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Physicist proposes method to teleport energy

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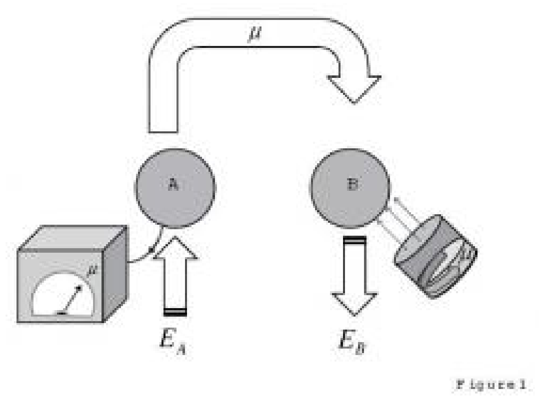

Masahiro Hotta's energy teleportation scheme.

(PhysOrg.com) -- Using the same quantum principles that enable the teleportation of information, a new proposal shows how it may be possible to teleport energy. By exploiting the quantum energy fluctuations in entangled particles, physicists may be able to inject energy in one particle, and extract it in another particle located light-years away. The proposal could lead to new developments in energy distribution, as well as a better understanding of the relationship between quantum information and quantum energy.

Japanese physicist Masahiro Hotta of Tohoku University has explained the energy teleportation scheme in a recent study posted at arxiv.org, called "Energy-Entanglement Relation for Quantum Energy Teleportation."

Previously, physicists have demonstrated how to teleport the quantum states of several different entities, including photons, atoms, and ions. Researchers predict that the principles of teleportation could also extend to molecules, viruses, and other more complex objects. Over the past year, physicists have also been exploring quantum energy teleportation, and Hotta's latest paper builds on these studies.

In quantum energy teleportation, a physicist first makes a measurement on each of two entangled particles. The measurement on the first particle injects quantum energy into the two-particle system, which is possible because there are always quantum fluctuations in the energy of any particle. This energy can then be immediately extracted at the second particle by making a second carefully chosen measurement on that particle. Throughout the process, the energy of the overall system remains the same.

As in previous examples of teleportation, the actual particles aren't teleported since they're basically identical at the quantum level. Rather, the information they carry is the important part. For this reason, physicists can simply send the information within a particle and not the particle itself. A receiving particle accepts the information from a sending particle, taking on the identity of the sending particle.

Hotta's paper marks the first example of the energy-entanglement relation for the smallest kind of quantum energy teleportation model. As he explains, the findings could enable scientists to explore the foundations of physics: specifically, the relationship between quantum information and quantum energy.

"These energy-entanglement inequalities are of importance because they help in gaining a profound understanding of entanglement itself as a physical resource by relating entanglement to energy as an evident physical resource," he writes.

As a story in MIT's Technology Review explains, these new ideas about entanglement and information could have far-reaching implications: "There is a growing sense that the properties of the universe are best described not by the laws that govern matter but by the laws that govern information. This appears to be true for the quantum world, is certainly true for special relativity, and is currently being explored for general relativity. Having a way to handle energy on the same footing may help to draw these diverse strands together."

More information: Masahiro Hotta. "Energy-Entanglement Relation for Quantum Energy Teleportation." arxiv.org

via: Technology Review