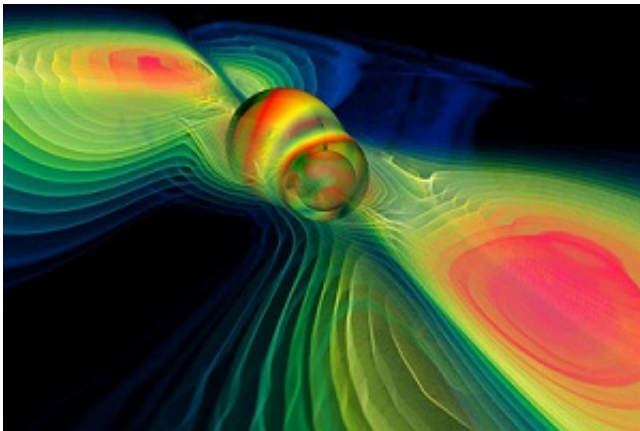


'Listening' to black holes form with gravity waves

August 16 2013, by Geoff Vivian



Gravity waves are ripples in space generated by extreme cosmic events such as colliding stars, black holes, and supernova explosions, which carry vast amounts of energy at the speed of light. Credit: Werner Benger, NASAblueshift

New technology that breaks the quantum measurement barrier has been developed to detect the gravity waves first predicted by Einstein in 1916.

Professor David Blair was one of 800 physicists from around the world who announced a breakthrough in measurement science last month.

"Gravitational wave astronomy is going to be the new astronomy that's likely to really revolutionise our understanding of the universe," he says.

"It will allow us to listen to the big bang and to black holes forming

throughout the universe.

"These are detectors that can allow humanity to explore the beginning of time and the end of time."

According to current theory, time began with the big bang and ends in black holes.

Specialised equipment known as the Laser Interferometer Gravitational-Wave Observatory (LIGO) uses [laser beams](#) to measure gravitational ripples of space and time.

The detector consists of an L-shaped vacuum system, four kilometres long, with mirrors at the ends.

Lasers directed at the mirrors are isolated from irrelevant vibrations by a vibration [isolation system](#).

He says the addition of a new technique called 'quantum squeezing' at the world's largest [gravitational wave detector](#) allowed researchers to eliminate a lot of the 'noise' caused by [quantum fluctuations](#).

"The recent announcement is the first implementation in a multi-kilometre detector."

"It proves that the quantum barrier [that] physicists thought would limit sensitivity can be overcome."

The new equipment has allowed the physicists to break the [quantum measurement](#) barrier, defined until recently by Heisenberg's [uncertainty principle](#).

"This is a major breakthrough that makes us even more confident that in

a few years we will begin to directly measure the ripples in space," he says.

As a result there is no lower limit on the amount of measurable energy, and extremely subtle [gravitational waves](#) will become detectable.

"These instruments represent the pinnacle of technology," he says.

"They've got the most perfect mirrors ever created, they've got the most powerful laser light that's ever been used in any measuring system.

"They've got a vacuum that is so good that the size of any leak would represent less than a teaspoon full of air leaking into it in about 300 years.

"They can measure the smallest amounts of energy that has ever been measured but the new method enables them measure even less.

"The uncertainties from empty space can be suppressed so as to measure something even smaller."

David Blair led a team of 16 physicists in Western Australia along with 800 physicists from around the world who announced the breakthrough in a paper just published in the journal *Nature Photonics*.

More information: [www.nature.com/nphoton/journal...
photon.2013.177.html](http://www.nature.com/nphoton/journal...photon.2013.177.html)

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