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Quantum nanosensors based on quantum dot-metallic nanoparticle systems

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Conventional nanosensors are based on intrinsic resonances of metallic nanoparticles (localized surface plasmons) and/or semiconductor quantum dots (excitons). In this report, we propose ultra-sensitive sensors based on fundamentally different concepts and principles. In these sensors the rules of quantum mechanics are used to detect ultra-small variations of the refractive index of the environment. These quantum nanosensors are based on hybrid systems consisting of metallic nanoparticles and quantum dots. Interaction of these systems with a laser field generates quantum coherence and coherent exciton-plasmon coupling. This allows us to convert minuscule changes in the environment, caused by biological molecules for example, into dramatic optical events detectable by conventional and simple electronic and optical means. These sensors are not based on excitons or plasmons as in conventional sensors, rather they utilize the way environment influences the dynamics of coherent exciton-plasmon coupling and the intrinsic resonances (plasmonic meta-resonances) of the hybrid quantum dot-metallic nanoparticle systems.

Biography

Seyed Sadeghi received his Ph.D. in Physics from the University of British Columbia in Canada. He held NSERC postdoctoral fellowship before joining industry. In 2007, he joined University of Alabama in Huntsville. His fields of research include nanomaterials, quantum sensors based on hybrid nanoparticle systems, coherent optics of nanoparticles, and photophysics and photochemistry of colloidal quantum dots. Currently he is serving as an editorial board member of Journal of Nanomedicine and Nanotechnology and Dataset Papers in Optics.

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