

Notes: generalised symmetries & related topics

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1 Defining higher-form symmetries

Most parts of this section are adopted from the reviews below.

- i.) 日高 義将, 高次対称性入門
- ii.) 日高 義将, 対称性の自発的破れ入門

1.1 Starting from the conventional symmetries

Let us start by introducing another standpoint of seeing the conventional symmetries. We start with an example of a free fermionic system. The action of the system is given by

$$S[\psi] = \int_{\mathcal{M}} d^d x \bar{\psi}(x) (\gamma^\mu \partial_\mu - m) \psi(x). \quad (1.1)$$

Here, \mathcal{M} is a Minkowski manifold as spacetime and $\psi(x)$ is a spinor field, which is a section of a vector bundle $E \xrightarrow{\pi} \mathcal{M}$ with $\text{Spin}(1,3)$ group as its structure group.

¹The sections with asterisk “*” are materials that is not directly related to generalised symmetries but supplemental.

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- 3 Reviewing the spontaneous symmetry breaking of conventional symmetries *
- 4 Generalising the spontaneous symmetry breaking & Nambu-Goldstone theorem
- 5 Reviewing Ginzburg-Landau theory *
- 6 Introducing category theory & higher groups as a tool *
- 7 Formulating higher gauge theories