



BSc/MSci EXAMINATION

PHY-312 Explaining the Universe

Time Allowed: 2 hours 15 minutes

Date: 27 May 2004

Time: 10:00 – 12:15

Answer ONE question from Section A and TWO questions from Section B. Each question in Section A carries 25 marks. The questions in Section B each carry 12.5 marks. The coursework carries 50 marks.

DO NOT TURN TO THE FIRST PAGE OF THE QUESTION PAPER UNTIL INSTRUCTED TO DO SO BY THE INVIGILATOR

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SECTION A

Answer ONE question from this Section

QUESTION 1

From the discovery of the electron in 1897 to the present day speculative theories of superstrings and M-theory, the significance of the word *elementary* when used by physicists in explaining the elementary constituents of matter has undergone radical change.

Write an essay (1200 – 1500 words) in which you discuss this.

You may wish to comment on any or all of the following:

- the atom (literally *indivisible*) of Democritus
- atoms contain constituents, which contain constituents, which contain constituents, which
- particles can be created or destroyed.

QUESTION 2

The ATLAS Experiment for the Large Hadron Collider (LHC) is under construction at the CERN Laboratory in Switzerland. ATLAS is the largest collaborative effort ever attempted in the physical sciences. There are 2000 physicists participating from more than 150 universities and laboratories in 34 countries. A group from Queen Mary led by Professor Carter plays an important part in this collaboration.

Write an essay (1200 to 1500 words) in which you discuss the implications for the future direction of research in physics of the need for such enormous undertakings. You may wish to comment on any or all of the following:

- possible distortions (personnel, financial) in the balance of research
- the difficulties inherent in setting long term plans for research
- fitting three year PhD students into giant ten year programmes.

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SECTION TWO

Answer TWO questions from this Section

QUESTION 3

A friend who is not a scientist asks you to explain what physicists mean when they talk about “Schrödinger’s cat”. Give an answer in 500 to 600 words.

QUESTION 4

You have been invited to give a talk to a school science club in which you describe a significant discovery in physics made in the last twenty years. Write 500 to 600 words in preparation for your talk.

QUESTION 5

Write an essay (500 to 600 words) on determinism, uncertainty and chaos in physics.

End of Examination Paper

Professor John M Charap