Sujet de stage de Master 1
Service de *Physique de l'Univers, Champs et Gravitation*
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All possible symmetries of S-matrix (E. Skvortsov)

S-matrix is the ultimate observable in quantum field theory. Therefore, it is important to understand as much as possible about its general properties, without having to appeal to any concrete QFT, Lagrangian and perturbation theory. One of the most important properties of any theory is in the global symmetry it has. This symmetry manifests itself in the S-matrix. One symmetry always present 'by default' is the Poincare symmetry. It is important to know what the options are to have a bigger symmetry: is it always a product of Poincare group with some internal (having nothing to do with space-time) symmetries or not?

This question was settled in an important paper by Coleman and Mandula. The goal of the project is to understand the proof as well as the weak points of the theorem they proved.

As different from many other important QFT-papers, the paper by Coleman and Mandula is short, written in a playful style, is easy to read and does not require a lot of QFT-material to understand it

The most important reference is

[1] All Possible Symmetries of the S Matrix, Sidney R. Coleman(, J. Mandula (1967) Published in: Phys.Rev. 159 (1967) 1251-1256

Plus any of the standard quantum field theory textbooks, e.g. Srednicki