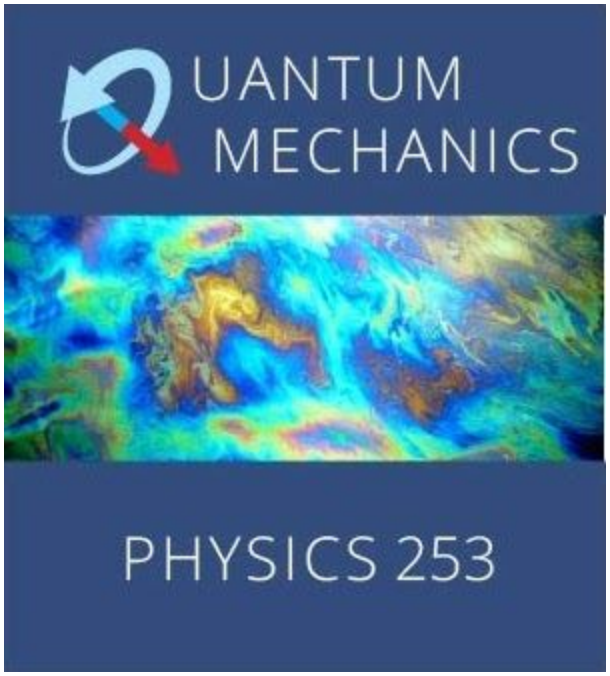

Physics 253 Syllabus

Professor Jim Freericks (james.freericks@georgetown.edu)
Office Hours: 12:00-12:30. T, Th; 12-1 F (but let me know that you want to meet by email)
https://georgetown.zoom.us/j/97932600568

TA: Pia Bhatia (pb919@georgetown.edu)
Office Hours: TBD

Course Meeting Times
Tuesdays, 12:30-1:45pm ET (https://georgetown.zoom.us/j/97932600568)
Thursdays, 12:30-1:45pm ET (https://georgetown.zoom.us/j/97932600568)
Fridays, 1:00-1:50pm ET (https://georgetown.zoom.us/j/97932600568)

Welcome to Intermediate Quantum Mechanics! In this course you will learn the conceptual and quantitative skills necessary to become a quantum mechanic! This course will operate in a flipped class format and take place via edX and Zoom. Please set up your edX account if you have not done so already. Specific course policies, information on grading, exams et cetera are detailed in the Overview section there. Below, I have listed what each course meeting will cover, as well as due dates for homeworks and exams.

Looking forward to seeing you soon,
Professor Freericks

Class Meeting	**edX Material**
Thursday, August 27th	*Before class:* Classical mechanics of moving magnets *In class:* Classical Stern-Gerlach in detail
Friday, August 28th	*Before class:* Probability *In class:* Dirac notation
Tuesday, September 1st	*Before class:* Quantum probability, Stern-Gerlach analyzer loop, Analog of the two-slit experiment *In class:* Introduction to spin
Thursday, September 3rd	*Before class:* Wheeler's delayed choice experiment *In class:* Measurement
Friday, September 4th	*Before class:* Einstein-Podolsky-Rosen, Bell's inequality *In class:* Delayed choice experiments revisited
Tuesday, September 8th	*Before class:* NMR and MRI *In class:* Implications of the EPR/Bell experiments
Thursday, September 10th	*Before class:* Wave or particle, Exploring the quantum nature of light, Developing the quantum model for light *In class:* Classical description of diffraction from slits
Friday, September 11th	*Before class:* Understanding the quantum mystery, Applications of the quantum theory of light *In class:* Dirac and the quantum mystery
Tuesday, September 15th	*Before class:* Introduction to quantum seeing in the dark, Mach-Zehnder interferometers *In class:* Mach-Zehnder the Dirac way
Thursday, September 17th	*Before class:* The quantum Zeno effect *In class:* Polarization the Dirac way
Friday, September 18th	*Before class:* Quantum seeing in the dark

	In class: Two-slit experiment with polarizers
Tuesday, September 22nd	*Before class:* Identical particles and the Hong-Ou-Mandel experiment *In class:* Boson statistics
Thursday, September 24th	*Before class:* Pauli spin matrices *In class:* Practice with Pauli spin matrices
Friday, September 26th	*Before class:* Pauli matrix identities *In class:* Exponential disentangling identity
Tuesday, September 29th	*Before class:* Canonical commutation relation of position and momentum *In class:* Commutators of position and momentum
Thursday, October 1st	*Before class:* Hadamard identity *In class:* Position and momentum eigenstates
Friday, October 2nd	**Midterm I.** Must be taken during a 24 hour period before October 4, 11:59 pm, ET
Tuesday, October 6th	*Before class:* Free particle on a circle *In class:* Technical issues with the particle on a circle
Thursday, October 8th	*Before class:* Heisenberg's uncertainty relation *In class:* Introduction to the simple harmonic oscillator
Friday, October 9th	*Before class:* Schroedinger factorization for the SHO *In class:* Another factorization for the SHO
Tuesday, October 13th	*Before class:* Baker-Campbell-Hausdorff identity *In class:* Simple harmonic oscillator wavefunction
Thursday, October 15th	*Before class:* Coherent states I *In class:* Coherent states II
Friday, October 16th	*Before class:* Simple harmonic oscillator in 3D *In class:* Applications of the SHO

Tuesday, October 20th	*Before class:* Commutation relations and angular momentum *In class:* Rotations
Thursday, October 22nd	*Before class:* Spherical harmonics *In class:* Examples of spherical harmonics
Friday, October 23rd	*Before class:* Schroedinger factorization method *In class:* Singlet states and Bohm's version of EPR
Tuesday, October 27th	*Before class:* Schroedinger factorization method II *In class:* The node theorem
Thursday, October 29th	*Before class:* The two-body problem *In class:* EPR and time of flight
Friday, October 30th	*Before class:* Radial momentum *In class:* Separation of variables
Tuesday, November 3rd	*Before class:* Isotropic simple harmonic oscillator *In class:* Isotropic simple harmonic oscillator wavefunctions
Thursday, November 5th	*Before class:* Hydrogen *In class:* He+ puzzle and discovery of deuterium
Friday, November 6th	*Before class:* Coulomb wavefunctions I *In class:* Coulomb wavefunctions II
Tuesday, November 10th	*Before class:* Cartesian factorization of Hydrogen *In class:* Momentum wavefunctions and electron momentum spectroscopy
Thursday, November 12th	**Midterm II.** Must be taken during a 24 hour period before November 14, 11:59 pm, ET
Friday, November 13th	*Before class:* First order perturbation theory *In class:* Hyperfine structure of Hydrogen and astronomy
Tuesday, November 17th	*Before class:* Second order perturbation theory

	In class: The proton charge radius
Thursday, November 19th	*Before class:* Particle in a box *In class:* Variational argument for the existence of bound states
Friday, November 20th	*Before class:* Time evolution and the Trotter formation *In class:* Time-dependence of coherent states
Tuesday, November 24th	*Before class:* Cyclotron resonance *In class:* Classical theory of light and Maxwell's equations
Tuesday, December 1st	*Before class:* Quantization of light and photons *In class:* Photomultiplier tubes
Thursday, December 3rd	*Before class:* Verifying single photons exist *In class:* Heterodyne and homodyne detection
Friday, December 4th	*Before class:* Mach-Zehnder interferometer and squeezed light *In class:* LIGO and gravitational waves
Tuesday, December 15th	**Final Exam.** Must be taken during a 24 hour period between Dec. 12 and Dec. 17, 11:59 pm, ET

Due Dates for Problem Sets

PS 1 - Friday, September 4
PS 2 - Friday, September 11
PS 3 - Friday, September 18
PS 4 - Friday, September 25
PS 5 - Friday, October 2
PS 6 - Friday, October 9
PS 7 - Friday, October 16
PS 8 - Friday, October 23
PS 9 - Friday, October 30
PS 10 - Friday, November 6
PS 11 - Friday, November 13
PS 12 - Friday, November 20
PS 13 - Friday, December 4

Welcome video