Quantum Dots: Changing Shape for New Properties

Quantum dots, or "artificial atoms", are the new hope for continuing progress in information transfer and quantum computing. However, they have one disadvantage: each quantum dot is comprised of thousands of atoms, all of which cannot be controlled. This means that no quantum dot is identical to any other. Dr. Armando Rastelli is developing a method of influencing the properties of quantum dots, meaning that millions of dots can be endowed with the same properties.

To do so, Rastelli and his team place the dots on a piezoelectric element, to which current is then applied. The current causes the piezoelectric element to change shape, as does the quantum dot on it. Because its shape changes, the spectrum and properties of the dot also change.

"In advance, we can only estimate how the properties of the quantum dot will change with its shape. Fine calibration has to take place step-by-step," says Rastelli. "However, the fact that we are able to deliberately and precisely control the properties of quantum dots at all is a huge step forward."

When quantum dots are used as a light source, their optical properties are of the most significance. Using an electrical or optical impulse, a quantum dot can be induced to emit a photon or a correlated pair of photons, thereby sending information.

In the development of hardware for quantum computing, semiconducting quantum dots with particular properties play a significant role.

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