

Parametric adjustments of solar neutrino oscillation data

Rachel TECHI

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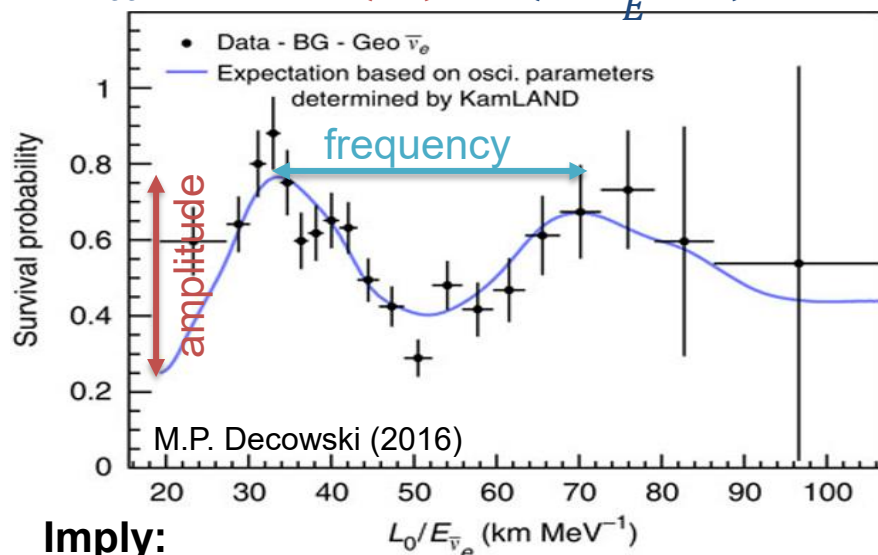
GraSPA Summer School

Historical note:

Why $Flux_{observe} \neq Flux_{prediction}$?

➤ Oscillation ($\Delta m_{21}^2, \theta_{12}$)

$$P_{ee} = 1 - \sin^2(2\theta) \sin^2\left(\frac{1.27 \Delta m^2 L}{E}\right)$$



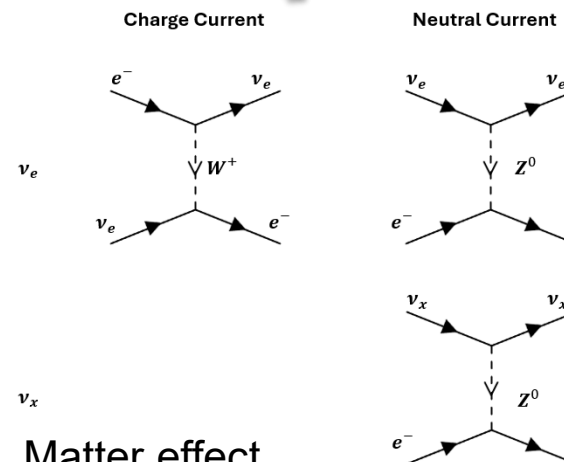
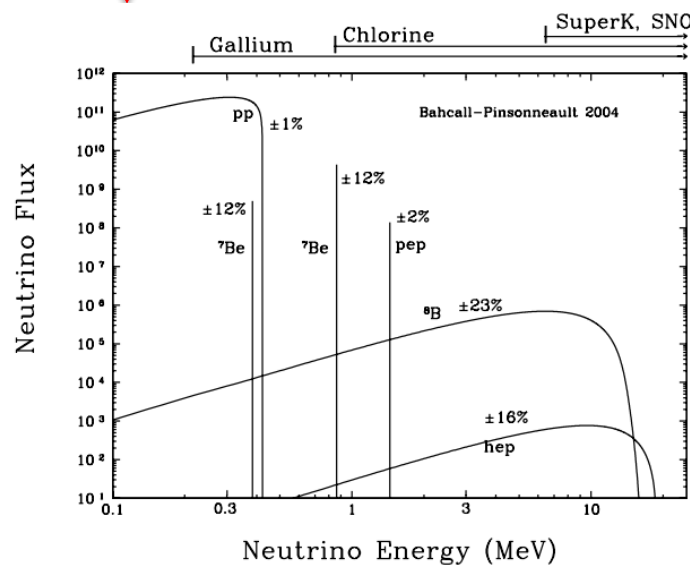
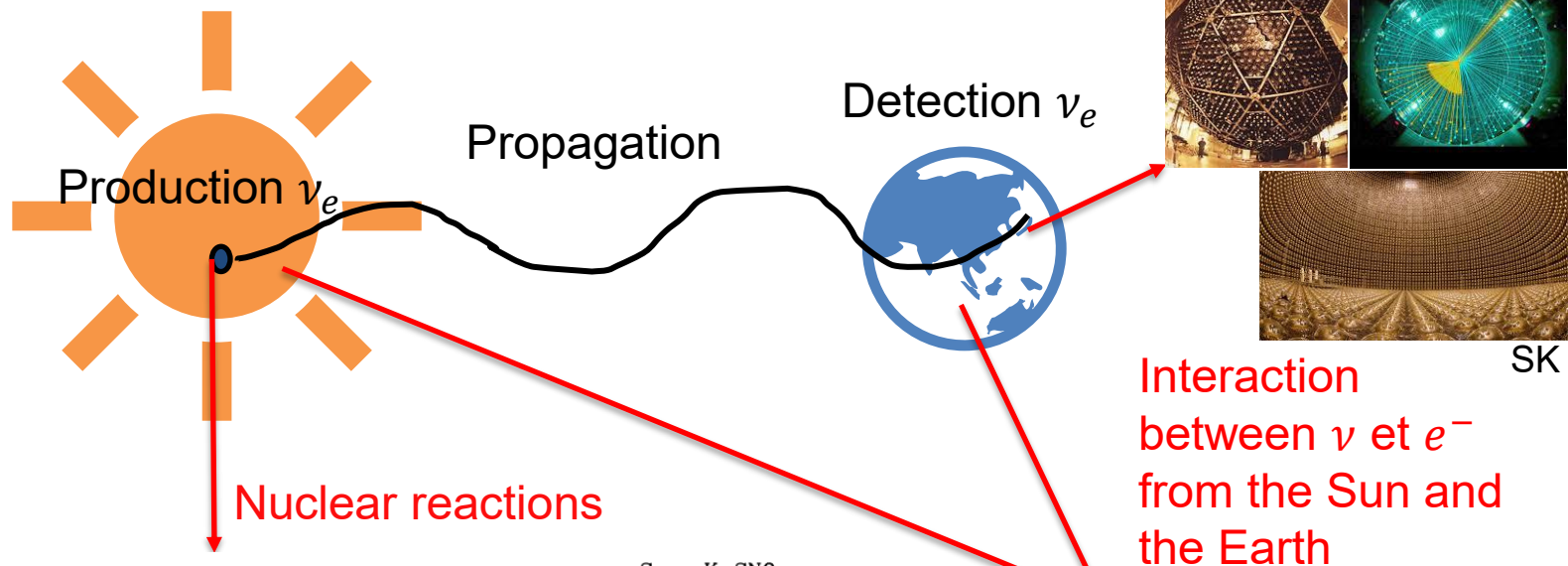
Imply:

- ν should have mass
- Superposition between flavor state and mass state

Matrix PMNS

$$\begin{pmatrix} \nu_e \\ \nu_\mu \\ \nu_\tau \end{pmatrix} = \begin{pmatrix} \cos(\theta_{12}) & \sin(\theta_{12}) & 0 \\ -\sin(\theta_{12}) & \cos(\theta_{12}) & 0 \\ 0 & 0 & 1 \end{pmatrix} \begin{pmatrix} \nu_1 \\ \nu_2 \\ \nu_3 \end{pmatrix}$$

16/07/2026

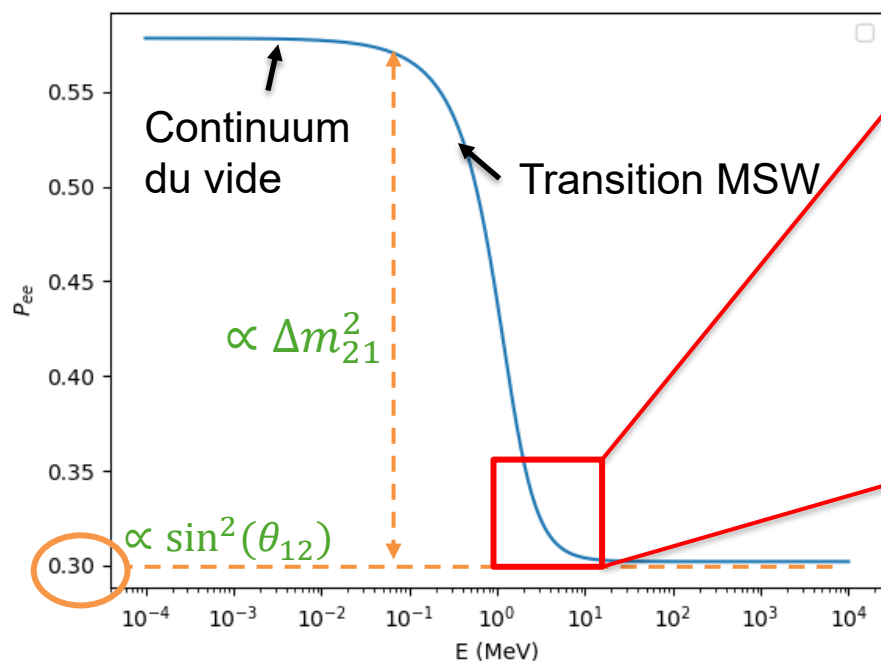


Matter effect

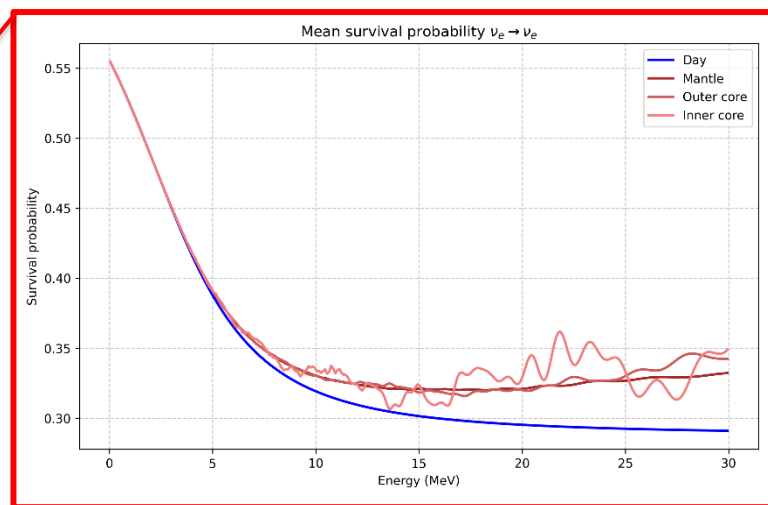
- Change oscillation parameters

How to combine data from the different experiments?

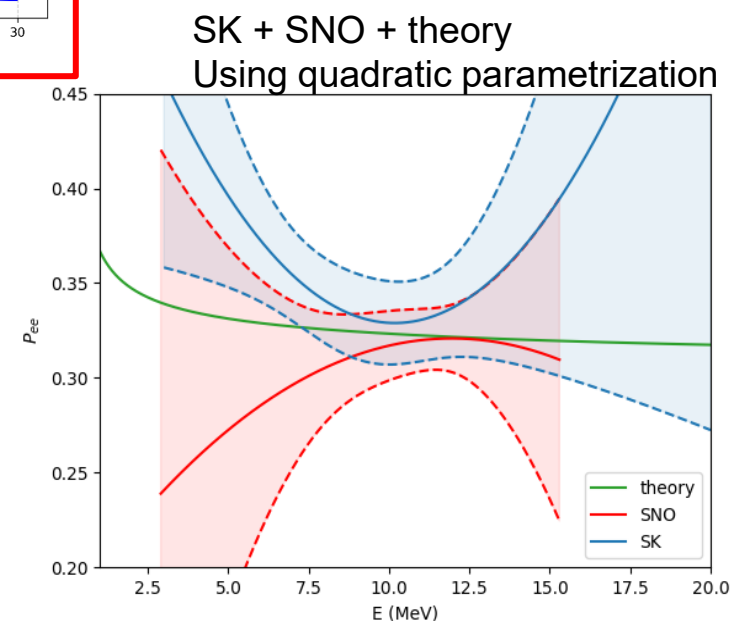
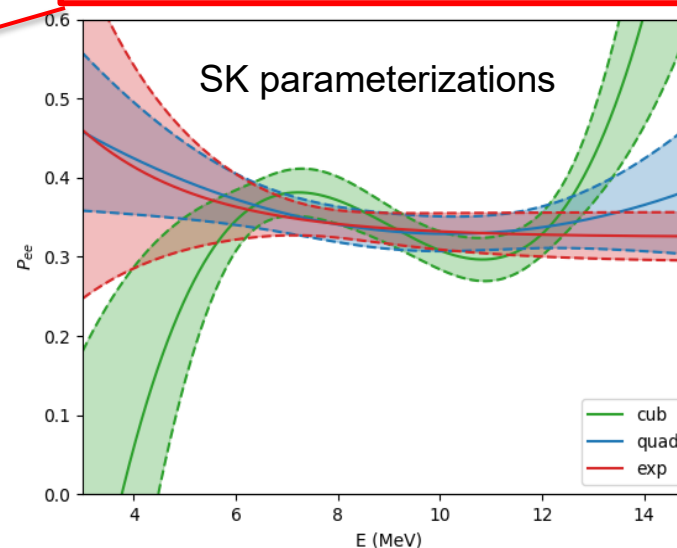
- Work in survival probability space

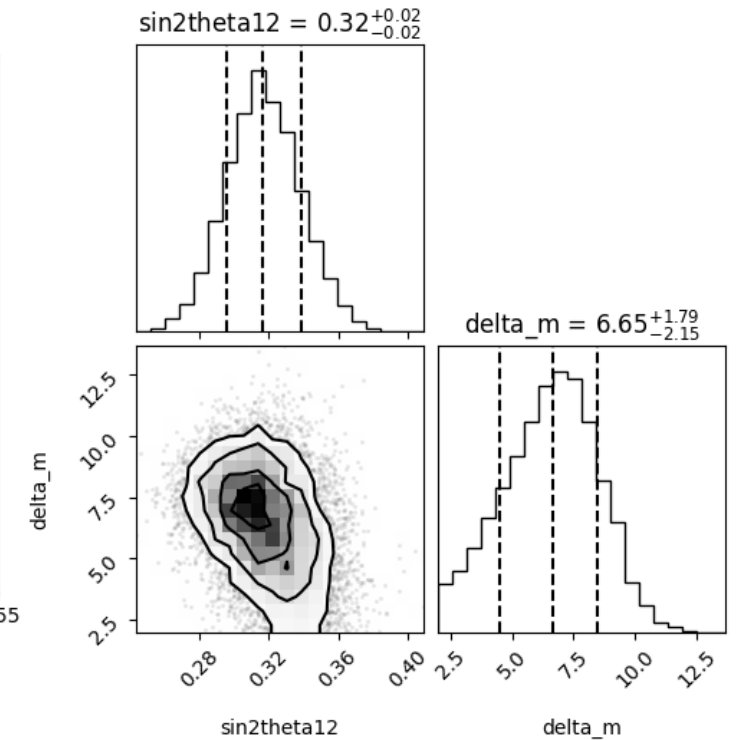
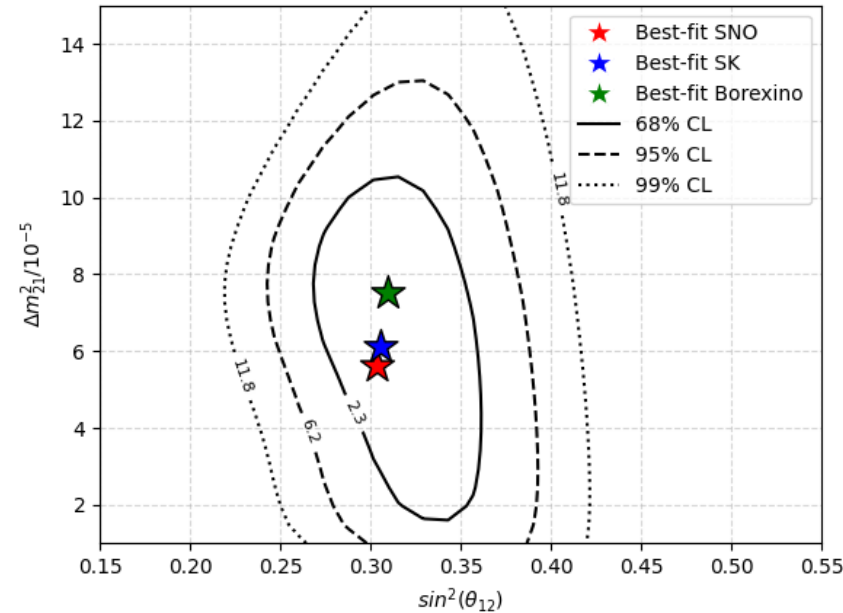
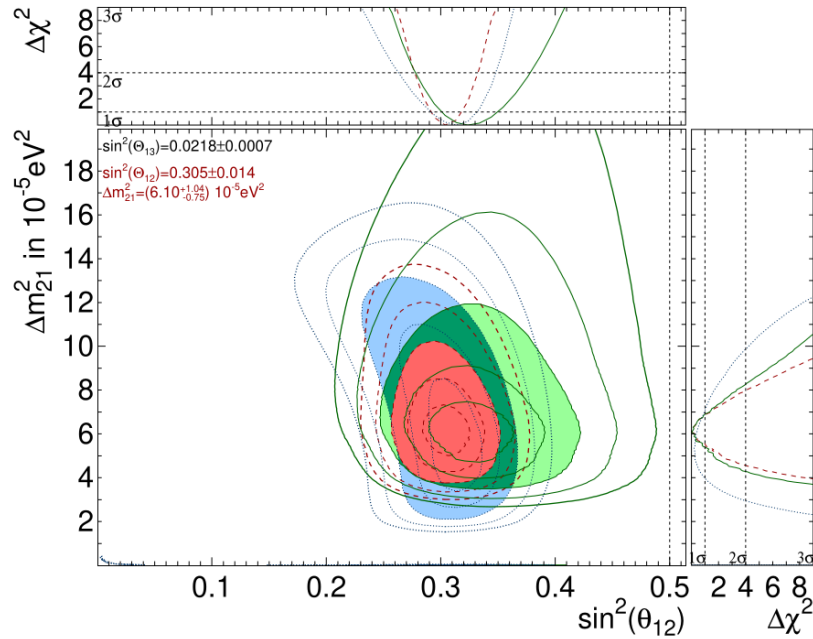


- Choice of parametrizations of the observed data:
 - Quadratic
 - Cubic
 - Exponential



- Theory Day/Night
- Matter effect





- Direct comparison with the theorists

$$\sin^2(\theta_{12}) = 0.305^{+0.014}_{-0.014}$$

$$\Delta m^2_{21} = 6.10 \times 10^{-5} \text{eV}^2$$

- Build of Likelihood function
- Exploration of the parameter space ($\Delta m^2_{21}, \theta_{12}$)

- Run of MCMC