

12 April 2005

## The Constants They Are A-Changin'

Einstein showed that Newton got the laws of physics wrong. But did Einstein get them right? A recent test of one of the universe's fundamental constants suggests we could be in store for another revolution.



**Not so constant.** Research with the Keck Observatory suggests that physical laws may have been different in the early universe.

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Scientists debate whether the laws of physics have remained the same since the universe began or have changed over time. Much of the controversy has centered on a constant called alpha, or the fine structure constant. Alpha is at the core of electromagnetism the theory of how light and matter interact. If alpha is changing, then so are such fundamental rules as the speed of light, and that would spell doom for Einsteinian

relativity.

The debate over alpha started in 2001 when a team led by Michael Murphy, an astrophysicist at Cambridge University, U.K., analyzed light from a few quasars, the super-bright hearts of galaxies. Murphy's team was shocked to find a slight shift in the metallic fingerprint of quasar light that had traveled billions of miles (and therefore billions of years) to Earth. Because alpha determines the position of visible lines within this fingerprint, the researchers argued that the shift was caused by an increase in alpha of about 0.001% since the big bang. But another

team of physicists challenged the theory in 2004 after they found no evidence for a shift in alpha by measuring the constant to great accuracy with an atomic clock.

Now Murphy's team has answered the challenge. Using the most powerful light telescope in the world, the Keck Observatory in Hawaii, the team fingerprinted light from 143 quasars, the largest survey to date. According to their analysis, presented 11 April at the Physics2005 conference in Warwick, U.K., alpha has indeed been on the rise. Murphy says the new measurement is 10 times more sensitive than the atomic clock experiment.

"Their result seems to be robust and has survived a number of systematic tests," says physicist Ekkehard Peik, a member of the clock team at the Physical-Technical Institute in Braunschweig, Germany, "but the controversy has not been settled." For his part, Peik hopes that Murphy turns out to be right because "it would open a window" to a completely new physics, such as the still unproven superstring theory, which posits that all physical constants can change in response to shifts in additional spatial dimensions.

The European Space Agency has plans to launch an atomic clock experiment into Earth orbit, possibly in 2006 that will be 100 times more accurate than Murphy's measurements. "That could finally settle the question," says Murphy.

**--JOHN BOHANNON**

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