Finite gyroradius effects on drift compressional modes in very high β plasmas.

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A dispersion relation for low frequency drift compressional modes in very high β plasmas with finite gyroradius effects, $k_\perp \rho_i \sim$ O(1), is derived from the coupled gyrokinetic-Maxwell equations using two small parameters: 1) cold electrons $T_e/T_i \sim$ O(δ) (to decouple the electrostatic modes from the compressional modes) and 2) the smallness of the mode localization width along the field line (to decouple the shear Alfvén modes from the compressional modes). In very high beta plasmas, $\beta \sim 0(1)$, such as the earth's magnetosphere, the strength of the magnetic field can be a very strong function of the distance along the field. This strong dependence allows the mode to be extremely localized and thus decoupled from the shear Alfvén mode. The derived dispersion relation is analyzed and solved to demonstrate that drift compressional modes can become unstable when the density gradient and ion temperature gradient are in the opposite directions ($\eta_i < 0$) or when the magnetic guiding center drift is opposite to the ion diamagnetic drift ($\omega_{*i}/\omega_{Di} < 0$). The dependence of the mode growth rate on $k_\perp \rho_i$ is studied in detail. It is found that, in general, the most unstable modes have a finite gyroradius. Effects of finite gyroradius in localizing the radial mode structures will also be discussed. [1]

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