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The quantized magnetic Brillouin scattering instability of transverse electromagnetic waves

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The signatures of Landau Quantization, and the associated quantized magnetic pressure of a degenerate electron gas, are issued on the exotic physics of magnetic stimulated Brillouin scattering instability (MSBS) of transverse electromagnetic waves (EMWs). Initially, the governing differential equation of quantized magnetosonic waves (QMWs) in the presence of super strong magnetic (SSH) field, required to study the nonlinear interaction of high frequency EMWs with strongly magnetized degenerate plasma at ion time scale, is derived by employing the quantum magneto hydrodynamic model, whereas Maxwell equations are used to derive the governing differential equation of pump EMWs. Then the nonlinear coupling of EMWs and QMWs is studied by following the phasor matching technique. The obtained dispersion relation of MSBS shows that quantum effects become function of SSH field for a fixed density fermi gas.

It is found that the SSH field alone suppresses the MSBS instability as a function of quantized magneto ion velocity (CHe) and the Alfven speed (VA) via the three-wave decay and modulational instabilities. However, for particular condition the MSBS instability is found to increase as a function of quantized magnetic pressure. Maximum scattering rate of MSBS instability γ_{MSBS}^{max}, is obtained by ignoring the nonlinear correction shift on the frequency of EMWs to

demonstrate that the quantized SSH field suppresses the growth rate of MSBS.

Maximum suppression in the frequency shifts of MSBS is observed in case of forward scatterings of modulated EMWs. Next, the analytical results are verified numerically and graphically for soft x-rays in the environment of neutron star. The present MSBS analysis may be critical in plasma-based technologies, where the enhancement or suppression of SBS is important.

Due to the present possibility of generating strong magnetic field in laboratory [1], our results can be valid for laboratory plasmas as well to get fruitful results via MSBS. MSBS may also provide valuable information about the density oscillations in cold microplasma and astrophysical settings, in a manner similar to plasma diagnostics in the Earth's ionosphere [2].

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