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Parity violation in the trace anomaly

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The trace anomaly is the breaking of Weyl (\sim scale) invariance upon quantisation of a theory, and occurs in a gauge and/or gravitational background. The presence of the parity violating Pontryagin densities $R\tilde{R}$ and $F\tilde{F}$ in the trace anomaly could have far reaching phenomenological consequences, and have been the subject of debates over the past decade.

In our latest work (arXiv:2309.08670) we investigate in a model-independent manner the presence of parity violating contributions to the trace anomaly. We show that the finiteness of the gauge, diffeomorphism and Lorentz anomalies can be used to constrain the generic form of the energy-momentum tensor, both with and without explicit breaking of the Weyl symmetry.

The main result is that any theory compatible with dimensional regularisation cannot admit a parity violating trace anomaly.

We also address the question of the R -term in the trace anomaly, and argue that it is unambiguous contrary to common claims.

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