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Alexander Govorov

Pedro Ludwig Hernández Martínez

Hilmi Volkan Demir

Understanding and Modeling Förster- type Resonance Energy Transfer (FRET)

Introduction to FRET,
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Nanoscience and Nanotechnology

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Hilmi Volkan Demir, Nanyang Technological University, Singapore, Singapore

Nanoscience and nanotechnology offer means to assemble and study superstructures, composed of nanocomponents such as nanocrystals and biomolecules, exhibiting interesting unique properties. Also, nanoscience and nanotechnology enable ways to make and explore design-based artificial structures that do not exist in nature such as metamaterials and metasurfaces. Furthermore, nanoscience and nanotechnology allow us to make and understand tightly confined quasi-zero-dimensional to two-dimensional quantum structures such as nanoplatelets and graphene with unique electronic structures. For example, today by using a biomolecular linker, one can assemble crystalline nanoparticles and nanowires into complex surfaces or composite structures with new electronic and optical properties. The unique properties of these superstructures result from the chemical composition and physical arrangement of such nanocomponents (e.g., semiconductor nanocrystals, metal nanoparticles, and biomolecules). Interactions between these elements (donor and acceptor) may further enhance such properties of the resulting hybrid superstructures. One of the important mechanisms is excitonics (enabled through energy transfer of exciton-exciton coupling) and another one is plasmonics (enabled by plasmon-exciton coupling). Also, in such nanoengineered structures, the light-material interactions at the nanoscale can be modified and enhanced, giving rise to nanophotonic effects.

These emerging topics of energy transfer, plasmonics, metastructuring and the like have now reached a level of wide-scale use and popularity that they are no longer the topics of a specialist, but now span the interests of all “end-users” of the new findings in these topics including those parties in biology, medicine, materials science and engineering. Many technical books and reports have been published on individual topics in the specialized fields, and the existing literature have been typically written in a specialized manner for those in the field of interest (e.g., for only the physicists, only the chemists, etc.). However, currently there is no brief series available, which covers these topics in a way uniting all fields of interest including physics, chemistry, material science, biology, medicine, engineering, and the others.

The proposed new series in “Nanoscience and Nanotechnology” uniquely supports this cross-sectional platform spanning all of these fields. The proposed briefs series is intended to target a diverse readership and to serve as an important reference for both the specialized and general audience. This is not possible to achieve under the series of an engineering field (for example, electrical engineering) or under the series of a technical field (for example, physics and applied physics), which would have been very intimidating for biologists, medical doctors, materials scientists, etc.

The Briefs in NANOSCIENCE AND NANOTECHNOLOGY thus offers a great potential by itself, which will be interesting both for the specialists and the non-specialists.

More information about this series at <http://www.springer.com/series/11713>

Alexander Govorov
Pedro Ludwig Hernández Martínez
Hilmi Volkan Demir

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Alexander Govorov
Department of Physics and Astronomy
Ohio University
Athens, OH
USA

Pedro Ludwig Hernández Martínez
School of Physical and Mathematical
Sciences, LUMINOUS! Centre of
Excellence for Semiconductor Lighting
and Displays, TPI—The Institute of
Photonics
Nanyang Technological University
Singapore
Singapore

Hilmi Volkan Demir
Department of Electrical and Electronics
Engineering, Department of Physics, and
UNAM—National Nanotechnology
Research Center and Institute of Materials
Science and Nanotechnology

Bilkent University
Ankara
Turkey

and

School of Electrical and Electronic
Engineering, School of Physical and
Mathematical Sciences, LUMINOUS!
Center of Excellence for Semiconductor
Lighting and Displays, TPI—The Institute
of Photonics
Nanyang Technological University
Singapore
Singapore

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