Trace Anomaly in Strong Electromagnetic Fields LANCE LABUN, JOHANN RAFELSKI, Department of Physics, University of Arizona, and Department fuer Physik der Ludwig-Maximillians-Universitaet Muenchen und Maier-Leibniz-Laboratory — Violation of the superposition principle in the Maxwell field could arise from intrinsic nonlinearity in the fundamental theory of the photon, such as seen in Born-Infeld (BI) electrodynamics, but certainly occurs due to charged particle vacuum fluctuations, i.e. one-loop quantum electrodynamics (QED). The necessary presence of a dimensioned scale in a nonlinear theory induces a nonvanishing trace in the energy-momentum tensor

\[ T_{\mu}^{\mu} = -M \frac{dL_{\text{eff}}}{dM} = -4 \left( L_{\text{eff}} - S \frac{\partial L_{\text{eff}}}{\partial S} - P \frac{\partial L_{\text{eff}}}{\partial P} \right), \]

where \( S, P \) are the scalar and pseudo scalar field invariants. \( T_{\mu}^{\mu} \) has the form of the Einstein cosmological constant, and hence intense electromagnetic fields generate a localized, dark energy-like concentration.

References:

*Trace Anomaly of Nonlinear Electrodynamics and its (Anti) Gravitational Effect* arXiv:0811.4467 [hep-th] and