

# PTYS-510B — Spring 2021

## Chemistry of the Solar System

Tuesday & Thursday 9.30am – 10.45am

[Live Online](#) (info on how to participate provided on D2L)

Instructor: Dr. Ilaria Pascucci ([pascucci@lpl.arizona.edu](mailto:pascucci@lpl.arizona.edu) web: [ilariapascucci.com](http://ilariapascucci.com))

### Course Description

This course will focus on the gas chemistry in planetary and astrophysical environments. We will discuss the theory of quantum mechanics, atomic and molecular structures, spectroscopy, gas phase equilibrium, and kinetics. The class consists of lectures, homework assignments, and a final project. This is a small class and should be highly interactive.

### Course objectives, learning outcomes, and topics:

During this course, students will learn quantum theory and its relevance to understanding atomic and molecular spectra. Upon completion of this course, students will know how to describe the behavior of matter on the small scales, atomic and molecular, and how to properly interpret spectroscopic features observed toward planetary and astrophysical objects.

Topics covered in class include:

- Quantum theory and its origin
- Hydrogen and many-electron atoms
- Atomic spectroscopy
- Valence-bond and molecular orbital theory
- Molecular spectroscopy
- Boltzmann distribution and partition function
- Kinetic theory of gas

**Pre-requisites:** Instructional level is aimed at beginning graduate students with an adequate background comparable to that obtained from advanced undergraduate courses in physics and chemistry.

**Grades** will be based on homework (70%) and one final project (30%). Extra points will be given based on participation. This course uses absolute grading. If your final percentage falls within the following ranges, you are guaranteed at least the corresponding letter grade

A:87.5-100%; B: 75-87.5%; C: 62.5-75%; D: 50-62.5%; E<50%

**Homework** assignments will be announced in class and will be posted on the D2L website (<https://d2l.arizona.edu/>) after the class. Homework are typically graded on a 10-point scale. Late homework that are turned in the day after the due date will receive a 25% penalty while homework submitted later will receive a 50% penalty. Any homework submitted later than the first class after the due date will not be accepted. You are encouraged to work together but the work that you submit **MUST** be your own.

**Final Project.** To further encourage discussion and participation, this class will include a month long project with a final presentation due the last day of class. Groups of 2-3 students will work together to develop an observing proposal for a state-of-the-art facility on a science topic of their choice and using some of the techniques discussed in class. Each group will present their proposal to the class and other students will provide feedbacks.

### **Suggested textbooks:**

There are no required textbooks for the class. We will mostly follow the classic textbook entitled “Physical Chemistry” by Atkins (Oxford University Press). A copy is available in the LPL library. All lectures will be recorded on Zoom with a setting that automatically hides students’ names. These recordings are part of the students’ educational record and should NOT be shared with anyone outside of the class. All lecture notes will be also posted on the D2L website (<https://d2l.arizona.edu/>). Students may not modify content or re-use content for any purpose other than personal educational reasons. All recordings are subject to government and university regulation.

### **Nondiscrimination and Anti-harassment Policy**

The University of Arizona is committed to creating and maintaining an environment free of discrimination. In support of this commitment, the University prohibits discrimination, including harassment and retaliation, based on a protected classification, including race, color, religion, sex, national origin, age, disability, veteran status, sexual orientation, gender identity, or genetic information. For more information, including how to report a concern, please see: <http://policy.arizona.edu/human-resources/nondiscrimination-and-anti-harassment-policy>

### **University Policies**

For other university policies, including academic integrity, please see: <https://academicaffairs.arizona.edu/syllabus-policies>.

### **Subject to Change Notice**

Information contained in the course syllabus, other than the grade and absence policies, may be subject to change with reasonable advance notice, as deemed appropriate by the instructor of this course.

**Graduate Student Resources:** <http://basicneeds.arizona.edu/index.html>