Atomic switch to design better solar panels and quantum computers

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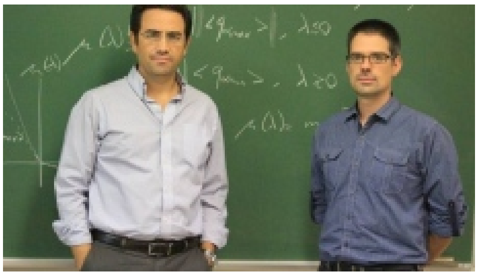

Scientists at the University of Granada (Spain) and the Massachusetts Institute of Technology (MIT) in Cambridge (USA), in collaboration with the University of Technology and Design in Singapore, have opened the doors to build the **first quantum power switch controlled by symmetry**. The manufacture of this device, which would monitor and modify the flow of energy at the atomic level, is still a major challenge for the international scientific community, and could be used, for example, to construct controlled insulating materials, or design solar panels (photovoltaic cells artificial) more effective, to optimize power transfer and hence performance, using as a basic tool symmetry.

This team of researchers, whose work has been published in the journal Physical Review B, of the American Physical Society, currently working on a realistic design of a quantum switch these features (controlled by symmetry), based on cold atoms in optical cavities coherent and using coupled to respective bathrooms microrresonadores to connect the system with heat sources at different temperatures. The next step, explained, that can be done is experimentally controlled switch quantum symmetry using this design basis.

In this study, scientists have described how the symmetry, one of the deepest and most powerful of theoretical physics concepts, to control and manipulate the energy transport in open quantum systems. “An open quantum system is nothing more than a set of atoms or molecules interacting, and subject to the action of an environment that constantly disturbed. Today we can manipulate with extreme precision these systems, which are the building blocks of future hope to build quantum computers, “says Pablo Ignacio Fernandez Hurtado, professor of Electromagnetism and Matter Physics of the University of Granada and author principal of this work.

The ‘magic’ of quantum systems causes, in the presence of symmetry, an open quantum system can simultaneously be in different stationary states. This work demonstrates that the coexistence of different quantum states due to the existence of a dynamic transition of first order, similar to the phase transition of liquid water to steam, where the two phases (liquid and vapor) phase coexist simultaneously. “Moreover, since the quantum dynamics is reversible temporarily (works like ‘camera forward’ or ‘camera back’), we show that this phase transition is accompanied by other twin, but that appears to rare fluctuations in current energy “said Hurtado. Coexistence induced quantum symmetry robustly to store multiple coherent quantum states, which opens many possibilities in quantum computing, as underlined Daniel Manzano, MIT researcher and co-author.

To make this work simulations, researchers have used the supercomputer PROTEUS, belonging to Carlos I of Theoretical and Computational Physics Institute of the University of Granada. PROTEUS is one of the most powerful supercomputers in scientific computation of Spain, with a capacity of calculation of over 13 teraflops reaching with its 1100 processing cores, 2.8 terabytes of RAM and 48 terabytes of data storage.