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Electromagnetic signatures of the chiral anomaly in Weyl semimetals[1] EDWIN BARNES, JEAN HEREMANS, DJORDJE MINIC, Virginia Tech — Weyl semimetals are predicted to realize the three-dimensional axial anomaly first discussed in particle physics. The anomaly leads to unusual transport phenomena such as the chiral magnetic effect in which an applied magnetic field induces a current parallel to the field. Here we investigate diagnostics of the axial anomaly based on the fundamental equations of axion electrodynamics. We find that materials with Weyl nodes of opposite chirality and finite energy separation immersed in a uniform magnetic field exhibit an anomaly-induced oscillatory magnetic field with a period set by the chemical potential difference of the nodes. In the case where a chemical potential imbalance is created by applying parallel electric and magnetic fields, we find a suppression of the magnetic field component parallel to the electric field inside the material for rectangular samples, suggesting that the chiral magnetic current opposes this imbalance. For cylindrical geometries, we instead find an enhancement of this magnetic field component along with an anomaly-induced azimuthal component. We propose experiments to detect such magnetic signatures of the axial anomaly.

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