Topological states of matter and non-supersymmetric dualities

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Abstract

In the first part of the lecture, we will briefly introduce topological phases of matter and their main properties by employing effective quantum field theories, such as Chern-Simons and relativistic fermion theories. In particular, we will review the role of the Dirac theory in these quantum phases by focusing on the fractional quantum Hall effect with filling factor 1/2 (FQHE-1/2), where an emergent particle-hole symmetry plays a prominent role. The second part of the lecture deals with dualities and their possible application to topological states of matter. Specifically, we will review recent papers where, starting from a relativistic form of flux attachment designed to transmute the statistics of particles, a web of new dualities can be derived. This includes the usual particle-vortex duality for bosons as well as the recently discovered counterpart for fermions in the FQHE-1/2 and on the surface states of three-dimensional topological insulators.

References

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