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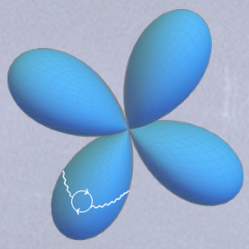
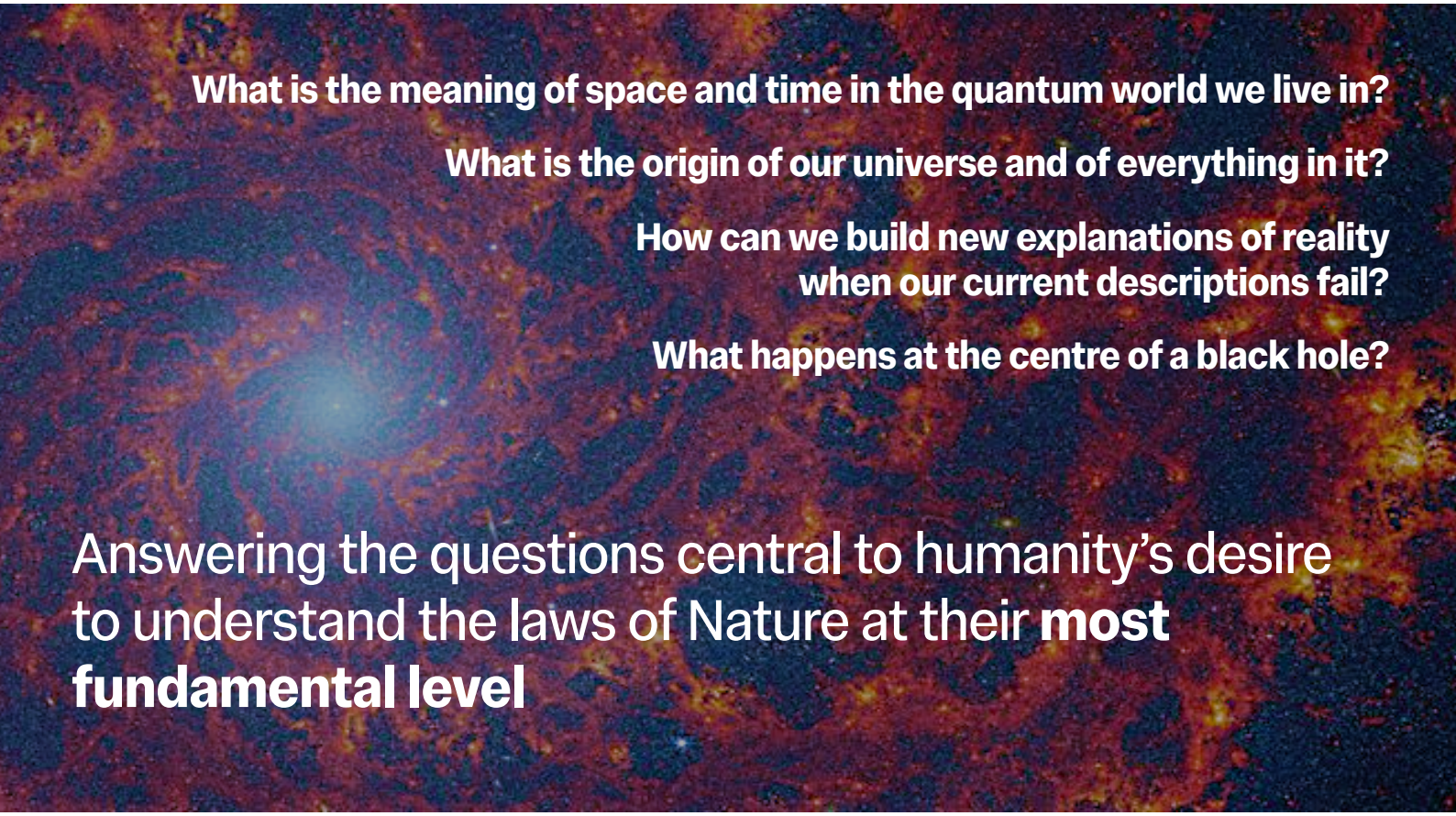


Abdus Salam Centre for Theoretical Physics

"Scientific thought and its creation is the common and shared heritage of humanity."

– Abdus Salam



The Centre

The **Abdus Salam Centre for Theoretical Physics** is the first of a new class of **Centre of Excellence in Fundamental Science** at Imperial, created to drive basic, discovery-driven science.

Building on a unique vision, heritage and history of excellence at Imperial it will establish a new international hub in fundamental physics with a mission to

- drive the next generation of breakthroughs in fundamental physics,
- promote and support the next cohort of leading scientists from across the globe, ultimately enabling new connections between theoretical physics and the rest of science and society,
- innovate transformative ways to connect with the next generation, empowering them to bring the approach of fundamental science to challenges across society.

Research in theoretical physics is truly a **global endeavour**. As a world-leading hub, the Centre will bring outstanding researchers together from across the globe through fellowships, visitor programmes, focused workshops and targeted research opportunities. Knowing that diversity underpins the foundations of outstanding innovative research it will foster key partnerships with the Global South to create capacity for underrepresented groups.

The Centre will support a high-impact **outreach and engagement** program aimed at schools, underprivileged communities and the general public to promote fundamental science for both discovery and global development.

A tradition of excellence

The Theoretical Physics Group at Imperial was founded by **Nobel prize winner Abdus Salam** and has been at the forefront of driving new discoveries for close to 70 years, currently **ranking 5th globally** among universities in terms of citation impact.

It is a record of success that builds on the legacy of **Salam**, the pivotal work of **Tom Kibble**, and, more recently, the deep connections between the Centre and **Stephen Hawking**, with more than half its members being trained in Hawking's Group.

Breakthroughs driven by the Centre span from the Salam's Nobel-prize winning work on unification in the quantum electroweak theory, to the theory of spontaneous symmetry and the Higgs particle driven by Kibble, to the grand unified theories of Pati and Salam and the birth of particle quantum cosmology as a field under Kibble. It runs from supersymmetry and supergravity, to developments in quantum foundations, to M-theory, branes and the unification of string theory and most recently to massive gravity as a quantum field theory, holography, causal sets, black hole entropy and numerous other breakthroughs.

The Centre's unique global profile drives research spanning

- the nature of space, time and **quantum gravity**,
- the fundamental quantum forces of Nature and their unification, within **quantum field theory**,
- the realm of **quantum cosmology** and our mission to uncover the origin and fate of the universe,
- the quantum properties of black holes, production of gravitational waves and testing the **imprints of fundamental physics**.

In addition, the centre runs the renowned **Quantum Fields and Fundamental Forces (QFFF) Master's programme** which attracts outstanding students from across the world and whose alumni have a created a strong and cohesive network across all continents and all fields. This degree is integral part of the Centre's activities, with the potential to increase the size of the cohort from diverse geographical backgrounds.

Driving global impact

While the complete answers to the questions central to understanding the fundamental laws of Nature still elude us, the effort to find them has led to remarkable technological applications, **transforming society** in ways that could not have originally been imagined.

For example, understanding the laws of quantum mechanics enabled the revolution in microelectronics, whilst the functioning of GPS devices now inbuilt in all our devices rely on Einstein's theory of gravity. There is little doubt that unifying the quantum laws of nature will lead to equally **world-changing technologies,** though precisely what they will be is impossible to predict.

Space and Time:

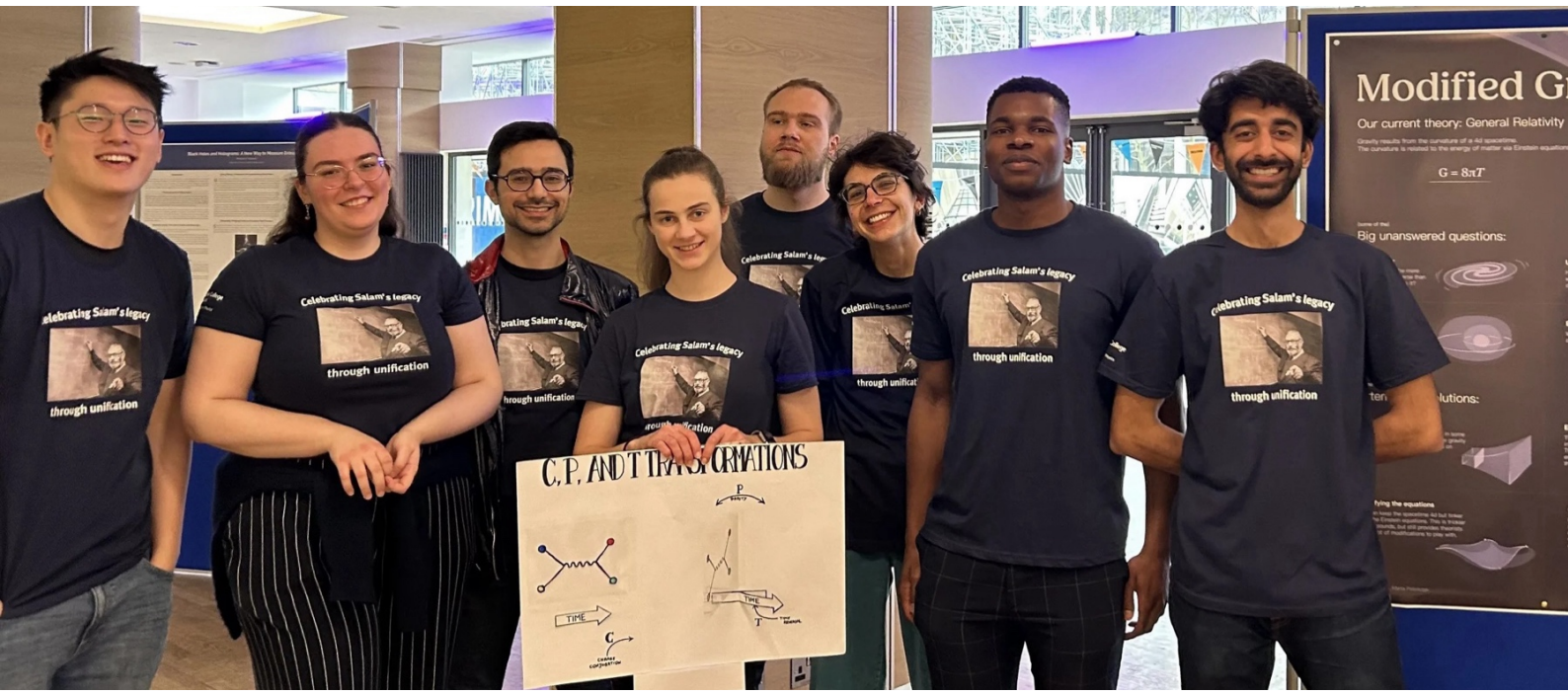
To truly understand our quantum Universe, we need both Space and Time. At the Abdus Salam Centre for Theoretical Physics, our aim is to **create an intellectual environment** in which our world-leading academics can ponder and explore new challenges, exchange ideas and engage with colleagues, visitors and students. We will build a space that enables scientists to focus and make progress on key questions, whilst a vibrant visitor and exchange program will facilitate collaboration across interconnected fields.

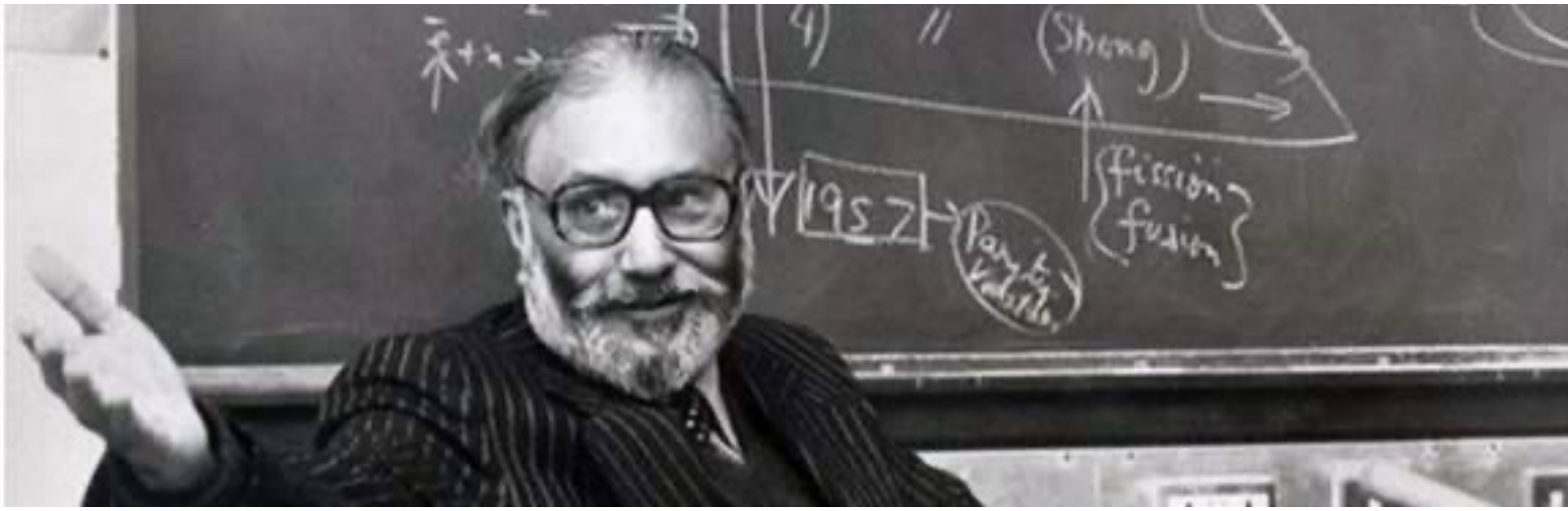
The next generation:

As an international hub, our Centre promotes and supports the **next cohort of leading scientists** from **across the globe**, ultimately enabling new connections between theoretical physics and the rest of science and society. Knowing, as Salam did, that diversity underpins outstanding research, our aim is to foster key international partnerships to provide new opportunities for underrepresented groups. The Centre also supports **high-impact outreach** and high visibility media programs, increasing engagement with the general public and promoting fundamental science for both discovery and global development.

Engagement:

The Centre will be a focal point for curiosity-driven research and interdisciplinary study with innovative paths for **global engagement and impact, as we recognise that scientists with core training in theoretical physics and mathematics make enormous** impact across multiple sectors and on **global challenges**, including climate change, energy, quantum computing, AI and medicine.





Programs

Core program:

The Centre's core research program addresses the most important current questions in fundamental theoretical physics, creating **a world-leading hub for breakthrough research**. It is strongly internationally focussed, with dynamic visitor and workshop programs, and provides a focal point linking multiple initiatives across outreach, training, MSc and PhD programmes and international collaboration.

Seed programs:

To kickstart its mission of building a global science community and transformative innovation, the Centre has initiated three focussed programs.

The **Salam Fellows Program** is dedicated to fostering new **exchanges and cohort building** with colleagues in theoretical physics from **Low- and Middle-Income Countries** (LMICs) or from a minority or an underrepresented background that are post-PhD but are not yet fully internationally established, allowing them to join the Salam Centre and collaborate with theoretical physicists at Imperial. This period is one of the most important times to establish long-term collaborations and connections and hence is crucial for the future success for this cohort.

To complement the Salam Fellows program, the **Kibble Visiting Fellows** program is designed to exploit the potential for **disruptive new science**, both within theoretical physics and for unlocking long-lasting benefits for society. Built around a visiting research program and seminar and lecture presentations, it will both help build capacity and open connections to new collaborations and **seed new ideas** and research directions. Fellows will include highly successful leaders that have moved to other fields who still harbour strong links to the fundamental science, irrespective of the seniority of their position. The program will drive **translational impact**, tackling the biggest challenges for our society, reconnecting fellows with fundamental science and sparking new partnerships.

The career progression of Imperial and Salam Centre alumni has multiple paths across many areas of society. To engage our cohort of students and young researchers in looking beyond their immediate work to **explore other transformative and high impact fields** driven by theoretical physics, the **New Horizon Initiative** will provide late-stage PhD students and postdocs with support to explore new skills, engagement, outreach and other diverse and interdisciplinary links, both at Imperial and internationally.

Engagement and outreach

Engaging with society at all levels is **central to the Centre's mission**. In the words of Salam, "scientific thought and its creation is the common and shared heritage of humanity". Communicating how scientists understand the universe at its most fundamental level captures the imagination of the public in profound way and **inspires future generations** of researchers.

The Centre has an **outstanding track-record** of outreach and engagement, from prize-winning, high-profile public events and talks with millions of online views, to stories in major print, TV and radio outlets, to podcast, festivals and popular books, to widening participation campaigns and school outreach.

We all have an innate desire to understand the structure of the world at its deepest level. The Centre is committed to sharing the beauty of theoretical physics, the profound impact of its ideas, and engaging everyone in the search for what comes next.