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Optical and Computational Analysis of Nanostructures

Master Thesis in Applied Sciences
(Photonics)
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ABBREVIATIONS

BS	Band structure
BZ	Brillouin zone
QS	Quantum Structures
VB	Valence Band
CB	Conduction Band
RAS	Reflectance Anisotropy Spectroscopy
PL	Photoluminiscense spectroscopy
PR	Photoreflectance spectroscopy
R	Reflectance spectroscopy
PRD	Photo-Reflectance Differential Spectroscopy
FDM	Finite difference method
CCD	Charge coupled device
0D	Zero-dimensional
1D	One-dimensional
2D	Two-dimensional
3D	Three-dimensional
fcc	Face-centered cubic
PD	Photo-Detector
PEM	Photo-Elastic Modulator
QM	Quantum Mechanics
$k \cdot p$	Semiempirical theoretical tool to calculate band-structure
TB	Semiempirical Tight-Binding Method
DFT	Density Functional Theory
SOC	Spin-Orbit Coupling, also called Spin-Orbit interaction
NanophotonIICOs	Nanophotonics IICO group .
MBE	Molecular Beam Epitaxy

LIST OF CODES AND PACKAGES

This list denote the *Open-Source* packages, codes, tools, and repositories for the development of this work. All inside in this work as images or code analysis are subject to the *Open-Source* ideology. Our codes are housed in our own GitHub repository, both personal and laboratory repository. It is important to say that without the development of the *Open-Source* codes like contents in this list, our codes could not have been enhanced.

puppy-project Repository of our codes implemented in this work. [1]

VESTA 3D visualization program for structural models, volumetric data such as electron/nuclear densities, and crystal morphologies. [2]

PGF/TikZ PGF is a macro package for creating graphics. It is platform- and format-independent and works together with the most important \TeX backend drivers, including pdf \TeX and dvips. It comes with a user-friendly syntax layer called TikZ. [3]

pst-optexp **PStricks** package to drawing optical experimental setups. [4]

SYMBOLS

\mathbf{X}^- Negative Trion Transition

\mathbf{X}^+ Positive Trion Transition

\mathbf{X} Direct Exciton Transition

\mathbf{IX} Indirect Exciton Transition

\hbar Planck's constant (eV)

m_0 electron effective mass

(hkl) Family of lattice planes with Miller indices h , k and l

E_g Energy bandgap

e electron

hh heavy-hole

lh light-hole

$e_n - \text{hh}_n$ **or** $e_n - \text{lh}_n$ Electronic transitions

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PHYISCAL BACKGROUND

In this chapter it discuss the physical concepts to understand

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BIBLIOGRAPHY

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- [3] T. Tantau, “Pgf/tikz,” 2007. [Online]. Available: <https://github.com/pgf-tikz/pgf.git> (Cited on page III.)
- [4] C. Bersch, “pst-optexp, drawing optical experimental setups,” 2022. [Online]. Available: <https://github.com/cbersch/pst-optexp> (Cited on page III.)