

# Unifying the Higgs Mass Hierarchy, the Cosmological Constant, and the Axion Quality Puzzles

*Wednesday, September 24, 2025 9:00 AM (30 minutes)*

The smallness of the Higgs boson mass, the cosmological constant, and the explicit breaking of the Peccei–Quinn symmetry are usually regarded as independent theoretical challenges. We show that these puzzles become interrelated when Einstein–Cartan gravity is incorporated into the Standard Model in a Weyl-invariant way. The resulting framework introduces only a single additional scalar degree of freedom —beyond the graviton and the Standard Model fields —which behaves as an axion-like particle. The smallness of this particle’s mass induced by gravity, together with that of the Higgs boson mass and the cosmological constant, is linked to tiny values of the local Lorentz gauge couplings.

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