

## Professor Kam-Biu LUK

Citation

You may not realize it but right here, right now, billions of neutrinos are passing through our body every second. While we have excellent understanding on how most of the elementary particles, such as electrons, behave and build up atoms, the neutrino, so strange in many ways, has so far defied full explanation. Neutrinos are generated inside stars and nuclear reactors on Earth. And the significance of this tiny ghostly particle is profound: it might explain why we exist.

Today, thanks to the insight and leadership of Hong Kong-born experimental physicist Prof Kam-Biu Luk, we are closer to answering this fundamental question. Prof Luk, a 1970s graduate of the University of Hong Kong and 1980s PhD graduate from the Rutgers University in the US, is a professor of physics at the University of California, Berkeley, a Faculty Senior Scientist of the Lawrence Berkeley National Laboratory, and a Senior Visiting Fellow at the HKUST Jockey Club Institute for Advanced Study.

Prof Luk conceived an experiment to explore neutrino oscillation – the particle’s peculiar capacity to switch between the three different types of neutrinos in Nature – in 2002, and identified the powerful reactors at Daya Bay as the perfect location for this experiment in 2003. What’s more, this mammoth multinational project in particle physics is taking place just 40 kilometers from where you are sitting. Results from the Daya Bay Reactor Neutrino Experiment

in Guangdong have been astounding. In addition, it marks the first time that Chinese and American researchers collaborate on such an impactful mega scientific undertaking based in China.

A courageous move and test of leadership? Yes. The initiative involves over 200 scientists from more than 35 institutions in six countries and regions, including Hong Kong. Guarantees of success or sustaining the massively expensive and lengthy undertaking? No. The first data-taking only took place in 2011.

The huge challenge, though, was just right for Prof Luk. As a child growing up in Hong Kong, he discovered his love of science through building models and telescopes. The three “Ps” of his character gave him a further edge for leading the Daya Bay endeavor: single-minded persistence, inspiring persuasion, and on-going perseverance. He always remained unassuming, keeping his own standing and achievements in the shade to let the collective spirit of the enterprise shine.

While it took nine years from inception to operation, including the design, building and positioning of multiple large particle detectors underground, spectacular results have been obtained remarkably fast. In fact, speed was the deciding factor of success as international groups in other countries were pursuing similar goals. After just 55 days of data-taking, the Daya Bay team discovered a new kind of neutrino oscillation that led to the first definitive measurement of a

fundamental parameter of Nature, called the  $\theta_{13}$  (theta one-three) mixing angle. This fundamental parameter is important for understanding how neutrinos morph from one type to the other. The prestigious Science journal praised the result as one of the top ten scientific breakthroughs in 2012. Furthermore, this discovery of a relatively large  $\theta_{13}$  has enabled a series of new experiments that could eventually lead to explanations of why matter dominates antimatter in the present universe and thus why we are here.

Showing the far-reaching attainments of this work, Prof Luk has already received two prestigious honors even though the studies are still on-going: the 2014 W K H Panofsky Prize from the American Physical Society; and the 2016 Breakthrough Prize in Fundamental Physics, established by entrepreneurial luminaries such as Yuri Milner, Google's Sergey Brin, Alibaba's Jack Ma and Facebook's Mark Zuckerberg, shared between the Daya Bay collaboration and four other global teams exploring different aspects of neutrino oscillation. The project's value for China as a scientific hub is similarly immense, with discussion of the next big thing already underway: a giant collider, more powerful than CERN's Large Hadron Collider in Europe and possibly built in Guangdong.

A dream is hugely important, Prof Luk believes, to give the impetus and direction in which to persevere. Following his own has led to a host of honors and professional recognitions during his career, including Fellowship of the American Physical Society, Divisional Coordinator of High-Energy Physics for the International Organization of Chinese Physicists and Astronomers, and a China Ministry of Education Cheung Kong Scholar from 2007-2010. It has also brought a dramatic step forward in our understanding of the cosmos,

the respect of hundreds of peers and students, and personal joy at not only the result but the process of getting there. For those starting out on their career – or even looking for a new direction partway through – it is an exhilarating example of what understanding your own interests and passion can achieve.

Mr Council Chairman, on behalf of the Council of the Hong Kong University of Science and Technology, I have the high honor of presenting to you, Prof Kam-Biu Luk, University of California, Berkeley, for the award of Doctor of Science *honoris causa*.