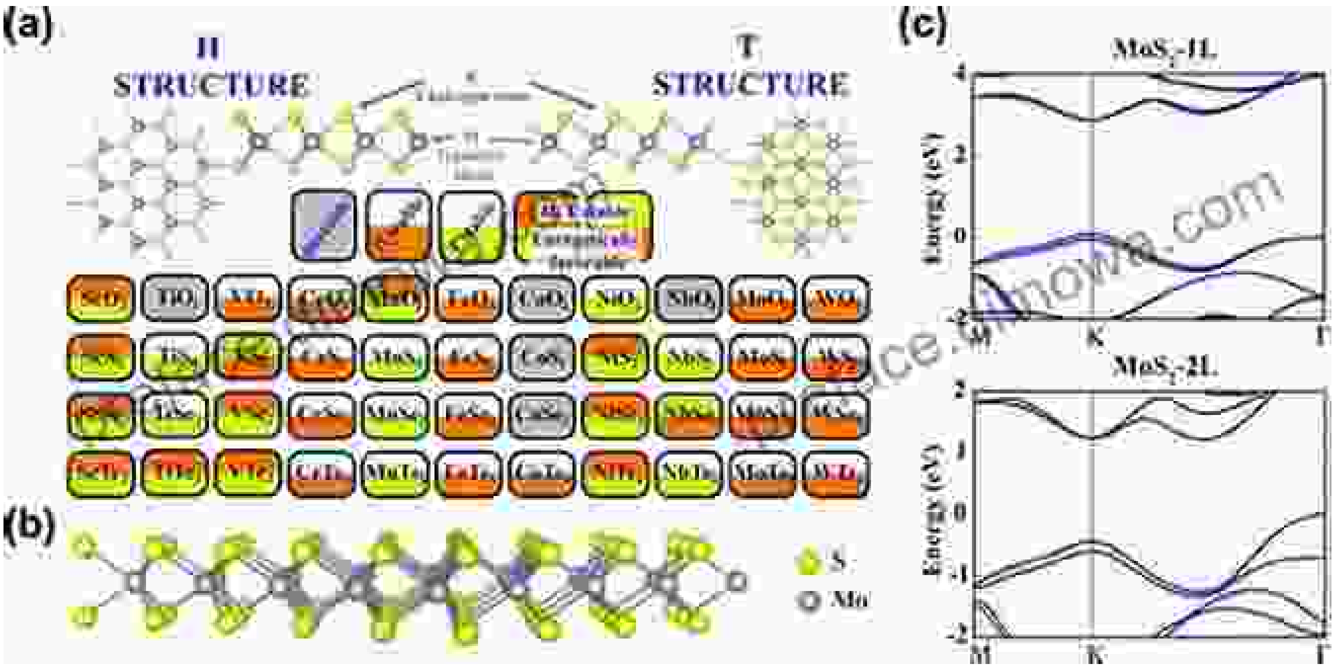
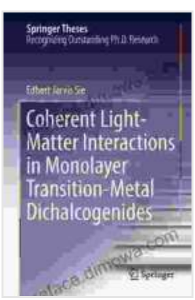
Unveiling the World of Coherent Light Matter Interactions in Monolayer Transition Metal Dichalcogenides





Coherent Light-Matter Interactions in Monolayer Transition-Metal Dichalcogenides (Springer Theses)

by Surender Kumar

★★★★★ 5 out of 5

Language	: English
File size	: 6251 KB
Text-to-Speech	: Enabled
Enhanced typesetting	: Enabled
Print length	: 146 pages
Screen Reader	: Supported

Monolayer transition metal dichalcogenides (TMDCs) have emerged as a new class of two-dimensional materials with extraordinary optical and electronic properties. These materials are composed of a single layer of atoms arranged in a hexagonal lattice, and they exhibit a wide range of properties that make them promising for applications in electronics, optoelectronics, and photonics.

One of the most fascinating properties of TMDCs is their strong interaction with light. When light interacts with a TMDC monolayer, it can excite electrons into an excited state, creating an exciton. Excitons are quasiparticles that consist of an electron and a hole, and they have a long lifetime and can travel long distances within the material. This makes TMDCs ideal for applications in light-emitting devices and solar cells.

Coherent Light Matter Interactions

Coherent light is light that has a well-defined phase relationship between its waves. When coherent light interacts with a TMDC monolayer, it can create a coherent superposition of excitons. This superposition can lead to a number of interesting effects, such as the formation of exciton polaritons and the generation of second harmonic light.

Exciton Polaritons

Exciton polaritons are quasiparticles that are formed by the interaction of excitons with photons. These quasiparticles have a mixed light-matter character, and they can travel long distances within the material with very little loss. This makes them ideal for applications in optical communication and sensing.

Second Harmonic Generation

Second harmonic generation (SHG) is a nonlinear optical process that occurs when light interacts with a material with a non-centrosymmetric crystal structure. In TMDCs, SHG can be used to probe the electronic structure of the material and to study the dynamics of excitons.

Applications

The unique optical and electronic properties of TMDCs make them promising for a wide range of applications in electronics, optoelectronics, and photonics. Some of the potential applications of TMDCs include:

- Light-emitting devices
- Solar cells
- Optical communication
- Sensing
- Quantum computing

TMDCs are a new class of two-dimensional materials with extraordinary optical and electronic properties. These materials have the potential to revolutionize a wide range of applications in electronics, optoelectronics, and photonics. Coherent light matter interactions play a key role in understanding the properties of TMDCs and in developing new applications for these materials.

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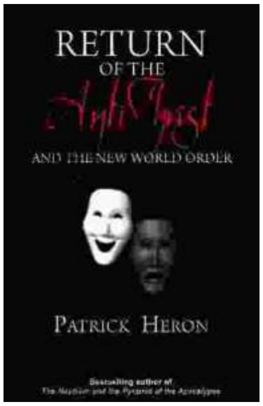

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