Consistent chiral kinetic theory in Weyl semimetals

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It is argued that the correct definition of the electric current in the chiral kinetic theory for Weyl semimetals should necessarily include the topological Chern–Simons contributions, which make the theory consistent with the local conservation of the electric charge in electromagnetic and strain-induced pseudoelectromagnetic fields. By making use of such a kinetic theory, electron collective excitations in constant magnetic and pseudomagnetic fields are investigated. Among the most interesting results are the transformation of the chiral magnetic wave into the chiral magnetic plasmon due to the effects of dynamical electromagnetism and the existence of pseudomagnetic helicons for strained Weyl semimetals. The latter are similar to usual helicons in metals but can exist even without external magnetic fields due to a strain-induced background pseudomagnetic field.

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