

Australian Institute of Physics NSW Branch (Einstein Lecture News)

Each year the AIP NSW Branch nominates a distinguished speaker whose work has covered a wide range of topics with an emphasis on Einstein's ideas and their consequences for physics and technology today. This year the Einstein Lecture was held at the Powerhouse Museum on Monday 24 August 2009 and featured two prominent speakers Dr Roger Rassool from the University of Melbourne on the topic of *"Einstein: Why is it So"* and Prof. Lawrence Krauss an internationally known theoretical physicist with wide research interests, including the interface between elementary particle physics and cosmology, where his studies include the early universe, the nature of dark matter, general relativity and neutrino astrophysics. Prof. Krauss has investigated questions ranging from the nature of exploding stars to issues of the origin of all mass in the universe. His topic at the Einstein Lecture was *"Einstein's Biggest Blunder? A cosmic Mystery Story"*

Enthusiastic audiences packed the Powerhouse Museum to be entertained and lectured on Einstein's most famous contribution to science and the theory of special relativity. The show took us on a journey to make sense of some of the surprising phenomena seen in every day objects: hover bikes, floating apples, bottomless pits, spontaneous combustion, and glue made out thin air and time dilation in action. The show consisted of a theatrical science show containing over 10 engaging science demonstrations, using various pieces of scientific equipment. The show linked science with the natural world to keep the audience engaged with real-life experiences and stimulated the imagination of school-age children. Hands-on demonstrations of physics phenomena—objects that defy gravity, spinning wheels and suitcases that move in unexpected ways and hair-raising fun with Van de Graff generators are just some of the 'magic' tricks that fascinated and amazed the audience of all ages. As a finale to the show, Dr Roger and the gang presented a spectacular laser and light show which used about 3000W of audio power with 6 speakers, 3 (one died!) programmable green lasers, 24 wobble-ating red lasers, 4 free moving mirror lights, 3 movable coloured spot lights, 16 1000W white spots, a light mixing desk with over 512 programmable channels, a sound mixer, a widescreen DLP projector, vision mixer and over 6 dedicated staff & students to help with the production. The show concluded with Dr Rassool answering students' questions and exposing the students to the diverse career paths available to physicists.



Photo from left to right: Dr Graeme Melville, Dr Roger Rassool, Professor Lawrence Krauss and Dr Fred Osman (AIP Branch Chair).

Krauss's lecture focused on the intersection on cosmology and elementary particle physics, addressing questions about the origin of matter in the universe, Einstein's theory of general relativity, astrophysics, and the properties and description of the dark energy that is thought to account for most of the universe's present energy content.

Here is a summary of Professor Lawrence Krauss discussing Einstein's field equations. It needs to be emphasised that any blunders in it are my own and not that of Lawrence Krauss or of Albert Einstein. When Einstein introduced the General Theory of Relativity his field equations suggested that the Universe must be either collapsing or expanding. As that seemed unlikely, Einstein introduced an extra term to keep the Universe stable. That term is equivalent to the energy of "nothing", a nothing that is full of virtual particles coming into and out of existence. In 1929 Edwin Hubble showed that the Universe is expanding so that galaxies in every direction are moving away from us at a rate depending on their distance. He introduced a constant of proportionality, called the Hubble Constant. This was great science even if his value was an over estimate by a factor of 10! According to Lawrence Krauss, the idea that there could be multiple universes, each with different values of physical constants appeals to string physicists. These scientists work on complex mathematical models based on the idea that particles are all due to the vibrations of tiny one-dimensional strings. If there are multiple universes they no longer need to make predictions with the theory and can talk about, "the landscape of nothingness". Krauss closed his presentation by briefly describing possible implications for our understanding of nature, and for life, of this astounding new result.



The talks were very well received and geared to scientists and members of the public alike with many discussions continuing later after the lecture. The Australian Institute of Physics thanks the Powerhouse Museum for hosting the event and Dr Roger Rassool and Professor Lawrence Krauss for delivering an outstanding and stimulating 2009 Einstein Lecture!

Dr Frederick Osman – AIP NSW Branch Chair