

QUANTUM MECHANICS II

3 credits

Bulletin Description: Continuation of Physics 485/685. Angular Momentum, Spin, Angular Momentum Addition, Bosons and Fermions in Atoms and Solids, Quantum Statistical Mechanics, Variational Principle, WKB Approximation, Tunneling, Perturbation Theory, Emission and Absorption of Radiation, Scattering. *Prerequisite: Phys 485*

Instructor: Andrei Kryjevski, South Engineering 318D
andrei.kryjevski@ndsu.edu Tel: 701-231-7046

Meetings: Tu Th 2:00-3:15 **Office Hours:** W 14:00-16:00
South Engineering 221 (or by arrangement)

Goal: To master the foundations of quantum mechanics, including fundamental concepts, key experiments, theoretical methods, and practical applications to a variety of systems.

Student Responsibilities: Read assigned material in advance. Come prepared for discussion. Ask questions and give me feedback. Complete assignments on time.

Text: D. J. Griffiths, D. F. Schroeter **Introduction to Quantum Mechanics**, 3rd edition (Cambridge University Press, 2018).

Major Topics:

- **Angular Momentum:** Spin, Addition of Angular Momenta
- **Identical Particles:** Bosons, Fermions, Atoms, Solids, Quantum Statistical Mechanics
- **Time-Independent Perturbation Theory:** Nondegenerate and Degenerate Cases, The Fine Hydrogen Structure, The Zeeman and Hyperfine Splitting
- **The Variational Principle:** The Helium Ground State, The Hydrogen Molecular Ion
- **WKB Approximation:** Tunneling, Wave Function Matching
- **Quantum Dynamics:** Two Level Systems, Emission and Absorption of Radiation
- **The Adiabatic Approximation** (if time permits)
- **Scattering:** Partial Waves, Phase Shifts, The Born Approximation
- **The Conceptual Issues:** The EPR Paradox, Bell's Theorem, The No-clone Theorem, Schrödinger's Cat, The Quantum Zeno Paradox (if time permits)

Evaluation: homework assignments (40%); 3 exams (15%, 15%, 30%); assignments for graduate students will include an additional project.

Homework and Lateness: Group discussion of homework is strongly encouraged, but written solutions must be your own. Late work will be accepted with a 20% penalty/day until next class.

Grading: A: 90-100%, B: 75-89.9%, C: 60-74.9%, D: 50-59.9%, F: < 50%

Additional Statements:

1. *Veterans and student service members with special circumstances or who are activated are encouraged to notify the instructor as soon as possible and are encouraged to provide Activation Orders.*
2. *Any students with disabilities or other special needs, who need special accommodations in this course are invited to share these concerns or requests with the instructor and contact the Disability Services Office as soon as possible (ndsu.edu/disabilityservices).*
3. *The academic community is operated on the basis of honesty, integrity, and fair play. NDSU Policy 335: Code of Academic Responsibility and Conduct applies to cases in which cheating, plagiarism, or other academic misconduct have occurred in an instructional context. Students found guilty of academic misconduct are subject to penalties, up to and possibly including suspension and/or expulsion. Student academic misconduct records are maintained by the Office of Registration and Records. Informational resources about academic honesty for students and instructional staff members can be found at www.ndsu.edu/academichonesty.*