

科目名 Course Title	Semiconductor Quantum Informatics (半導体量子情報 E) [Semiconductor Quantum Informatics]		
講義題目 Subtitle			
責任教員 Instructor	武藤 俊一 [Shunichi MUTOH] (大学院工学研究院)		
担当教員 Other Instructors			
開講年度 Year	2014	時間割番号 Course Number	092036
開講学期 Semester	2学期	単位数 Number of Credits	2
授業形態 Type of Class	講義	対象年次 Year of Eligible Students	～
言語コード・言語 Language Code, Language Type			
補足事項 Other Information			
キーワード Key Words			
quantum information, quantum mechanics, semiconductor, nano-structures, quantum dots			
授業の目標 Course Objectives			
There is a growing interest in quantum information processing, in which semiconductor nano-structures represented by quantum dots are the candidates for the practical applications. We first review the semiconductor nano-structures where quantum mechanics is the physics characterizing essential properties. A special emphasis is on the presentation by students on introduction and explanation of related scientific papers.			
到達目標 Course Goals			
The final goal of this course is to understand the basic physics for quantum information processing and the potential use of semiconductor nano-structures for its realization.			
授業計画 Course Schedule			
Introduction Quantum physics in semiconductors Schrodinger equation of electron envelope function Size quantization Tunneling phenomena Self-assembled dots by Stranski-Krastanow mode Wavepacket contraction for quantum cryptography EPR paradox and quantum teleportation for quantum repeaters Quantum computing Coherent control of single electron spins Quantum computing using electron spins in quantum dots Semiconductor spintronics			
THE HIGHLIGHTS: Introduction and explanation of related scientific papers by students			
準備学習 (予習・復習) 等の内容と分量 Homework			
30-60 min. for homework			
成績評価の基準と方法 Grading System			
20%: class participation, 40%: assignments (3 assignments are required during the term), 40%: presentation			
テキスト・教科書 Textbooks			
講義指定図書 Reading List			
Explorations in Quantum Computing / C. P. Williams, S. H. Clearwater: Springer, NY, 1998 Quantum Computation and Quantum Information / M.A. Nielsen, I.L. Chuang: Cambridge University, 2010			
参照ホームページ Websites			
研究室のホームページ Website of Laboratory			
備考 Additional Information			
undergraduate-level quantum mechanics and elementary solid state physics are needed to understand this lecture			