Department of Physics & Astronomy
Module Report
Semester 1, 2018-19

Course Title: Particle Physics
Module: PHY304
Lecturer(s): Chris Booth
Number of students: 154 (excluding those not present for exam)

General Comments: In response to student feedback last year, extra quantum mechanical background was provided in the course booklet for this session. Due to the larger size of the class this year, and in response to students' comments last year, the number of assessed homeworks was reduced from five to three. To compensate for this, more worked kinematics problems were included in the lectures, and there were expanded unassessed exercises, for which full solutions were provided. The use of a feedback sheet for each homework, discussing common problems and errors, was continued.

Problems Experienced: None.

Coursework Performance: (3 homeworks) This was generally performed very well. Students appeared to appreciate that it gave them practice in kinematic calculations in particular. Most students attempted all questions, though two did not engage with the coursework at all and three handed in only 1 of the 5 homeworks. A few students handed work in late and were penalised. The average mark overall was good, at 74%.

Exam Performance:
Exam performance was slightly better than recent years'. It was very noticeable that mathematical questions were preferred over descriptive/explanatory ones. Questions on quark symmetries have been introduced over the last three years and until this year have been very unpopular in the exam. This year, many of the topics requested for the pre-exam revision session were on symmetries, and a large majority of students attempted the question on this topic, most very successfully.

Question 1 (compulsory short answers) – most sections were well answered. Quite a few students did not appreciate the significance of scale invariance. Some incorrect Feynman diagrams were drawn, and many statements about virtual particles were only true in a particular frame. The explanation of why the strong quantum number is known as colour was not done very well – many wrote general essays rather than answering the question. Overall the question was probably too easy, with average mark 13.1 out of 20 (65%).

Question 2 (Form factors) – a surprisingly popular question with very high marks. The FF was not described well, many saying it was a "modification" for a finite size particle, without saying what was modified. The book-work derivation was probably worth too many marks. Many people did the calculation well, though several left the result in a form which needed much simplifying. Overall, probably too easy (though this was a mathematical question and it did attract the more mathematically competent students). Average 10.9/15 (72%) for 102 attempts.

Question 3 (Quark quantum numbers, symmetry, kinematics) –an extremely popular question. Definitions of isospin were very sketchy; several people confused I and I_3. Question on symmetry generally done well, but many people used a reverse logic, using their prior knowledge of the Δ spin to deduce flavour symmetry, rather than the information given in the question. Kinematic question done very well. Average 9.5/15 (63%) for 140 answers.

Question 4 (Quarks, weak interactions and allowed/forbidden reactions) – not popular. The last section, explaining if/why reactions occurred, was done very well. In contrast, the other two parts were often either ignored or material written that bore no resemblance to the question. Even the better attempts did not distinguish between experimental observations and theoretical predictions. Average 6.2/15 (41%) for 44 answers.

Question 5 (Conserved quantities, kinematics) – not popular. Many people were very confused about representing a translation in space, and instead described a variety of other invariances! For the symmetry requirements of a 2-pion system, many instead talked about the quark wavefunction inside the mesons. There were some good calculations of the kaon decay, but many got completely bogged down in the algebra. Average 6.0/15 (40%) for 26 answers.

Overall average 63.5% on exam, 65.3% including homeworks; 6 students failed; 68 first class marks.

Feedback on Coursework

Feedback was provided by comments written on the marked scripts, a specimen solution for each question and a "feedback sheet" containing comments on common errors, easier approaches etc.

Responses to Questionnaire comments

Satisfaction with the module is generally high, with many positive comments on the handout material, homeworks and feedback, and the support provided for individual questions, which is very gratifying. It is pleasing to know that many students found this an interesting subject.

There was criticism that feedback was provided on paper, rather than on-line. It had been explained that this was deliberate, as the sheets were intended to be used in conjunction with the students' own attempts, and so were provided at the same time as marked work was returned. (It was disappointing to see how much marked work was never collected from outside F10.)

There was a request for more unassessed exercises – this will be considered for next year.

One person complained that particle properties had to be remembered but had not been provided (in summary form) in lectures. This was not true, though the most comprehensive summary was provided in diagrammatic rather than tabular form.

There was a request for more material on key experiments. It would be nice to include this, but there is little room, and this approach is adopted in the 4th year module PHY466 for those who are interested.

Planned Revisions for next session: The course book may be expanded to include more material currently only presented in lectures (as requested in the questionnaire). This may include more kinematics, building on the changes introduced this year.

Course work deadlines and return of marked work

All work was handed out and required on the dates indicated at the start of the semester on the Third Year timetable. Each piece of work was returned with comments not more than two week after being handed in.

Work	Given out	Handed in	Returned to students
Homework 1	2nd Oct.	9th Oct.	23rd Oct.
Homework 2	23rd Oct.	30th Oct.	13th Nov.
Homework 3	27th Nov.	4th Dec.	14th Dec.

C N Booth
12th February 2019