

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: Strain induced 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 – Relaxation mechanisms
 - II.2 – Escaping the λ -level system
- III – Dynamics of carrier coupled in the λ -level system
 - III.1 – Influence of the strain anisotropy
 - III.2 – Evolution under magnetic field

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

- I – A system strongly coupled to strain state at the Cr position
 - I.1 – Magneto-optical probing of a single dot
 - I.2 – Energetic structure of a Cr-doped quantum dot
- I – Cr in a (quasi) strain free environment
- III – Study of X^C -Cr

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 – Resonant optical spin pumping
- III – Optical Stark effect

IV – Cr in a positively charged QD

?? – Coupling to phonon

Appendix A: Tsukuba machine specification

Appendix B: Magneto-optical and dynamical experiment apparatus