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Chiral magnetic effect by synthetic gauge fields

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The chiral magnetic effect has attracted much interest in various areas of physics from condensed matter physics to nuclear and particle physics.
In condensed matter physics it has actively investigated in the so called Weyl (semi-)metals in which Weyl fermions are realized as points of band touching with definite topological character.
The chiral magnetic effect arises only in nonequilibrium.
It needs finite chiral chemical potential, which equals the mismatch of the Fermi surfaces of right- and left-handed Weyl fermions.
The mismatch (chiral chemical potential) does not appear in equilibrium and is only dynamically generated.
However the dynamics of the chiral chemical potential has not been fully understood yet, which is important to understand the physics of anomaly induced transports in the chiral systems.

We study the dynamical generation of the chiral chemical potential in a Weyl metal in a three-dimensional optical lattice system, which will be realized by using ultracold atom gases.
Even though atoms are neutral and do not interact with electromagnetic fields, we can simulate the chiral magnetic effect by using ultracold atoms thanks to the so called synthetic gauge fields.
By numerically solving the Boltzmann equation with the Berry curvature in the presence of parallel synthetic electric and magnetic fields,
we analyze the time evolution of the chiral chemical potential and the chiral magnetic current.

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