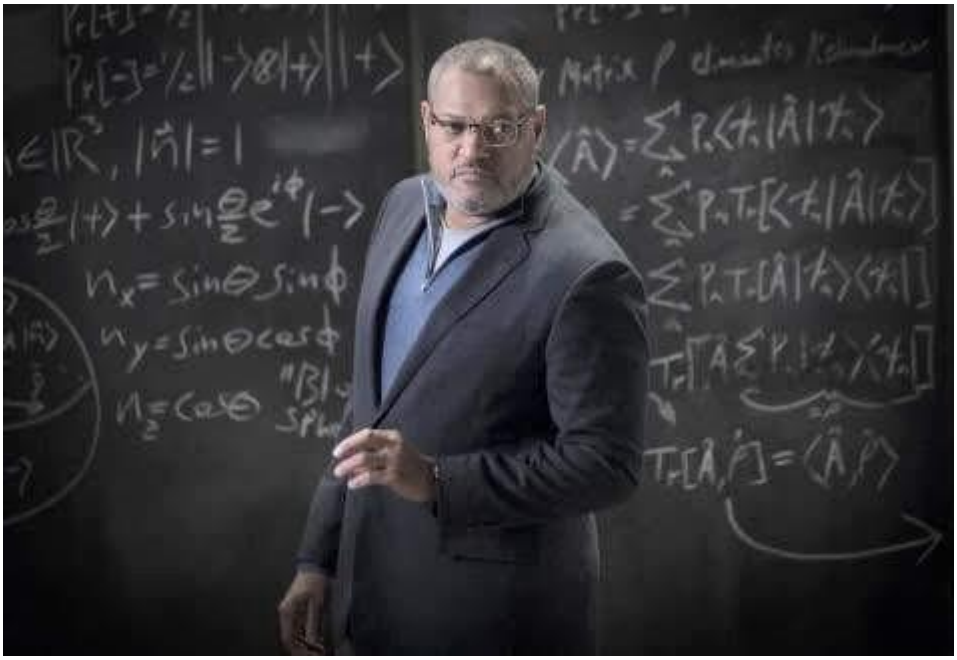
Are you ready to enter the quantum realm?



A scene from Ant-Man and the Wasp ***filmed at Emory*** *(in White Hall, across the street from the MSC)*

Course Objectives

- We'll go through most of the textbook, covering topics including
    - propagators and quantum dynamics
    - introduction to the Feynman path integral
    - harmonic oscillator (raising and lowering operators)
    - identical particles (symmetric and antisymmetric state vectors)
    - symmetries and generators of translations and rotations
    - hydrogen atom
    - spin and addition of angular momenta
    - variational, WKB, and perturbation methods
        - ground state of helium atom
        - fine structure of hydrogen atom
- You'll write a short paper about implications and interpretations of quantum mechanics.
- Using real quantum processors accessed remotely through IBM Quantum, you'll test Bell's inequality and do other experiments with spin correlations.

Instructor Contact Info

- email: jbrody@emory.edu. I reply within 24 hours on weekdays. Please contact me as often as you like! If you have lots of questions about the course, you're welcome to email me 10+ times a day!
- Office hours: Unlimited, by appointment or drop in, in N308. Please feel free to meet with me as often as you want.

Textbook

R. Shankar, *Principles of Quantum Mechanics*, Second Edition

Grades

- 20% each of three tests (Sept. 28, Nov. 9, Dec. 2)
- 15% short paper about interpretations of quantum mechanics **(due Oct. 28)**
- 25% lab report about testing Bell's inequality and modeling spin correlations with real quantum processors accessed remotely via IBM Quantum (**due Dec. 14**)
- You may start working any time on the short paper and lab report. You don't have to wait until we cover anything in class.

	Topic	Sections	Exercises (ungraded)
8/26	Vector spaces	1.1-1.3, 1.5-1.6	1.6.2, 1.6.3, 1.6.4
8/31	Diagonalization	1.4, 1.7-1.8	1.8.2, 1.8.3
9/2	Infinite dimensions	1.9-1.10	1.8.10, 1.9.2, 1.10.1
9/7	Quantum postulates	4.1-4.2	4.2.1
9/9	Propagator	4.3, 5.2	5.2.1, 5.2.2, 5.2.3
9/14	Sectionally constant potentials	5.1, 5.4, 6	5.4.2
9/16	Harmonic oscillator	7.3-7.4	7.4.2, 7.4.3

9/21	Uncertainty relations	7.5, 9.1-9.3	7.4.4, 7.4.5
9/23	Feynman path integral	8.1-8.4	
9/28	Test 1		
9/30	Multiple particles	10.1-10.2	10.2.1, 10.2.3
10/5	Identical particles	10.3	10.3.1, 10.3.2, 10.3.3
10/7	Translational invariance	11.2	10.3.4, 10.3.6, 11.2.2
10/14	2D rotations	12.1-12.3	12.3.7
10/19	3D rotations	12.4-12.5	12.5.3, 12.5.13
10/21	Hydrogen atom	12.6, 13.1	12.6.1, 12.6.11
10/26	Spin kinematics	14.1-14.3	14.3.2, 14.3.3, 14.3.4
10/28	Spin dynamics	14.4-14.5	14.4.3
11/2	Addition of angular momenta	15.1-15.2	15.1.1, 15.1.2, 15.2.2

11/4	Time translation and reversal	11.3-5	
11/9	Test 2		
11/11	Variational method	16.1	16.1.1, 16.1.3, 16.1.5
11/16	WKB method	16.2	16.2.4, 16.2.7
11/18	Time-independent perturbations	17.1-17.3	17.2.1, 17.2.2, 17.3.3
11/23	Time-dependent perturbations	18.1-18.2	18.2.2, 18.2.4, 18.2.6
11/30	Electromagnetic interactions	2.6, 18.4-18.5	
12/2	Test 3		
12/7	Calculating spin correlations with a quantum computer		