Relativistic Quantum Mechanics

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This course of six lectures in weeks 1 to 3 of HT03 is intended primarily for fourth year undergraduates reading Physics or Physics and Philosophy and who are taking the fourth-year option B6 (Theoretical Physics), for whom it covers the part of the syllabus *Quantum Mechanics: relativistic quantum mechanics*. Knowledge of my last term's course on 'Scattering Theory' will be assumed, as will familiarity with the use of four-vectors in Special Relativity, and with non-relativistic quantum mechanics at the level of Part A Theoretical Physics.

Topics to be covered:

Revision of relativistic notation. **The Klein-Gordon equation**: plane wave solutions; probability current; Green function; interpretation of negative-energy solutions; inclusion of electromagnetic interactions; first order Born Approximation; relativistic Rutherford scattering. **The Dirac equation**: properties of the α and β matrices; free particle solutions; probability current; spin; rotations and boosts; hole theory; inclusion of electromagnetic interactions; $g = 2$; Mott scattering.

Books:

Aitchison and Hey 'Gauge Theories in Particle Physics' 3rd edtn (2002) Vol 1 chapter 3, chapter 4, sections 8.1 and 8.2.1, and Appendices B, C, and D.

Aitchison 'Relativistic Quantum Mechanics' (1972) contains more detail, but is long out of print (and beware misprints!).

Bjorken and Drell 'Relativistic Quantum Mechanics' (1964) is a classic, but is at a more advanced level.

Classes:

(i) There will be one class on last term's Scattering Theory course, the problems for which have already been circulated. This class will be in week 2.

(ii) A second class, on RQM, will be held in week 4 (problems yet to be circulated).

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