gradB:

$$ec{v} = -c\{B_z + rac{mc}{q}(rac{cE_A\sin\{2\pi(rac{t}{T} - rac{LR_0 heta}{\lambda}) + rac{\pi}{2}\}}{B_z^2}\xi_r)\}^{-1}(E_A\sin\{2\pi(rac{t}{T} - rac{LR_0 heta}{\lambda}) + rac{\pi}{2}\} - rac{\mu}{q}\xi_r + rac{mc^2}{q}rac{(E_A\sin\{2\pi(rac{t}{T} - rac{LR_0 heta}{\lambda}) + rac{\pi}{2}\})^2\xi_r}{B_z^3})ec{e_ heta}$$

so,
$$v_{grad}=rac{c}{B_z}rac{\mu}{q}\xi_r$$

assumption
$$B_z=rac{B_E}{L^3}$$
 (in magnetic equator) , $B_E=3.11 imes10^{-5}{
m T}=3.11 imes10^{-1}{
m G}$ if $L=6$, $B_z=1.4 imes10^{-7}{
m T}=1.4 imes10^{-3}{
m G}$

assumption : $v_{\perp}=0.01c=3.0 imes10^8 {
m cm/s}$

$$\mu = \frac{mv_{\perp}^2}{2B_z} = \frac{(9.1 \times 10^{-28} \text{g}) \times (3.0 \times 10^8 \text{cm/s})^2}{2.0 \times 1.4 \times 10^{-3} \text{G}}$$

$$\xi_r=rac{\partial B_z}{\partial r}=rac{\partial B_z}{\partial L}rac{\partial L}{\partial r}=-3rac{B_E}{L^4}rac{1}{R_0}=rac{-3 imes3.1 imes10^{-1} ext{G}}{6^4 imes6 imes10^8 ext{cm}}$$

$$v_{grad} = rac{c}{B_z} rac{\mu}{q} \xi_r = rac{3.0 imes 10^{10} cm/s}{1.4 imes 10^{-3}
m G} imes rac{1}{4.8 imes 10^{-10}
m statC} imes rac{(9.1 imes 10^{-28}
m g) imes (3.0 imes 10^8
m cm/s)^2}{2.0 imes 1.4 imes 10^{-3}
m G} imes rac{-3 imes 3.1 imes 10^{-1}
m G}{6^4 imes 6 imes 10^8
m cm}$$

$$v_{grad} = -rac{3.0 imes 9.1 imes 3.0 imes 3.0 imes 3.0 imes 3.0 imes 3.3 imes 1}{1.4 imes 4.8 imes 2.0 imes 1.4 imes 6^4 imes 6} 10^5 {
m cm}/s pprox 1500 {
m cm}/s$$

from basic space plasma physics

$$v_
abla \, = rac{m v_\perp^2}{2q B^3} (ec{B} imes
abla B)$$

$$v_{
abla} = rac{9.1 imes 10^{-31} ext{kg} imes (3.0 imes 10^6 ext{m/s})^2}{2 imes (1.6 imes 10^{-19} ext{C}) imes (1.4 imes 10^{-7} ext{T})^3} (1.4 imes 10^{-7} ext{T}) imes (-3 rac{B_E}{L^4} rac{1}{R_0})$$

$$v_{
abla} = rac{9.1 imes 10^{-31} ext{kg} imes (3.0 imes 10^6 ext{m/s})^2}{2 imes (1.6 imes 10^{-19} ext{C}) imes (1.4 imes 10^{-7} ext{T})^3} (1.4 imes 10^{-7} ext{T}) imes (-3 rac{3.11 imes 10^{-5} ext{T}}{6^4} rac{1}{6.0 imes 10^6 ext{m}})$$

$$v_{
abla} = -rac{9.1 imes 9.0 imes 1.4 imes 3 imes 3.11}{2 imes 1.6 imes 1.4^3 imes 6^4 imes 6}rac{10^{-31}}{10^{-34}} \mathrm{m/s}$$

$$v_{
abla} = -rac{9.1 imes 9.0 imes 1.4 imes 3 imes 3.11}{2 imes 1.6 imes 1.4^3 imes 6^4 imes 6} 10^3 ext{m/s} = 0.015 imes 10^3 ext{m/s} = 15 ext{m/s}$$