatly improves the efficiency of the lancet by 80%.

Konstantin Blyuss's paper on practical applications of his theoretical work published in Frontiers on Plant Science (world's most cited journal in the research area of Plant Science) on the 17 April: <https://www.frontiersin.org/articles/10.3389/fpls.2019.00483/full>

Other news

- Gisela Hafezparast reported a busy submission period including 16 submissions, 7 of which were EU projects (see attached spreadsheet). Two STFC consolidated grants were submitted; the University of Sussex Astronomy Consolidated Grant 2020-2023 and the South-Eastern Particle Theory Alliance Sussex – RHUL – UHL- 2020-2023.
- Sussex takes cosmic ray detection to the Observatory Science Centre at Herstmonceux. In January a team of our scientists led by Dr Fabrizio Salvatore and Dr Kate Shaw, installed one of the HiSPARC cosmic ray detectors at the Observatory Science Centre at Herstmonceux.
- Bertram Duering was the organiser of a minisymposium "Recent advances in PDE models describing emergent behaviour and collective dynamics". This was held at the British Applied Mathematics Colloquium 2019, 24-26 April 2019, University of Bath, UK
- Ali Taheri was an Invited Guest Editor to:
 - 1) Orthogonal Polynomials and Special Functions OPSF2019.
 - 2) Proceedings of the First International Conference on Orthogonal Polynomials, Special Functions, and Computer Algebra: Applications in Engineering.
 - 3) To be published by Springer and DE GRUYTER, 2019 respectively.
- Kathy Romer to host the DES Fall Meeting at Sussex in November 2019
- Stephen Wilkins was invited to Sesto conference (Jan 2019) - *The Growth of Galaxies in the Early Universe*
- Anastasia Fialkov attended research visits to Israel (Tel Aviv), Montreal (Canada), Cambridge (UK), Strasbourg (France).
- Research Fellow Matthew Large has been offered a place at the 69th Lindau Nobel Laureate meeting in Germany in June – July. This meeting is a unique international forum for scientific exchange to be attended this year by at least 40 Nobel Laureates.

Publications deposited in SRO

Mathematics

- 5 papers accepted
- 19 papers published

Physics and Astronomy

- 3 papers accepted
- 34 papers published

Grant Report

PI/Co-I	Principal Funding	Funder Programme	Project Title	Overall Applied Amount (£)
Submitted				
Michael C Coulon	European Union	H2020 - Marie Curie ITN: European Training Network (ETN)	SWING: Mathematical Modelling and Scientific Computing for Future Energy Markets	244,480
Peter Thomas	European Union	H2020 - Marie Curie ITN: European Training Network (ETN)	COSMO: Cosmology with Galaxy Clusters: Present and Future	0
Veronica Sanz	European Union		HIMALAYA: High energy physics inspiring MACHINE Learning for Aspiring Young Analysts	244,481
Ilian Iliev	European Union	H2020 - Marie Curie ITN: European Training Network (ETN)	EXASIM: Exascale numerical simulations for future astronomical surveys	0
Marco Peccianti	European Union	H2020 - Marie Curie ITN: European Training Network (ETN)	MIMOSAE - Multifunctional Meta-Optics for Small footprint reconfigurable systems	244,480.5
Marco Peccianti	European Union	H2020 - ERC Proof of Concept	THINK: TeraHertz emitting IN	60,482
Peter Kruger	European Union	H2020 - Marie Curie ITN: European Training Network (ETN)	Atines: Atomtronic Inertial Sensing	122,240.5
Peter Kruger	EPSRC-ENGINEERING & PHYSICAL SCIENCES RESEARCH COUNCIL	None	Magnetic imaging of axonal transport in motor neuron disease	457,356
Anotida Madzvamuse	EPSRC-ENGINEERING & PHYSICAL SCIENCES RESEARCH COUNCIL	GCRF - Building capacity to tackle global development challenges through mathematical sciences research	UK-Africa Postgraduate Advanced Study Institute in Mathematical Sciences (UK-APASI)	14,891.2

Nicholas Simm	LONDON MATHEMATICAL SOCIETY	LMS - Celebrating New Appointments - Scheme 9	Celebrating New Appointments	591
Minmin Wang	LONDON MATHEMATICAL SOCIETY	LMS - Celebrating New Appointments - Scheme 9	Celebration of New Appointments	1,036
Peter Kruger	EPSRC-ENGINEERING & PHYSICAL SCIENCES RESEARCH COUNCIL	EPSRC Building Collaboration at the Physics of Life Interface	Imaging for neural activity throughout the brain using Electrical Impedance Tomography and SQUID or OM Magnetoencephalography (MEG)	209,988
Antoine Dahlqvist	LONDON MATHEMATICAL SOCIETY	None	Celebrating of New Appointments	1,011
Ilian Iliev	STFC-SCIENCE AND TECHNOLOGY FACILITIES COUNCIL	STFC Astronomy Consolidated Grant 2020-2023	University of Sussex Astronomy Consolidated Grant 2020-2023	414,878.72
Peter Kruger	EPSRC-ENGINEERING & PHYSICAL SCIENCES RESEARCH COUNCIL	EPSRC QuantERA 2019	JAGUAR: Junctions And GUIDes for Atomtronic ciRcuits	68,796.5
Stephan Huber	STFC-SCIENCE AND TECHNOLOGY FACILITIES COUNCIL	STFC 2019 Particle Physics Review of Theory Consolidated Grants	South-Eastern Particle Theory Alliance Sussex - RHUL - UCL 2020-2023 - Sussex node	417,551.85
Xavier Calmet	Royal Society	Newton Mobility Grant	Quantum gravity and the problem of ghosts and instabilities	12,000
Jacob Dunningham/Jimenez	ROYAL ACADEMY OF ENGINEERING (BEIS)	RAE UK IC Postdoctoral Research Fellowship	New frontiers in sensors: advancing quantum metrology for ground-breaking applications	200,249
Pierre Hanzard	ROYAL ACADEMY OF ENGINEERING (BEIS)	RAE UK IC Postdoctoral Research Fellowship	Development of ultrafast characterisation techniques for optical frequency combs	200,193
Winnie Hensinger/Bostock	ROYAL ACADEMY OF ENGINEERING (BEIS)	RAE UK IC Postdoctoral Research Fellowship	RF and microwave trapped ion quantum sensor for counter-eavesdropping, explosives detection and radar	200,216

Istvan Kiss	Australian Research Council	AUSRC Discovery Program	Identifying network properties that govern dynamically spreading processes	34,200
Peter Kruger	EPSRC	EPSRC ISCF Faraday Battery Challenge: Battery Characterisation Call	Non-invasive electric vehicle current density mapping through magnetic field imaging	291,998
Matthew Large	Bill & Melinda Gates Foundation	GAT Grand Challenges Explorations Scheme	Ultra-cheap, Low-Power Wearable Medical Sensors for Infants Based on Graphene	68,601
Peter Lynch	Bill & Melinda Gates Foundation	GAT Grand Challenges Explorations Scheme	Emerging Technologies for New Solutions in Global Health Priority Areas – Printable Copper Hydroxide Glucose Sensor	68,600
Anotida Madzvamuse	Leverhulme Trust	Leverhulme Research Grant	A continuum differential equation formalism for modelling of DNA replication	318,335
Alessia Pasquazi/Rowley	ROYAL ACADEMY OF ENGINEERING (BEIS)	RAE UK IC Postdoctoral Research Fellowship	Artificial intelligence solutions for portable optical frequency combs	198,976
Fabrizio Salvatore	European Union	H2020 - RISE	Big data Analysis innovation and Acceleration for Medicine and Physics	84,642
Manoj Tripathi	Bill & Melinda Gates Foundation	GAT Grand Challenges Explorations Scheme	Curcumin functionalized silk fibroin as an edible coating for preserving food stock at ambient conditions	68,601
Iacopo Vivarelli	Royal Society	Newton International Fellowship	Probing Dark Matter using tau leptons with the ATLAS	100,500
Iacopo Vivarelli	European Union	H2020 - RISE	Future Experiments seek Smart Technologies (FEST)	16,355
Forecasted				
Andrea Banfi	STFC	Ernest Rutherford Fellowship	From Higgs physics to dark matter searchers a quest for precision	509,503
Winnie Hensinger	US Department of Defence	Research Grant	Grant extension proposal - Development of microwave ion chip entanglement architectures for quantum technologies	213,108
Marco Peccianti	European Union	Proof of Concept	THINK: TeraHertz emitting INK	120,964
Awarded				
Alan Dalton	ARCHENT NANOTECHNOLOGIES, S.L. (ARCHENT NANOTEC)	Consultancy	Training in automated spraying of silver nanowires	2,240

Seb Oliver	STFC	STFC Food Innovation Network	STFC Food Innovation Network - Vertical Farming Follow On	6,500
Seb Oliver	STFC	STFC Food Innovation Network	STFC Food Innovation Network - FACYNation Follow On Funding	6,500

