Filamentation In Spin Polarized Magnetized Quantum Plasma

Punit Kumar
Department of Physics, University of Lucknow, Lucknow-226007, India

- In plasmas, where the de-Broglie wavelength of the charge carriers is comparable to the dimension of the plasma system, quantum mechanical effects are expected to play a major role in the behavior of charged plasma particles.
- In recent years, quantum effects have proved to play a crucial role in ultrasmall electronic devices, laser plasmas and dense astrophysical plasmas.
- Till now, plasma electrons have been considered as single species with macroscopically average spin-1/2. Spin-up and spin-down interactions are not taken into account.
- The high magnetic field produces difference in concentration of spin-up and spin-down electrons which results in spin polarization.
- Quantum Hydrodynamic (QHD) model has been modified to include spin effects and the new evolved model has been termed as SSE-QHD.
- In the present paper, using the modified model the filamentation of a short laser pulse in a magnetized quantum plasma is presented.
- Spin-up and spin-down electrons have been taken to be separate species of particles and spin-spin interaction picture has been developed.
- The effects of quantum Bohm potential, electron Fermi pressure and spin have also been taken into account.
- The direction of the external field has been taken to be along the direction of electron beam propagation.
- The nonlinear dispersion relation has been obtained and growth rate evaluated.