



# CHM 4412: Physical Chemistry: Quantum Mechanics and Spectroscopy

Fall 2016 (Aug 22 - Dec 15) Section 0823  
(4 Credit Hours)  
T R [Periods 2-3](#) (08:30 - 10:25) FLI 105

- No (specifically) Required Textbook:** Useful texts include *the one you have* or something like: “Physical Chemistry”, P. W. Atkins, or similar titles by McQuarrie & Simon, Levine, Raff, Castellan, etc.  
{See Brucat if you have questions...}

**Instructor:** PJ Brucat  
Office Location: CLB311E  
Office Hours: by appointment  
Contact method: Use Canvas Messaging

**Teaching Assistant:** Xiang Gao  
Office Location: TBA  
Office Hours: TBA  
Contact Method: TBA

**Course Website:** <https://ufl.instructure.com/courses/331592>

**Tentative Syllabus** (for exact ordering and schedule of lectures, see the course website)

## An Introduction to Quantum Mechanics

Compare and Contrast Classical and Quantum Descriptions of Matter  
Fundamental Principles (Postulates) of Quantum Mechanics  
Operators, Observables, Wavefunctions, Eigenvalues, and Boundary

Conditions

## Exactly Soluble Systems in One Dimension

Free Particle                      Particle in a Box                      The Harmonic Oscillator  
Traditional (Diff. eq.) Treatment  
Operator Algebra Treatment

## Systems in More than One Dimension

3D Particle in a Box                      3D SHO  
Rigid Rotation and the Spherical Harmonics  
The Hydrogen Atom  
Many-Electron Atoms

## Approximate Methods in Quantum Mechanics

Perturbation Theory                      Variational Principle

## Independent Particle Approaches to Electrons in Molecules

Molecular Orbitals (Qualitative Aspects)                      Molecular Symmetry and its Consequences

## Understanding Molecular Motion *Spectroscopically*

The Separation of Molecular Motion by Time/Energy Scale  
The Measurement, Excitation and Control of Molecular Motion with Light  
A Survey of Spectroscopic Techniques  
Magnetic Resonance, Coherence, and Pure vs. Mixed States

FALL SEMESTER 2016						
S	M	T	W	T	F	S
Aug. 14	15	16	17	18	19	20
21	22	23	24	25	26	27
28	29	30	31			
Sept. 4	5	6	7	8	9	10
11	12	13	14	15	16	17
18	19	20	21	22	23	24
25	26	27	28	29	30	
Oct. 2	3	4	5	6	7	8
9	10	11	12	13	14	15
16	17	18	19	20	21	22
23	24	25	26	27	28	29
30	31					
Nov. 6	7	8	9	10	11	12
13	14	15	16	17	18	19
20	21	22	23	24	25	26
27	28	29	30			
Dec. 4	5	6	7	8	9	10
11	12	13	14	15	16	17
18	19	20	21	22	23	24
25	26	27	28	29	30	31

IDENTIFICATION SYMBOL:  
Classes [ ] Exams [ ]

## Preparation is key to learning Quantum Mechanics

The subject matter we approach together this term is so odd and wonderful that we must choose the optimal method for its learning.

The structure of the course, as determined by the UF Registrar, is twice a week meetings in a classroom. I *could* simply lecture on the material, while y'all sit and watch. This is a traditional method of teaching, but isn't the best use of our time together. Instead, you will prepare for engaged discussions at these meeting times by studying online materials and perhaps even your textbook, *before* class. Then, we will discuss what is confusing, skip what is understood, and delve deep into the implications of our subject. The learning objects you will start your preparation for class with are suggestively called "Readings", because they should lead you to knowledge the way reading a textbook could. (Of course, you may need to *actually read* a textbook as well. Many are available on this subject ; Ask your instructor for recommendations )

The course website: < <https://ufl.instructure.com/courses/331592> > is where the 'Readings' are found. These objects each have due dates just before the related class discussions. The 'Readings' for the entire term are posted on our site --- feel free to use them anytime --- just make sure you have thoroughly mastered them before they are due.

## Classwork

We are going to learn Quantum Mechanics and Spectroscopy as a team. After the immediate questions from the class regarding our 'Readings' are answered, each class will tackle some exemplary problems related to our material together. Since we are working together, your timely presence in our class meetings is kindly requested. *You* are an integral part of the classwork sessions, and these class meetings are crucial to our collective success. If you choose not to attend, that is your choice, but this action lets down your classmates, and forfeits your classwork points (see below) and access to instructor office hours, scheduled or by appointment. Naturally, if you cannot attend class due to a medical/justifiable reason, exceptions are made. Just contact your instructor in advance using the Canvas website messaging tool.

## Office Hours

Office hours held by Brucat are intended for one-on-one discussion of a student's standing in the class (grades), learning strategy and habits, and any other things not appropriate for group discussion. (Group discussions occur twice a week in our scheduled class time). Private discussions will be held at times *you* arrange. If you want a meeting of this sort, message (from within Canvas, *only*) your instructor *3 options* for meeting times that are convenient for you, and your instructor will reply with a choice that works and a location for the meeting. Make sure you out the three time options in your *initial* message --- don't make me beg.

Office hours held by TA's are to provide perspective potentially different from Brucat on the subject material. TA office hours will be posted on the course website calendar as soon as they are known, or by appointment.

## --- Graded Activities ---

'Readings' Brucat's 'Readings' are also delivered online, and have a few embedded assessment questions which are graded, but not challenging. You should be easily capable of obtaining 100% of these "Readings" points.

Classwork Traditional classes have you, the student, work exemplary problems to cement your mastery at home, usually alone. We are going to work those problems in class, together. A small portion of your grade will be derived in these problem sessions, so be prepared.

Online Quizzes Periodically throughout the term, short on-line assessments will be delivered through the course website. These 'Quizzes' will appear in the course website Modules list (as well as several other places) with well defined due dates. Most of these quizzes will have unlimited attempts, so getting full credit is up to you and your dedication.

## Exams

There will be **four** in-class exams during the term, which determine the bulk of your course grade, *tentatively* to be held on the following scheduled class sessions:

09/13

10/13

11/15

12/06

Final Exam ! Who needs a final ? Let me know, and I will make one

### Course Grade Computation

Course grades will be computed from the weighted-average of the earned percentages of each graded item submitted by the student. The weighting factors are as follows:

Grade Category	% of Course Grade
Exams	70
Readings	10
Quizzes	10
Classwork (Participation)	10

Your letter grade will be computed from your weighted-average grade percentage using the following scale:

Course Grade	Minimum percentage
A	87.5
A-	80.0
B+	77.5
B	72.5
B-	70.0
C+	67.5
C	62.5
C-	60.0
D	50.0
E	< 50.0

Students, faculty, and all participants in UF's Academic activities are bound by an Honor Code. Students with Disabilities may request special accommodations through the Dean of Students. Counseling services are available in many forms at UF.

UF's Grading Policy: <http://www.registrar.ufl.edu/grades/gradepolicy.html>

**Any and all course policies and procedures are subject to change at any time at the sole discretion of Brucat**

*We, the members of the University of Florida Community, pledge to hold ourselves and our peers to the highest standards of honesty and integrity*