

## Extra Credit Projects

The option exists to earn extra points toward your final course grade by doing an Extra Credit Project. The maximum contribution toward your course grade is 8 points (out of 100 total), which is approximately one-half of a grade division. A project must be an individual effort, and it is judged on creativity, quality, and effort. The final due date for a project is one week before the last day of class (which corresponds to Apr. 18, 2001), **but** you must obtain approval of your project **before** you get started. Possible projects include:

1. A written report on a topic in modern physics
2. A graphical solution or detailed calculation to a complex problem in modern physics using a tool like Maple or Mathematica
3. A virtual demonstration (applet or program) of a modern physics principle using a programming language like JAVA, JAVASCRIPT, C++, etc.

### Report

The typed report should be at least 4000 words long (approximately 10 pages with 1.5 line spacing) on a topic related to modern physics that is either not covered by the textbook or is covered in more detail in your report. Your report will be graded on substance as well as style. You should clearly cite your references, but make sure your report is self-contained (*i.e.* Do not just refer to reference X for the reason to your argument). Be sure to mention how your topic pertains to the concepts learned in this course. Include illustrations as appropriate. The structure of your report should include a title page, an abstract, a body with subsection as appropriate, and a reference section. Use 8.5 x 11" paper with a 12-point font and 1" margins.

### Calculation

The detailed calculation (or calculations) could be on a problem not covered in the text (like the derivation of the 3D Schrodinger Equation and new applications of it), or on the graphical presentation of a solution derived in the text (such as the 3D rendering of the hydrogen orbitals). You can use the power of a mathematical analysis package like Maple, Mathematica, MathCad, Origin, etc. to help you derive your solution and plot your results. You might use a graphic arts program if the math packages are too limiting for plotting. You will be graded on how creative you were with the problem you chose or the way you presented it, the accuracy of the solution, and the effort that went into solving it.

### Program

If you like programming computers, you might try writing an applet that demonstrates some principle in modern physics. This could include an effect in relativity (time dilation, length contraction...), waves (interference, diffraction...), quantum mechanics (wavefunctions...), or a special topic in modern physics (radioactivity...) A pseudo-random number generator could be very useful in determining where an electron hits a screen, when a nucleus decays, or what value a quantum measurement makes. You will be graded on the creativity of the program, how successful you were in

implementing it, and how much effort went into it. If a graphical user interface is too difficult, you might just provide text output.