Researcher studies the universe through quantum electrodynamics

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(PhysOrg.com) -- Fundamental constants, such as the standards for length and mass, are a given in our society. However, research has shown that these constants might be changing slightly with the expansion of the universe.

Dr. Ulrich Jentschura, assistant professor of physics at Missouri University of Science and Technology, has received $100,000 from the National Science Foundation to study quantum electrodynamics in an attempt to understand cosmological processes and atomic interaction within the laboratory.

Quantum electrodynamics is an extremely accurate theory that describes the interaction of atoms and atomic processes. Jentschura's research involves electrons in a bound state, where in some cases the electron does not emit light during an optical transition.

Instead, the electron undergoes a virtual transition, immediately jumping back to its lowest energy state, or ground state. This is explained through the quantization of the electromagnetic field, in which photon packets carry a discrete amount of energy.

Using this information, Jentschura is able to employ lasers to scan through specified wavelengths and find the resonance of atoms where these bound-state transitions occur.

"This has advanced spectroscopic accuracy to a level that was thought to

be impossible only a few decades ago," says Jentschura.

Spectroscopy is an important tool used in all scientific fields to determine properties of compounds, from the length of a chemical bond to the composition of forensic samples.

Jentschura is also doing some work with high powered lasers. "Quantum mechanics is usually thought to occur on a microscopic level," he says. "With intense laser fields, we can see an almost macroscopic entanglement of photons."

The funding for Jentschura's project is part of the American Recovery and Reinvestment Act, which involves support from partners like NSF.

Jentschura was recently named an Outstanding Referee by the American Physical Society. This is a highly selective award that recognizes scientists who have provided exceptional service in assessing manuscripts for publication in APS journals.

Provided by Missouri University of Science and Technology

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