Physics News of the Week: a New Laser for Faster Internet and Testing Bell's Theorem

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This week we have some great news from both experimentalists and theorists: a new laser was introduced, that potentially could increase the data transfer rates and a new way to test Bell's theories was proposed as well. These and other news are summarized below. To receive these news every week, register for our email **newsletter**.

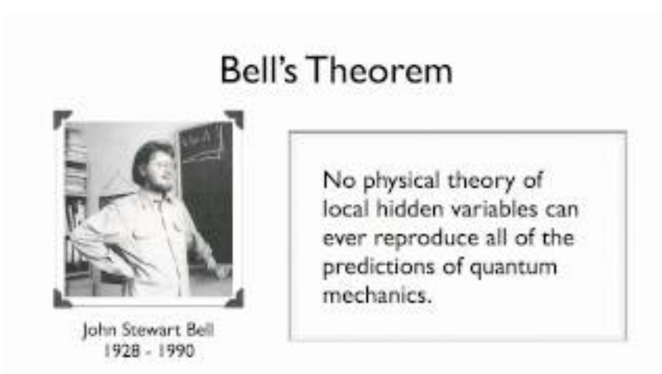
1. **A New Laser for Faster Internet (February 20)**

Feel like your internet connection is killing you? Well don't worry — a new laser technology will most likely introduce a much faster internet connection in the future. The main idea here is that light is capable of carrying vast amounts of information—approximately 10,000 times more bandwidth than microwaves, the earlier carrier of long-distance communications. However, to utilize this potential we need light that is as close to a single frequency as possible. This is where the work of Caltech scientists come in. A recently published paper by Amnon Yariv, Martin and Eileen Summerfield offers a new kind of laser that takes a big step towards the goal of faster internet. To find out more use the link above.

2. **LUX Dark Matter Search Results Confirmed (February 20)**

The LUX or Large Underground Xenon detector is dedicated to the search for the elusive dark matter particles. In October the first ever results from the detector were published — the detector, as expected, gave highly accurate results, however, no evidence of dark matter was found. These initial results were very important, as they ruled out some of the proposed models.

Recently, a new calibration technique was used to to fire neutrons straight to LUX detectors increasing the measurement accuracy by a factor of 10. This calibration confirmed that if any "low-mass" dark matter particles had passed through the detector during its initial run, Large Underground Xenon would have seen them.



3. **A Test of Bell's Theorems Using Distant Quasars (February 20)**

In a paper recently published in the journal *Physical Review Letters*, MIT scientists proposed an experiment that may close the last major loophole of Bell's inequality. For those who forget what Bell's theorem is all about, here's a short reminder. In 1964, physicist John Bell published a paper "On the Einstein Podolsky Rosen paradox", in which he provided a mathematical formulation of locality and realism and showed that a choice of measurement setting should not affect the outcome of a measurement in the EPR paradox.

Since then Bell's theorem became an important part of quantum mechanics, confirmed and tested by countless experiments. Essentially all of these experiments have shown that entangled particles are correlated more strongly than would be expected under the laws of classical physics—findings that support quantum mechanics. However, as one might expect, critics of Bell's ideas suggested a variety of ways how the experimental results might be explained by "hidden variables" that give the illusion of a quantum outcome. Most of such suggestions, often referred as "loopholes" have been closed, but a few still remain.

In particular, the loophole named "free will" proposes that a particle detector's settings may "conspire" with events in the shared causal past of the detectors themselves to determine which properties of the particle to measure. Recently, however, David Kaiser, along with MIT postdoc Andrew Friedman and Jason Gallicchio of the University of Chicago, have proposed an experiment to close this loophole. The idea, essentially, is to use distant quasars on opposite sides of the sky that are sufficiently distant from each other to determine the settings for each particle detector that would be used in the experiments. The idea is that before setting each particle detector in the experiment, scientists would use telescopic observations of distant quasars to determine which properties each detector will measure of a respective particle. Since the quasars are so far away from each other, there's no way that they could have "conspired" with anything in their shared past to give a biased measurement.

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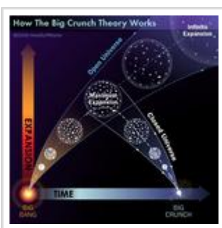

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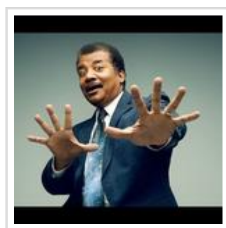

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