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Anomalies for anomalous symmetries

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4d gauge theories with massless fermions typically have axial U(1) transformations that suffer from the ABJ anomaly. One can modify the theory of interest by adding more fields in a way that restores the axial symmetry, and use it to derive rigorous 't-Hooft anomaly matching conditions. These conditions are not valid for the original theory of interest, but for the modified theory. We show that the modification can be done in a specific way that allows us to relate the dynamics of the modified theory to the dynamics of the original theory. In this way, the anomaly matching conditions of the modified theory can be used to learn new things on the original theory even though they involve axial transformations which are not a symmetry of the original theory. We describe this method and discuss some applications to various examples.

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