



Reactor Antineutrino Anomaly

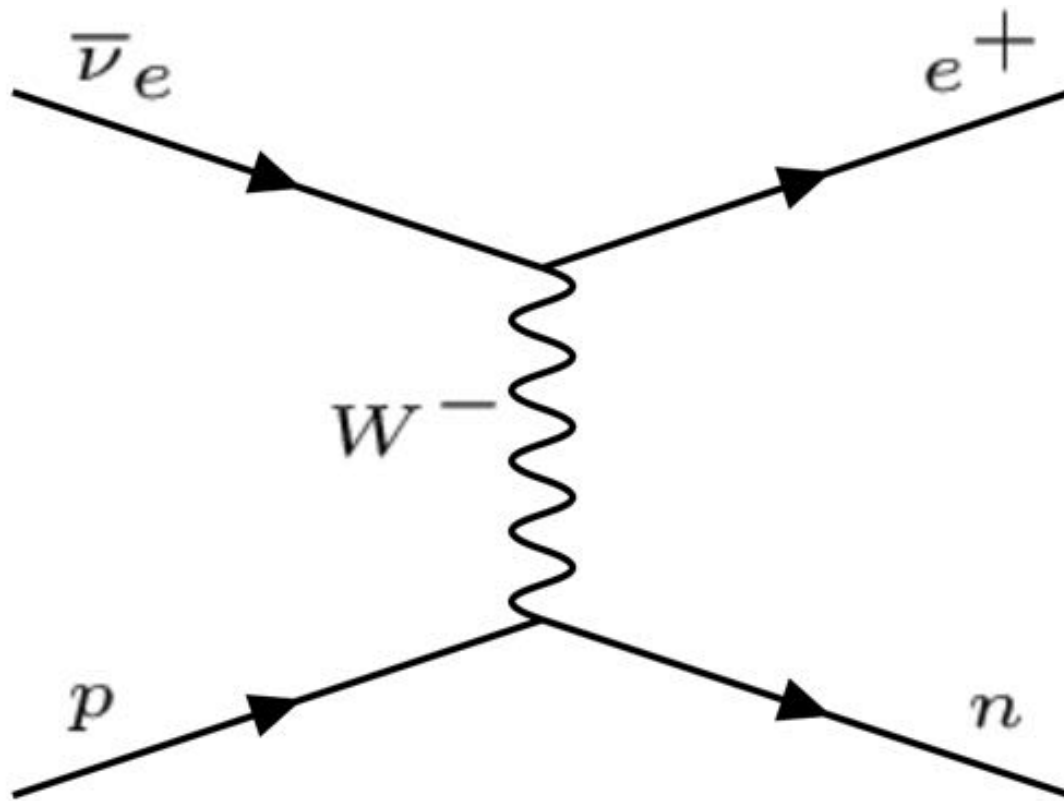
By: Marwa Selim

Supervisor: Andrej Arbuzov

Standard Model of Elementary Particles

		three generations of matter (fermions)			interactions / force carriers (bosons)	
		I	II	III		
mass	$\approx 2.2 \text{ MeV}/c^2$		$\approx 1.28 \text{ GeV}/c^2$	$\approx 173.1 \text{ GeV}/c^2$	0	$\approx 124.97 \text{ GeV}/c^2$
	charge	$\frac{2}{3}$	$\frac{2}{3}$	$\frac{2}{3}$	0	0
	spin	$\frac{1}{2}$	$\frac{1}{2}$	$\frac{1}{2}$	1	0
LEPTONS		u up	c charm	t top	g gluon	H higgs
	QUARKS	$\approx 4.7 \text{ MeV}/c^2$	$\approx 96 \text{ MeV}/c^2$	$\approx 4.18 \text{ GeV}/c^2$	0	SCALAR BOSONS
		$-\frac{1}{3}$	$-\frac{1}{3}$	$-\frac{1}{3}$	0	
$\frac{1}{2}$		$\frac{1}{2}$	$\frac{1}{2}$	1		
		d down	s strange	b bottom	γ photon	
	$\approx 0.511 \text{ MeV}/c^2$	$\approx 105.66 \text{ MeV}/c^2$	$\approx 1.7768 \text{ GeV}/c^2$	$\approx 91.19 \text{ GeV}/c^2$	GAUGE BOSONS VECTOR BOSONS	
	-1	-1	-1	0		
	$\frac{1}{2}$	$\frac{1}{2}$	$\frac{1}{2}$	1		
		e electron	μ muon	τ tau	Z Z boson	
	$< 1.0 \text{ eV}/c^2$	$< 0.17 \text{ MeV}/c^2$	$< 18.2 \text{ MeV}/c^2$	$\approx 80.39 \text{ GeV}/c^2$		
	0	0	0	± 1	GAUGE BOSONS VECTOR BOSONS	
	$\frac{1}{2}$	$\frac{1}{2}$	$\frac{1}{2}$	1		
		ν_e electron neutrino	ν_μ muon neutrino	ν_τ tau neutrino		W W boson

Neutrinos

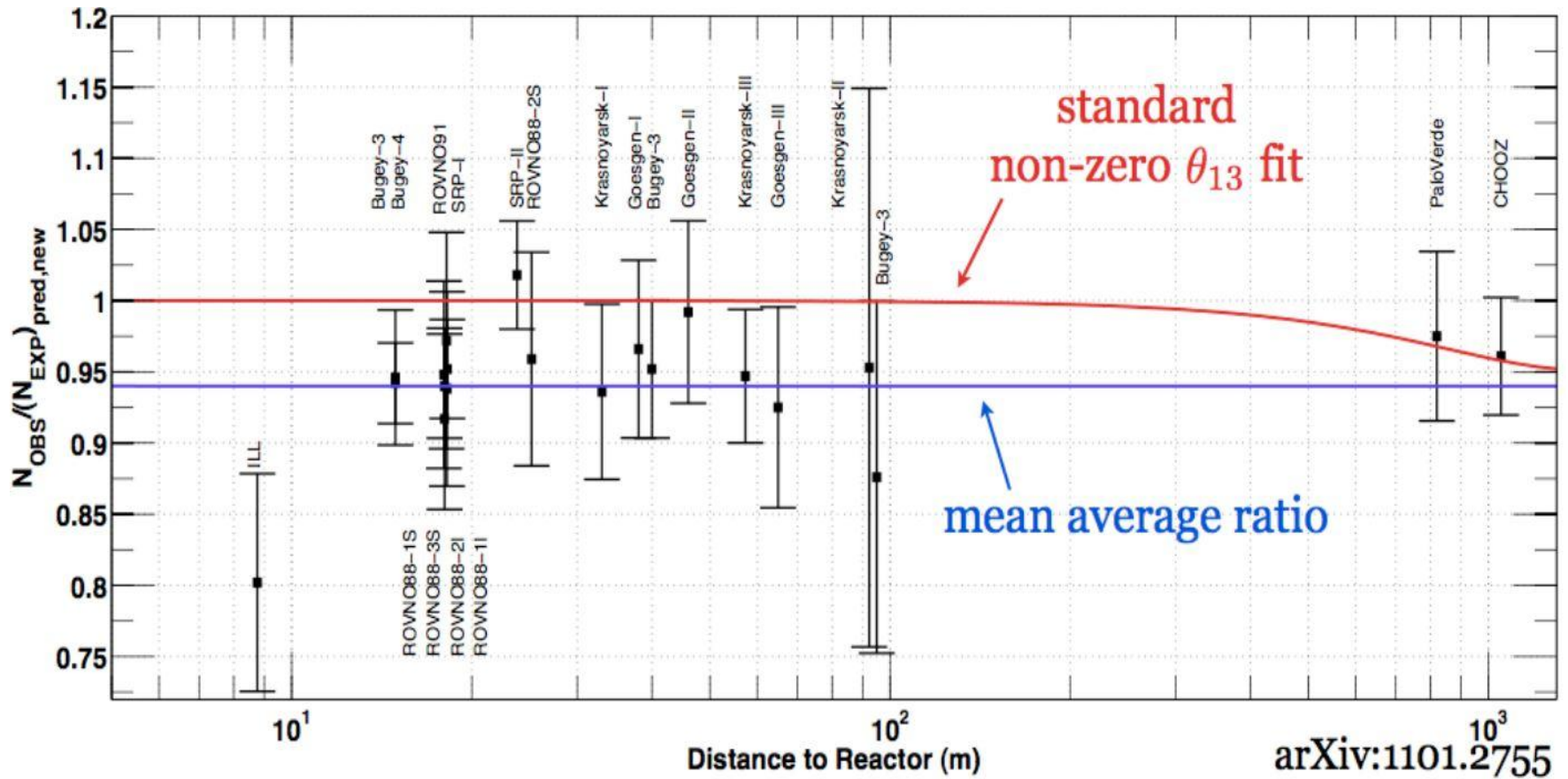


PMNS Mixing

Pontecorvo–Maki–Nakagawa–Sakata Matrix

$$\begin{pmatrix} \nu_e \\ \nu_\mu \\ \nu_\tau \end{pmatrix} = \begin{pmatrix} U_{e1} & U_{e2} & U_{e3} \\ U_{\mu1} & U_{\mu2} & U_{\mu3} \\ U_{\tau1} & U_{\tau2} & U_{\tau3} \end{pmatrix} \begin{pmatrix} \nu_1 \\ \nu_2 \\ \nu_3 \end{pmatrix}$$

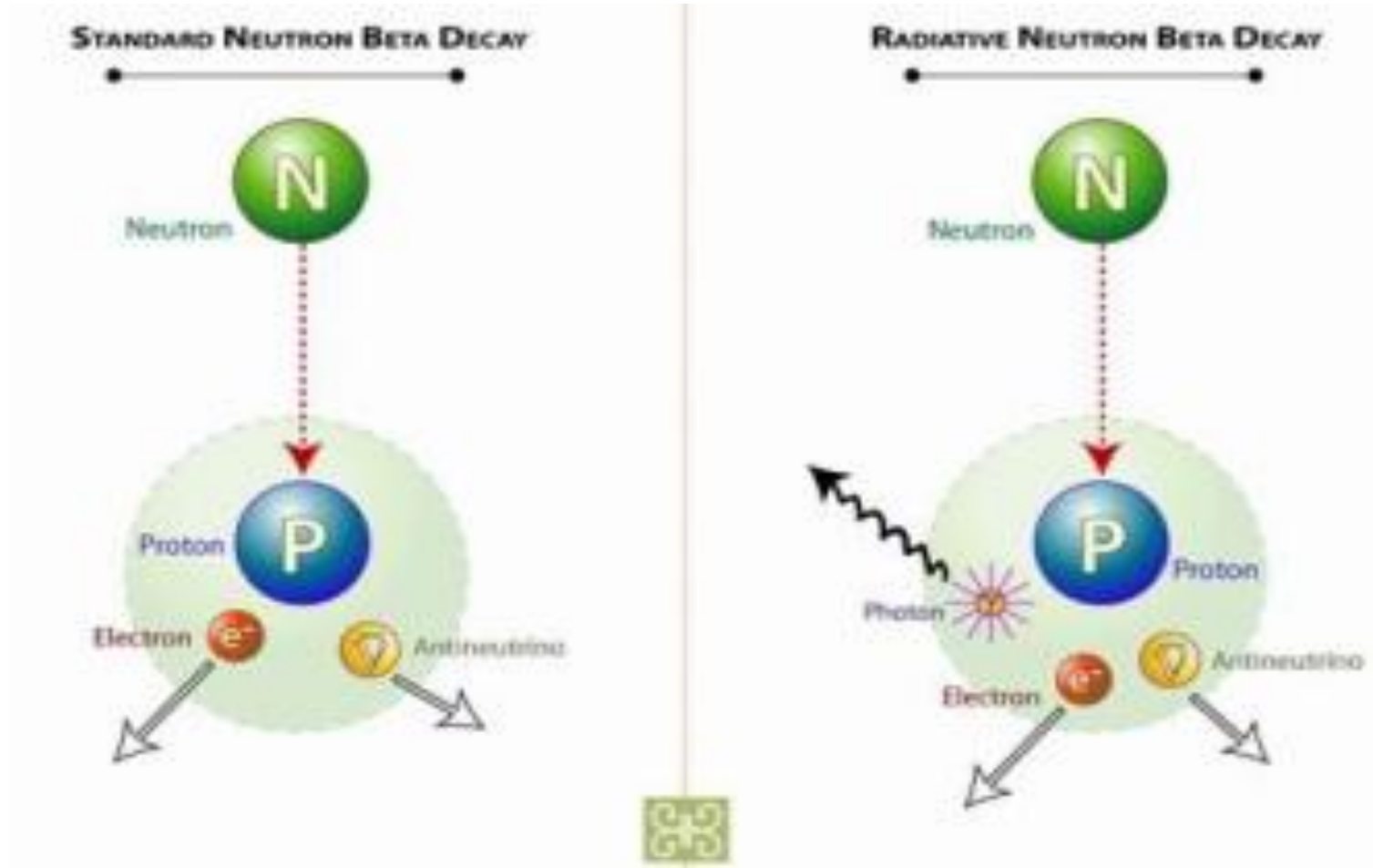
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Sterile Neutrino



Radioactive Corrections



Conclusion

- I. Neutrino Physics is Very Interesting.
- II. Window to Physics Beyond SM.
- III. Many New Experiments and Theoretical Investigations.
- IV. There are Anomalies (Theory \neq Experiment).
- V. These Anomalies Indicate Either New Physics or Missed Effects.
- VI. First Try All Effects Within SM including RC.

Thank You!