

PHYS 144 – Atomic Physics

Instructor: Professor Lin Tian

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Lecture time and location: MF 1:30 pm – 2:45 pm, COB 272

Office hour and location: by appointment with instructor

Requirement and rubrics:

- The students will learn basic concepts in modern atomic physics including atomic structure, energy spectrum of atoms, and light-matter interaction.
- Student will learn modern topics in atomic, molecular, and optical physics including Doppler free laser spectroscopy, laser cooling and trapping, BEC, and ion trap physics.
- The students will learn how to use basic quantum mechanics to solve simple questions in AMO physics

Course Materials:

- atomic structures: hydrogen, helium, alkalis
- LS-coupling, hyperfine
- Light-matter interaction
- Doppler free laser spectroscopy
- Laser cooling and trapping
- BEC, ion trap

Text book: Christopher J. Foot, *Atomic Physics*, Oxford University Press (2008)

Course contents: The course includes 14 weeks of lectures and discussion sessions
Tentative list of topics and homework assignments include:

01/24 intro, hydrogen, HW1

01/31 hydrogen, helium, HW2

02/07 helium, alkalis, HW3

02/14 alkalis, LS-coupling, no HW

02/21 president's day, hyperfine, HW4

02/28 hyperfine, light-matter, HW5

03/07 light-matter, light-matter, HW6

03/14 light-matter, Doppler-free, HW7

03/21 spring holidays

03/28 Doppler-free, laser cooling, HW8

04/04 laser cooling, laser cooling, HW9, assign term paper topics

04/11 laser cooling, BEC, HW10

04/18 BEC, BEC, HW11

04/25 BEC, ion trap, HW12

05/02 ion trap, class presentation

Homework and Grade: is an integrated part of this course and is designed to deepen the students' understanding of the concepts and techniques from class.

I will assign one homework problem each Friday at the end of the lecture. The problem can contain several small questions to be answered. A discussion to guide the students in solving the problem will be conducted in the discussion session in the following week. The due date will be the following Friday before the class. Each homework set will be graded with 5 points. **Homework submitted late will not be graded and zero point will be given.** Graded homework will be returned one week after the due date.

The grade will be determined based on performance in homework sets (60%), term paper (20%), and class presentation (20%). Class presentation will be during the last lecture of the Spring semester.