



## **BSc/MSci EXAMINATION**

**PHY-312**      **Explaining the Universe**

**Time Allowed:** 2 hours 15 minutes

**Date:** 15 May 2007

**Time:** 10:00

**Answer ALL questions in section A. Answer ONLY TWO questions from section B. Section A carries 40 marks, each question in section B carries 30 marks. The coursework contributes 50% to the final assessment.**

**COMPLETE ALL ROUGH WORKINGS IN THE ANSWER BOOK AND CROSS THROUGH ANY WORK WHICH IS NOT TO BE ASSESSED.**

**YOU ARE NOT PERMITTED TO START READING THIS QUESTION PAPER UNTIL INSTRUCTED TO DO SO BY AN INVIGILATOR**

**Section A.** Write 30 – 50 words on EACH of the following (4 marks for each):

- A1. The size and age of the Universe
- A2. Schrödinger's cat
- A3. "The butterfly effect" – sensitivity to initial conditions.
- A4. CERN
- A5. Pulsars
- A6. Dark energy
- A7. The cooling and trapping of atoms by laser light
- A8. Emergent phenomena
- A9. What is special about special relativity
- A10. Symmetry in physics

**Section B.** Write 500 – 600 words on TWO of the following (30 marks each):

B1. "Nanotechnology is changing the way we live." You may wish to consider that areas producing the greatest revenue for nanoparticles reportedly are chemical-mechanical polishing, magnetic recording tapes, sunscreens, automotive catalyst supports, biolabelling, electroconductive coatings and optical fibres.

B2. The 2006 Nobel Prize in Physics was awarded to John C. Mather and George F. Smoot "for their discovery of the blackbody form and anisotropy of the cosmic microwave background radiation". Explain the significance of their discovery to an undergraduate student in the Arts and Humanities.

B3. Physicists have been criticised for their "relentless reductionism". Write an essay in which you explain the basis for this criticism and support and/or rebut it. You may wish to comment on examples of "emergent phenomena" in physics, such as temperature, or superconductivity. And you may also wish to explore the limits to reductionism (if any) that restrict its extension to biology and other sciences.

**End of Examination Paper**  
**Professor John M Charap**