Bilkent University, Department of Physics

PHYS 453: Nuclear & Particle Physics

Term Paper

(version: 14 April 2012) **Due Date:** 14 May 2012

Select one of the themes from below and prepare your term paper around it.

1. For the **theoretically-inclined**: *Majorana Fermions*
   - Make a theoretical survey on Majorana fermions, presented pedagogically
   - Starting reference: *P. B. Pal, "Dirac, Majorana, and Weyl fermions"*
2. For the **computationally-inclined**: *Dirac Equation Solver*
   - Compute the stationary solutions of the relativistic hydrogen atom and compare with exact analytical results (risky, if you are not good in computation)
   - Starting reference: *E. Ackad et al., "Numerical solution of the Dirac equation . . . "*
3. For the **phenomenogically-inclined**: *Nuclear Power in the 21st Century*
   - Make a qualitative survey on sustainable nuclear energy, based on modern alternatives, such as thorium-fueled or nuclear fusion reactors
   - Starting references: *Mackay, "Sustainable Energy"*, *Energy From Thorium & Nuclear Fusion*
4. **Or**, propose your own theme, but we must finalize its negotiation by April 20th.

Requirements of your Report: (Grading will be based on these guidelines)

- Respect the rules of academic honesty
- Due date is absolutely strict, so plan your time accordingly!
- Report must be typeset, with +10 pt bonus for LaTeX (no handwritten reports)
- Report must be submitted in hardcopy (no emails)
- It must be in scientific paper format (with abstract and references), preferably in double-column format, with a minimum of 5 full pages
- Give proper citations; quality and diversity of the references are crucial
- The main purpose here is to contribute to your knowledge, so do not put any material that you do not appreciate