His tale encompasses the vast sweep of modern science, from the infinitesimal to the infinite, from the emission of photons to the expansion of the cosmos. A century after his great triumphs, we are still living in Einstein’s universe, one defined on the macro scale by his theory of relativity and on the micro scale by a quantum mechanics that has proven durable even as it remains disconcerting.

His fingerprints are all over today’s technologies. Photovoltaic cells and lasers, nuclear power and fiber optics, space travel, and even semiconductors all trace back to his theories. He signed the letter to Franklin Roosevelt warning that it may be possible to build an atom bomb, and the letters of his famed equation relating energy to mass hover in our minds when we picture the resulting mushroom cloud.

From “Einstein: His Life and Universe” by Walter Isaacson.

Course Readings

Readings posted to Blackboard

Readings available for download:
*Conceptual Physics* by Benjamin Crowell (download at http://www.lightandmatter.com/cp/)

Examination Schedule and Course Grade

<table>
<thead>
<tr>
<th>Examination</th>
<th>Percentage</th>
<th>Date/Time</th>
</tr>
</thead>
<tbody>
<tr>
<td>Examination 1</td>
<td>20%</td>
<td>Monday, February 25</td>
</tr>
<tr>
<td>Examination 2</td>
<td>20%</td>
<td>Monday, April 7</td>
</tr>
<tr>
<td>Laboratory</td>
<td>25%</td>
<td></td>
</tr>
<tr>
<td>Paper</td>
<td>5%</td>
<td>Due no later than, Wednesday April 2.</td>
</tr>
<tr>
<td>Final examination</td>
<td>30%</td>
<td>Monday, May 12, 2:00 to 3:50 pm</td>
</tr>
</tbody>
</table>

(No early dates for any examination will be offered under any circumstance)
Isaacson’s “Einstein” Book Review

A portion of the assessment for the course is a 4 page paper with references. References can include the assigned texts for the course, but must include additional references. Your paper will be a book review limited to Isaacson’s treatment of any one of the following topics: Einstein and the Philosophy of Science, Einstein and God, Einstein and Zionism, Einstein and Judaism, Einstein and Pacifism, Einstein and Atomic Weapons. Guidelines for the paper will be handed out in class.

The paper can be turned in at any date no later, Wednesday April 2. After this date the paper will be marked late with a reduction in credit.

Laboratory Sessions

These weekly sessions are an important part of the course. You must be registered for one lab section. You will have to submit a lab report for each experiment performed. The lab report has to include answers to all questions and any data you may have collected. The lab report will be due in lab one week after the experiment has been performed, or at the end of the lab period depending upon instructions from your lab instructor. The laboratory sessions will be held in Meyer 103 and will begin the week of Monday, January 28.

<table>
<thead>
<tr>
<th>Section</th>
<th>Day</th>
<th>Time</th>
<th>Section</th>
<th>Day</th>
<th>Time</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td>Thursday</td>
<td>11:00 – 12:40 p.m.</td>
<td>5</td>
<td>Thursday</td>
<td>5:00 – 6:40 p.m.</td>
</tr>
<tr>
<td>3</td>
<td>Thursday</td>
<td>1:00 – 2:40 p.m.</td>
<td>6</td>
<td>Friday</td>
<td>9:00 – 10:40 a.m.</td>
</tr>
<tr>
<td>4</td>
<td>Thursday</td>
<td>3:00 – 4:40 p.m.</td>
<td>7</td>
<td>Friday</td>
<td>11:00 – 12:40 p.m.</td>
</tr>
</tbody>
</table>

Laboratory Instructors:
Giga Chkareuli
Abhishek Kumar
Kun-Ta Wu

Attendance
If you arrive at least 10 minutes late for the lab session credit will be deducted from your lab grade.

Absence Policy
Excused absences will only be given in the case of illness (with a doctor’s note) or observation of a religious holiday. You must notify your lab instructor in advance in writing if you miss a lab due to religious reasons. All other absences will be considered unexcused and will result in a lab grade of zero. You cannot make up a lab by attending a laboratory session that you are not registered for.

Late Assignments
Late assignments will be penalized for each day late (excluding weekends). If you wish to submit a late lab report you must do so only at your laboratory instructor’s office.

Lab Instructor Access
Each lab instructor will hold a weekly office hour where you can discuss lecture and laboratory material. Office locations and office hour time and day will be announced during the first laboratory session. The lab instructors and their email addresses are
Date | Lab Experiment
---|---
Jan. 24/25 | No Lab
Jan. 31/Feb. 1 | Math Review
Feb. 7/8 | Photoelectric effect
Feb. 14/15 | Spectroscopic Analysis of Light
Feb. 21/22 | Young’s Experiment
Feb. 28/29 | Kinematics
Mar. 6/7 | Newton’s 2nd Law
Mar. 13/14 | No Lab
Mar. 20/21 | No Lab
Mar. 27/28 | Relativistic Addition of Velocities
Apr. 3/4 | Time Dilation and Length Contraction
Apr. 10/11 | Principle of Equivalence
Apr. 17/18 | Observing the Cosmological Redshift
Apr. 24/25 | Hubble’s Law and the Expanding Universe
May 1/2 | Review for Final Exam

**Homework**

Homework problems will be assigned to help prepare you for the course examinations. Homework will not be collected nor graded.

**Missed Exams**

There is no make-up exam for students who miss one of the two midterm exams. If you miss a midterm exam because of illness, you must contact Dr. Adler by phone or email before the start of the exam and follow up with a doctor’s note. In the event of an excused absence from one of the midterm exams, your final exam will count for more.

A make-up for the final examination will be given under exceptional circumstances, which must be discussed with Dr. Adler before the examination. A doctor’s note must be provided in the case of illness. In this case a grade of incomplete will be assigned and the make-up will be scheduled for the beginning of the Fall 2008 semester. Please avoid making travel plans before the date of the final exam.

**Readings**

Introduction to Course/Galilean Relativity – 2 lectures

Isaacson, Chapter 1,
Isaacson, Chapter 2, The Swabian, Munich, School, Aarau
Isaacson, Chapter 3, The Impudent Scholar, Graduation, August 1900
Isaacson, Chapter 4, Einstein’s First Published Paper, Jobless Anguish, Disputes with Drude and Others, The Patent Office, The Olympia Academy
Crowell (Conceptual Physics), Chapter 1: 1.1, 1.3, 1.4 section entitled “The principle of inertia” (pages 16 to 19)
Crowell (Conceptual Physics), Chapter 2: 2.1, 2.2

Brownian Motion and the Existence (and Sizes) of Atoms/Blackbody Radiation/The Photoelectric Effect – 2 lectures

Isaacson, Chapter 5: Turn of the Century, Light Quanta March 1905, Doctoral Dissertation on the Size of Molecules April 1905, Brownian Motion May 1905
Isaacson, Chapter 7: *Light Can Be Wave and Particle*

Isaacson, Chapter 8: *The 1911 Solvay Conference*

Crowell (*The Modern Revolution in Physics*), Chapter 3: 3.1, 3.2

**Stimulated Emission of Radiation (The Laser)** – 1 lecture

Isaacson, Chapter 14: *Niels Bohr, Lasers, and “Chance”, Quantum Leaps*

**Quantum Entanglement: EPR and Bell’s Theorem** – 2 lectures

Greene, Chapter 4, pages 77-123

Isaacson, Chapter 15: *The Great Solvay Debates, 1927 and 1930*

Isaacson, Chapter 20: “*Spooky Action at a Distance*, Schrodinger’s Cat, “Physics and Reality”, Against the Current”

Crowell (*The Modern Revolution in Physics*), Chapter 4: 4.1

**Electricity and Magnetism (The four laws of electromagnetism)** – 2 lectures

Crowell (*Conceptual Physics*), Chapter 5: Sections 1 and 2

Crowell (*Conceptual Physics*), Chapter 6: Sections 1, 2 and 3

**Newton’s Bucket and Mach’s Principle** – 1 lecture

Greene, Chapter 2

Newburgh (article found on Blackboard), *Inertial forces, absolute space, and Mach’s principle: The genesis of relativity*

**Special Relativity** – 6 lectures

Greene, Chapter 3, pages 39-61


Crowell (*Conceptual Physics*), Chapter 1: 1.7

Crowell (*Conceptual Physics*), Chapter 4: 4.1, 4.2

Isaacson, Chapter 21: *The Letter, Citizen Einstein, Atomic Fears*

“Relativistic addition of velocities directly from the constancy of the velocity of light” by N. David Mermin, American Journal of Physics (1983)

**General Relativity** – 4 lectures

Greene, Chapter 3, pages 62-78

Isaacson, Chapter 7: *The Equivalence of Gravity and Acceleration*


Isaacson, Chapter 11: *The Eclipse, 1919*

Isaacson, Chapter 20: “*Lights All Askew*”

Crowell (*Conceptual Physics*), Chapter 1: 1.5

**Cosmology** – 3 lectures

Isaacson, Chapter 11: *Cosmology and Black Holes, 1917*

Isaacson, Chapter 15: *His Greatest Blunder?*

Greene, Chapters 8, 9, 10, 11

**Entropy and Time** – 1 lecture

Greene: Chapter 6