Journal of Nanomaterials

Special Issue on

The Applications of Double Quantum Dot Structures

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The possibility of growing different shapes of quantum dots (QDs) makes researchers go ahead to study complex structures from QD. They were nanostructures that are quantized in all three dimensions resulting in discretized energy states like artificial atoms. They can be designed flexibly, depending on their size, to work at the required spectrum.

The nonlinear optical properties of atomic media can be modified by quantum coherence and interference too. The quantum coherence theory such as optical bistability, electromagnetically induced transparency (EIT), superluminal light propagation without absorption, and other related coherence phenomena have important applications in atomic media and in semiconductor structures.

High Kerr nonlinear dispersion (real part of third-order nonlinear susceptibility) can be used for applications such as quantum nondemolition measurements, quantum bit regeneration, quantum state teleportation, and the generation of the optical solitons. To get a high nonlinearity at low-light powers, minimization of linear absorption was required. This is impossible in conventional devices and may require multilevel atomic system.

QDs have high nonlinearity and, additionally, a multilevel system can be designed from double QD (DQD) system, a QD molecule. The optical coherence can be created by coupling of two states in QDs via interdot tunnel coupling by a bias voltage, Fano interference by external electric field, and/or laser beam pumping. This can also be used to attain optical bistability and multistability. Other optical properties can also be substantially modified similarly. DQDs have similar properties to atomic vapors but with the advantage of flexible design and controllable interference strength. Such a QD molecule can be fabricated using self-assembled growth technology.

This special issue welcomes the articles dealing with DQD properties and its applications.

Potential topics include but are not limited to the following:

- Quantum coherence and quantum computer
- All-optical processes
- Slow-light applications
- Photovoltaic applications
- Bistability in DQDs
- DQD EIT window

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