CONCEPTS IN THEORETICAL PHYSICS (A11)

Easter Term 2019

John D. Barrow

Course Schedule

Lecture 1: Equations in Physics, Simplicity, and Chaos (25/4/19 at 12 noon)

Lecture 2: Invariances, Constants, and Dimensions (30/4/19 at 12 noon)

Lecture 3: Action Principles (2/5/19 at 12 noon)

Lecture 4: Quantum Mechanics (7/5/19 at 12 noon)

Lecture 5: Statistical Physics: Entropy, demons and black holes (9/5/19 at 10am – note change of time)

Lecture 6: General Relativity (14/5/19 at 12 noon)

Lecture 7: The Maths of Whole Universes (16/5/19 at 12 noon)

Lecture 8: Elementary Particles (21/5/19 at 12 noon)

All lectures are on Tuesdays and Thursdays in the Mill Lane 3 Lecture Theatre. All lectures are at 12 noon except for Lecture 5 which is at 10am because of the Rouse-Ball Lecture that day at 12 noon.

Course Overview

This short course of eight lectures is intended to introduce you to some of the most important parts of theoretical physics that you will encounter during your course. It builds on elements of the excellent courses given previously by Prof. David Tong and Dr. Daniel Baumann. Each lecture is self-contained, although cross-references between them will be made where appropriate, and emphasises the importance of mathematics in physics. The first three lectures are more wide-ranging than the others, looking at general features of the mathematical equations used in physics, the illuminating role played by constants and dimensions, and the surprising power of 'action principles'. The subsequent lectures each focus upon a particular subject. The aim throughout is to communicate the essential features of each topic, using mathematics that you know, together with words and diagrams, to take you from the foundations to unsolved frontier questions today. Overall, the course will explore the mathematical physics of the very small (quantum mechanics and elementary particles), the very large (general relativity and cosmology), and the very complex (chaos, organised complexity and statistical physics). The remarkable role often played by past Cambridge mathematicians will not be overlooked.

There are no example sheets, exams, or required additional reading -- although I will supply some references and web links for those who want to explore the content of each lecture further.

A pdf of each lecture presentation will appear on the DAMTP Examples webpage (the course reference number is A11 – right at the top of the list) immediately after the lecture at http://www.damtp.cam.ac.uk/user/examples/

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