Modular Anomalies in (2+1)-D and (3+1)-D Edge Theories

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The classification of topological phases of matter in the presence of interactions is an area of intense interest. One possible means of classification is via studying the partition function under modular transforms as the presence of an anomalous phase arising in the edge theory of a D-dimensional system under modular transformation signals the presence of a (D+1)-D non-trivial bulk [1-2]. In this talk, we discuss the modular transformations of conformal field theories along a (2+1)-D and (3+1)-D edge. Using both analytical and numerical methods, we show that chiral complex free fermions in (2+1)-D and (3+1)-D are modular invariant. However, we show that in (3+1)-D that when the edge theory is coupled to a background U(1) gauge field this results in the presence of a modular anomaly that is the manifestation of a quantum Hall effect in a (4+1)-D bulk. We further discuss using the modular anomaly to classify interacting (4+1)-D spacetime inversion symmetric insulators.

References:

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