



Australian Government

Chief Scientist

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GRAVITATIONAL WAVES ANNOUNCEMENT

A moment 1.3 billion years in the making

Friday 12 February 2016

**Parliament House
CANBERRA**

As a physics enthusiast you dream of days like this.

I was excited for black holes and I really sat up for Dark Energy. But I am calling *this* the most significant announcement in cosmology in my lifetime.

Mainly because it is so specific, so definitive.

It is an event just one tenth of a second in duration.

A moment 1.3 billion years in the making.

The collision of two massive black holes.

Visible in a single oscillating blip on a computer screen.

A blip that will be a poster child for physicists for all time.

And best of all – the promise of more to come.

As an engineer you have to marvel at the instrumentation. Einstein himself did not think that we would be able to build instruments sufficiently sensitive to detect gravitational waves. Any rational observer even ten years ago would have suggested that it would be impossible. But that did not daunt the physicists, engineers and mathematicians.

You will learn today that the fluctuation in the length of the 4 km arms of LIGO (Laser Interferometer Gravitational-Wave Observatory) was just the width of a proton. This is astonishing! But it is a little hard to conceive.

I did some back of the envelope calculations this morning to try to explain it. If we expand the scale and imagine that the arms

of LIGO were the length from here to the nearest star system, Alpha Centauri, 4.4 light years away, it would be like measuring fluctuations over that distance to the width of a single human skin cell.

Now if you were a gambler you would wonder at the extraordinary conflux of events.

After eight years in development, Advanced LIGO began its observing run in September last year. *One hour later*, an event was recorded.

But it was more than luck, it was brilliant science.

Another coincidence: it happened 100 years after the publication of Albert Einstein's Theory of General Relativity. In this company, I don't mind saying that Einstein is my uber-hero.

Time magazine named him the 'Person of the Century' in 1999; and just one of the 'Millennium Top 10'. That doesn't do him justice. In my mind, Einstein is THE Person of the Millennium.

This is not just a victory for Einstein but for big science, for global collaboration, for human beings and for Australia.

My particular congratulations to the Australian teams who contributed critical instrumentation:

- The Australian National University contributed to the system that sets the length of LIGO's arms.
- The University of Adelaide created the high precision sensors to enable correction of optical distortion.

- The University of Western Australia provided the damping instruments to negate the effects of instability.
- CSIRO provided mirror coatings better than anything that anybody in the rest of the world could supply.
- And contributions to instrumentation design and results analysis from Monash University, University of Melbourne and Charles Sturt University.

Every time scientists have developed a better microscope, telescope or measurement instrument of any sort it opens up a new pathway of learning.

Today is no exception. LIGO is a new way to observe the universe. I expect many more discoveries in the coming years.

I expect Australian scientists to continue to play a significant and hopefully expanded role.

I know my sons and their children will look back on the timeline of human history and see the bright mark we leave today. I hope they will look back with more knowledge – better tools – and unquenched thirst to explore.