3 Oct. '67 0830 Woods

Concepts of Computers

Solar Wind [redacted] 1100 Micels

- Electr. + Mag.

Maxwells Eqns - (MKSC)

① $\oint \underline{E} \cdot d\underline{s} = Q/\epsilon_0$

$E\,ds\cos\theta$

All lines of E begin and end on charges -

Coloumbs law

$4\pi r^2 E = Q/\epsilon_0$

$E = \frac{Q}{4\pi\epsilon_0 r^2}$

② $\oint E \cdot dl = -\frac{\partial}{\partial t}\int B \cdot ds$

Electromagnetic Induction

③ $\oint \underline{B} \cdot d\underline{s} = 0$

Lines of B are closed

④ $\oint \underline{B}\, d\underline{l} = \mu_0 \int \left(\underline{I} + \epsilon_0 \frac{\partial E}{\partial t}\right) \cdot dS$

Term $\epsilon_0 \frac{\partial E}{\partial t}$ accounts

for case where current doesnt flow -

It is for conservation of charge - (4A)

(4A)

$\frac{2Q}{\partial t} + \oint J \cdot ds = 0$

$i = \oint J\,ds$

In this case no current

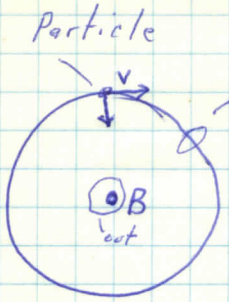
B Area = const. = Flux in surface

B = flux/unit area

⑤ Lorenz

$$\underline{F}_{orce} = e(E + V \times B)$$

↑ Estatic | Emagnetic



Particle is also a current when "tries" to reduce field B ⊂ it's own field

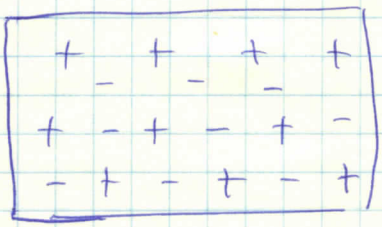
Particles move to reduce field they experience - Particles never see their own fields - a second particle would see the field.

Plasma is an ionized gas.

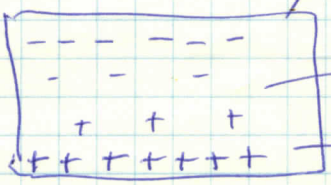
Unusual on earth ⊂ low temps - common in space ⊂ high "temp." + large distances

Plasma has bulk neutrality - does not ~~mean~~ imply $E = 0$

$$\frac{F_e}{F_g} = 10^{40}$$

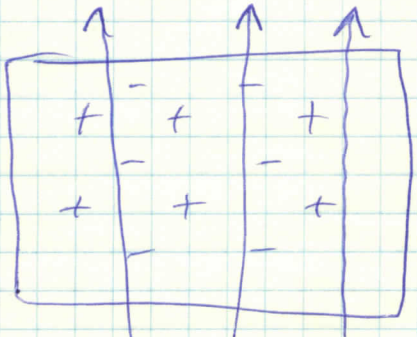


In gravitational field ⊂ light electrons + heavy ions there is a displacement ⊂ resulting field -



offset by charge to prevent separation

Concentrated by gravity



Magnet Field.

If magnetic field lines are decreased + from equation ② a field is generated + from ④ this generates field -

"Frozen in flux" (conductivity high Few collisions low densities)

P-3 1100 3 Oct '67 Michels

Particle drift.

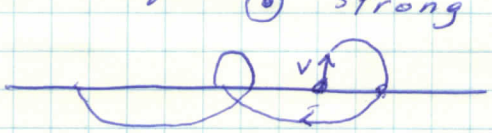
under this case particle continues to move

$F = eVB \quad \therefore \quad V_{drift} = \frac{F}{eB}$

F may be electric for electric field drift $F = eE$

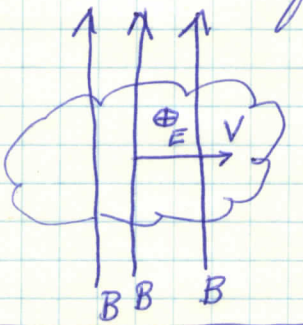
$V_{drift} = \frac{E}{B} \left(\frac{E \times B}{B^2}$

F may be gravitation -
Gradient drift

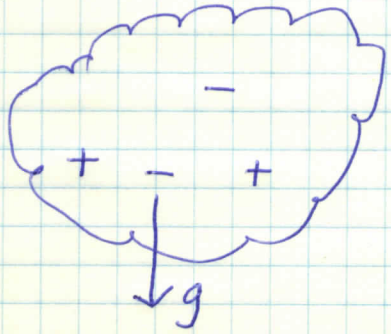


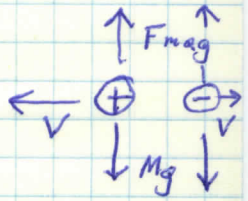
If particle Vel is zero -
It will be accelerated by F which in turn induces a velocity 

Particle drift. For movement there must be an electrostatic field.



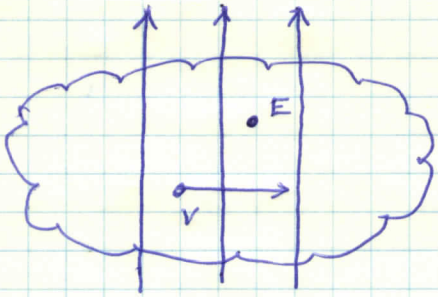
Now in gravity field:





+ + - particles move in opposite direction

this polarizes field which sets up neutralizing electrostatic field ~~allowing~~ leaving gravity free to act -



$B_{\parallel} \rightarrow B_{\parallel}$

$E_{\parallel} \rightarrow E_{\parallel}$

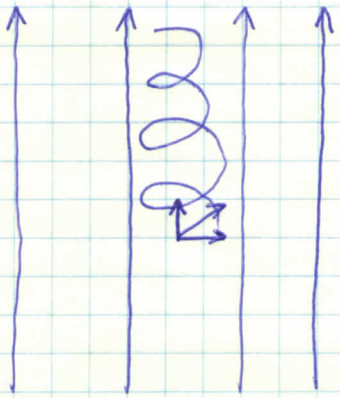
$\gamma = \sqrt{1 - \frac{V^2}{c^2}}$

$E \rightarrow (E + V \times B)\gamma$

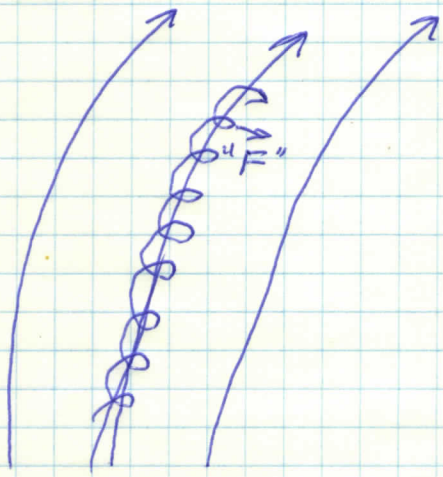
$B \rightarrow (B - \frac{V \times E}{c^2})\gamma$

Moving & stationary coordinate system cause different forces -

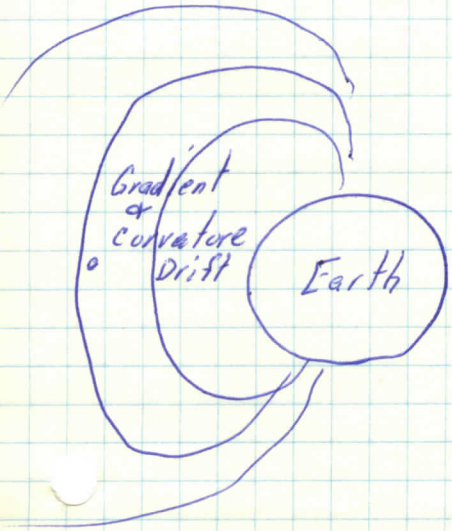
Curvature drift



Uniform Mag. Field



Curved Mag. Field



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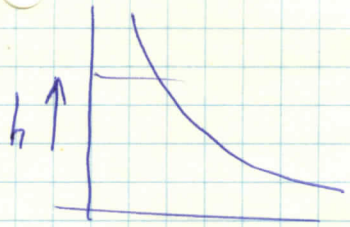
Solar Wind –

Earth's atmosphere



$$n(h) = n(0)\, e^{-(mgh/kT)}$$ ← $\tfrac{1}{2}mV_{sound}^2$

$$H = \frac{kT}{mg} = \text{scale height (7 Km)}$$

Scale ht. may be written ~ velocity

$$\approx n(0)\, e^{-V^2/V_s^2}$$

$V_s = 10^3$ fps $\approx \tfrac{1}{5}$ mps

$V_{escape} = 7$ mps

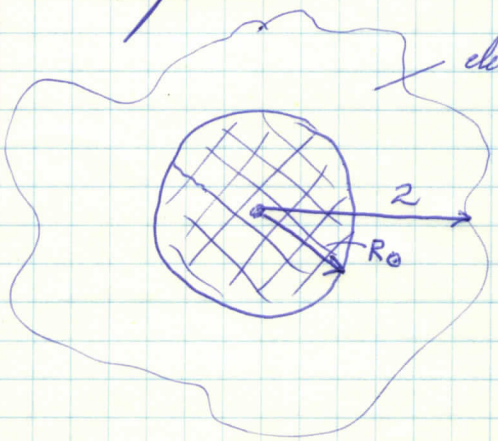
$$n(\infty) = n(0)\, e^{-(35)^2} \approx n(0)\, e^{-\frac{1000}{27}}$$

Thus there is a small loss of gas - especially of ~~small~~ light molecules like hydrogen -

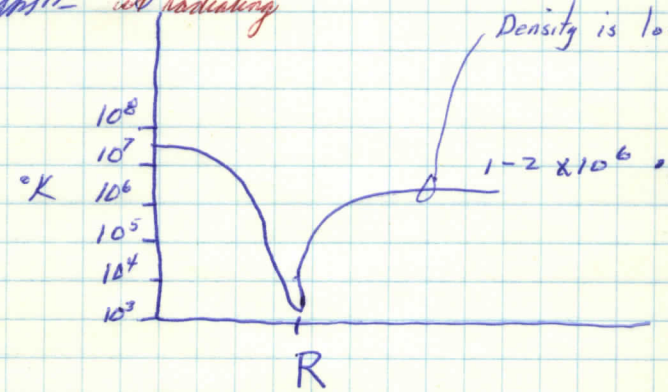
Radius earth = 6400 Km

$\frac{R}{H} \approx 10^3$ There is a larger loss of atmosphere ~ increasing atmospheric depth -

Suns atmosphere



electrons reflecting light – radiating



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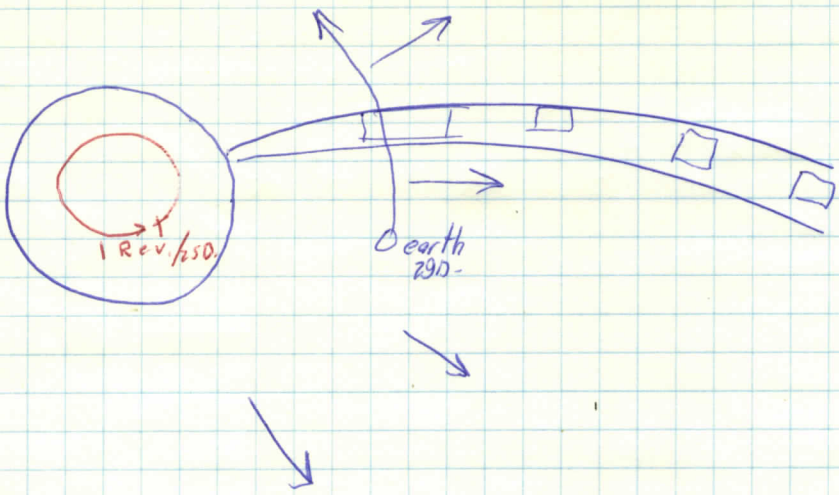
Sun



$300°K = \frac{1}{40}$ eV

$12{,}000°K = 1$ eV

160,000 = 136 eV
= ion. of He