Notes for Classification of topological quantum matter with symmetries

Taper

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Abstract

As title suggests.

Contents

Asks

1. Page 6. Why the scalar in Schur's lemma becomes of unit lenght.
2. page 9. What does it mean by:

   > Note that unitary symmetries, which commute with the Hamiltonian, allow us to bring the Hamiltonian into a block diagonal form.

3. page 9, table I. When he talks about *codimension*, what is the dimension of the whole space? (3? 3+1?). Similar problem also exists in page 10. Note, he mentions codimension of gaples modes on page 11. He asserts that codimension 1 means 1 dimension less than the bulk. But it should be strange to compare the dimension of defects with the dimension of the bulk.

   Possibly related resources:Online notes about Imperfection:

   - 0D (zero dimension) – point defects: vacancies and interstitials. Impurities.
   - 1D – linear defects: dislocations (edge, screw, mixed)
   - 2D – grain boundaries, surfaces.
   - 3D – extended defects: pores, cracks.

   Note: it is finally defined on page 12. that is: codimension of defect $d_c := d_{\text{bulk}} - d_{\text{defect}}$.
4. page 6, what does it mean by saying *"unitary symmetry"*.
5. page 10, what is a *"quantum phase diagram"*.

6. page 11, what does he says, *"Topological properties of adiabatic cycles can also be discussed in a similar manner."*. Does this mean that all previous classification does not concern the adiabatic cycles? What is *"adiabatic cycles"* exactly in his language?
7. page 12, "disinclination" is what kind of defect? Any books on crystall defects?
8. page 12, is the *"mass gap"* a massive gap or a gap composed of mass?
9. page 12, about the D: if $d_c = 1$ (line defect in a $2d$-bulk), then $D = 0$. So a line is wrapped by a point? also, on fig. 2, the $(D = 2, d = 1)$ gives a $d_{\text{defect}} = -1$! Judging from this graph, a $d_{\text{defect}} = -1$ means a temporal defect. Is this true?

Doubts

1. page 10. Amazingly, he says, *"all TIs and TSCs in the ten AZ symmetry classes are stable against disorder, and hence the assumption of translation invariance is not at all necessary"*. How can translational invariance be ignored?
2.

1 Anchor

References

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