2.17.22

Thursday, February 17, 2022 10:05 AM

"B - L" force in Standard Model

(Possibly related to Neutrino Osc.)

Sun: p^+, N, e^-

$+1 \quad +1 \quad -1 \quad = +1$ ← net "B-L" charge

↓

emits "B-L" field

QFT → Model like normal Mag field.

$\vec{F}_{B-L} = q_{B-L}(\vec{V} \times \vec{B})$

Neutrino: Sun emits lots of these

ν

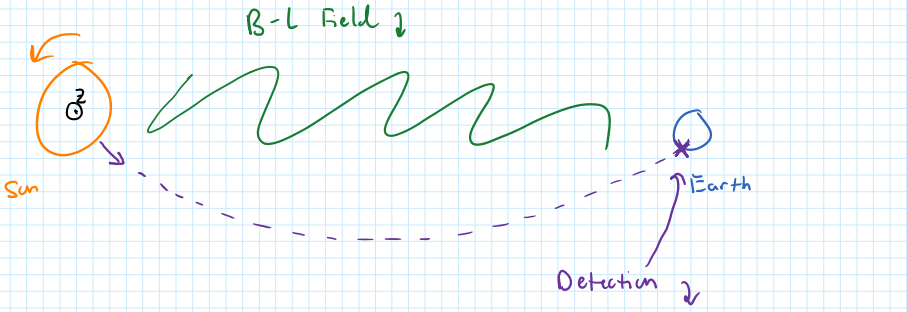
↓ B-L

-1, so ν feels the B-L field of sun

and its trajectory will bend.

We care about how much it bends.

Top Down



Neutrino picture from Super-K

$F = q\vec{V} \times \vec{B}$

$\ddot{X} = \frac{q}{m}\vec{V} \times \vec{B}$, ν are basically massless $m \to E$

$\ddot{X} = \left(\frac{q}{E}\right)\vec{V} \times \vec{B}$

$\frac{q}{E}$: Amount; $\vec{V} \times \vec{B}$: direction

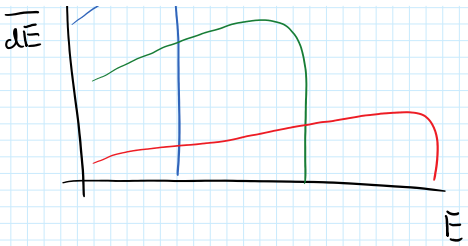
Sun emits spectrum of neutrinos

direction

Amount of bend

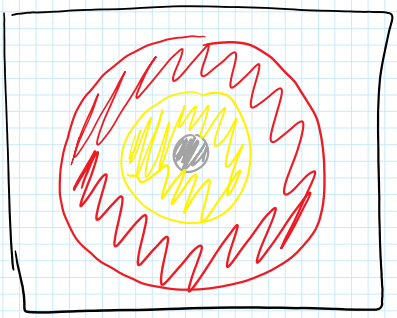
High energy ν bend less

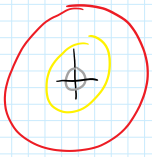
Low energy ν bend more.



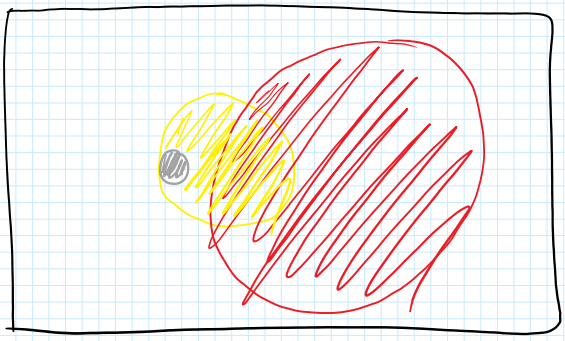
Super-K Picture

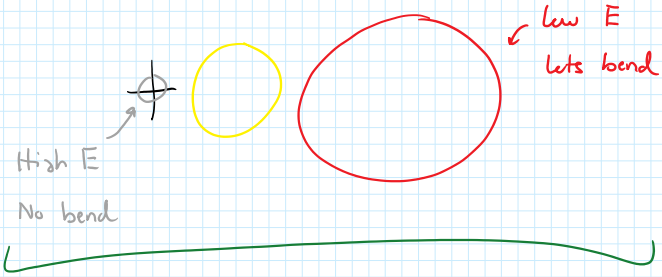
Concentric Circles





"B-L" Picture





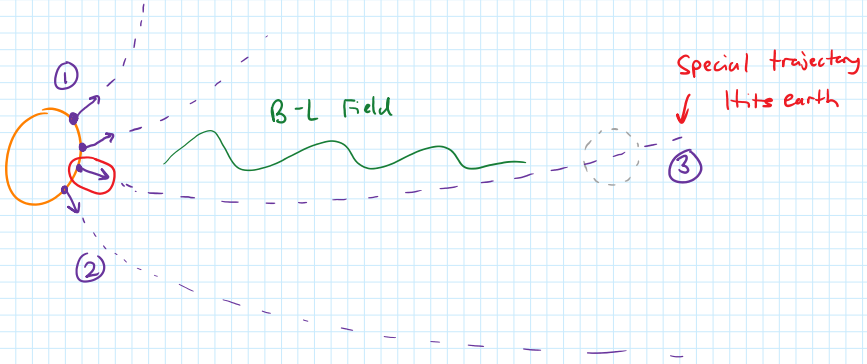
Spread is proportional to Strength of B-L field.

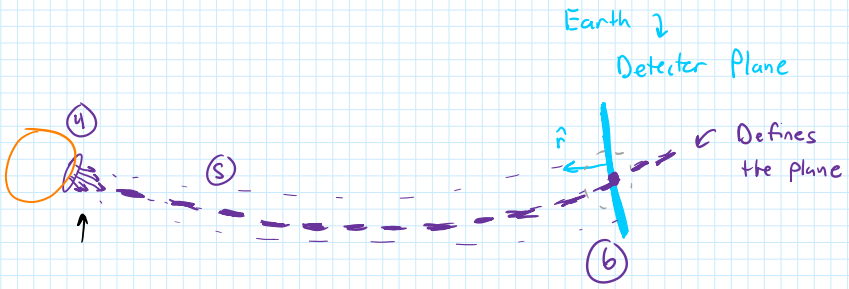
Compare spread to Super-K to bound max B-L strength

Code

Notebook: ! Plane_Formulation

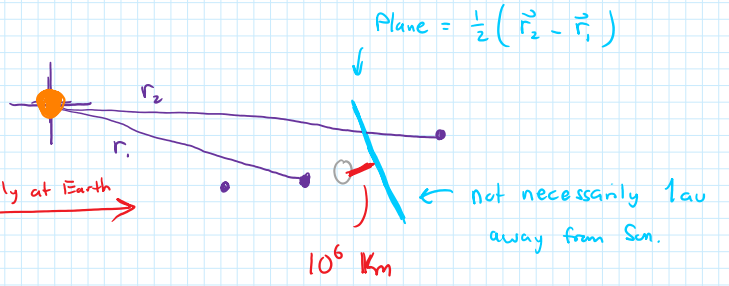
Section 1.9 "The full pipeline"





(IC)

1. Make a bunch of Initial Conditions on the Sun
2. Evolve all trajectories (traj) ✡ Speed of light sanity check
3. Identify a traj that actually hits earth
4. Make more IC near the traj from step 3.
5. Determine the detecter plane ✡
6. Evolve all new trajs and get hits on detecter



Given $\vec{r}_1$ & $\vec{r}_2$, make a line from them. Where on that line is 1au away from the origin.

$f(r_1, r_2)$