

Supersymmetry (L16)

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This course provides an introduction to the use of supersymmetry in quantum field theory. Supersymmetry combines commuting and anti-commuting dynamical variables, thus relating fermions to bosons.

Physical and theoretical motivations for supersymmetry are provided. The supersymmetry algebra and representations are then introduced, followed by superfields and superspace. 4-dimensional supersymmetric Lagrangians are then discussed, along with the basics of supersymmetry breaking. The minimal supersymmetric standard model will be introduced.

Three examples sheets and examples classes will complement the course.

Prerequisites

It is necessary to have attended the Quantum Field Theory and the Symmetries, Particles and Fields courses, or be familiar with the material covered in them.

Literature

Introductory Reading

1. The first chapters of <http://arxiv.org/abs/hep-ph/0505105>

Reading to complement course material

For more advanced topics later in the course, it will be helpful to have a knowledge of renormalisation, as provided by the Advanced Quantum Field Theory course. It may also be helpful (but not essential) to be familiar with the structure of The Standard Model in order to understand the final lecture on the minimal supersymmetric standard model.

Beware: most of the supersymmetry references contain errors in minus signs, aside from (as far as we know) Wess and Bagger.

1. Bailin and Love, *Supersymmetric Gauge Field Theory and String Theory*, IoP Publishing, 1994 has nice explanations of the physics. An erratum can be found at <http://www.phys.susx.ac.uk/~mpfg9/susyerta.htm>
2. J. D. Lykken, *Introduction to supersymmetry*, <https://arxiv.org/abs/hep-th/9612114>
This introduction is good for extended supersymmetry and more mathematical aspects.
3. Wess and Bagger, *Supersymmetry and Supergravity*, Princeton University Press, 1992.
Note that this terse and more mathematical book has the opposite sign of metric to the course.
4. Bailin and Love, *Supersymmetric Gauge Field Theory and String Theory*, IoP Publishing, 1994 has nice explanations of the physics. <https://inspirehep.net/literature/378624>
5. Dreiner, Haber and Martin, *From Spinors to Supersymmetry*, CUP, 2023 is an extensive (over 1000 pages) and definitive supersymmetry text. <https://www.cambridge.org/core/books/from-spinors-to-supersymmetry/06451973CF57A146A17F1CE72E425FDD>.