Abstract

The study of magnetization in solid-state plasma systems is to analyze the Magnetic field production mechanism that has not been investigated before in solid-state systems. We will investigate the Karpman–Washimi (K-W) ponderomotive magnetization while taking into account the various quantum characteristics in solid-state plasma. The literature regarding the generation of K-W magnetization reveals that such magnetization phenomenon can take place in the degenerate plasmas [1] even in the non-relativistic regime, and due to effective masses of electrons and holes which are far smaller than the rest mass of electrons, the solid-state plasma attains the characteristics of astrophysical degenerate plasmas at the lower plasma number densities. So, we intend to employ the K-W magnetization process on the solid-state systems [2]. Self-generated magnetic fields have been observed in space and laboratory environments and play an important role in plasma dynamics. We will explain the mechanisms of self-generated magnetic fields via the nonlinear ponderomotive force of the slowly time-varying electromagnetic waves. In this investigation, we will employ the quantum fluid model for the magneto quantum plasma consisting of quantum Fermions i.e., electrons and holes. The K-W ponderomotive magnetization and the total radiation power due to the non-stationary Karpman- Washimi interaction related to the time-varying field intensity will be derived as the function of two parameters, such as the ratio of the thermal temperature of plasma species to the Fermi temperature of electrons [3]. The analytical calculations will show how qualitatively and quantitatively the K-W magnetization in quantum plasma is influenced by various quantum effects of plasma species. Finally, the results will be interpreted graphically along with their physical reasoning.