

MPS Research Update

January and February 2019

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Staff have had mentions in the following press

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>)

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>)

Awards and Recognitions

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.

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

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.

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

"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.

"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.

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

Impact

No impact news reported.

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>). The Sussex group, under leadership of Dr Simon Peeters, has been very influential in the shaping of this experiment, from its early conception to the first exploitation of the data. The Sussex group has delivered a novel system for the optical calibration of this experiment.

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%.

Other news

Reported by Gisela Hafezparast

It has been a very 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.

Grant Report

PI/Co-I	Principal Funding	Funder Programme	Project Title	Overall Applied Amount (£)
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

Department of Mathematics. Publications deposited in SRO in January and February 2019

To view the paper enter the SRO ID as <http://sro.sussex.ac.uk/nnnnn>

Sussex Author	SRO ID	Status	Author(s)	Output Title	Volume Title
Cagnetti, Filippo	81805	Accepted	Cagnetti, Filippo	Rigidity for perimeter inequalities under symmetrization: state of the art and open problems	Portugaliae Mathematica
Düering, Bertram	81278	Published	Düring, Bertram; Gottschlich, Carsten; Huckemann, Stephan; Kreuzer, Lisa Maria; Schonlieb, Carola-Bibiane	An anisotropic interaction model for simulating fingerprints	Journal of Mathematical Biology
Düering, Bertram	81599	Published	Düring, Bertram; Pitkin, Alexander	High-order compact finite difference scheme for option pricing in stochastic volatility jump models	Journal of Computational and Applied Mathematics
Kiss, Istvan Z	81305	Accepted	Message, Antoine; Parisi, Georgios; Kiss, István Z; Harper, Robert; Tee, Phil; Berthouze, Luc	Functional topology inference from network events	
Merino Aceituno, Sara	81473	Accepted	Degond, Pierre; Merino-Aceituno, Sara; Vergnet, Fabien; Yu, Hui	Coupled self-organized hydrodynamics and stokes models for suspensions of active particles	Journal of Mathematical Fluid Mechanics
Scalas, Enrico	81410	Published	Ponta, Linda; Trinh, Mailan; Raberto, Marco; Scalas, Enrico; Cincotti, Silvano	Modeling non-stationarities in high-frequency financial time series	Physica A: Statistical Mechanics and its Applications
Scalas, Enrico	81576	Accepted	Leonenko, Nikolai; Scalas, Enrico; Trinh, Mailan	Limit theorems for the fractional non-homogeneous Poisson process	Journal of Applied Probability
Styles, Vanessa M	81088	Accepted	Deckelnick, Klaus; Elliott, Charles M; Miura, Tatsu-Hiko; Styles, Vanessa	Hamilton-Jacobi equations on an evolving surface	Mathematics of Computation
Wang, Minmin	81832	Published	Wang, Minmin	Height and diameter of Brownian tree	Electronic Communications in Probability
Wang, Minmin	81893	Published	Broutin, Nicolas; Wang, Minmin	Cutting down p-trees and inhomogeneous continuum random trees	Bernoulli
Wang, Minmin	81894	Published	Duquesne, Thomas; Wang, Minmin	Decomposition of Lévy trees along their diameter	Annales de l'Institut Henri Poincaré - Probabilités et Statistiques
Wang, Minmin	81895	Published	Broutin, Nicolas; Wang, Minmin	Reversing the cut tree of the Brownian continuum random tree	Electronic Journal of Probability

Wang, Minmin	81912	Published	Wang, Minmin	Scaling limits for a family of unrooted trees	Latin American Journal of Probability and Mathematical Statistics
Wang, Minmin	81913	Published	Marckert, Jean-François; Wang, Minmin	A new combinatorial representation of the additive coalescent	Random Structures and Algorithms

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Sussex Author	SRO ID	Status	Author(s)	Output Title	Volume Title
Banfi, Andrea	80505	Published	Banfi, Andrea; El-Menoufi, Basem; Monni, Pier Francesco	The Sudakov radiator for jet observables and the soft physical coupling	Journal of High Energy Physics
Barrett, Adam B	81803	Published	Barrett, Adam B; Mediano, Pedro A M	The Phi measure of integrated information is not well-defined for general physical systems	Journal of Consciousness Studies
Carron, Julien	81804	Accepted	Carron, Julien	Optimal constraints on primordial gravitational waves from the lensed CMB	Physical Review D
Di Lauro, Luigi	81570	Published	Di Lauro, Luigi	Control of dynamical regimes in optical microresonators exploiting parametric interaction	Doctoral thesis (PhD)
Falk, Elisabeth E	81333	Accepted	Anderson, M; Andringa, S; Askins, M; Auty, D J; Barros, N; Bartlett, D; Barão, F; Bayes, R; Beier, E W; Bialek, A; and 8 other(s)	Measurement of the 8B solar neutrino flux in SNO+ with very low backgrounds	Physical Review D
Falk, Elisabeth E	81456	Published	Back, A R; Clark, K J; Falk, E; Hartnell, J; Lefeuvre, G M; Leming, E J; Mlejnek, M; Mottram, M J; Nirkko, M; Peeters, S J M; and 6 other(s)	Search for invisible modes of nucleon decay in water with the SNO+ detector	Physical Review D
Falk, Elisabeth E	81818	Published	Anderson, M; Andringa, S; Asahi, S; Askins, M; Falk, E; Hartnell, J; Mlejnek, M; Nirkko, M; Peeters, S; Rigan, M; and 1 other(s)	Measurement of the 88 solar neutrino flux in SNO+ with very low backgrounds	Physical Review D
Fekete, Julia	82081	Published	Chai, Shijie; Fekete, Julia; Andersen, Mikkel F	Measuring the local gravitational field using survival resonances in a dissipatively driven atom-optics system	Physical Review A
Fernandez Lorenzo, Samuel	81274	Published	Fernandez Lorenzo, Samuel	Exploiting symmetry and criticality in quantum sensing and quantum simulation	Doctoral thesis (PhD)

Huber, Stephan J	81209	Published	Dorsch, G C; Huber, S; Konstandin, T	Bubble wall velocities in the Standard Model and beyond	Journal of Cosmology and Astroparticle Physics
Litim, Daniel F	81808	Published	Litim, Daniel F; Trott, Matthew J	Asymptotic safety of scalar field theories	Physical Review D
Lunn, Jessica C	82038	Accepted	Lunn, Jessica; Sjoblom, Amanda; Ward, Jamie; Soto-Faraco, Salvador; Forster, Sophie	Multisensory enhancement of attention depends on whether you are already paying attention	Cognition
Mondal, Rajesh	81342	Published	Mondal, Rajesh; Bharadwaj, Somnath; Iliev, Ilian T; Datta, Kanan K; Majumdar, Suman; Shaw, Abinash K; Sarkar, Anjan K	A method to determine the evolution history of the mean neutral hydrogen fraction	Monthly Notices of the Royal Astronomical Society: Letters
Navickas, Tomas	79060	Published	Navickas, Tomas	Towards high-fidelity microwave driven multi-qubit gates on microfabricated surface ion traps	Doctoral thesis (PhD)
Peeters, Simon JM	81598	Accepted	Aharmim, B; Ahmed, S N; Anthony, A E; Barros, N; Beier, E W; Bellerive, A; Beltran, B; Bergevin, M; Biller, S D; Bonventre, R; and 2 other(s)	Constraints on neutrino lifetime from the Sudbury Neutrino Observatory	Physical Review D
Rubio Jimenez, Jesus	82178	Published	Rubio Jiménez, Jesús; Dunningham, Jacob A	Quantum metrology in the presence of limited data	New Journal of Physics
Sanz, Veronica	81095	Published	Carrillo-Monteverde, A; Kang, Yoo-Jin; Lee, Hyun Min; Park, Myeonghun; Sanz, Veronica	Dark matter direct detection from new interactions in models with spin-two mediators	Journal of High Energy Physics
Sanz, Veronica	81106	Published	Davoli, Alessandro; De Simone, Andrea; Jacques, Thomas; Sanz, Verónica	Displaced vertices from pseudo-Dirac dark matter	Journal of High Energy Physics
Sanz, Veronica	81107	Published	Sanz, Veronica; Setford, Jack	Composite Higgs models after Run 2	Advances in High Energy Physics
Sanz, Veronica	81108	Published	Ferreira, Felipe; Fichet, Sylvain; Sanz, Veronica	On new physics searches with multidimensional differential shapes	Physics Letters B
Sanz, Veronica	81109	Published	Brivio, I; Gavela, M B; Merlo, L; Mimasu, K; No, J M; del Rey, R; Sanz, V	ALPs effective field theory and collider signatures	The European Physical Journal C: Particles and Fields
Sanz, Veronica	81110	Published	Ellis, John; Roloff, Philipp; Sanz, Verónica; You, Tevong	Dimension-6 operator analysis of the CLIC sensitivity to new physics	Journal of High Energy Physics
Sanz, Veronica	81111	Published	Ferreira, Felipe; Fuks, Benjamin; Sanz, Verónica; Sengupta, Dipan	Probing CP-violating Higgs and gauge-boson couplings in the Standard Model effective field theory	The European Physical Journal C

Sanz, Veronica	81112	Published	Degrande, Céline; Fuks, Benjamin; Mawatari, Kentarou; Mimasu, Ken; Sanz, Verónica	Electroweak Higgs boson production in the standard model effective field theory beyond leading order in QCD	The European Physical Journal C
Sanz, Veronica	81113	Published	Albert, Andreas; Bauer, Martin; Brooke, Jim; Buchmueller, Oliver; Cerdeño, David G; Citron, Matthew; Davies, Gavin; de Cosa, Annapaola; De Roeck, Albert; De Simone, Andrea; and 15 other(s)	Towards the next generation of simplified Dark Matter models	Physics of the Dark Universe
Sanz, Veronica	81114	Published	Dillon, Barry M; Sanz, Veronica	Kaluza-Klein gravitons at LHC2	Physical Review D
Sargent, Mark	81477	Published	Coogan, R T; Sargent, M T; Daddi, E; Valentino, F; Strazzullo, V; Béthermin, M; Gobat, R; Liu, D; Magdis, G	Suppressed CO emission and high G/D ratios in z=2 galaxies with sub-solar gas-phase metallicity	Monthly Notices of the Royal Astronomical Society
Sargent, Mark	81478	Accepted	Riechers, Dominik A; Pavesi, Riccardo; Sharon, Chelsea E; Hodge, Jacqueline A; Decarli, Roberto; Walter, Fabian; Carilli, Christopher L; Aravena, Manuel; Da Cunha, Elisabete; Daddi, Emanuele; and 6 other(s)	COLDz: shape of the CO luminosity function at high redshift and the cold gas history of the universe	The Astrophysical Journal