PHY100 — The Nature of the Physical World

January 13, 2010

Welcome to Physics 100

Arán García-Bellido

Bausch & Lomb 314

585 276 3422

aran@pas.rochester.edu

http://www.pas.rochester.edu/~aran/class/PHY100_10S

UNIVERSITY of ROCHESTER

Course outline

- This class is a tour of the Universe as seen by modern science
- Broad range of topics: from classical Physics to modern experiments
- Not comprehensive: focus on main ideas and why be believe them to be valid
- Physics 100 is designed for non-science majors
- The course is conceptual and the use of mathematics will be very limited
- No previous physics instruction is assumed
- Book: “PHYSICS: Concepts & Connections 4th ed”, Art Hobson, Pearson

- Motion
- Gravitation
- Energy
- Forces and fields
- Conservation of energy and momentum
- Constant acceleration in motion
- Rotational motion
- Electricity and magnetism
- Waves, light, radiation
- The atomic model
- Nuclear forces
- Fusion and fission
- Quantum mechanics
- Heisenberg's Uncertainty Principle
- Special theory of Relativity
- General theory of Relativity
- The Standard Model of particle physics
- Quarks, leptons, gluons, baryons, etc.
- The Big Bang
- Dark matter
- Stellar evolution
- Cosmic microwave background
- Inflation
- … and more!

What I expect of you

- You should read the chapters in Hobson and do the weekly **problem sets** (not graded)
- Attend the **recitations**
  - will have exercises and discussions, work in groups, guided by TA
  - help you check you understand all the concepts and iron out doubts
  - material covered there will be included in exams
- End of semester **presentation**
  - form groups of ~5 students, choose topic from list
  - make a lecture for all the class: evaluate each other
- Participate in class! Stop me if you don't understand something!
- Let me know if there are any subjects you'd like to hear about

Grading

- There will be two exams (Feb. 17 and Mar. 31) and a final
- I will not give make up exams
  - If you miss two exams, contact me before you miss the second!
- I will use the best numerical average from the following schemes:

Scheme	Exam1	Exam2	Final	Present.	Recitation
1	24%	24%	24%	20%	8%
2	32%	0%	40%	20%	8%
3	0%	32%	40%	20%	8%

  - You will receive 1 out of the 8 possible points for each recitation you attend
  - Problem sets will not have to be handed in, solutions will be posted the next week. I could ask that you hand them in for credit, if it is needed to keep the class on track
- I will not grade on a curve
- I will assign a letter grade to the numerical grade as calculated above

A little info...

- Please fill out the forms and return next Wednesday:

NAME:

email:

Year: Fr/So/Jr/Sr?

Did you receive the email sent yesterday to the class mailing list?: Yes/No

Major/main career interest:

What interests you about Physics (why are you in this course)?:

Schedule/Syllabus - part 1

1. **Wed, Jan 13:** Introduction to class, nature of science, scales in the universe
   Reading in Hobson: Chapter 1 (p.2-25) and sections 2.4 and 2.5 (p.37-41)
2. **Wed, Jan 20:** Fundamental physical quantities and Newton's laws
   Reading in Hobson: Chapters 3 & 4 (p.52-84)
3. **Mon, Jan 25:** Newton's laws, gravitational and electrostatic forces, fields
   Reading in Hobson: Sections 5.1-5.2 (p.90-98), 8.4-8.5 (p.171-174), 8.8 (p.181-184)
4. **Wed, Jan 27:** Fields, relativity
   Reading in Hobson: Sections 10.1-10.6 (p.220-235)
5. **Mon, Feb 1:** Relativity
   Reading in Hobson: Sections 3.4 (p.59-60), 10.7-10.8 (p.235-242), 11.1 (p.248-254)
6. **Wed, Feb 3:** Magnetism, Maxwell?s equations, light
   Reading in Hobson: Section 8.8 (p. 181-184), Section 9.1 (p. 190-194)
7. **Mon, Feb 8:** Light, electromagnetic radiation, waves
   Reading in Hobson: Sections 8.1-8.3 (p. 162-171), sections 9.2-9.4 (p.195-200)
8. **Wed, Feb 10:** Blackbody radiation, photoelectric effect, quanta of light
   TBA
9. **Mon, Feb 15:** DeBroglie matter waves, Bohr model of atom
   Reading from Hobson: Chapter 13 (p. 298-316)

Wed, Feb 17: EXAM 1

Schedule/Syllabus - part 2

10. **Mon, Feb 22:** Bohr model, Schroedinger's equation, rise of quantum mechanics
    Reading from Hobson: Sections 14.6-14.7 (p. 338-347)
11. **Wed, Feb 24:** Quantum uncertainty
    TBA
12. **Mon, Mar 1:** Quantum uncertainty, chemistry
    Reading from Hobson: Sections 14.6-14.7 (p. 338-347)
13. **Wed, Mar 3:** Rutherford scattering, nuclear physics
    Reading in Hobson: Chap 2 (p.29-46), Sections 8.4-8.7 (p. 171-180), Chap 15 (p. 354-376)
14. **Mon, Mar 15:** Nuclear physics
    Reading from Hobson: Chapter 16 (p.380-404)
15. **Wed, Mar 17:** Stars
    Reading from Hobson: Secs 5.1-5.6 (p. 90-110), Sec 11.1 (p. 248-254),
    review sections 16.1-16.4 (p. 380-387)
16. **Mon, Mar 22:** Quantum fields and the nature of forces
    Reading from Hobson: Sections 18.1-18.3 (p. 439-449)
17. **Wed, Mar 24:** Standard model of particle physics
    Reading from Hobson: Sections 18.4-18.5 (p. 449-459)
18. **Mon, Mar 29:** Particles and cosmology
    Reading from Hobson: Sections 11.2-11.7 (p. 254-268)

Wed, Mar 31: EXAM 2

Schedule/Syllabus - part 3

19. **Mon, Apr 5:** Big Bang Cosmology
    TBA
20. **Wed, Apr 7:** More Cosmology: inflation, dark matter
    TBA
21. **Mon, Apr 12:** History of the Universe
    TBA
22. **Wed, Apr 14:** Student presentations
23. **Mon, Apr 29:** Student presentations
24. **Wed, Apr 21:** Student presentations
25. **Mon, Apr 26:** Student presentations

Tue, May 4, 4pm: Final Exam (tentative)