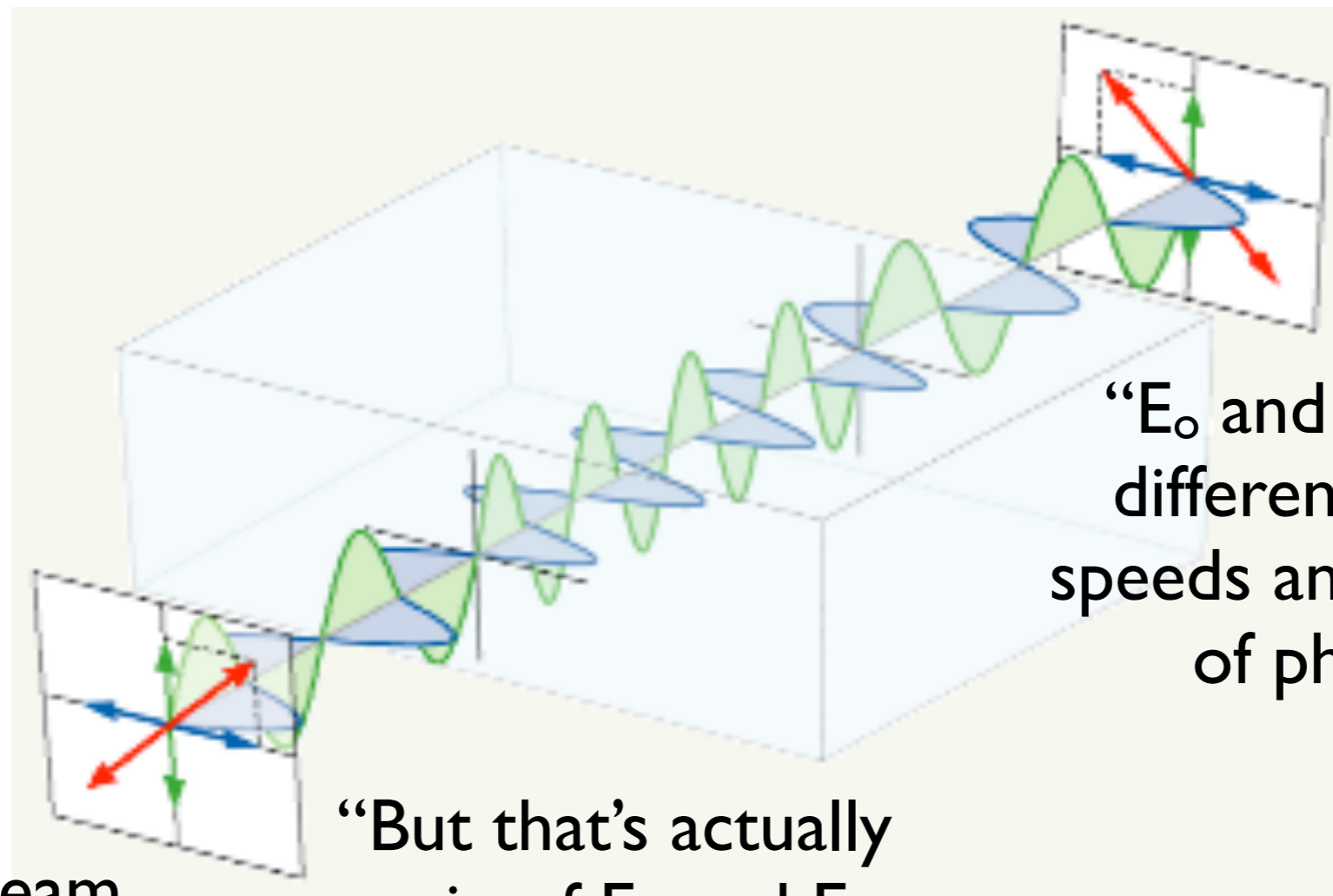


Neutrino oscillation is just like birefringence

“I can only detect the surviving E_ν in because I only own a vertical polarizer.”



“ E_o and E_e have different phase speeds and get out of phase”

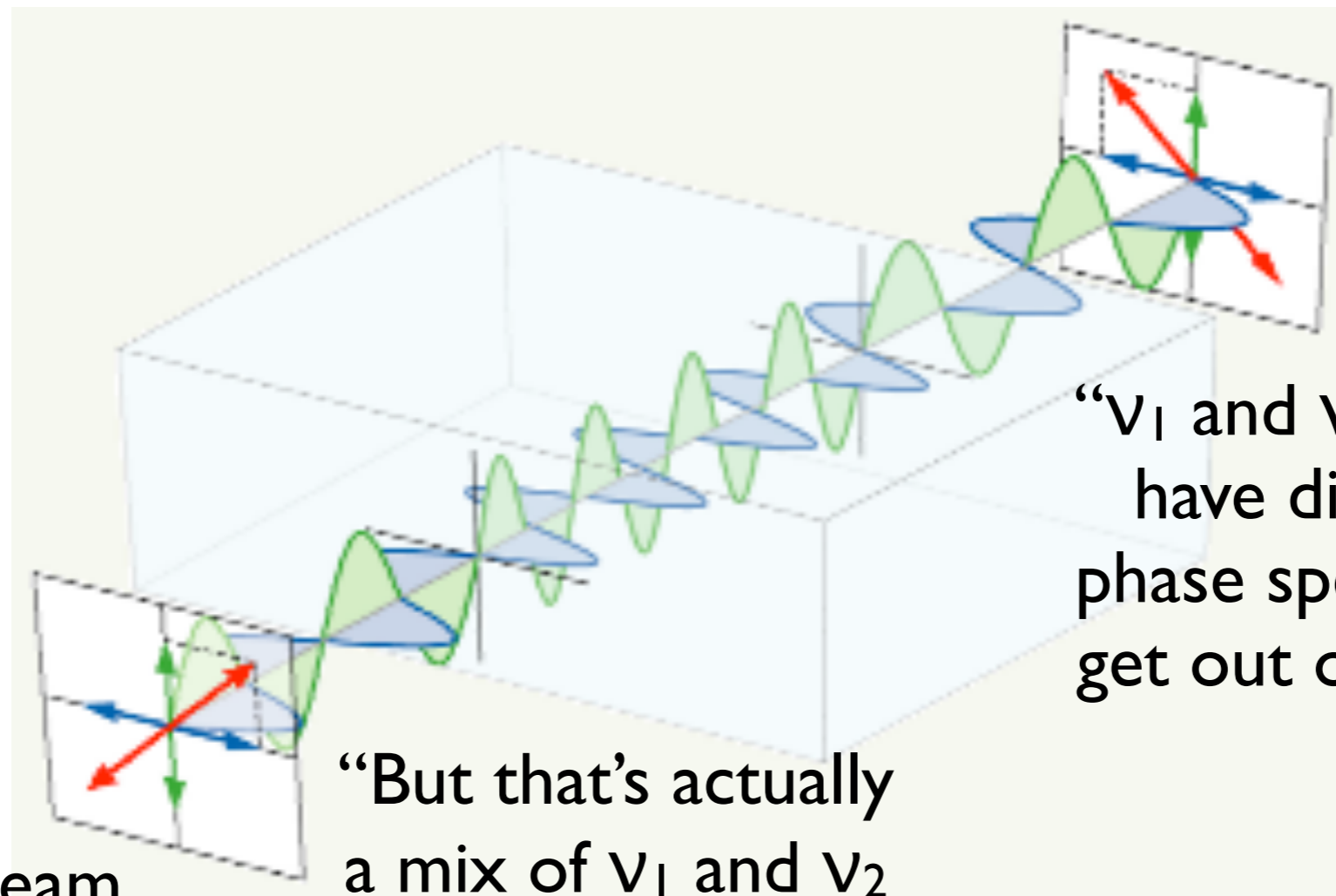
“But that’s actually a mix of E_o and E_e ”

“I made in a beam of E_ν because I only own a vertical polarizer”

$$P(\nu \rightarrow \nu) = 1 - A \sin^2(\Delta n L/\lambda)$$

Neutrino oscillation is just like birefringence

“I can only detect the surviving ν_e because my detector physics is specific to electrons, not μ, τ ”



“ ν_1 and ν_2 and ν_3 have different phase speeds and get out of phase”

“But that’s actually a mix of ν_1 and ν_2 and ν_3 ”

“I made in a beam of ν_e because beta decay involves electrons, not μ, τ ”

$$P(\nu_e \rightarrow \nu_e) = 1 - \sin^2(2\theta_{12})(\Delta m_{12}^2 L/E)$$

There is no electron neutrino. There is only ν_1, ν_2, ν_3

$$\begin{array}{l}
 \text{light } \nu \\
 \text{medium } \nu \\
 \text{heavy } \nu
 \end{array}
 \left\{ \begin{array}{l} \nu_1 \\ \nu_2 \\ \nu_3 \end{array} \right\}
 \left\{ \begin{array}{l} Ae^{ia} \quad Be^{ib} \quad Ce^{ic} \\ De^{id} \quad Ee^{if} \quad Ge^{ig} \\ He^{ih} \quad Je^{ij} \quad Ke^{ik} \end{array} \right\}
 = \begin{array}{l}
 \text{emitted with } e^\pm \\
 \text{emitted with } \mu^\pm \\
 \text{emitted with } \tau^\pm
 \end{array}$$

Beta decay (e^-) makes particular superposition of ν waves, including amplitudes and phases

Schrodinger's Equation makes phases evolve in time

e-based detector picks up only the e-friendly projection of the new superposition

$$\left\{ \begin{array}{l} \nu_1 e^{im_1 t} \\ \nu_2 e^{im_2 t} \\ \nu_3 e^{im_3 t} \end{array} \right\}
 \left\{ \begin{array}{l} Ae^{ia} \quad Be^{ib} \quad Ce^{ic} \\ De^{id} \quad Ee^{if} \quad Ge^{ig} \\ He^{ih} \quad Je^{ij} \quad Ke^{ik} \end{array} \right\}
 = \begin{array}{l}
 \text{detected with } e^\pm \\
 \text{detected with } \mu^\pm \\
 \text{detected with } \tau^\pm
 \end{array}$$

