PHY 5312 – 601 Atomic Structure - 8 Week Course  
TR (9:30 – 10:45) am, MWF (11:00 - 11:50) am STEM 201 or Zoom

**Instructor:** Robert Friedfeld Ph.D.  
**Office:** STEM 207G or Miller Science 126  
**Office Hours:** By appointment or via Zoom  
**Email:** rfriedfeld@sfasu.edu  
**Phone:** 468-2197

**Textbook:** Atoms, Molecules and Photons An Introduction to Atomic, Molecular and Quantum Physics, 3rd Ed.  
**Authors:** Wolfgang Demtröder

**Course Description:** This is a graduate level course in advanced atomic structure. The goal is to give the student an in-depth understanding of the field. Prerequisite: PHY 431 (Introductory Quantum Mechanics).

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**Course Objectives:** 
The course goal is to give the student an in-depth understanding of the field. It is a semi-historical treatment of the progress in understanding the atom from the classical period pre-1900 to the beginnings of quantum mechanics.

- To study the physical applications of quantum mechanics.
- To examine the behavior of systems through the application of physical laws and make quantitative judgments of future behavior based upon the boundary conditions which exist.
- To develop the facility to solve the wave equation in closed form where possible and, when it is not possible, through the use of perturbation theory as well as other approximation methods.
Student Learning Outcomes:

- The student will demonstrate proficiency in the basic and applied fields of physics.
- The student will apply physical principles to novel situations, both in the classroom and in research settings.

Calendar - *(subject to change at discretion of the instructor)*

<table>
<thead>
<tr>
<th>Week</th>
<th>Chapters</th>
<th>Topics</th>
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<tbody>
<tr>
<td>Aug 24</td>
<td>4</td>
<td>Basic Concepts of Quantum Mechanics</td>
</tr>
<tr>
<td>Aug 31</td>
<td>5</td>
<td>The Hydrogen Atom</td>
</tr>
<tr>
<td>Sept. 07</td>
<td>6</td>
<td>Atoms with More Than One Electron</td>
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<tr>
<td>Sept. 21</td>
<td>7</td>
<td>Emission and Absorption of Electromagnetic Radiation by Atoms</td>
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<tr>
<td>Sept. 22</td>
<td></td>
<td><strong>Midterm Exam</strong></td>
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<tr>
<td>Sept.</td>
<td>8</td>
<td>Lasers</td>
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<tr>
<td>Oct. 13-14</td>
<td></td>
<td><strong>Final Class Presentations</strong></td>
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EXAMS & GRADING:

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<tbody>
<tr>
<td>Midterm Exam</td>
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<tr>
<td>Final Class Presentation</td>
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<tr>
<td>Problem Presentations</td>
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The exams will be conducted on the following dates and will each cover a limited amount of course material:

- September 22  Midterm Exam
- October 13-14 Final Class Presentations

The Final is a presentation on a topic in atomic structure of current interest. This topic may, for example, relate to your graduate research project. The homework problems will be taken from the text. Complete, easily followed solutions are expected. Where graphical results are requested, students should use a good spreadsheet.
GRADING SCALE FOR FINAL AVERAGE:

<table>
<thead>
<tr>
<th>90-100</th>
<th>80-89.9</th>
<th>70-79.9</th>
<th>60-69.9</th>
<th>0-59.9</th>
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<tbody>
<tr>
<td>A</td>
<td>B</td>
<td>C</td>
<td>D</td>
<td>F</td>
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IMPORTANT DATES: (8 week course)

Aug. 24    Classes begin
Oct. 14    Final Presentations

CELL PHONES & OTHER ELECTRONIC DEVICES:

Cell phones and other electronic devices are to be turned off upon entering the classroom and stowed in a zipped up book bag or brief case. An unsecured cell phone during class or during an exam is subject to confiscation and in the case of an exam, will result in an automatic zero for the exam. Any programmable calculator used on an exam must have its memory wiped before the exam.

ACADEMIC INTEGRITY (A-9.1):

Academic integrity is a responsibility of all university faculty and students. Faculty members promote academic integrity in multiple ways including instruction on the components of academic honesty, as well as abiding by university policy on penalties for cheating and plagiarism.

DEFINITION OF ACADEMIC DISHONESTY:

Academic dishonesty includes both cheating and plagiarism. Cheating includes but is not limited to (1) using or attempting to use unauthorized materials to aid in achieving a better grade on a component of a class (homework, clicker, exams, lecture or lab); (2) the falsification or invention of any information, including citations, on an assigned exercise; and/or (3) helping or attempting to help another in an act of cheating or plagiarism. Plagiarism is presenting the words or ideas of another person as if they were your own. Examples of plagiarism are (1) submitting an assignment as if it were one's own work when, in fact, it is at least partly the work of another; (2) submitting a work that has been purchased or otherwise obtained from an Internet source or another source; and (3) incorporating the words or ideas of an author into one's paper without giving the author due credit.

Please read the complete policy at http://www.sfasu.edu/policies/academicintegrity.asp Penalties may include no credit or failure in the course.

WITHHELD GRADES SEMESTER GRADES POLICY (A-54):

Ordinarily, at the discretion of the instructor of record and with the approval of the academic chair/director, a grade of WH will be assigned only if the student cannot complete the course work because of unavoidable circumstances. Students must complete the work within one calendar year from the end of the semester in which they receive a WH, or the grade automatically becomes an F. If students register for the same course in future terms the WH will automatically become an F and will be counted as a repeated course for the purpose of computing the grade point average.
The circumstances precipitating the request must have occurred after the last day in which a student could withdraw from a course. Students requesting a WH must be passing the course with a minimum projected grade of C.

STUDENTS WITH DISABILITIES:

To obtain disability related accommodations, alternate formats and/or auxiliary aids, students with disabilities must contact the Office of Disability Services (ODS), Human Services Building, and Room 325, 468-3004 / 468-1004 (TDD) as early as possible in the semester. Once verified, ODS will notify the course instructor and outline the accommodation and/or auxiliary aids to be provided. Failure to request services in a timely manner may delay your accommodations. For additional information, go to http://www.sfasu.edu/disabilityservices/.

ATTENDANCE:

Attendance may be taken on certain dates during the semester. This may be done without prior warning and will be recorded. Attendance may be used to help bring up the final average at the end of the term. “Regardless of attendance, every student is responsible for course content and assignments.” University Policy A-10