



Professor Mark Thomson

United Kingdom Candidate for Director-General of the
European Organization for Nuclear Research (CERN) 2024



Introduction by the United Kingdom Secretary of State for Science, Innovation and Technology



“Mark is one of the most accomplished experimental particle physicists in his generation”

The United Kingdom is delighted to confirm that we are nominating Professor Mark Thomson as our candidate for Director-General of the European Organization for Nuclear Research (CERN).

For 70 years, CERN has been a beacon for science excellence and has proved the value of European cooperation. Bringing together the creativity of so many different nationalities, backgrounds and fields of research has established CERN as the global centre for particle physics. Other global research infrastructure and science experiments look to CERN as an exemplar of international research collaboration and governance. The UK is proud to have been a critical contributor to all major experiments and discoveries at CERN, including the discovery of the Higgs boson in 2012. The UK leads in many aspects of the CERN scientific programme and is championing important matters at CERN including transparent and robust governance, and environmental sustainability.

Professor Thomson is exceptionally well qualified to serve as the Director-General of CERN. He has the experience, skills and knowledge to lead CERN in its mission and keep CERN at the forefront of particle physics research. He has substantial experience of CERN over more than twenty-five years.

Mark is one of the most accomplished experimental particle physicists in his generation. He worked at CERN for six years, first as a fellow and then as a staff research physicist. He has a strong and well-documented record of important achievements in the field, with a global reputation, pioneering particle flow calorimetry for future collider experiments. Mark is Professor of Experimental Particle Physics at the University of Cambridge. He is a highly respected member of the physics community, with over 1,100 publications covering a number of major areas in high energy particle physics. His research interests are in neutrino physics and electron-positron collider physics. In 2013, he published ‘Modern Particle Physics’, a textbook that has been widely adopted for undergraduate courses around the world. Since 2018, he has been the UK’s representative to CERN Council and has extensive knowledge of the organisation and its challenges.

Mark has also had a remarkable record of dedicated service to the scientific community. In particular his distinguished leadership as Executive Chair of the Science and Technology Facilities Council, the UK government agency that runs facilities and carries out research in particle physics, nuclear physics, space science and astronomy.

Mark has held international research leadership roles at the forefront of neutrino and collider physics. From 2015-18 he was Co-Spokesperson of the Deep Underground Neutrino Experiment (DUNE), a collaboration of over 1,000 scientists constructing the next major global particle physics experiment in the US. As a UK delegate to CERN Council and governing bodies of other multilateral organisations, he has significant experience in international diplomacy and the challenges of intergovernmental organisations. He has a clear and achievable vision for how CERN can continue to be Europe's premier particle physics laboratory and remain at the forefront of particle physics research.

CERN is approaching a critical time of decision making on its future direction. We believe that Professor Mark Thomson is the best person to provide the expert, inclusive and strategic leadership CERN needs during this critical period.

I wholeheartedly endorse his candidature for the Director-General of CERN.



**The Rt Hon Michelle Donelan MP
Secretary of State for Science,
Innovation and Technology**



Professor Mark Thomson: Motivation and Experience



“I have successfully led a complex organisation of a similar size to CERN”

Motivation

I am honoured to be considered as a candidate for the Director-General (DG) of CERN. If elected, I would bring to this role over 25 years of scientific leadership, an extensive knowledge of CERN, and deep experience of operating successfully at the highest level in major research infrastructures at national and international levels.

Experience

For the last six years I have successfully led a complex organisation of a similar size to CERN and will build on this experience to provide the outstanding leadership that CERN deserves. CERN is a unique and exceptional organisation that has secured Europe’s position as the global leader in particle physics, not only leading to profound Nobel prize winning discoveries but also inspiring the wider public, delivering societal benefits, and providing exceptional training for highly skilled scientists, engineers and technical staff.

I believe passionately that it is of strategic importance to Europe for CERN to remain at the global forefront of particle physics, continuing to push forward the boundaries of technology and inspiring the next generation to pursue careers in science and engineering. Continuing to deliver a vibrant research programme at CERN is also central to the health of the field globally. Working with international partners to ensure success in the next stage of CERN’s extraordinary journey would be my highest priority. CERN is much more than just the physical research infrastructure – its exceptional staff are vital. Nurturing and empowering the talent within the organisation will be a critical component of CERN’s future success.

For the continued success of CERN, the next Director-General DG will need extensive experience to provide strong leadership across three fundamental areas:

Scientific Leadership – delivering for the scientific community: The next DG will require the scientific vision and judgement to steer the organisation through a period where it is completing the construction of the High-Luminosity LHC – by far the world’s most powerful collider – and planning the long-term future of CERN, including securing the next large global particle physics project for Europe.

International Leadership – delivering for all member states: At a political level, the funders of CERN expect to see the benefit from membership that goes beyond science, whether it be in technology, skill development or high-tech industrial growth. The next DG will need to work closely with each of the member states to ensure that national priorities are also the priority of CERN.



Organisational Leadership – delivering operational excellence: CERN is a large organisation, with approximately 2,500 highly-skilled staff. Effective, engaging and inclusive management is a key component to CERN’s future success. The next DG will need to have the leadership and management skills to steer the organisation through a complex time.

I have the background, experience, ability and proven track record to excel in all three areas.

As a scientist, I have pursued research at the highest level in collider physics at CERN and neutrino physics in the US. Unsurprisingly, CERN has been a major part of my scientific career. During the 1990s, I worked for CERN on the OPAL experiment at the Large Electron Positron (LEP) collider, focussing on the precision studies of the electroweak sector, central to CERN’s scientific programme at that time – and potentially its future. My association with CERN continued throughout my career, however my experience goes much wider. Most recently, I led the Deep Underground Neutrino Experiment – the multi-billion-dollar flagship project of the current US particle physics programme. My scientific experience is both deep and broad. The breadth of my scientific research and my passion for science motivated me to write “Modern Particle Physics”, a textbook that is now used in university courses around the globe. I would bring my diverse scientific experience and organisational perspectives to the leadership of CERN.

Since 2018, I have been the Executive Chair of the Science and Technology Facilities Council in the UK, with responsibility for almost 3,000 staff and an annual budget of over £900m. This has equipped me with the experience of successful scientific leadership of an organisation of a very similar scale to CERN. As STFC Executive Chair I am responsible for UK funding of big science (particle physics, nuclear physics and astronomy), combined with responsibility of the operation of the UK’s largest multidisciplinary research facilities at STFC’s Rutherford Appleton Laboratory and Daresbury Laboratory. STFC’s laboratories host a complex and broad ranging portfolio of the UK’s key national R&D infrastructure, including the Diamond Light Source, the ISIS Neutron and Muon Source, and RAL Space. Over the last six years, I have set a high

level of ambition for STFC. During this time, I have secured investments to deliver our roadmap to upgrade all our large-scale multi-disciplinary national facilities as well as delivering new initiatives such as the National Quantum Computing Centre and the National Satellite Test Facility. I am particularly proud of the initiatives I established to bolster the culture of the organisation for example working through my senior leadership team to champion equality, diversity and inclusion, bring in external voices, and develop talent.

At a national level, I have set direction to deliver major strategic initiatives, including the development of the strategy for UKRI’s infrastructure work. This involved establishing a process for prioritisation of large infrastructures, the establishment of the UK Infrastructure Roadmap and the resulting long-term investment portfolio of over two billion pounds, spanning the physical and biological sciences to the arts and humanities.

Partnerships are key to the success of all large international research organisations. Decisions are based on building multi-lateral consensus at agency/ministry level, often requiring compromise and a high level of trust. I have significant experience of operating effectively and collaboratively in this environment, balancing national needs with organisational needs. For the past six years I have been the UK delegate to CERN Council and the Councils of the Square Kilometre Array Observatory and European Spallation Source. My scientific and technical background and collaborative approach have enabled me to make important contributions to these major global research infrastructures. Applying insight from my broad experience, I am viewed as a trusted voice when grappling complex issues in the development of a consensus resolution.

In my role as Executive Chair, I have worked closely with ministry and agency colleagues outside the UK to foster a collaborative approach to existing and new international partnerships. I believe my proactive and personal approach has strongly influenced the success of these collaborations, resulting in new partnership agreements and securing the UK’s investment in the LHCb upgrade and the Electron-Ion Collider in the US.

My Vision for CERN

CERN requires strong, experienced and well-rounded leadership.

If elected as DG of CERN, the above three pillars of Scientific, International and Organisational Leadership would underpin my five-year mandate. My priorities are to ensure that CERN fulfils its core mission and in doing so delivers for its three key stakeholders: the scientific community, the Member States, and CERN's staff.

Delivering Outstanding Science: The next five years will be crucial for setting the long-term future of CERN. I would have three priorities: i) delivering HL-LHC construction programme (machine and detectors) on schedule; ii) establishing the next major project after the Large Hadron Collider (LHC); and iii) leveraging CERN's existing accelerator complex to provide a broad range of scientific opportunities for the next generation of researchers. To deliver this high-level vision, I will develop a "CERN Strategic Plan" that outlines the principles and priorities for how CERN will deliver the European Strategy over the five-year period. This would provide the strategic framework to inform investment decisions and how to develop the organisation.

The main challenges for the next CERN Director-General will be planning for the laboratory's future beyond the HL-LHC, and at the same time completing the HL-LHC on schedule. **CERN's future vision needs to be ambitious.** The European Strategy for Particle Physics identified an electron-positron Higgs Factory as the highest priority for the next collider and I am convinced that Future Circular Collider (FCC) is scientifically the best option. The main question is cost and affordability. Given the scale of the potential investment and the impact on CERN, one of my main goals as DG would be to present to Council a financially viable approach to the FCCee that is based on a well-understood transparent cost model and a clear plan for resources from outside the CERN subscription. At a future decision point, I believe it is essential that CERN Council is presented with options, including an alternative plan. Realising the FCC will be challenging, but the prize is worth it.

Delivering for the Member States: I believe it is essential that each of the countries that fund CERN, large or small, see the benefits of membership of CERN. In my current role, I have worked with government to develop UK Strategy for Engagement with CERN, for the mutual benefit of the UK and CERN. This has provided a focus to improving, for example, industrial return. This strategy has been well received within the UK community and by CERN. One of my main goals as DG of CERN would be to build on this experience to strengthen the connection between CERN and all its members. In my first six months, I would meet representatives of the different Member States to understand their specific priorities and subsequently develop plans for how these priorities could be better addressed.

Delivering for CERN: In my current role as a leader of a major research organisation, I am committed to building an inclusive culture that delivers our goals and at the same time supports our staff. The importance of CERN's staff in delivering its mission cannot be over-stated. My third main priority as Director General would be to focus on the overall effectiveness of CERN as an organisation and ensuring all staff are empowered and supported to thrive. In my experience, providing the right structure and culture to empower staff, at all levels, is a "win-win" for individuals and the organisation. I am deeply committed to inclusivity and passionately believe that CERN, as an international governmental organisation should be representative of the diversity within the member states. If elected, I would champion actively the inclusivity and diversity in all activities of CERN.

I would, for example, target the goal of better gender and geographical balance for CERN staff. Such goals are not easy to achieve and cannot happen overnight, but progress is possible with commitment from CERN's leadership.

Under my leadership, CERN would reinforce its position as the world's pre-eminent fundamental physics laboratory, securing its future for the next generations.



Professor Mark Thomson: Curriculum Vitae

Executive Chair of the Science and Technology Facilities Council (STFC) (2018–present). Responsible for providing overall leadership, and for the management and performance of STFC which is part of UK Research and Innovation (UKRI). He is responsible for an annual budget of about £900m. He also leads delivery of the UKRI Research and Innovation Infrastructure Roadmap with an investment portfolio estimated to be £1.6 billion. He represents the UK on the governing Councils of three major intergovernmental organisations; CERN, the Square Kilometre Array Observatory and the European Spallation Source.

Overview

Mark Thomson's main research activities are centred around three core areas. He is one of the leading figures in **neutrino physics**. Until April 2018, he was the co-spokesperson of the Deep Underground Neutrino Experiment (DUNE), which is the next generation of long-baseline neutrino oscillation experiment in the US, aiming to discover CP violation in the leptonic sector. He played a leading role in the development of the **first automatic reconstruction software** to process images from liquid argon detectors such as DUNE and MicroBooNE at Fermilab. He is also the world-leading expert on **high-granularity particle flow calorimetry**, which drives the design of future collider detectors. At CERN, he played a leading role in the precision measurements of the properties of the W and Z bosons with the OPAL experiment at the Large Electron-Positron (LEP) collider.

Academic and Professional Experience

- Co-spokesperson of the Deep Underground Neutrino Experiment (DUNE) collaboration (2015-18)
- University of Cambridge, Professor of Experimental Particle Physics at the Cavendish Laboratory and Professorial Fellow of Emmanuel College, Cambridge (2008-present)
- University of Cambridge, Reader in Experimental Particle Physics at the Cavendish Laboratory and Fellow of Emmanuel College, Cambridge (2004-2008)
- University of Cambridge, Lecturer in Physics at the Cavendish Laboratory and Fellow of Emmanuel College, Cambridge (2000-2004)
- CERN, Staff Research Physicist (1996-2000)
- CERN, CERN Fellow (1994-1996)
- University College London, Research Fellow in the High Energy Physics group (1992-1994)



Education

- University of Oxford, D.Phil. in Experimental Particle Astrophysics (1988-1991)
- University of Oxford, BA Physics (1985-1988)

Publications

Thomson is the author or co-author of more than 1100 publications in peer reviewed scientific journals covering a number of major areas in High Energy Particle Physics. In addition to his research activities, he is the author of "Modern Particle Physics", a best-selling undergraduate/graduate-level textbook in particle physics, which has been adopted for university physics courses around the globe.

Selected publications include:

- Modern Particle Physics, Thomson, M.A., Cambridge University Press (2013).
- Improved search for muon-neutrino to electron-neutrino transitions in MINOS, MINOS collaboration, Phys. Rev. **Lett** **107** (2011).
- Particle Flow Calorimetry and the PandoraPFA Algorithm, Thomson, M.A, NIMA **611** (2009).
- Measurement of the mass and width of the W boson, OPAL Collaboration, Eur. Phys. J. **C45** (2006).
- Precise determination of the Z resonance parameters at LEP, OPAL Collaboration, Eur. Phys. J. **C19** (2001).

If you would like further information on Professor Thomson's candidacy for the Director-General of the European Organization for Nuclear Research (CERN), please contact:

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