Didactic Program for undergraduates

QUANTUM PHYSICS OF LOW DIMENSIONAL STRUCTURES

QPLDS-MSc

Duration: One semester, 2h/week=30h/semester

The aim: To Introduce to quantum formalism and to phenomena in low dimensional structures at the mesoscopic level and the presentation of the possible applications in **quantum computations**

Main issues:

1. INTRODUCTION TO QUANTUM MECHANICS – PRINCIPLES
2. INTRODUCTION TO QUANTUM MECHANICS – SPIN AND ANGULAR MOMENTUM
3. INTRODUCTION TO QUANTUM MECHANICS – ADVANCED EXAMPLES I
4. INTRODUCTION TO QUANTUM MECHANICS – ADVANCED EXAMPLES II
5. MANY-BODY QUANTUM FORMALISM. INTRODUCTION
6. 2^{ND} QUANTIZATION FORMALISM. EXAMPLES
7. 2^{ND} QUANTIZATION FORMALISM. QUANTUM OPTICS
8. 2^{ND} QUANTIZATION FORMALISM. COHERENT STATES
9. QUANTUM COMPUTATIONS. INTRODUCTION
10. QUANTUM ALGORITHMS. CODING, TRANSORMING, READING AND SEARCHING
11. QUANTUM ALGORITHMS. MRI IN QUANTUM COMPUTATIONS
12. PHYSICS OF QUANTUM DOTS I
13. PHYSICS OF QUANTUM DOTS II
14. QUANTUM-POINT CONTACTS
15. MESOSCOPIC TRANSPORT AND MAGNETOTRANSPORT

Suggested, preliminary literature-list:

1. L. I. Schiff, MECHANIKA KWANTOWA, PWN, Warszawa, 1987.
2. S. Węgrzyn, J. Graja, S. Bugajski, M. Gibas, R. Winiarczyk, L. Znamirowski, J. A. Miszczak, S. Nowak, NANO I KWANTOWE SYSTEMY INFORMATYKI, Wyd. Pol. Śl., Gliwice 2003.
3. M. Hirvensalo, ALGORYTMY KWANTOWE, WSiP, Warszawa 2004.
4. M. P. Das et al., QUANTUM POINT CONTACTS AND BEYOND: NEW RESULTS ON MESOSCOPIC CONDUCTANCE AND FLUCTUATIONS, arXiv: cond-mat/0404412 (http://lanl.arxiv.org).
5. H. A. Engel et al., CONTROLLING SPIN QUBITS IN QUANTUM DOTS, arXiv: cond-mat/0409294 (http://lanl.arxiv.org).