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# Einstein's theory is proved - and it is bad news if you own a penthouse

Scientists use atomic clocks to show that time moves faster at altitude, even on Earth

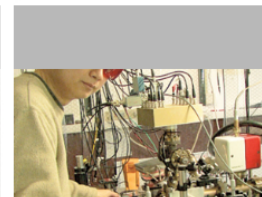
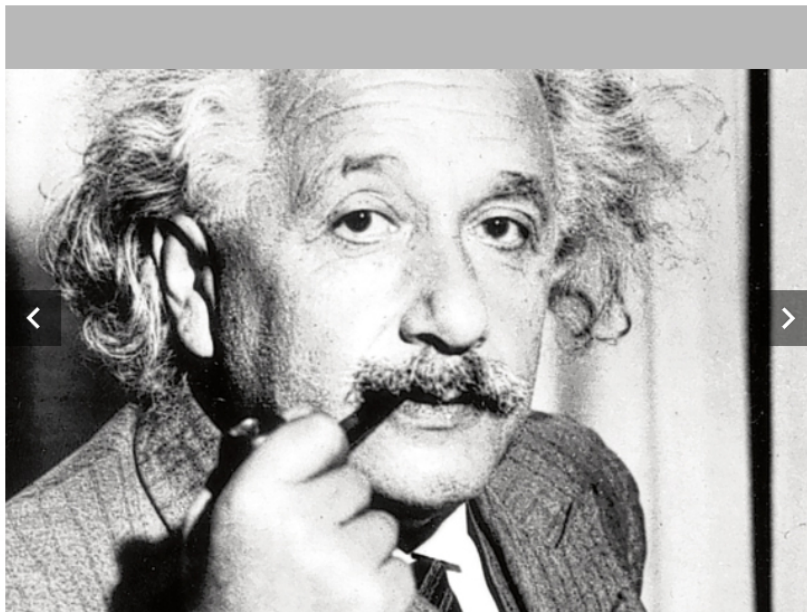
Science Editor, **Steve Connor** | @SteveAConnor | Friday 24 September 2010 00:00 | 103 shares |



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The world's most accurate clock has neatly shown how right Albert Einstein was 100 years ago, when he proposed that time is a relative concept and the higher you live above sea level the faster you should age.


Einstein's theory of relativity states that time and space are not as constant as everyday life would suggest. He suggested that the only true constant, the speed of light, meant that time can run faster or slower depending on how high you are, and how fast you are travelling.

Now scientists have demonstrated the true nature of Einstein's theory for the first time with an incredibly accurate atomic clock that is able to keep time to within one second in about 3.7 billion years – roughly the same length of time that life has existed on Earth.

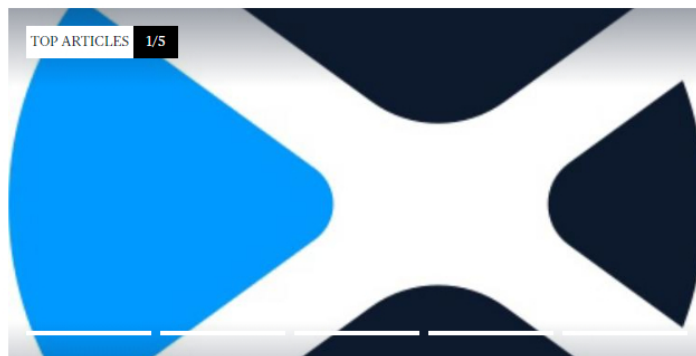
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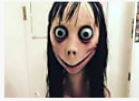
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James Chin-Wen Chou and his colleagues from the US National Institute of Standards and Technology in Boulder, Colorado, found that when they monitored two such clocks positioned just a foot apart in height above sea level, they found that time really does run more quickly the higher you are – just as Einstein predicted.

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"These precise clocks reveal the effects of gravitational pull, so if we position one clock closer to a planet, you also increase the gravitational pull and time actually runs slower than for another, similar clock positioned higher up," Dr Chou said. "No one has seen such effects before with clocks which is why we wanted to see if these effects are there. We would say our results agree with Einstein's theory – we weren't expecting any discrepancies and

we didn't find any," he explained.

The atomic clocks used in the study are based on the tiny vibrations of aluminium atoms trapped in an electric field. These vibrations are in the same frequency range of ultraviolet light, detected by lasers, which effectively means that the atomic timepieces are optical clocks, accurate enough to measure billionths of a second and to keep time accurately over millions of years.

It means that the clocks were able to perceive the dilation of time with height above ground that was first predicted by Einstein. For every foot above ground, for instance, the clocks showed that someone would age about 90 billionths of a second faster over a 79-year lifetime, Dr Chou said.

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