COURSE PHILOSOPHY:
“Advanced physics” can bring to mind at least two images. One could be the latest innovations and advancements and cutting edges to reveal the fibers of string theory or the multiple dimensions of general relativity. Another – this course’s approach to “advanced physics” – is to develop a more genuine and in-depth understanding of the physics principles that are fundamental: concepts regarding motion, forces, and energy. Although this doesn’t at first sound like the most exciting and truly “advanced” physics, what we often find is that this is exactly what we need to understand every other aspect of the physical universe. In addition, it turns out to be fun.

This course is intended to provide the content knowledge for practicing teachers to become experts in the field of physics teaching. To truly serve such a purpose, this course probably should be about 18 months long, but we’ll settle for a one-week workshop! As professional teachers, experts in the field of learning, you realize that this could be problematic. This course will leave much of the responsibility for developing a thorough understanding to you, but will model the process of learning physics by modeling authentic science and inquiry-based learning. The hope is that this will not only enable you to become better prepared in physics, but also to have examples of activities that you can take to your classroom.

The greatest assets of this classroom are one another. You are surrounded by teaching and science experts, and we will rely heavily on each other’s experiences and perspectives, both the freshest and the most well aged. You are expected to participate, listen, suggest, volunteer, laugh, deliberate, build, design, interact, etc. – all of the things that you should expect from your own ideal classroom. Knowledge, after all, is not produced in a vacuum, but is a creative and social endeavor that begs your constructive contributions. The one contribution which is not welcome is the one which only serves to bemoan the “system,” government, administrators, mothers-in-law, students, etc. Our discussions and foci will be upon those things that we can control. These things, ultimately, are the ones that will make a difference in our classrooms.

COURSE OBJECTIVES:
This course should enable the student to:
• Evaluate his/her own understanding of fundamental physics content.
• Begin to develop a deeper understanding of motion, force, and energy, including the historical development of these concepts.
• Design course curricula for the physics and physical science classroom.

THE DETAILS:
Instructors:
Adam Johnston, Weber State University (Phone: 801.626.7711; Email: ajohnston@weber.edu; Office: SL 207)
Gordon Haueter, Davis High School (Email: ghaueter@dsdmail.net)
Meeting times: 19-23 June 2006; 8:30 AM – 4:00 PM
Meeting place: SL 225, Department of Physics, Weber State University
Course Web Page: http://physics.weber.edu/johnston/phsxteach
Text: Holton & Brush (2001). Physics, the Human Adventure: From Copernicus to Einstein and Beyond. Rutgers Press.
**SCHEDULE:**

Everything below is subject to revision, but at least you can see that there was some semblance of planning that went into this course. If you aren’t told otherwise, expect the following itinerary to hold true.

<table>
<thead>
<tr>
<th>Time</th>
<th>Monday</th>
<th>Tuesday</th>
<th>Wednesday</th>
<th>Thursday</th>
<th>Friday</th>
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<tbody>
<tr>
<td><strong>8:30 – 9:00</strong></td>
<td><strong>Introductions</strong></td>
<td><strong>Problem of the day: Ice cream in Utah</strong></td>
<td><strong>Problem of the day: The bee and the train</strong></td>
<td><strong>Problem of the day: The tree branch</strong></td>
<td><strong>Problem of the day: The problem of the paper towel</strong></td>
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<td><strong>9:00 – 10:00</strong></td>
<td><strong>Bubbles: Observations of the natural world</strong></td>
<td><strong>Discuss Holton &amp; Brush: Ch. 6-8</strong></td>
<td><strong>Discuss Holton &amp; Brush: Ch. 9-11</strong></td>
<td><strong>Discuss Holton &amp; Brush: Ch. 15-18</strong></td>
<td><strong>Discuss Physics and Pseudoscience (see Holton &amp; Brush: Ch. 3, handout/online references)</strong></td>
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<td><strong>10:00 – 11:00</strong></td>
<td><strong>The madness of stirring hot chocolate</strong></td>
<td><strong>What do we know and how do we know what we don’t know? The Force Concept Inventory (FCI)</strong></td>
<td><strong>Rocket physics continued . . .</strong></td>
<td><strong>Conservation of energy: Heat and mechanical energy</strong></td>
<td><strong>Pseudoscience investigations</strong></td>
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<tr>
<td><strong>11:00 – 12:00</strong></td>
<td><strong>What is science? Umbrellaology, tracks, solar systems, and atoms.</strong></td>
<td><strong>Fun with motion: The case of freefall</strong></td>
<td><strong>Elevator physics</strong></td>
<td><strong>Break and brainstorm</strong></td>
<td><strong>Pseudoscience debriefed</strong></td>
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<td><strong>12:00 – 1:00</strong></td>
<td><strong>LUNCH</strong></td>
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<td><strong>1:00 – 2:00</strong></td>
<td><strong>The biggest: Measuring the sun</strong></td>
<td><strong>Moving right along: Motion graphs</strong></td>
<td><strong>Debrief FCI</strong></td>
<td><strong>Sticky tape and balloons</strong></td>
<td><strong>Lesson presentations</strong></td>
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<tr>
<td><strong>2:00 – 3:00</strong></td>
<td><strong>The smallest: Measuring a molecule</strong></td>
<td><strong>More fun in a different direction: Rocketry</strong></td>
<td><strong>Making waves: The case of sound and resonance</strong></td>
<td><strong>Electromagnetism: How to light a light bulb</strong></td>
<td><strong>Lesson presentations</strong></td>
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<tr>
<td><strong>3:00 – 4:00</strong></td>
<td><strong>Break and brainstorm</strong></td>
<td><strong>Break and brainstorm</strong></td>
<td><strong>Break and brainstorm</strong></td>
<td><strong>A simple DC motor</strong></td>
<td><strong>Lesson presentations</strong></td>
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**ASSIGNMENTS:**

You knew that there had to be something in the way of assessment, didn’t you? In addition to your active participation in the course and completion of lab activities, there are two major assignments that you will complete:

- During the week of the course, you will complete the design of a lesson which meets the following criteria:
  1. It should be something that you could actually use in your classroom. (In fact, you may have tested some aspect of it already).
  2. It is related to the state core.
  3. It focuses on the historical development of some physics concept, likely as outlined by Holton & Brush.
  4. It will be presented to your classmates on the last day of class.
  5. An electronic version of your lesson will be turned into the instructor within four weeks after the course. The lesson can then be posted to the course website so that others may use your creation and adapt it to their own needs.

- After the course is completed, you will complete a final “take home” exam. This exam will be open book, open note, etc., but will require your reflection upon the week’s activities and readings. This assessment is meant to measure your understanding of the physics concepts covered during the course. It will be due four weeks after the week of the class (though it isn’t expected that you will need this much time).