# QUANTUM PHYSICS I

3 credits

**Bulletin Description:** Kets, Bras, Operators, Observables & Uncertainty, Time Evolution, Schrodinger equation, Harmonic Oscillator, Angular Momentum, Spin, Symmetry in Quantum Mechanics, Perturbation Theory, Emission and Absorption of Radiation, Identical Particles. Prerequisite: PHYS 486 or similar course

**Instructor:** Andrei Kryjevski, South Engineering 220C
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**Meetings:** T Th 9:30-10:45  **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 physical systems.

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


**Major Topics:**

- **Fundamental Concepts:** Kets, Bras, Operators, Base Kets, Matrix Representations, Measurements, Observables, Uncertainty Relations, Position, Momentum, Wave Functions
- **Quantum Dynamics:** Time Evolution, Schrodinger Equation, Elementary Solutions to Schrodinger’s Wave Equation, Simple Harmonic Oscillator, Propagators and Feynman Path Integrals
- **Theory of Angular Momentum:** Rotations and Angular Momentum Commutation Relations, Orbital and Spin Angular Momentum, Central Potentials, Addition of Angular Momenta, Tensor Operators
- **Symmetry in Quantum Mechanics:** Symmetries, Conservation Laws, Degeneracies
- **Identical Particles:** Permutation Symmetry, Symmetrization Postulate, The Helium Atom, Multi-Particle States, Quantization of the Electromagnetic Field
- **Scattering Theory (if time permits):** Scattering Amplitude, Born Approximation, Phase Shifts and Partial Waves
Evaluation: homework assignments (50%); 3 exams (15%, 15%, 20%)

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: 70-89.9%, C: 60-69.9%, D: 50-59.9%, F: < 50%

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.

Any students with disabilities who need accommodation in this course are encouraged to speak with the instructor as soon as possible to make appropriate arrangements.