Landau levels and quantum oscillations in nano-film of Weyl semimetals under crossed electric and magnetic fields

Z. Alisultanov[1, 2]

[1] *Amirkhanov Institute of Physics RAS, Dagestan Science Centre, Makhachkala, Russia*

[2] *Dagestan State University, Makhachkala, Russia*

In this paper, we investigated the Landau band and quantum oscillations in the Weyl semimetal under crossed magnetic and electric fields. We obtained an expression for the energy spectrum of such system using three different methods: an algebraic approach, an Lorentz boost approach and quasi-classical approach. It is interesting that the quasi-classical expression for the energy spectrum completely coincides with the expression obtained in the framework of the microscopic approaches. We have shown that the electric field leads to a cardinal change the Landau bands. In addition, we investigated the classical motion of a three-dimensional Dirac fermions in crossed fields. When an electric field is equal to $\vartheta_F H/c$, the collapse of the Landau levels occurs, and the motion becomes completely linear. But, this linearization occurs in a special way. Under this electric field, the wave function for the bulk states vanishes. The states with only preserved. It will fundamentally change the character of the surface states, called the Fermi arcs. The electric field affects on the character of the quantum oscillations. The density of states has a singularity at $E = \vartheta_F H/c$.