

- H_p and H_c are different SPTs

→ check by inserting U sym defect: gives rise to twisted boundary conditions

$$Z_{j+L} = -Z_j$$

1) H_p unaffected:

$$U|gs\rangle = |gs\rangle \quad \tilde{U}|gs\rangle = |gs\rangle$$

2) H_c becomes $H_c + 2Z_L \tilde{X}_L Z_L$

$$U|gs\rangle = |gs\rangle \quad \tilde{U}|gs\rangle = -|gs\rangle$$

→ Different responses \Rightarrow different SPTs

$$Z_p[A, \tilde{A}] = 1 \quad Z_c[A, \tilde{A}] = (-1)^{\int A \vee \tilde{A}}$$

LSM anomalies

A sym has an anomaly if it does not admit an SPT phase.

- Related to obstruction to gauging

- called an 't Hooft anomaly for internal symmetries

- called an LSM anomaly for internal + spatial sym.

Example

- 1d closed chain w/ 1 qubit per site