QUANTUM MECHANICS II (PHYS 5302-001)
Spring 2013

Instructor: Igor Volobouev, i.volobouev@ttu.edu
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Office Hours: TTH 14:00-15:00, by appointment, and open door
Meetings: TTH 11:00 – 12:20 in MATH 012

Objectives: Understand conceptual foundations of Quantum Mechanics (QM), mathematical techniques, and key results. Acquire the ability to solve problems and to comprehend QM applications at the research level. Prepare for subsequent self-study of advanced QM material as you need it.

Coverage: Addition of angular momenta
Density matrix approach, entanglement, EPR paradox, Bell's theorem
Path integral formulation of Quantum Mechanics
Systems of identical particles
Time-independent perturbation theory
Time-dependent perturbation theory, interaction of atoms with radiation
Introduction into scattering theory
Research topics selected by the students

Homework: Problem sets will be assigned on a regular basis and will be discussed in class after the due date. You are welcome to work in groups. Homeworks will not be collected or graded, but you must understand the problems assigned and be able to work them out: they are an important part of the tests! You must have understood the homework in order to be able to discuss it and to do well on the tests.

Tests: There will be three midterm tests (in-class or take-home, time TBA). The tests will include conceptual and qualitative questions discussed during the class sessions as well as problems similar to those in the homework. I will expect that you will work on the tests strictly on your own, without consulting with others.

Final Project: I will expect a presentation to the class (~25 min) on an interesting modern quantum mechanics research topic, methodological development, or problem of your choice (if you can, pick a subject related to your thesis research). You will need to get your project topic approved on or before March 7.

Grading Policy: The following weighting scheme will be used:
10% class participation 60% midterm tests 30% final project

The following serves as an approximate grade scale:
100-85: A 84-65: B 64-50: C 49-40: D < 40: F

Course Textbook (required): R. Shankar, *Principles of Quantum Mechanics*, 2nd ed., Springer, 1994. This book is not available from the campus bookstore, please order it elsewhere (for example, www.abebooks.com or www.amazon.com).

In order to succeed in this course, you must read the assigned text before coming to class. The importance of this can not be overemphasized.

Advanced Textbook (strongly recommended): R. P. Feynman and A. R. Hibbs, *Quantum Mechanics and Path Integrals*, emended edition, Dover Books on Physics, 2010. A lucid introduction into the path integral formulation of QM is developed in the first five chapters. These are followed by advanced applications in perturbation theory, quantum electrodynamics, and statistical physics. Simple, elegant, and full of conceptual insights.

Supplementary Texts:
K. Gottfried and T.-M. Yan, *Quantum Mechanics: Fundamentals*, 2nd ed., Springer, 2004. This book offers wider, in-depth coverage of modern topics (symmetries, density matrix formalism, entanglement, QM interpretation, *etc*). However, the presentation is more abstract and assumes stronger background in physics and math than the Shankar's text.
Michel Le Bellac, *Quantum Physics*, Cambridge University Press, 2006. This book emphasises applications of QM in atomic, molecular, and optical physics. Contains a chapter on entangled states.

Feedback: Please let me know what you think about the course. Frequent, honest, and constructive feedback will be highly appreciated. It is the best way to teach your instructor how to teach the course and to enhance your own learning experience.

ADA Statement: Any student who, because of a disability, may require special arrangements in order to meet the course requirements should contact the instructor as soon as possible to make any necessary arrangements. Students should present appropriate verification from Student Disability Services during the instructor's office hours. Please note: instructors are not allowed to provide classroom accommodations to a student until appropriate verification from Student Disability Services has been provided. For additional information, please contact Student Disability Services in West Hall or call 806-742-2405.