



## PARTICLE CREATION, QUANTUM ANOMALIES, AND GRAVITY

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Particles are spontaneously created from the vacuum by time-varying gravitational or electromagnetic backgrounds. Typically, the number of created particles is an adiabatic invariant, but one can find counterexamples. On the other hand, it is well known that not every classical symmetry is preserved in the quantum theory. When this occurs, we speak of quantum anomalies. In this talk we point out a connection between the (anomalous) breaking of the adiabatic invariance of the particle number and the emergence of a quantum anomaly in the chiral symmetry of massless fermions. Within this context, we will also argue that the symmetry under electric-magnetic duality rotations of the source-free Maxwell theory is anomalous. This implies that the net polarization of photons propagating in a gravitational field can change in time. This is a quantum effect, and it can be understood as the generalization of the fermion chiral anomaly to fields of spin one.