

Proposed nuclear clock may keep time with the Universe

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(PhysOrg.com) -- A proposed new time-keeping system tied to the orbiting of a neutron around an atomic nucleus could have such unprecedented accuracy that it neither gains nor loses 1/20th of a second in 14 billion years - the age of the Universe.

"This is nearly 100 times more accurate than the best atomic clocks we have now," says one of the researchers, Scientia Professor Victor Flambaum, who is Head of Theoretical Physics in the UNSW School of Physics.

"It would allow scientists to test fundamental physical theories at



unprecedented levels of precision and provide an unmatched tool for applied physics research."

In a paper to be published in the journal *Physical Review Letters* - with US researchers at the Georgia Institute of Technology and the University of Nevada - Flambaum and UNSW colleague Dr Vladimir Dzuba report that their proposed single-ion clock would be accurate to 19 decimal places.

The exquisite accuracy of atomic clocks is widely used in applications ranging from GPS navigation systems and high-bandwidth data transfer to tests of fundamental physics and system synchronization in particle accelerators.

"With these clocks currently pushing up against significant accuracy limitations, a next-generation system is desired to explore the realms of extreme measurement precision and further diversified applications unreachable by atomic clocks," says Professor Flambaum.

"<u>Atomic clocks</u> use the orbiting electrons of an atom as the clock pendulum. But we have shown that by using lasers to orient the electrons in a very specific way, one can use the orbiting <u>neutron</u> of an <u>atomic</u> <u>nucleus</u> as the clock pendulum, making a so-called nuclear clock with unparalleled accuracy."

Because the neutron is held so tightly to the nucleus, its oscillation rate is almost completely unaffected by any external perturbations, unlike those of an atomic clock's electrons, which are much more loosely bound.

Provided by University of New South Wales

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