Philosophical Aspects of Quantum Field Theory (M8)

Non-Examinable (Part III Level)

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Quantum field theory has for many decades been the framework for several basic and outstandingly successful physical theories. Nowadays, it is being addressed by philosophy of physics (which has traditionally concentrated on conceptual questions raised by non-relativistic quantum mechanics and relativity). This course will introduce this literature. The content will be moulded by students’ interests. But I hope: (i) to emphasize quantization theory, and algebraic methods; (ii) to mostly use the books by Folland, and by de Faria and de Melo; and (iii) to lead up to the Unruh effect.

I also expect, in the first half of the course, to review: (a) the mathematical structure of quantum theories in general, at the level of the books by Hannabuss, Jordan and Prugovecki; (b) some foundational issues, using the books by Araki, Clifton and Landsman (which is Open Access); (c) ideas of operator algebras, using the books by Emch, Haag and Ruetsche.

Pre-requisites

There are no formal prerequisites. Previous familiarity with quantum field theory, such as provided by the Part III courses, will be helpful.

Preliminary Reading

This list of reading gives an overview of the course’s topics, and is approximately in order of increasing difficulty.


**Literature**

The main resource will be the books by Folland, and by de Faria and de Melo. For mathematical background, we will draw on the books by Hannabuss, Jordan and Prugovecki. For foundational issues, we will draw on the books by Araki, Clifton and Landsman (the last being freely downloadable, and an invaluable resource for the whole course). For operator algebras, we will also use the books by Emch, Haag and Ruetsche. An overall reference is Ticciati (1999); a recent advanced monograph is Rejzner (2016).


**Additional support**

One or two Part III essays—one of them probably about the Unruh effect—will be offered in conjunction with this course.