General outline

Chapter 1: Diluted magnetic semiconductor quantum dots

I – II-VI semiconductor quantum dots
- I.1 – Band structure of CdTe/ZnTe
- I.2 – Lattice mismatch and the Bir-Pikus Hamiltonian
- I.3 – Valence band mixing
- I.4 – Electron-hole interaction in confined structure

II – Fine and hyperfine structure of a magnetic atom in II-VI semiconductor
- II.1 – Mn atom in II-VI semiconductor
- II.2 – Cr atom in II-VI semiconductor

III – Exchange interaction between carrier and magnetic atom
- III.1 – Exchange interaction in Diluted Magnetic Semiconductors
- III.2 – Mn case
- III.3 – Cr case
- III.4 – Effect of the confinement

IV – A simple example: the X-Mn system

Chapter 2: Growth of CdTe/ZnTe quantum dots doped with a single magnetic atom

I – Strained dots: CdTe/ZnTe
II – Strain-free dots: CdTe/CdMgTe

Chapter 3: Coherent dynamics of Mn-doped positively charged quantum dots

I – Mn in a II-VI positively charged quantum dot
- I.1 – Quantum dot charged state selection
- I.2 – Energy structure
- I.3 – Optical λ-level identification

II – Time evolution of a Mn spin coupled to carrier
- II.1 – Cycling in and escaping the λ-level systems
- II.2 – Relaxation mechanism

III – Influence of the strain anisotropy

Chapter 4: Magneto-optical study of Cr-doped CdTe quantum dots

I – Strained quantum dots containing an individual Cr atom
- I.1 – Energy structure of a Cr in a quantum dot
- I.2 – Excited states of a Cr-doped QD
- I.3 – Magneto-optics of a quantum dot doped with a single Cr

II – Modelization of a Cr-doped QD
III – Charge fluctuation of a Cr ion in the vicinity of the QDs

Chapter 5: Dynamics of a single Cr spin in a ZnTe quantum dot

I – Cr spin time fluctuations
- I.1 – Autocorrelation: conservation of the Cr spin
- I.2 – Cross-correlation: flipping of the Cr spin
- I.3 – Model of the spin dynamics

II – Preparation the spin of a Cr atom in a quantum dot
- II.1 – Resonant optical pumping of a spin level