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Tribute to Thomas W.B. Kibble – Perspectives in Fundamental Physics

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The Large Hadron Collider (LHC) is a formidable scientific instrument, the largest single machine in the world and arguably the most complex experimental facility ever built. Constructed between 1998 and 2008 in a 27-kilometre-long tunnel near Geneva, Switzerland, it has been in operation since 2010. A pinnacle of decades of worldwide accelerator development and operation, scientists use it to accelerate and collide subatomic particles at a total energy of initially 7 trillion electronvolts (7×10^{12} eV), now reaching a total energy of 13 TeV after significant upgrades in 2014. These unprecedented collision energies produce a vast array of new exotic particles and allow a glimpse into the early Universe only a few quadrillionths of a second (10^{-15} s) after the Big Bang.

A large part of the motivation for the construction of the LHC was the search for the elusive Higgs particle, which was independently proposed by three theoretical groups (Robert Brout and François Englert; Peter Higgs; and Gerald Guralnik, Carl Hagen, and Tom Kibble) in 1964. The quantum field produced by the Higgs particle is required in the Standard Model as a mechanism to give mass to bosons, a class of fundamental particles, which would otherwise be massless, contrary to experimental observation. The observation of the Higgs particle in October 2013 was the greatest success for the LHC facility to date and quickly led to the award of the 2013 Nobel Prize in Physics to Higgs and Englert.

But the Higgs boson, as a missing piece in the puzzle of the Standard Model, is (or rather, was) only one of the great questions in Physics today. The preponderance of mysterious dark matter and energy in the Universe, the imbalance between matter and antimatter, the properties of the strong interaction at high temperatures and densities, symmetry breaking (or a lack thereof) in different sectors of the Standard Model, and the role of gravity among the four fundamental interactions are other burning issues. Science will not be able to answer them with a single type of (ever larger and more expensive) instruments, but only by employing a combination of techniques that study the natural world through different types of complementary 'lenses' in order to gain a better understanding of the inner workings of the Universe.

Thomas W.B. (Tom) Kibble was one of the world's foremost theoretical physicists. Educated at Melville College and the University of Edinburgh (where he earned his PhD in 1958), he became a Professor at Imperial College London in 1970, serving as Head of the Physics Department from 1983 to 1991. In addition to being one of the fathers of the Higgs particle, he made many other crucial contributions to Particle Physics, on topics including symmetry breaking, phase transitions and topological defects. He received a great number of prestigious awards, such as the Hughes Medal of the Royal Society of London (1981), the Guthrie Medal and Prize of the Institute of Physics (1993) and the Sakurai Prize of the American Physical Society (2010), to name but a few. He was controversially not included in the 2013 Nobel Prize, to the disappointment of Peter Higgs.

Starting in the 1950s and 1960s, Tom Kibble took a critical view of the (nuclear) arms race, and in the 1970s took a leading role in organisations promoting the social responsibility of scientists. He became a member, then chair, of the British Society for Social Responsibility on Science and trustee of the Science and Society Trust. In the 1980s, as a member and later chair of Scientists against Nuclear Arms, he was an effective campaigner against nuclear weapons.

In 2000, Tom Kibble was elected as member of the Academia Europaea (AE). He helped advance the goals of the AE by his commitment to excellence in science, to social responsibility, and the importance of science communication. We met Tom personally as one of the speakers (Figure 1) in a session dedicated to 'Understanding the Universe' at the 25th Annual Conference of the Academia Europaea in Wrocław, Poland, in September 2013, to which we contributed as speaker and convenor, respectively. His paper on 'The Standard Model of Particle Physics' was published in *European Review*.[1] We remember him as a brilliant yet humble scientist with an admirable ability to capture, educate and entertain his audience.

Tom Kibble passed away on 2 June 2016 at the age of 83. We would like to honour his memory with a collection of articles by Laura Baudis, Jo van den Brand, Dmitry

Figure 1. Tom Kibble speaking at the 25th Annual Conference of the Academia Europaea in Wrocław, Poland, in September 2013. Photo: André Mischke.

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Budker, Gerard 't Hooft, and Guido Tonelli, who have graciously agreed to contribute papers highlighting very diverse aspects of perspectives in fundamental physics.

Reference

1. T.W.B. Kibble (2015) The standard model of particle physics. *European Review*, **23**, p. 36. doi: 10.1017/S1062798714000520.

About the Authors

Alban Kellerbauer holds an MSc in Physics from McGill University in Montreal and in 2002 obtained a PhD in Nuclear Physics from Heidelberg University. He completed his post-doc as a CERN Fellow, working at ISOLDE and with the antimatter experiment ATHENA. From 2006 to 2011 he was head of an Emmy Noether junior research group at the Max Planck Institute for Nuclear Physics (MPIK) in Heidelberg. In 2007 he was a founding member of the AEGIS Collaboration, which is operating an antimatter gravity experiment at CERN. He received his habilitation in Heidelberg in 2009. Since 2011, Alban Kellerbauer has been research group leader at MPIK and grant holder of an ERC Starting/Consolidator Grant. He is a founding member of the Young Academy of Europe and was a Board member from 2012 to 2016. Since 2017 he has been an Associate Editor of European Review.

André Mischke studied physics and mathematics at the Philipps University of Marburg and earned his PhD at the Johann Wolfgang Goethe University in Frankfurt, Germany. After a post-doc position in Darmstadt and Nikhef in Amsterdam, as well as several research visits in the United States and Switzerland, he began at Utrecht University as a Veni recipient. There, he was awarded a Vidi grant in 2008 and an ERC Starting/Consolidator Grant in 2009. In 2013 he also received an ERC Proof of Concept grant for his proposal for using particle-physics technology to improve the detection of breast cancer. In 2015 he received a Vici grant for his work on the ALICE experiment at CERN. André Mischke has been a member of the Young Academy of Europe since 2012, serving as its first Chair of the Board from 2012 to 2014. In 2017, he became a member of the Academia Europaea.