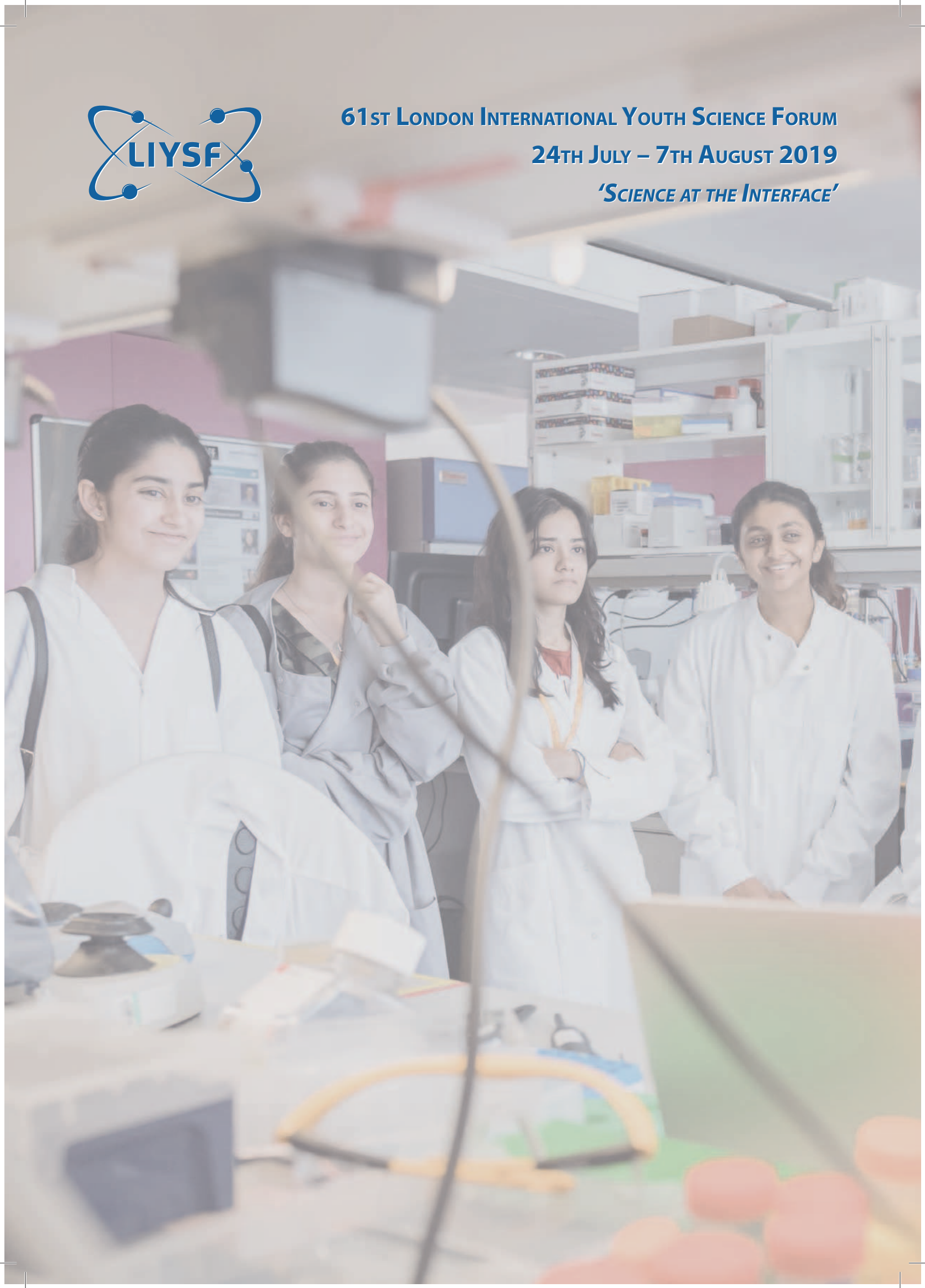
LIYSF

61ST LONDON INTERNATIONAL YOUTH SCIENCE FORUM 2019

61st London International Youth Science Forum

24th July – 7th August 2019

'Science at the Interface'



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United Nations
Educational, Scientific and
Cultural Organization

Under the patronage of
UNESCO

Founded in 1959, LIYSF aims to give a deeper insight into science and its applications, for the benefit of humankind and to develop a greater understanding between young people of all nations.

President
Professor Clare Elwell: 2018 – Present

Chairman
Mr Mike Clark: 2009 – Present

Director
Mr Richard Myhill: 2009 – Present

Founder Patron
HRH Prince Philip, Duke of Edinburgh OM KG 1959 – 1969

Past Patron
HRH The Duke of Kent KG 1983 – 1988

Past Presidents

The Rt Hon Lord Nathan 1959 – 1962

Sir John Cockcroft OM 1963 – 1967

Sir Lawrence Bragg CH FRS 1968 – 1969

Dame Kathleen Lonsdale FRS 1970 – 1971

Professor Sir Joseph Rotblat KCMG CBE FRS 1972 – 1974

Professor Sir Hermann Bondi FRS FRAS 1975 – 1979

The Rt Hon Lord Ritchie Calder 1980 – 1982

The Rt Hon Lord Briggs 1983 – 1986

The Rt Hon Lord Porter OM PRS 1987 – 1989

Sir John Meurig Thomas FRS 1990 – 1993

Professor Brian FG Johnson FRS FRSE FAcad 1994 – 2004

Professor Richard O'Kennedy PhD FSB 2005 – 2017

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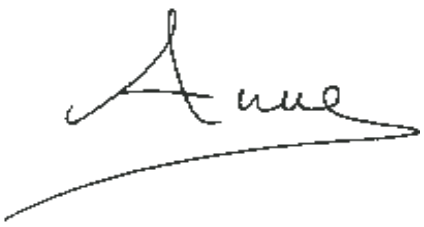
HRH
THE PRINCESS ROYAL

BUCKINGHAM PALACE

The goal of the science forum is to bring together brilliant young men and women that have a passion for science, so they can learn more about the applications science can deliver across a wide range of disciplines. During the forum, you will have the opportunity to explore some of the world's leading research facilities based here in the UK and hear from pioneering scientists. Over the two weeks of the forum the representatives from the 70 countries become a single international science community. During this time together, it is vital also to share your own culture and to learn about others. This is the start of your journey as you become part of the international science community and it is hoped this experience will enable you to foster international friendships and connections, that will help facilitate the growth of your future career.

I welcome you to the United Kingdom and hope that you enjoy and make the most of your time here over the coming two weeks. Seize every opportunity for scientific and cultural learning, immerse yourself in the experiences offered and embrace each moment.



HRH The Princess Royal

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The Prime Minister
2016 – 2019

10 DOWNING STREET
LONDON SW1A 2AA

I am pleased to send a message of support to the students attending the 61st London International Youth Science Forum.

Forums such as this play an important role in demonstrating the variety and diversity of what a modern career in science can offer – and the London International Youth Science Forum has been doing this successfully for so many years.

For all the young people attending, this forum's exciting programme will demonstrate how science has the potential to be the vehicle that enables you to change the world of the future. It also provides a unique opportunity for those taking part to interact with a truly global scientific community of their peers, building networks that will support participants in their future careers.

I hope that this forum provides an inspirational, instructive and enjoyable experience for everyone attending.

Theresa May
The Prime Minister

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President
2018 – present

UCL
DEPARTMENT OF MEDICAL PHYSICS & BIOMEDICAL ENGINEERING

It is with great pleasure that I welcome you to the 2019 London International Youth Science Forum.

As the Forum enters its seventh decade, scientific discoveries and innovations continue to affect enormous change in our world. Increasingly those discoveries and innovations emerge from interdisciplinary collaborations between scientists from a range of different backgrounds. We celebrate this through the theme of this year's Forum - Science at the Interface.

During the next two weeks, the Forum will give you the opportunity to engage with world leading scientists and learn about their cutting-edge work. You will be encouraged to debate, communicate and challenge scientific ideas. And in the true spirit of the Forum, you will interact and share these experiences with other young scientists from all over the globe.

I know how impactful and inspiring these experiences can be as I attended the Forum myself as a student over thirty years ago. It was here that I was first introduced to Medical Physics – an area of science which I have pursued as a career ever since. Importantly, the Forum also opened my eyes to the power of collaboration and communication across scientific disciplines and national borders to address global challenges – something which has formed a key element of my journey in science and which the world needs now more than ever.

My experiences at the Forum were life changing and I hope that yours will be too. Enjoy this fortnight and grab all of the opportunities that it provides. Use them to shape your future, and the future of science. Change the world.

Clare Elwell
President, London International Youth Science Forum
Vice Dean for Impact & Professor of Medical Physics,
Department of Medical Physics and Biomedical Engineering,
University College London

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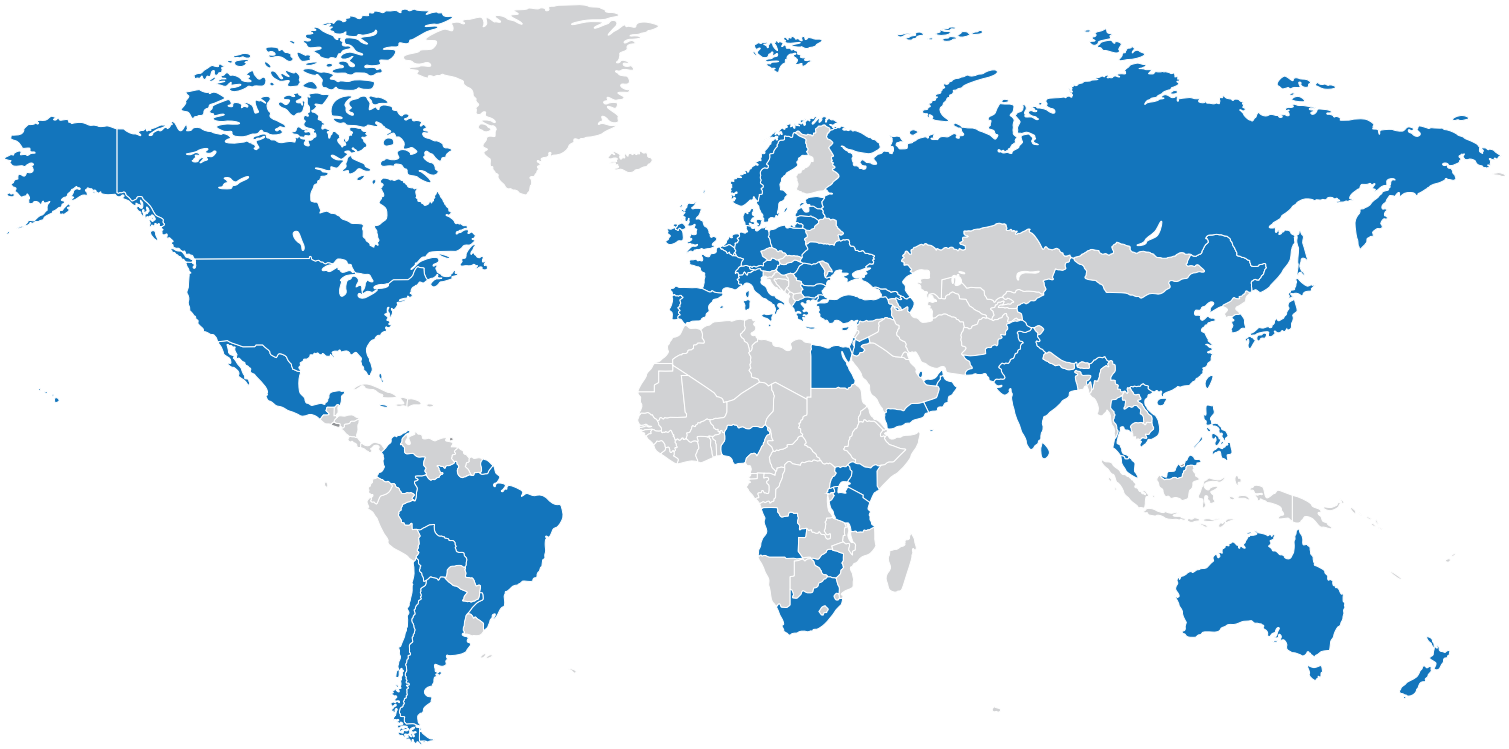
Represented Countries
2019



The following 75 countries and territories will be represented this year:

American Samoa
Andorra
Angola
Argentina
Australia
Austria
Azerbaijan
Bahamas
Bahrain
Belgium
Bermuda
Bolivia
Brazil
Bulgaria
Canada
Chile
China
Colombia
Cyprus
Denmark
Egypt
England
Estonia
France
Georgia
Germany
Greece
Guernsey
Hungary
India
Ireland
Israel
Italy
Jamaica
Japan
Jordan
Kenya
Latvia
Lithuania
Luxembourg
Malaysia
Malta
Mexico
Netherlands
New Zealand
Nigeria
Northern Ireland
Norway
Oman
Pakistan
Philippines
Poland
Portugal
Qatar
Romania
Russian Federation
Rwanda
Scotland
South Africa
South Korea
Spain
Sri Lanka
Sweden
Switzerland
Taiwan
Tanzania
Thailand
Turkey
Uae
Uganda
Usa
Vietnam
Wales
Yemen
Zimbabwe

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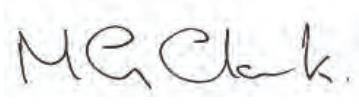
Chairman
Mike Clark

Welcome to our 61st anniversary of the London International Youth Science Forum "LIYSF" with this year's theme, "Science at the Interface". Scientific disciplines should not be considered as individual subjects, as scientific approaches are best employed when disciplines are combined to form a unified and holistic approach. Disciplines are co-dependent to be able to provide effective solutions and therefore we need to consider how science interacts across many different disciplines.

We are delighted to welcome so many eminent speakers to this year's forum and our 500 or so students from 75 countries can look forward to a challenging fortnight, whether it be in the lecture theatre, on technical visits, promoting their own science projects or participating in the numerous events intended to highlight the diversity of their backgrounds.

The recurring theme from past forums is that our global challenges are more likely to be resolved by multi-disciplinary and multi-national research teams. We trust that your time at LIYSF will enable you to make new friends, build lifelong friendships and help you open doors to a whole new range of opportunities. Whilst in London we hope you make the most of our capital city with new friends made at LIYSF. Enjoy London and have fun!



Director
Richard Myhill

In 1959, what was then called the 'Science Fortnight', began with the belief that "out of like interests, the strongest friendships grow". Today in 2019, we hold the same belief: with our focus on cultural interaction and the very best in science and engineering.

LIYSF was founded in the aftermath of the Second World War - in an effort to overcome the animosity resulting from war with a coordinated programme in science. HRH The Duke of Edinburgh agreed to be Patron. In the seventh decade of its existence, the structure of LIYSF and its participation is constantly evolving, but our core principle remains; we pride ourselves in welcoming the best science students from across the world to put science and culture into perspective and to encourage those attending to; be aware of and consider how to help address the needs of the world.

LIYSF has a full, rich and varied programme with students participating in incredible lectures from world renowned speakers, visits to leading university departments and research organisations, debates and an engaging social programme. As Director, it is my job to bring this all together. I work throughout the year, carefully managing all aspects and development of LIYSF, to ensure that we fulfil and exceed the responsibility and expectations of our attending students, supporting organisations and governments. It is with great pleasure that I welcome you to London and to LIYSF.

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Schedule

Wednesday 24th July	**10:00 – 16:00**	Arrivals
	19:30 – 21:00	Welcome to LIYSF 2019 – Kensington Suite, Millennium Gloucester
Thursday 25th July	**11:00 – 12:30**	LIYSF Opening Ceremony – Ondaatje Theatre, Royal Geographical Society
		President's Address: Professor Clare Elwell Key Note Address: Sir Venki Ramakrishnan
	15:00 – 15:30	Programme Introductions – Ondaatje Theatre, Royal Geographical Society
	15:30 – 17:00	Professor Sir Nigel Shadbolt: 'Artificial Intelligence: Fact & Fiction' Ondaatje Theatre, Royal Geographical Society
	17:00 – 19:00	Optional Visits Collection Point – Sentosa Suite, Millennium Gloucester
	20:30 – 23:30	Welcome Party – Orchard Suite, Millennium Gloucester
Friday 26th July	**09:00 – 13:00**	Visits to Research & Scientific Establishments in London
	15:30 – 17:00	Professor Sir Steven Cowley: 'The Ultimate Energy Source – Fusion' Ondaatje Theatre, Royal Geographical Society
	19:30 – 21:30	Great Crossword Treasure Hunt – Queen's Lawn & South Kensington Area
Saturday 27th July	**10:30 – 12:00**	Dr Tolullah Oni: 'Can Cities Make Us Healthier?' Ondaatje Theatre, Royal Geographical Society
	13:00 – 16:00	Optional Visit to the London Eye
	18:30 – 22:00	The Science Forum Bazaar, Student Project Poster Board Evening Royal Geographical Society
Sunday 28th July	**08:30 – 17:30**	Optional Visit to Stonehenge & Salisbury
	19:30 – 21:00	Student Debate Evening – Ondaatje Theatre, Royal Geographical Society
Monday 29th July	**09:30 – 12:00**	Specialist Lectures – Queen's Lawn, Imperial College London
	14:00 – 15:30	Professor Dame Jocelyn Bell Burnell: 'Bursts, Bangs & Things That Go Bump in the Night' Ondaatje Theatre, Royal Geographical Society
	19:30 – 21:00	Student Topics – Ondaatje Theatre, Royal Geographical Society
Tuesday 30th July	**07:00 – 17:30**	National Visits to Research & Scientific Establishments
	19:00 – 22:30	Optional Theatre Shows
Wednesday 31st July	**09:15 – 17:00**	Specialist Study Day – 'Science at the Interface'. Queen's Lawn, Imperial College London
	19:30 – 21:00	Dr Anna Ploszajski: 'Smart Materials – The Future of Stuff' Ondaatje Theatre, Royal Geographical Society

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Thursday 1st August	**07:30 – 17:30**	Visits to Oxford and Cambridge Research and Scientific Institutions
	19:00 – 21:00	Rehearsals and Auditions – Cromwell Suite, Millennium Gloucester
Friday 2nd August	**09:30 – 12:00**	LIYSF Alumni Specialist Lectures – Queen's Lawn, Imperial College London
	13:30 – 15:00	Dervilla Mitchell: 'Realising Design' Ondaatje Theatre, Royal Geographical Society
	15:30 – 18:00	Visits to Science and Natural History Museums
	20:30 – 22:00	International Cabaret: A Cultural Showcase Performance Evening Orchard Suite, Millennium Gloucester
Saturday 3rd August	**10:30 – 12:00**	Professor Clare Elwell & Dr Gemma Bale: 'Lighting the Way to a Healthy Brain' Ondaatje Theatre, Royal Geographical Society
	15:00 – 17:00	LIYSF Sports Day Session – Ethos Sports Hall, Imperial College London
	19:30 – 21:00	Professor Sir Martyn Poliakoff: 'From Test-Tube to YouTube' Ondaatje Theatre, Royal Geographical Society
Sunday 4th August	**08:30 – 17:30**	Optional Visits to Oxford or Cambridge
	09:00 – 16:00	Optional Visits to the Tower of London & Thames Sightseeing River Cruise
	20:30 – 22:00	Traditions of Home: Sharing World Customs and Fashion Orchard Suite, Millennium Gloucester
Monday 5th August	**09:30 – 12:00**	Specialist Lectures – Queen's Lawn, Imperial College London
	13:00 – 17:00	Optional Visits to Buckingham Palace and the London Eye
	19:00 – 22:30	Optional Theatre Shows
Tuesday 6th August	**09:30 – 11:30**	Participants' Forum Ondaatje Theatre, Royal Geographical Society
	14:00 – 15:30	Closing Address: Professor Jim Al-Khalili OBE: 'Does Life Need Quantum Mechanics?' Ondaatje Theatre, Royal Geographical Society
	15:30 – 16:00	Closing Ceremony – Ondaatje Theatre, Royal Geographical Society
	20:30 – 23:30	Farewell Party – Orchard Suite, Millennium Gloucester
Wednesday 7th August	**08:00 – 10:00**	Departures

Principal Lectures & Demonstrations	**Specialist Lectures**	**Visits**	**Social Programme**	**Optional Visits**

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Keynote Address

THE QUEST TO DECIPHER THE MOLECULE THAT READS OUR GENES

Sir Venki Ramakrishnan

President of the Royal Society

In every life form, the thousands of types of proteins in each cell are made according to instructions specified in our genes. This process is carried out by an enormous molecular complex called the ribosome. Because the ribosome is so complex, deciphering its structure and how it works in detail took many decades and ended in a race between several groups. Because the ribosome is such an ancient and fundamental complex, our ribosomes and those of bacteria are sufficiently different that many useful antibiotics work by inhibiting the bacterial ribosome. The structures of the ribosome also shed light on how antibiotics bind to it and may lead to the development of new and improved antibiotics.

Venki Ramakrishnan is a Group Leader of the Medical Research Council Laboratory of Molecular Biology (LMB) in Cambridge and current President of the Royal Society. He is best known for his work on the structure and function of ribosomes, the large molecules in all cells that read genetic information to make proteins, for which he shared the Nobel Prize for chemistry in 2009.

Venki Ramakrishnan has a long-standing interest in ribosome structure and function. In 2000, his laboratory determined the atomic structure of the 30S ribosomal subunit and its complexes with ligands and antibiotics. This work has led to insights into how the ribosome "reads" the genetic code, as well as into various aspects of antibiotic function. In the last few years, Ramakrishan's lab has determined the high-resolution structures of functional complexes of the entire ribosome at various stages along the translational pathway, which has led to insights into its role in protein synthesis during decoding, peptidyl transfer, translocation and termination. More recently his laboratory has been applying cryoelectron microscopy to study eukaryotic and mitochondrial translation.

Under the patronage of **UNESCO**

United Nations Educational, Scientific and Cultural Organization

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UNESCO

The London International Youth Science Forum is very proud to have been granted UNESCO patronage for the fourth year in a row. The UNESCO Director General has granted LIYSF UNESCO patronage, recognising it as an important initiative to "empower students from across the world to think globally and scientifically about global problems such as climate change, food and water security, sustainable energy, and biodiversity. UNESCO acknowledges the importance of such a Forum for scientific discussion, particularly under this year's theme of 'Science at the Interface.'"

Minister of State for Universities, Science, Research and Innovation

Chris Skidmore MP

Minister

Chris Skidmore was appointed as a Minister of State jointly at the Department for Education and the Department for Business, Energy and Industrial Strategy on 5 December 2018. The minister's Department for Education responsibilities include; universities and higher education reform; higher education student finance; widening participation and social mobility in higher education; education exports; review of post-18 education and funding and tackling extremism in higher education. The minister's Department for Business responsibilities include; Industrial Strategy; science and research; innovation; intellectual property; agri-tech; space and technology.

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Plenary Lectures & Demonstrations

25th July
ARTIFICIAL INTELLIGENCE: FACT & FICTION

Professor Sir Nigel Shadbolt

University of Oxford

This lecture will discuss current artificial intelligence (AI) research, its history so far and outline the major approaches and techniques that have emerged. The lecture will consider the balance between raw computing power and intelligent software algorithms. The most recent developments will be explored along with various predictions of the imminent emergence of super-intelligent machines. The lecture will consider how the emergence of large scale data sets has also driven attainments in the field and the practical impact of artificial intelligence now and in the near future and consider the various technical, societal, professional and ethical questions such research raises.

Sir Nigel Shadbolt is Professor of Computing Science at the University of Oxford and Principal of Jesus College. He is also the Chairman and Co-Founder of the Open Data Institute (ODI). Since 2009, Sir Nigel has helped transform public access to Government information. He has over 500 publications and in 2013 he was awarded a Knighthood for services to science and engineering. He is a member of the Data Advisory Board and in 2015 the Chancellor asked him to Co-Chair the UK French Data Task Force. In 2018 he published The Digital Ape: how to live (in peace) with smart machines, described as a 'landmark book'.

26th July
THE ULTIMATE ENERGY SOURCE – FUSION

Professor Sir Steven Cowley

Princeton University, USA

Fusion may be the perfect way to make clean sustainable energy. However, despite some remarkable progress we don't yet know how to build a fusion plant. The US National Academy has recently called for the fusion program to adopt a strategy to produce fusion electricity from a compact pilot plant by mid-century. This approach requires innovations in technology (e.g. superconducting magnets and power handling systems) and innovations in physics. This lecture will introduce key concepts in fusion, the issues that challenge the current program and, recent experimental progress.

Sir Steven Cowley is a theoretical physicist and international authority on fusion energy and is the Director of the Princeton Plasma Physics laboratory, USA. He most recently served as president of Corpus Christi College and professor of physics at the University of Oxford. He was chief executive officer of the United Kingdom Atomic Energy Authority (UKAEA) and director of the Culham Centre for Fusion Energy. He served in key advisory roles for the U.K., U.S. and European governments. He has been a member of the U.K. Prime Minister's Council for Science and Technology. He has been honored with fellowships of the Royal Society and the Royal Academy of Engineering, and was Knighted by the Queen in 2018.

27th July
CAN CITIES MAKE US HEALTHIER?

Dr Tolullah Oni

University of Cambridge

For the first time in 2007, the proportion of people living in cities globally exceeded 50%, with the most rapid growth in cities occurring in Africa and Asia. Whilst cities hold promise of the potential for a better life, many of the characteristics of the urban form are contributing to worsening health, with the urban poor disproportionally affected. The lecture will speak to aspects of the city that influence health, who should be doing something about it, the opportunities for health creation, and the role of science and science diplomacy in improving health in cities worldwide.

Tolullah Oni is a Public Health Physician Scientist and urban epidemiologist, a Clinical Senior Research Associate at the University of Cambridge MRC Epidemiology Unit, and Honorary Associate Professor at the University of Cape Town. Born in Lagos, she studied at UCL and postgraduate medical training in the UK and Australia, a Masters at the University of Cape Town, and a research doctorate at Imperial College London. She leads the Research Initiative for Cities Health and Equity (RICHE). She serves on several advisory boards. Profiled in the Lancet, Science Magazine and the British Medical Journal. She is a Fellow of the African Academy of Sciences, immediate past co-chair of the Global Young Academy, Next Einstein Forum Fellow, and a World Economic Forum Young Global Leader.

28th July
STUDENT DEBATE EVENING: AUTHORITY OF ONLINE INFORMATION

Dr Jason Nurse

University of Kent

The student debate this year will focus on the value of information online, look to the benefits of the internet, but also the challenge of misinformation and fake news. Incorrect information is a significant problem today and what its impact on society will be considered. Is it anyone's responsibility for verifying and ensuring the accuracy of online information? What about free speech? Is there a conflict here regarding monitoring what is posted and taking it down that may infringe on people's freedom of speech? What can science and technology do to help us with this problem – at least with regards to identifying clearly fake or misleading information?

Dr Jason R.C. Nurse is an Assistant Professor in Cyber Security at the University of Kent and a Visiting Academic at the University of Oxford. Jason's research explores the interaction between people and aspects of cyber security, privacy and trust. He's an EPSRC RISE Rising Star, and regularly gives keynotes and public lectures across the UK and world.

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Plenary Lectures & Demonstrations

29th July
BURSTS, BANGS & THINGS THAT GO BUMP IN THE NIGHT - TRANSIENT ASTRONOMY

Professor Dame Jocelyn Bell Burnell

University of Oxford

Developments in CCDs and in computing mean that it is now possible for astronomers to take many repeated short observations of a patch of the sky, rather than one long exposure. Consequently we are finding many new short-duration phenomena. This lecture will describe some of the things we are discovering.

Jocelyn Bell Burnell inadvertently discovered pulsars as a graduate student in radio astronomy in Cambridge, opening up a new branch of astrophysics - work recognised by the award of a Nobel Prize to her supervisor. She has subsequently worked in many roles in many branches of astronomy, working part-time while raising a family. She is now a Visiting Professor in Oxford and Chancellor of the University of Dundee. In 2018, she was awarded the Special Breakthrough Prize in Fundamental Physics. In her spare time she gardens, listens to choral music and is active in the Quakers. She has co-edited an anthology of poetry with an astronomical theme – 'Dark Matter; Poems of Space'. Image courtesy of RSE.

31st July
SMART MATERIALS: THE FUTURE OF STUFF

Dr Anna Ploszajski

University College London

You've heard of smartphones, smart watches and even smart fridges - well now it's the turn of smart materials. These are metals, plastics, fabrics and fluids that react, sense, change colour and morph in response to the outside world, and they promise to revolutionise the way we live. In this talk, award-winning materials scientist and engineer Dr Anna Ploszajski will be introducing the smart materials of today and explore how they shape tomorrow.

Dr Anna Ploszajski is an award-winning materials scientist, engineer and communicator. By day, Anna is a Research Fellow at the Institute of Making, researching 4D printing and metamaterials. By night she communicates materials science on stage, on radio, on TV and on the page. In 2017 she was named Young Engineer of the Year by the Royal Academy of Engineering, and in 2018 won the Silver Medal from the Institute of Materials, Minerals and Mining. In her spare time, Anna plays the trumpet in a funk and soul covers band and swam the English Channel in July 2018. Oh, and it's pronounced "Por-shy-ski".

2nd August
REALISING DESIGN

Dervilla Mitchell

Arup

In this lecture Dervilla will share her career journey and describe a number of large scale aviation projects, including T5 Heathrow, T2 Dublin and Abu Dhabi Mid Field Terminal. She will outline the design drivers for each and how different factors influence how our designs develop and how other factors influence the eventual outcomes.

Dervilla Mitchell is Chair of the UK, India, Middle East and Africa Region of Arup and a member of their Group Board with responsibility for ethics. Trained as a civil engineer she has spent most of her career working in the UK but prior to that she was based in Boston and Dublin. Dervilla has been involved on a wide range of projects but a large part of her career has been involved with airports at Heathrow, Dublin and more recently Abu Dhabi on the Midfield Terminal. Dervilla is a Fellow of Engineers Ireland, the Institution of Civil Engineers and the Royal Academy of Engineering where she currently chairs the Diversity & Inclusion Committee. She is a member of the Prime Minister's Council for Science and Technology. She was awarded a CBE for services to engineering in 2014 and received an honorary doctorate from University College Dublin in 2016.

3rd August
FROM TEST-TUBE TO YOUTUBE

Professor Sir Martyn Poliakoff

University of Nottingham

This lecture will describe how a curious coincidence led Sir Martyn Poliakoff to collaborate with video maker, Brady Haran, and with his help becoming a communicator of chemistry on the internet (www.periodicvideos.com). It will describe some of his research in green chemistry and supercritical fluids and, with the help of technician Neil Barnes, he will show some demonstrations highlighting the advantages and disadvantages of communicating science over the internet compared to live lecture demonstrations.

Martyn Poliakoff studied Chemistry at King's College, Cambridge. From 1972-79, he worked at the University of Newcastle upon Tyne and then moved to the University of Nottingham where he is a Research Professor of Chemistry. He was elected Fellow of the Royal Society (2002) and was awarded CBE (2008) for "Services to Sciences", and knighted in 2015 for "Services to the Chemical Sciences". He was made Honorary Member of the Chemical Society of Ethiopia (2008) and Foreign Member of the Russian Academy of Sciences (2011) and Honorary Fellow of the Chinese Chemical Society (2015). and Associate Member of the Ethiopian Academy of Sciences (2014), Honorary Fellow of the RSC (2015), and Fellow of the Royal Academy of Engineering (2017). He was Foreign Secretary and Vice-President of the Royal Society (2011-16).

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3rd August
LIGHTING THE WAY TO A HEALTHY BRAIN

Professor Clare Elwell & Dr Gemma Bale

University College London

Clare and Gemma are medical physicists who spend their lives shining light on brains. They create optical technology to monitor the brain, both its activity and health, in spaces where conventional brain monitors won't fit: from tracking the brain's development during malnutrition in the Gambia, to searching for biomarkers of newborn brain injury in intensive care. This lecture will illuminate the science and engineering behind their tech - using live demos and lots of audience participation - and take an in depth look into how they are pioneering the future of brain monitoring.

Clare Elwell is a Professor of Medical Physics at University College London (UCL) and Vice Dean for Impact of UCL Engineering. She develops novel optical systems to image the human brain and her research projects include studies of autism, acute brain injury, migraine and malaria. She is President of LIYSF and also the Society for Functional Near Infrared Spectroscopy. She has won awards for her research, teaching and public engagement, and was a 2018 British Science Association Media Fellow at the Financial Times. She is Founder and Trustee of the charity, Young Scientists for Africa.

Dr Gemma Bale is a Research Associate in Medical Physics at University College London. Gemma obtained her B.Sc at Imperial College London, Masters and PhD at UCL and the University of Cambridge. She has worked as a visiting scientist at the University of Western Ontario in Canada and the Institute of Photonic Sciences in Barcelona. Gemma received the Dietrich Lubbers award from the International Society on Oxygen Transport to Tissue in 2016, and in 2017, she founded and chaired the UK meeting for functional NIRS. She was awarded the UCL Provost's Engineering Engager of the Year (2015).

6th August
CLOSING ADDRESS:
DOES LIFE NEED QUANTUM MECHANICS?

Professor Jim Al-Khalili OBE

University of Surrey

There is now strong evidence that enzymes, those metabolic workhorses that drive much of the action in our cells, use the process known as quantum tunnelling to accelerate chemical reactions. And over the past few years it has emerged that plants use quantum coherence – sending lumps of energy in many directions at once – to calculate the most efficient route for sunlight to get to their photosynthetic cells. More intriguingly, it appears that some birds might use quantum entanglement – what Einstein called "spooky action at a distance" – to 'see' the earth's magnetic field for navigation. This lecture introduces the exciting new field of Quantum Biology.

Jim Al-Khalili OBE FRS is a physicist, author and broadcaster. He holds a distinguished chair in physics at the University of Surrey. He received his PhD in nuclear reaction theory in 1989 and has published widely in the field. He is a recipient of the Royal Society Michael Faraday medal, the Institute of Physics Kelvin Medal and the inaugural Stephen Hawking Medal for Science Communication. He is the author of twelve books, translated into over twenty languages and is a regular presenter of TV science documentaries, but is probably best known among the British public as the presenter of the long-running weekly BBC Radio 4 programme, The Life Scientific. He is co-director of the Surrey Leverhulme Doctoral Training Centre for Quantum Biology where is still trying to make sense of quantum mechanics. He is the current president of the British Science Association.

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Monday 29th July – Specialist Lectures

29.1
The Birth of Planets: New Theories, New Observations

Professor Cathie Clarke

University of Cambridge

We live in an age of exoplanetary discovery when a variety of missions are providing an ever expanding census of the planets that orbit stars beyond the solar system. At the same time we have in recent years started to discover young planets which are still in the process of formation from their natal discs of dust and gas. Some of the most spectacular evidence for such planets comes from pioneering images from the Atacama Large Millimetre Array, a radio observatory located at high altitude in Chile. Equally important to our study of planetary birth is the use of computer simulations involving both physics and chemistry. Cathie shall report on the latest research from her group and elsewhere which illustrate how astronomers are currently unraveling the mysteries of planetary birth.

Cathie Clarke was educated at Cambridge and Oxford Universities and is Professor of Theoretical Astrophysics at the Institute of Astronomy, University of Cambridge. Her work is focused on the theory of star and planet formation. In 2017 she was awarded the Eddington Medal of the Royal Astronomical Society for her work on the photevaporation of protoplanetary discs, exploring how planet forming material is blown away by energetic radiation from the young star.

29.2
Money, Myths & Man-Eaters: Big Cat Conservation in Tanzania and Beyond

Dr Amy Dickman

University of Oxford

Amy established the Ruaha Carnivore Project in Tanzania in 2009, one of the most important areas in the world for lions, leopards and cheetahs. Amy and her Tanzanian team are researching the ecology of these vital populations and working to develop conservation plans and reduce human-carnivore conflict. The project focuses on reducing carnivore attacks on livestock, providing local communities with real benefits from carnivore presence, and training the next generation of local conservation leaders. Amy will discuss the significance of this project, the difficulties of working in an area where witchcraft and mythology abound, and the conservation successes that are emerging from this important work.

Dr Amy Dickman is the Kaplan Senior Research Fellow in Wild Cat Conservation at Oxford University's Wildlife Conservation Research Unit. She has worked in Africa for over 20 years at the Cheetah Conservation Fund in Namibia until 2005 and then obtaining her MSc and PhD in Tanzania. She is a member of the IUCN Cat Specialist Group, the IUCN Steering Committee on Human-Wildlife Conflict, the African Lion Working Group and is a National Geographic Explorer. Amy has published over 60 papers and book chapters on large carnivore ecology and conservation and received multiple awards for her work.

29.3
Regulation of Blood Flow in Dementia: Misconception & Misdirection

Professor Seth Love

University of Bristol

It is widely believed that Alzheimer's disease begins with abnormal accumulation of amyloid-β peptide (Aβ). Yet the production of Aβ is normal in most patients. In 2004, Professor Love submitted a grant proposal entitled 'Amyloid-β processing and clearance in the pathogenesis of Alzheimer's disease', proposing that Alzheimer's disease usually resulted from impaired enzymatic degradation of Aβ. The research was funded but the findings were not what was expected.

Seth Love trained in medicine in South Africa, and in neuropathology at Queen Square, London. He completed his PhD in 1984 and his neuropathology training in 1985. He then spent two years as a Research Fellow at UCSD before returning to the United Kingdom in 1987 to work in Bristol. He is Director of the MRC UK Brain Bank Network, President of the International Society of Neuropathology, and serves on multiple editorial boards and grant review committees. His current research, supported by the MRC, Alzheimer's Research UK, Alzheimer's Society and BRACE, is focused on brain oxygenation and vascular dysfunction in dementia.

29.4
Organic Solar Cells – What Difference Can They Make?

Dr Moritz Riede

University of Oxford

Organic solar cells are an emerging solar cell technology that has the potential to provide light-weight, cheap, flexible, large area, long-living and efficient solar cells. These novel kind of solar cells are based on organic semiconductors, which have already been commercialised in form of OLED displays found in many modern smartphones. The lecture will describe how far organic solar cells have come and what challenges lie ahead towards their large scale commercialisation both in terms of research and within the greater picture of society where this technology could aid in transition towards renewable energy.

Moritz Riede is Associate Professor for Soft Functional Nanomaterials in the Department of Physics at the University of Oxford. Before moving to Oxford in 2013, he worked in Germany at the Fraunhofer Institute for Solar Energy Systems ISE and the University of Freiburg as PhD student (2002-2006), and at the Technische Universität Dresden as postdoctoral researcher and head of a junior research group (2007-2013). He was member of the Global Young Academy (2014-2018) and his interests extend to the transition of our energy system to renewable energy as well as capacity building among early stage researchers and the role of science in society.

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29.5 HITTING CANCER WHERE IT HURTS: CYTOSKELETON AS A THERAPEUTIC TARGET

Professor Victoria Sanz-Moreno

Barts Cancer Institute

Rho GTPases are molecular switches that control the cytoskeleton. Deregulation of Rho GTPases can result in aberrant function and disease, including cancer. The other major challenge in the clinic is drug resistance. This lecture will look to research as to how Rho GTPase signalling and cytoskeletal remodelling can control many processes: invasion and metastasis, tumour promoting inflammation and drug responses. The ultimate goal is to define if manipulations in the cytoskeleton of cancer cells will lead to improved efficacy of current therapeutic approaches.

Victoria received her first degree in chemistry and master's degree in biochemistry at University of Oviedo, Spain, followed by a PhD in chemical sciences. After a postdoc with a Lady Tata Memorial Trust Fellowship, she moved to the Institute of Cancer Research in London. In 2008, she received an EACR 40th Anniversary Research Award. In 2011 she established her lab with a CRUK Career Development Fellowship at King's College London. In 2015, she was highly commended as CRUK Communications and Brand Ambassador. In 2017 she was awarded the BSCB Women in Cell Biology Early Career Award Medal and received a CRUK Senior Fellowship. In 2018 she joined Barts Cancer Institute as a Professor of Cancer Cell Biology.

29.6 FETAL GENE THERAPY

Professor Simon Waddington

University College London

Gene therapy is becoming a clinical reality. Incurable, and sometimes untreatable, genetic diseases are now being cured by a single dose of a gene therapy vector. However if the disease has progressed too far, gene therapy can only stop its progression. Prevention is better than cure – so perhaps we could prevent the disease from taking hold – by treating the fetus in utero.

Simon was born in a declining cotton mill town in the north of England. His parents and older brother loved science, engineering and technology and he gained inspiration from reading their books around the house. Although all science intrigued him, biology is his first love. He remembers reading about the work of Sir Alexander Fleming on penicillin. He gained his first and masters degrees from the University of York and his PhD from Imperial College London. He is now Professor of Gene Therapy at University College London. He has cycled to and from work every day for the past 26 years.

29.7 WHY DOESN'T MARS LIKE US? & WHAT CAN WE DO ABOUT IT?

Alastair Wayman

Airbus

Missions to Mars are hard. Getting there is hard, landing is even harder, and it doesn't get any easier once we're on the surface. Despite this we have successfully sent 21 missions there, 6 of which are operating there right now, and are sending two more rovers to the surface next year. This talk will look at why we do it, what makes it so hard and how we manage to do it.

Alastair Wayman joined Airbus as a Mission Systems Engineer in 2012 developing the next generation of interplanetary space missions, as well as the new technologies that allow them to happen. In this role he has played a key part in European Space Agency's collaboration with NASA to bring samples back from the surface of Mars. Airbus has been helping answer big questions from space for over 50 years and Airbus Defence and Space is a division of Airbus, responsible for defence and aerospace products and services.

29.8 INDIVIDUAL IDEAS, WORKING TOGETHER: THE DISCOVERY OF THE HIGGS BOSON

Dr Seth Zenz

Queen Mary University of London

The discovery of the Higgs boson at the CERN Large Hadron Collider (LHC) was the culmination of many years of work by many thousands of scientists, engineers, and technicians – many of them students. In an such a large long-term project, how do individual scientists contribute? This lecture will trace the flow of ideas in a big particle physics experiment, starting from individual insights, through collective discussion and refinement, on to the final world-changing output. The examples will follow the development of the LHC and its large experiments, the discovery of the Higgs Boson, and future plans for the LHC and beyond.

Seth Zenz is an expert on the Higgs boson who became a Lecturer in the Queen Mary University of London in 2018. He completed his PhD in 2011 at the University of California, Berkeley, studying early Large Hadron Collider (LHC) data. Subsequently, as a researcher at Princeton University and Imperial College London, he led a range of measurements of the Higgs boson. Motivated by the central role of charged particle tracking in all Higgs boson measurements, he has worked on the construction, operation, and upgrade of several silicon pixel detectors for LHC experiments; his current project is the ATLAS Inner Tracker.

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Wednesday 31st July – Specialist Study Day

31.1 Understanding the data from the Large Hadron Collider

Professor Freya Blekman

Vrije Universiteit Brussel, Belgium

Ever wondered about why the 27 kilometer Large Hadron Collider was built and what scientists do with it? Then this is the talk for you! The collider is the Swiss army knife of experiments, and investigates anything from new particles and forces to the birth of the universe. As one of the physicists who works with the enormous detectors that record the collisions of the Large Hadron Collider, this lecture will not only convince you that particle physics is necessary and interesting for everyone (including tax payers), but also on the fun and social aspects of this exceptional human effort to understand the building blocks of matter. And if you bring your laptop, the lecture will teach you how to understand and analyse LHC data yourself. Only a modern web browser is necessary.

Freya Blekman is a professor of physics at the Vrije Universiteit Brussel and visiting lecturer at Oxford University. She works at CERN, where she uses the data from the Large Hadron Collider, collected with the enormous Compact Muon Solenoid (CMS) experiment, to search for undiscovered physics processes and new particles. Blekman is also responsible for the communication to the outside world of the 130+ papers per year by the 3000+ person strong CMS Collaboration and has won multiple prizes on science and science communication.

31.2 Attention economics in the age of information

Professor Vincent F Hendricks

University of Copenhagen, Denmark

This lecture will consider the current state of the information age, a market for both prime as well as defective information products; from individual verified facts in accordance with best practice to wisdom of crowds, from singular lies to collective nonesnse and fake news. The World Economic Forum recently declared misinformation and digital wildfires some of the great challenges of our time: "the global risk of massive digital misinformation sits at the centre of a constellation of technological and geopolitical risks ranging from terrorism to cyber attacks and the failure of global governance." How did we get to to this point riding on the back of the Enlightenment in which more information – or rather knowledge – was envisioned as a boon rather than a bane?

Vincent Hendricks is Professor of Formal Philosophy at The University of Copenhagen. He is Director of the Center for Information and Bubble Studies (CIBS) sponsored by the Carlsberg Foundation and was awarded the Elite Research Prize by the Danish Ministry of Science, Technology and Innovation and the Roskilde Festival Elite Research Prize both in 2008. He was Editor-in-Chief of Synthese: An International Journal for Epistemology, Methodology and Philosophy of Science between 2005-2015.

31.3 Engineering immune systems to fight cancer

Professor Ronjon Chakraverty

University College London

Treatment for cancer is undergoing a revolution. New treatments are being used to harness the immune system to fight cancer. Doctors have become engineers, taking blood cells from patients, then modifying them by inserting genes and then giving them back to patients. The modified immune cells can then attack the cancer and in some cases, this leads to a cure. But we need to do better. This lecture will describe the beginnings of the next revolution, the use of gene editing to develop super immune systems that destroy cancers.

Ronjon is a Clinician Scientist and Professor of Haematology and Cellular Immunotherapy at UCL. Following his training in Internal Medicine in Cambridge, he was awarded an MRC Clinical Training Fellowship at the Institute of Molecular Medicine in Oxford where he attained his PhD. He has served as Transplant Fellow at University College Hospital London and in 2000, he was awarded a Senior Research Fellowship in Experimental Haematology from Leukaemia & Lymphoma Research, which funded post-doctoral studies in the laboratory of Professor Megan Sykes at Harvard.

31.4 Nature-inspired chemical engineering

Professor Marc-Olivier Coppens

University College London

Solving persistent engineering challenges related to energy, water, environment, health and manufacturing requires a transformative approach. We turn to nature for inspiration. Nature provides us with examples of solutions, perfected over the eons, to similar challenges as those we encounter in technology, such as scalability, efficiency and resilience. This lecture will consider unique, nature-inspired chemical engineering (NICE) methodology as a pathway to innovation. The NICE approach merges creativity with rational design - how we can learn from trees, lungs, kidneys and sandy beaches to engineer sustainable processes, high-performing fuel cells, and new materials for biomedical applications.

Marc-Olivier Coppens is Ramsay Memorial Chair and Head of Department of Chemical Engineering at UCL. He is Fellow of IChemE and AIChE, Qiushi Professor at Zhejiang University in China, as well as a member of the Saxon Academy of Sciences in Germany. Originally from Belgium, where he obtained his PhD at Ghent University, he has been a Professor in the Netherlands and the USA, and also researched in France, China, and Norway. Professor Coppens is most recognised for pioneering NICE work. In 2013, he founded the UCL Centre for Nature Inspired Engineering (CNIE), which was granted a £5M "Frontier Engineering" Award from EPSRC.

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31.5 HARNESSING SCIENCE TO PROVIDE PERSONALISED MEDICAL INTERVENTIONS

Professor Richard O'Kennedy

The Qatar Foundation, Qatar

The availability of information on genomes has the capacity to greatly improve the quality of healthcare to diagnose diseases, to provide highly valuable insights on potential disease threats and the required medical interventions. These significant benefits can only be achieved by harnessing many scientific disciplines including molecular biology, bioinformatics and artificial intelligence. However, there are many challenges to be faced including ethical considerations, personal data management issues, sophisticated training requirements for clinical personnel, development of better, faster and cheaper methodologies for genome analysis, and effective communication with the public.

Vice-President for Research, Development and Innovation at the Qatar Foundation, Vice-President for Research at Hamad Bin Khalifa University, Qatar and Chair of the board of Qatar Science and Technology Park. Previously, served as Scientific Director of the Biomedical Diagnostics Institute and Vice-President at Dublin City University, Ireland. He is LIYSF Science Patron and immediate-past President. He directs the Applied Biochemistry Research Group and is a Founder of AbYBiotech. He is renowned for innovative approaches to Healthcare and has received many awards for research.

31.6 UNTANGLING DNA, ONE MOLECULE AT A TIME

Dr Alice Pyne

University College London

Did you know that the DNA in each of your cells is taller than you are? DNA in the cell is tangled and twisted, adopts complex topologies, is decorated with a myriad of DNA binding proteins and is frequently maintained under stress. Understanding how DNA interacts with molecular machines, essential for life in both humans and bacteria, in its complex native environments is a challenge of complexity. We use a unique method, known as Atomic Force Microscopy, to 'see' individual strands of DNA in otder to "see" and "feel" DNA molecules and watch how complex DNA interacts with molecular machines, called DNA topoisomerases.

Dr Alice Pyne is an MRC/UKRI Innovation Fellow at the London Centre for Nanotechnology at University College London. Alice has a decade of experience in scanning probe microscopy, spanning high-speed and high-resolution imaging, probe development and cantilever sensing. Alice has worked closely with industry to develop high-resolution Atomic Force Microscopy technologies able to resolve variations in the DNA double helix on a single molecule for the first time. Her research exploits these technologies to understand how the structure of knotted and twisted genomic DNA, affects vital cellular interactions.

31.7 THE AFFECTIVE BODY IN A TECHNOLOGY-MEDIATED WORLD

Professor Mark McCaughrean

European Space Agency

As we mark 50 years since the first human landings on the Moon, there is a resurgence in spaceflight involving more nations than ever, as well as an increasing number of private companies. Many are intent on exploiting low-Earth orbit for telecommunications and resource mapping, and also plan to mine asteroids, develop heavy industry in space, and even build colonies on Mars. How do we protect our common cultural heritage, the planet Earth and its night sky, while harnessing the power of space applications? Where should the balance lie between the commercial exploitation of space by the few and its exploration on behalf of all humankind?

Mark McCaughrean is the Senior Advisor for Science & Exploration at the European Space Agency (ESA). He is also responsible for communicating results from ESA's astronomy, heliophysics, planetary, exploration, and fundamental physics missions to the scientific community and wider general public. Following a PhD from the University of Edinburgh, he worked at the NASA Goddard Space Flight Centre, followed by astronomical institutes in Tucson, Heidelberg, Bonn, and Potsdam, and taught as a professor of astrophysics at the University of Exeter. He is also an Interdisciplinary Scientist for the NASA/ESA/CSA James Webb Space Telescope.

31.8 PLASTIC, HOW FANTASTIC?

Dr Charles Romain

Imperial College London

Materials shape our history and our society. After stone, bronze and iron, are we now in the plastic age? Polymers, fascinating large molecules which are the main ingredient of plastics, are literally everywhere in our daily life. They contribute to improving our quality of life but at the same time raise some environmental issues. This lecture will be the opportunity to learn more about how researchers try to find sustainable solutions, in particular using renewable resources to make plastics that won't cost us the earth.

Graduated in 2008 from Université de Rennes 1 were he obtained his M.Sc degree as well as his engineering degree, Charles then obtained his PhD degree in 2011 from Université de Strasbourg. In January 2012, he joined Econic-Technologies as a research scientist to make plastics from CO_2. In February 2013, Charles joined a multidisciplinary research project at Imperial College London dealing with "the deconstruction of biomass and the valorisation of carbohydrates". Since September 2016, Charles is a junior research fellow in the department of chemistry at Imperial College London where he leads a research group focusing at developing new methodologies to make sustainable polymers.

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Friday 2nd August – Alumni Specialist Lectures

2.1 When the air hits your brain

Dr Michael Amoo – LIYSF 2011

Beaumont Hospital, Ireland

This lecture provides a brief overview into the science and intricacy of the human brain. It explores the diseases that affects this unique organ; from trauma to tumours. It also presents current challenges and discussions regarding future areas of research.

Michael Amoo is a Specialist Registrar (SpR) in Neurosurgery at Beaumont Hospital, Dublin, Ireland. Working as part of a multi-disciplinary team, he is involved in the management of patients with a variety of brain disorders. He has a special research interest in traumatic brain injury. Michael attended LIYSF in 2011. For over 200 years The Royal College of Surgeons Ireland has played a major role in medical education and training in Ireland. Founded in 1784 to train surgeons, today the College provides extensive education and training in the healthcare professions at undergraduate and postgraduate level.

2.2 Moving towards treatments for dementia and motor neuron disease

Dr Rubika Balendra – LIYSF 2003

University College London

The health and socioeconomic burden of dementia is vast, and will only increase over the next few decades. Motor neuron disease is a devastating neurodegenerative disease which affects one in 250 people. How will we move towards finding treatments for these diseases? This lecture will discuss recent developments in this field of neurodegeneration with a focus on using genetics to drive forwards our understanding of mechanisms and therapeutics. This lecture will consider novel disease models, including human stem cell-derived neurons and fruit flies, as approaches to investigate clinically applicable pathways in neurodegeneration.

Rubika is a Specialist Registrar doctor in Neurology. She recently completed a PhD as a Wellcome Trust and UCL Leonard Wolfson Research Training Fellow at the UCL Institute of Neurology. She read medicine at the University of Cambridge and UCL and trained as an academic clinical neurosciences foundation trainee at the Univeristy of Cambridge. She continued clinical and academic training as an academic clinical fellow at King's College London. She enjoys teaching science and medical students and is actively involved in public engagement in science. She was an LIYSF participant in 2003 and a staff member from 2004-2007.

2.3 The impact of hydrogen fuel technology

Maurice Brown – LIYSF 1986

Utrecht University, The Netherlands

The Hydrogen fuel cell has been around since 1839. This relatively obscure, but highly valued technology, helped power the United Space programme from the 1960's and still today. The technology holds great promise, as it presents a real alternative to fossil fuel energy. However, the industry will face a tough future. Promoters of this energy source must master the learning curve of the energy industry, if it is to become a feasible alternative. How does this technology work, what are its applications and what problems does it face as an industry?

Maurice Brown is from Kingston, Jamaica, studying at Campion College and the College of Arts Science and Technology. He moved to the Netherlands in 1994 and completed his Bachelor's degree in International Business Administration and Master's Degree in Business Management. He became a consultant to the aviation industry and later, held financial positions in various international companies. Currently, he is lecturer in Finance and Business Strategy at the University of Applied Sciences, Utrecht, (Netherlands) and is owner of a small company looking into promoting and exporting to developing countries.

2.4 Engineering for the future

Jameer Emmamally – LIYSF 2003

UK Atomic Energy Authority

How do discoveries made today become tomorrow's reality? How does science move from the classroom to something you can touch and feel, or something that can help you solve a problem, investigate an idea, meet the needs of a city, a person or a company? This interactive lecture will give you an introduction to engineering and an awareness of the design process as we go on a brief journey to take an idea from concept to reality.

Jameer Emamally attended LIYSF 2003. Jameer is a Chartered Engineer working for the United Kingdom Atomic Energy Authority. He graduated from Imperial College London where he completed his Master's degree in Aeronautical Engineering. He has held various positions where he worked at both the national and international level with government and the private sector. Jameer has project managed complex teams to deliver high integrity fission and fusion related systems.

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2.5 FROM FROGS TO MAN: 55 YEARS IN VISUAL NEUROSCIENCES

Professor Chris Kennard – LIYSF 1964

University of Oxford

55 years since attending the LIYSF, Professor Kennard will describe the ups and downs of an academic career in clinical neurology and visual neuroscience. The emphasis will be on clinical research and the different methods we can use to understand the human brain in health and disease.

Professor Christopher Kennard is Head of the Medical Sciences Division at the University of Oxford. He is a medical graduate of the University of London and obtained a PhD at the MRC's National Insititute of Medical Research. After training posts in neurology, he was appointed Consultant Neurologist at the Royal London Hospital, subsequently moving to Imperial College London as Professor of Clinical Neurology in 1991, and then Deputy Principal of the Faculty of Medicine. He became Head of the Nuffield Department of Clinical Neurosciences at the University of Oxford in 2008. He has chaired the UK's Medical Research Council's Neuroscience and Mental Health Board and is a Fellow of the Academy of Medical Sciences. His reasearch has covered many aspects of vision, oculomotor control and cognition in health and disease.

2.6 WHAT RESEARCH CAN YOU DO NOW TO CHANGE THE WORLD?

Dr Becky Parker – LIYSF 1978

The Institute of Research in Schools

This lecture will introduce the opportunities available for you to do fundamental research right now including particle physics, space science, genomics, sustainable chemistry, biodiversity and well-being, and climate change and Earth Observation.

The Institute for Research in Schools where Becky is Director, encourages contributions from young people in cutting edge research while they are at school. She set up the Institute for Research in Schools with Trustees including Professor Sir Leszek Borysiewicz, Vice-Chancellor of the University of Cambridge and Professor Dame Julia Goodfellow, Vice-Chancellor of The University of Kent. This will empower young people and their teachers to take part in authentic research.

The aim is to produce papers, speak at scientific conferences and tackle some of the huge challenges that we face. Come and see how you can get involved and how we can establish a research community from LIYSF.

2.7 ANIMALS DON'T READ THE TEXT BOOKS

Judith O'Toole – LIYSF 1985

Mount Temple School, Ireland

In recent years, the veterinary world has provided us with many examples which illustrate how nature and science are constantly changing. The emergence of new diseases in recent years has shown us that we can never afford to become complacent, believing that if we know the facts of a subject today, we will know them tomorrow. This lecture will take a look at the history of veterinary medicine and explain how scientific advances have helped to reveal mysteries of the past. This lecture will discuss the evolution of new pathogens, whilst also considering the understanding of certain diseases as merely a new way of looking at old information.

Judith attended LIYSF in 1985 and graduated with a degree in Veterinary Science (Bristol) in 1990. Judith worked as a veterinary surgeon until 1998. She obtained a Post Graduate Diploma in Education (UCD) 1998, set up Diploma in Veterinary Nursing in UCD 2001 - 2003, teaching Science in Mount Temple Comprehensive School 1998 to present.

2.8 MACHINE LEARNING IN MEDICAL IMAGE ANALYSIS

Dr Matt Sinclair – LIYSF 2004

Heartflow

In recent years, advances in machine learning applied to image and video analysis have revolutionized applications across many domains, including but not limited to autonomous vehicles and drones, video streaming, facial recognition, and medical image analysis. This lecture will explore how AI is impacting the way in which medical images are being used to aid and improve medical diagnosis. A broad introduction on AI in computer vision will first be presented, and then we will look at several applications in medical imaging, including work we are doing at Heartflow to improve outcomes for patients with coronary artery disease.

Matthew is a Research Scientist at Heartflow, working on deep learning and computational fluid dynamics to assess coronary artery disease in patients non-invasively. He is also an Honorary Research Fellow at Imperial College London, where his research focuses on automating and aiding clinical assessment of medical image data, particularly fetal ultrasound and cardiac MRI. He graduated from the University of Auckland in 2009 with a Bachelor of Biomedical Engineering and received his PhD from King's College London in 2014, where he worked on the analysis of blood flow distribution in the coronary circulation.

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Monday 5th August – Specialist Lectures

5.1 Space Astronomy: From the Edge of the Universe to our own Earth

Professor Graziella Branduardi

University College London

Virtually all astronomers make use of instruments in space to learn more about the Universe. This lecture focuses on X-ray astronomy, explains the basics of how observations are carried out in space and describes some of the recent results from space observatories built by the European Space Agency and NASA. Cosmic X-ray sources encompass some of the most energetic and exotic phenomena in the Universe: from distant active galaxies, harbouring supermassive black holes around which energy production is more efficient than in nuclear reactors, to the magnetic environment of our own Earth, where X-rays are produced by the dynamic injection of the wind of charged particles emanating from the Sun.

Graziella Branduardi has been fascinated by astronomy and space research since she was a teenager. After a degree in Physics at the University of Milano, Italy, and a PhD in X-ray Astronomy at UCL, she worked at the Harvard-Smithsonian Center for Astrophysics, USA and then returned to UCL's Mullard Space Science Laboratory where she is based. After participating in major X-ray observatory missions over many years, she is now co-leading the development of a joint ESA-Chinese Academy of Sciences mission called SMILE which will investigate the X-ray emission produced in the near Earth environment by the dynamic impact of the solar wind.

5.2 Type 2 Diabetes in Young People: An Emerging Crisis?

Dr James Brown

Aston University

Diabetes is a condition of dysregulated glucose control that is currently incurable and which affects millions of people worldwide. Recently, increasing numbers of children and adolescents have been diagnosed with type 2 diabetes, which is normally associated with late-middle age. This potentially new form of diabetes is more aggressive, meaning that young people are at risk of developing the serious conditions such as heart disease at as young age. This talk will characterise this population, and try to explain why we have seen the sudden increase in numbers.

Dr James Brown is a Senior Lecturer at Aston University and Director of the Aston Research Centre for Healthy Ageing. His research areas include obesity, diabetes and ageing and he regularly works with the media to improve public understanding of these conditions. The centre takes a multidisciplinary approach to understanding and promoting successful ageing by asking how biological, technological, strategic, therapeutic and psychosocial strategies can be employed to understand and therefore improve age-related decline.

5.3 Evolution of HIV Treatment

Dr Michael Elliott
Samm Kabagambe

Gilead

This lecture will cover what it means to live with HIV today and the strides that have made to show that people living with HIV can have a near to normal life expectancy. It will cover viral replication and treatment, the global challenges with medicines development and access and the U=U message.

Dr Michael Elliott is the Vice President Europe, Middle East & Australia Medical Affairs at Gilead and has worked for twenty-eight years in the pharmaceutical industry. His current role leads a team of 400 scientists (Physicians, Pharmacists, and PhD's) who engage with the scientific community on Gilead's portfolio of medicines both in research and available to patients. Samm Kabagambe is a Medical HIV Scientist at Gilead Sciences, after previously working for ten years for the National Health Service (NHS). Samm was born and raised in Uganda.

5.4 Waking up to the Importance of Sleep

Dr Simon Kyle

University of Oxford

In this talk Dr Kyle will give an introduction to the fascinating world of sleep research and outline the importance of sleep for health and wellbeing. For example, he will discuss the impact of artificial light on our sleep-wake patterns and present the latest science on how technology can be used to improve sleep.

Dr Kyle is Associate Professor in the Sleep and Circadian Neuroscience Institute (SCNi), Nuffield Department of Clinical Neurosciences, University of Oxford. He is also programme director for the Oxford Online Programme in Sleep Medicine. He holds an MA in Psychology and PhD in Psychological Medicine, both from the University of Glasgow. Dr Kyle has research expertise in the aetiology and management of sleep disturbance and the interaction between sleep disturbance and health. He has published more than 100 articles and book chapters and serves as Associate Editor of the journal, Behavioral Sleep Medicine.

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5.5 IS IT POSSIBLE TO BUILD A STAR ON EARTH (WITH HUMONGOUS LASERS)?

Dr Kate Lancaster

University of York

Trying to recreate the energy source of the stars, nuclear fusion, on earth presents huge challenges in physics and engineering. The benefits of nuclear fusion if successful are an almost limitless, clean energy source. There are many challenges associated with keeping matter at 150 million degrees trapped inside a reactor without touching it! This talk is the story of how, in the absence of a lab the size of a star, we are attempting to make fusion into an energy source for the future using some of the world's most powerful lasers.

Dr Kate Lancaster is a lecturer and programme leader for the Msc in Fusion Energy, based at the York Plasma Institute at the University of York. She received her PhD from Imperial College whilst based in Central Laser Facility at the Rutherford Appleton Laboratory. A post-doctoral position was followed by a permanent research position at the Central Laser Facility. Kate is very active in science communication and has spoken to tens of thousands of people. She gave a prestigious Friday Evening Discourse at The Royal Institution in 2015 on "The Extreme World of Ultra Intense Lasers", which has subsequently received over 260,000 views on YouTube. Recently Kate was a guest on the BBC Radio 4 show "in our time" talking about plasma.

5.6 DATA-DRIVEN PERSONALISATION

Professor Iván Palomares Carrascosa

University of Bristol

Recommender System techniques provide users with tailored information to meet their needs and preferences, overcoming the nowadays humongous information overload in the Internet and helping us make good decisions when the amount of options available is simply enormous. Notable application areas include e-commerce, tourism, leisure, etc. However, the rise of Big Data and connected data infrastructures and devices in smart cities, is impacting virtually every aspect of human lives, thereby urging the need for personalisation services in novel, unprecedented domains such as health and wellbeing, leisure and entertainment for city residents and visitors alike.

Ivan is a lecturer in Computer Science (Assistant Professor) with the School of Computer Science at the University of Bristol. He is a member of Bristol's Intelligent Systems Laboratory, where he leads the research theme on Decision Support and Recommender Systems. He obtained a PhD in Computer Science (Honors) at the University of Jaén (Spain).

5.7 MAKING NEW MEDICINES FOR NEURODEGENERATION

Professor Marcus Rattray

University of Bradford

We are in an era of rapid scientific discoveries to understand disease and discover effective treatments. However, we are still lacking medicines to treat many important conditions, one example being Motor Neurone disease, also known as Amyotrophic Lateral Sclerosis or Lou Gehrig's Disease, another Alzheimer's Disease. This specialist lecture will discuss how to develop safe and effective medicines and explore the science underlying medicines development, including the innovations that are being developed to conquer illnesses.

Marcus Rattray is Professor of Pharmacology, University of Bradford and a Fellow of the British Pharmacological Society. He has held academic positions at the University of Reading, King's College London, and was a postdoctoral fellow at the National Institutes on Drug Abuse in Baltimore, USA. Marcus' research interests have been understanding the processes involved in neurodegenerative diseases, particularly motor neurone disease and Alzheimer's disease and working towards the discovery of more effective medicines.

5.8 UNDERSTANDING ELASTIC DEFORMATIONS: WRINKLES ON GAUSS' PIZZA THEOREM

Professor Dominic Vella

University of Oxford

Thin objects are easy to deform is familiar from everyday life: a piece of paper crumples, while bridges may vibrate in the wind. A guiding principle of such deformations is that the material will choose to bend, rather than change its length, whenever possible. Gauss' "Remarkable Theorem" has a lot to say about how such bending deformations can happen, and its consequences are everywhere from pizza slices to the domed roofs of buildings. However, as I will show, this is not the whole story and super-thin objects have some neat ways around Gauss' Theorem.

After undergraduate study at Cambridge, a year at Harvard and a PhD back in Cambridge, Dominic Vella worked in Paris as a post-doc supported by the Royal Commission of 1851. He returned briefly to Cambridge, before moving to Oxford to take up his current position in 2011. He works to develop mathematical models of a range of physical problems including floating objects (the 'Cheerios effect') and the wrinkling of thin elastic objects and his current research is supported by the European Research Council and the Leverhulme Trust.

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Friday 26th July
London Scientific Visits

26.A Association of Anaesthetists of Great Britain & Ireland
Founded in 1932 by Dr Henry W Featherstone, The Association of Anaesthetists of Great Britain and Ireland (AAGBI) represents the medical and political views of over 11,000 anaesthetists in the UK, Ireland and internationally.

26.B Imperial College Healthcare, Alexander Fleming Laboratory Museum
St Mary's Hospital is home to the Alexander Fleming Laboratory Museum. Fleming discovered the antibiotic penicillin at St Mary's Hospital in 1928, a breakthrough that revolutionised medicine and earned him a Nobel Prize. Visitors to the Museum can see Fleming's laboratory, restored to its 1928 condition, and explore the story of Fleming and the discovery and development of penicillin through displays and video.

26.C Imperial College London, Department of Chemical Engineering
See the laboratories, pilot plant and computing facilities of one of the UK's largest departments of its kind.

26.D Imperial College London, Department of Life Sciences
One of the largest life science groups in Europe, research of full breadth of modern life science activity including, Molecular Biosciences, Cell & Molecular Biology and Ecology & Evolution.

26.E Imperial College London, Department of Materials: Biomaterials in Regenerative Medicine
Research into biomaterials for tissue engineering and regenerative medicine; and bio-nanotechnology for nanostructures and create nano-biomaterials.

26.F Jodrell Laboratory at the Royal Botanic Gardens, Kew
World-famous centre for botanical research and study; includes a visit to the Jodrell Laboratory, whose mission is to unlock the potential of plants and fungi, through the power of scientific discovery and research.

26.G King's College London – Centre for Stem Cells & Regenerative Medicine
Led by Professor Fiona Watt, located on the Guy's Hospital campus, the Centre acts as a focus for cutting-edge stem cell research taking place across the College and its partner NHS Trusts. The centre is particularly interested in how stem cells interact with their local environment, or niche and how an understanding of these interactions is important for developing effective cell therapies.

26.H Linnean Society
The Linnean Society of London is the world's oldest active biological society. The Society takes its name from the Swedish naturalist Carl Linnaeus (1707–1778) whose botanical, zoological and library collections have been in its keeping since 1829. These unique collections are of continuing fundamental importance as a primary reference for taxonomy.

26.I Lloyd's Register Foundation
The Lloyd's Register Foundation is a UK charity which aims to protect the safety of life and property, and to advance transport and engineering education and research.

26.J London Metropolitan University Faculty of Life Sciences & Computing – Sports Science
Sports courses at London Met are led a by a team of passionate andexperienced lecturers with varied experience within sports teams, private practice and research environments. Teaching and learning is built around a mix of practical and theoretical sessions in custom built facilities.

26.K London Wetland Centre
Over 100 acres of wetland sites, with extensive populations of wild birds, plants and insects. Talk to the experts about biodiversity and conservation.

26.L National Physical Laboratory
UK's principal facility in measurement and materials science. Visit state of the art facilities ensuring accuracy, consistency and innovation in physical measurement.

26.M Old Operating Theatre and Herb Garret
Original Operating Theatre dating from 1821, with original instruments; find out about surgery before anaesthesia and antiseptics.

26.N Queen Mary University of London - School of Engineering and Materials Science
The School of Engineering and Materials Science (SEMS) is ranked as one of the best in the UK, with cutting-edge research focused in: Modelling and Simulation in Engineering Systems, Bioengineering and Materials Science. SEMS provides outstanding degree programmes coupled with internationally leading research.

26.O The Royal Institution
The Royal Institution (Ri) is an independent charity dedicated to connecting people with the world of science with over 200 years of history. At the L'Oreal Young Scientist Centre students will undertake a magnets and motors workshop, seeing a demonstration of Faraday's original electric motor and then building a simple battery powered motor that uses similar principles.

26.P University College London - Faculty of Engineering
This department's teaching programmes are designed to engage students and give them the skills to address the world's challenges with pioneering highly-rated academic research. UCL graduates progress to a wide range of roles, within engineering and technology sectors and beyond.

26.Q University College London Hospitals – Department of Haematology and Blood Transfusion
The laboratory issues approximately 50,000 blood and plasma products per annum, supporting the large Haemato-Oncology Department, a tertiary referral centre for the North West London area and the large Sickle Cell and Thalassaemia Unit which transfuses more patients than any other Trust in the UK.

26.R University College London, Jill Dando Institute of Security and Crime Science
Visit the first Institute in the world devoted to crime science. Research is concentrated on new ways to cut crime and increase security.

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Tuesday 30th July
National Scientific Visits

30.A Airbus UK
Core activities at Filton include the design, engineering and support for Airbus wings, fuel systems and landing gear integration.

30.B Animal & Plant Health Agency (APHA)
APHA is the UK Government agency responsible for; identifying and controlling endemic and exotic diseases and pests in animals, plants and bees, and surveillance of new and emerging pests and diseases; scientific research in areas such as bacterial, viral, prion and parasitic diseases and vaccines, and food safety.

30.C University of Birmingham, School of Biosciences
Across the breadth of life and environmental sciences, we discover, apply and translate science, forging major advances in human and environmental health. From exercise, biomedicine and mental health to climate change, food security and resilience we combine original thinking and real-world experience with clear focus and rigour. This is underpinned by our enabling technologies, which combine state-of-the-art equipment with expert staff.

30.D Cardiff University - School of Pharmacy and Pharmaceutical Sciences & Cardiff University Brain Research Imaging Centre
The school has a strong tradition of innovative pharmaceutical education, scientific research and service to the pharmacy profession. Cardiff University Brain Research Imaging Centre (CUBRIC) is set to become one of Europe's top facilities for brain imaging.

30.E Cranfield University
Cranfield University has a global reputation for inspirational teaching and research, industrial-scale facilities and superior links with industry and commerce.

30.F University of Essex, Human Performance Unit
The HPU provides physiological testing, nutritional support and body composition assessments to athletes. Athletes are attracted to Essex University due to the high calibre coaching and sports science services.

30.G John Innes Centre, Norwich Research Park
An independent, international centre of excellence in plant science and microbiology working to generate knowledge of plants and microbes through innovative research to benefit agriculture, the environment, human health and well-being.

30.H University of Leicester Space Research Centre & National Space Academy
As an research organisation mainly; developing novel sensors and optics for high energy astrophysics, planetary landers and orbiters and interdisciplinary research in the Life Sciences and Medicine, providing engineering capability in Space as well as planetary science including concepts for the next generation of instrumentation, tools and techniques and planetary materials and their analysis.

30.I Liverpool School of Tropical Medicine (LSTM)
An independent, international centre of excellence in plant science and microbiology working to generate knowledge of plants and microbes through innovative research to benefit agriculture, the environment, human health and well-being.

30.J National Oceanography Centre & University of Southampton's School of Ocean and Earth Science
NOCS is the national focus for oceanography in the UK with a remit to achieve scientific excellence in its own right as one of the world's top five oceanographic research institutions.

30.K University of Nottingham, The School of Chemistry - Carbon Neutral Laboratories
A £4 million HEFCE-STEM funded award is supporting new teaching laboratories at the University of Nottingham. The development within the School of Chemistry will see the creation of a new teaching laboratory that will be fully equipped with cutting-edge, facilities used for research and teaching.

30.M Rolls Royce
Visit to see Rolls-Royce, from its beginnings to present day product range. See the largest collection of aero engines in the country, ranging from World War 1 era piston engines, the famous Merlin, right up to modern day jet engines.

30.N Rothamsted Research Centre
The longest running agricultural research station in the world, providing cutting-edge science and innovation, in areas of crop productivity and quality and sustainable solutions for food and energy production.

30.O Syngenta's International Research Centre at Jealott's Hill
Syngenta is a leading agriculture company helping to improve global food security by enabling millions of farmers to make better use of available resources. Key activities include the discovery of new active ingredients, new formulation technologies, product safety and seeds research.

30.P UK National Quantum Technology Hub, University of Birmingham
Led by the University of Birmingham, the Quantum Technology Hub in Sensors and Metrology brings together expertise in physics and engineering working to transform laboratory-based research into technology. They are developing smaller, cheaper, more accurate and energy efficient components and systems to build and sustain a supply chain which will have a potentially transformative impact across business and society as a whole.

30.Q University College London, Mullard Space Science Laboratory
Exploiting the capabilities of rockets and spacecraft as platforms for scientific instruments it strives to understand our physical environment and our place in the Universe.

30.R University of Sussex, School of Life Sciences
At Sussex, research in Chemistry is making world-changing impact in many areas, including renewable energy, drug design and quantum chemistry. University of Sussex - School of Life Sciences - Biology
At Sussex, Biology is for those who are curious about the natural world and who want to understand the past, present and future of life on Earth, seeking solutions to some of the most important problems facing humanity – from managing environmental change to controlling disease.

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Thursday 1st August
Oxford and Cambridge Scientific Visits

1.A BMW - Mini Plant Oxford
Experience production and take a look behind the scenes with our experts. The products made by BMW Group inspire with unique design, dynamic and agility. It is exciting and fascinating to experience live production.

1.B British Antarctic Survey
The British Antarctic Survey (BAS) is an international leader in Antarctic science. BAS provide world-leading research infrastructure that enables scientists to work safely and effectively in the polar regions.

1.C University of Cambridge, MRC Laboratory of Molecular Biology
The MRC Laboratory of Molecular Biology is one of the world's leading research institutes. Its scientists work to advance understanding of biological processes at the levels of atoms, molecules, cells and organisms.

1.D University of Cambridge. NIHR Cambridge Biomedical Research Centre and Cambridge Science Centre
The partnership between the hospital and the University creates an environment where internationally outstanding biomedical and clinical scientists work alongside clinical practitioners to achieve translation of research for the benefit of patients. The Cambridge Cancer Centre is a dynamic collaboration of researchers, clinicians, and the pharmaceutical and biotech industries to pioneer new ways to prevent, detect and treat cancer.

1.E University of Cambridge, Scott Polar Research Institute
The institute is the oldest research institute of its kind, with a mission to enhance the understanding of the Polar Regions through scholarly research and publication.

1.F Culham Centre for Fusion Energy
The Culham Centre for Fusion Energy (CCFE) is the UK's national laboratory for fusion research, owned and operated by the United Kingdom Atomic Energy Authority (UKAEA). CCFE hosts the world's largest magnetic fusion experiment, JET (Joint European Torus).

1.G HR Wallingford
HR Wallingford has been involved in research and consultancy to solve water-related challenges worldwide for 70 years. The company has impressive physical modelling facilities which include seven wave basins, used to build and test scale models of ports, harbours and beaches.

1.H University of Oxford, Botanic Gardens & The Museum of Natural History
Houses the University's zoological, entomological and geological specimens. Among its famous features are a dodo, the first dinosaur to be scientifically described, and the swifts in the tower.

1.I University of Oxford, History of Science Museum
The History of Science Museum houses an unrivalled collection of historic scientific instruments in the world's oldest surviving purpose-built museum building. By virtue of the collection and the building, the Museum occupies a special position, both in the study of the history of science and in the development of Western culture and collecting.

1.J University of Oxford - Nuffield Department of Clinical Neurosciences
NDCN provides a focus for world-leading translational neuroscience allowing the swift transfer of basic biomedical findings to the clinical setting and the delivery of evidence-based therapies.

1.K University of Oxford, NIHR Oxford Biomedical Research Centre
The Nuffield Department of Clinical Neurosciences (NDCN) provides a focus for world-leading translational neuroscience allowing the swift transfer of basic biomedical findings to the clinical setting and the delivery of evidence-based therapies for the benefit of society and the economy.

1.L University of Oxford, Pitt Rivers Museum
The museum displays the archaeological and anthropological collections of the University of Oxford. The museum was founded in 1884 by Lt-General Augustus Pitt Rivers.

1.M Wellcome Genome Campus
A leader in the Human Genome Project, this institute is focused on understanding the role of genetics in health and disease with research into connection between genetics and infectious disease.

1.N University of Oxford Department of Zoology
The Department is a large university zoology department, containing the Biodiversity Institute; Edward Grey Institute of Field Ornithology; Institute for Emerging Infections and the Wildlife Conservation Research Unit.

Friday 2nd August

2.A Natural History Museum
The Natural History Museum's vision is to advance knowledge of the natural world, inspiring better care of our planet with the mission to maintain and develop collections, and use them to promote the discovery, understanding, responsible use and enjoyment of the natural world. The 8-storey, landmark Darwin Centre and cocoon structure is the most significant development at the Natural History Museum since it moved to South Kensington in 1881.

2.B Science Museum
The Science Museum has over 300,000 objects in its care, with particular strengths in the history of western science, technology and medicine since 1700. It has been uniquely placed to acquire objects recording the Industrial Revolution, and now holds unrivalled collections in this area. Medical artefacts from all periods and cultures also form an important part of its holdings.

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Saturday 27th July
Science Bazaar – Student Projects Evening

All students are invited to take part in the Science Forum Bazaar, either presenting a project or visiting the stands and asking questions. The Science Bazaar is an exciting opportunity to present an independent research project in a non-competitive environment with fellow students from all over the world and our science experts.

LIYSF is very privileged to have the support and help of a team of science experts who will be asking questions at the stands and giving feedback.

Science Bazaar Judges


Elizabeth Chambers


Ndiuwem Essien


Shaun Holmes


Anin Luo


Dr. Claire McNulty


Simran Mohnani


Sean O'Callaghan


Michael Olafisoye


John Romero


Emmanuel Shofoluwe


Spencer Wilson


Ojali Yusuff

FameLab at LIYSF

Ten projects will be chosen to be presented on Monday 29th July during the FameLab LIYSF evening. This evening will provide an introduction to FameLab and how you can join in the future, with some former FameLab winners presenting. FameLab is a communications competition designed to engage and entertain by breaking down science, technology and engineering concepts into three minute presentations.

FameLab TALKING SCIENCE

BRITISH COUNCIL

CHELTENHAM Science Festival

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Programme Venues

Halls of Residence

Beitside Halls of Residence
Hall Host: Enrico Caprioglio

Beit Halls

Southside Halls

MGM Halls of Residence
Hall Host: Ariadna Gistas

Millennium Gloucester

Metrogate House

Richmond Halls of Residence
Hall Host: Krsna Mohnani

Atlantic House

Ambassador House

Programme Venues

Royal Geographical Society

Imperial College London

Millennium Gloucester

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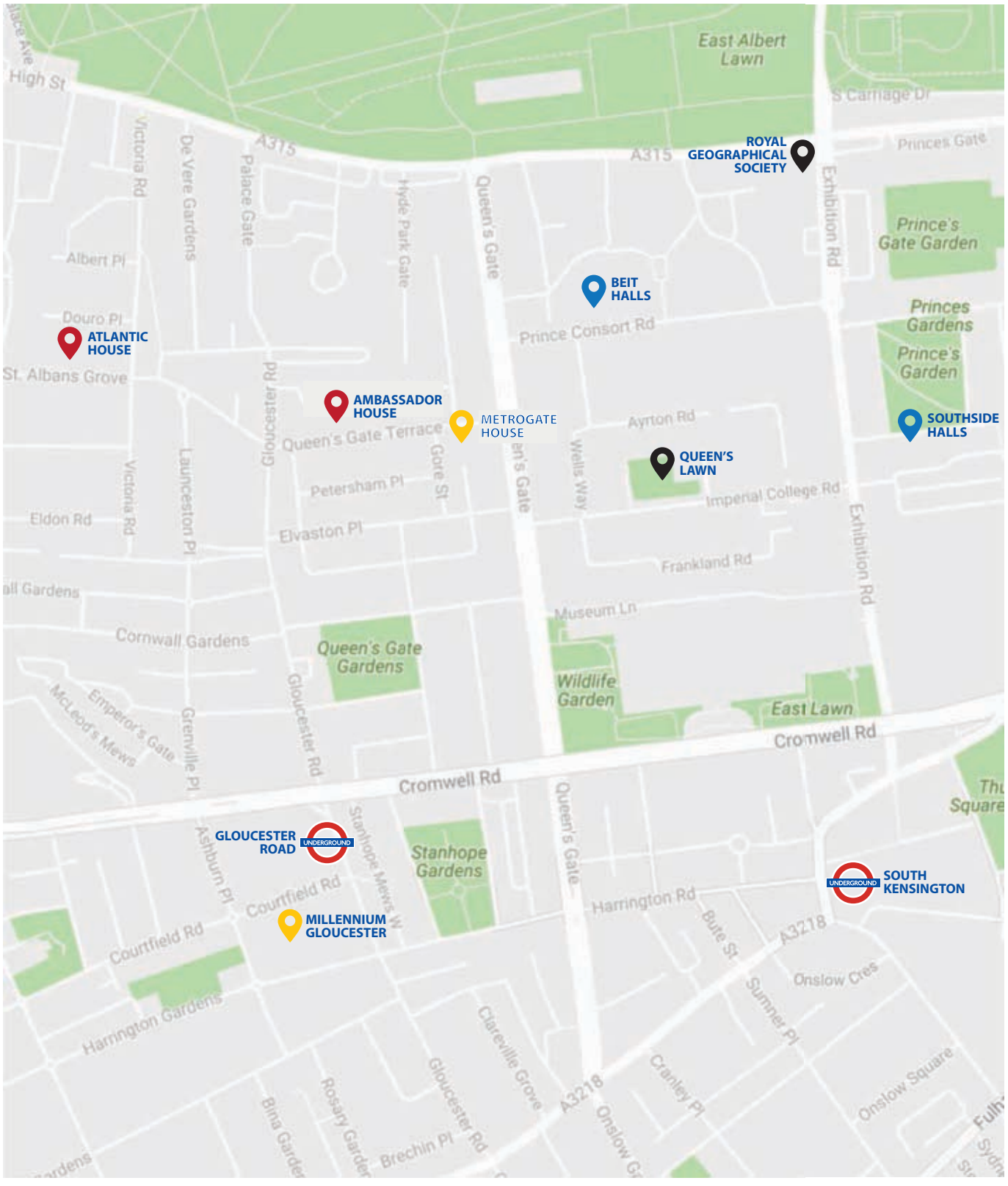
LIYSF Campus



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62nd London International Youth Science Forum

29th July – 12th August 2020

London International Youth Science Forum
Royal Parade Mews
Chislehurst
BR7 6TN
United Kingdom

www.liysf.org.uk | info@liysf.org.uk | +44 20 8295 8395

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LONDON INTERNATIONAL YOUTH SCIENCE FORUM

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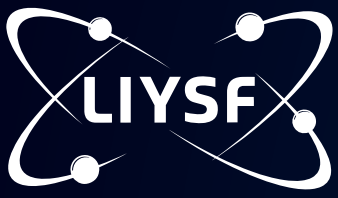

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