Poster based on [4]

A combined analysis of JUNO and HK will ensure a precise determination of the oscillation parameters and will improve bounds on NSI too.

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Weak Interactions and Neutrinos 2021
June 7-12, 2021

NON-STANDARD INTERACTIONS and the future of the NEUTRINO SOLAR SECTOR

Non- Standard Interactions

Neutral current NSI with charged fermions can be parametrised as follows:

$$\mathcal{L}_{\text{NC-NSI}} = -2\sqrt{2}G_F\varepsilon^{fX}_{\alpha\beta}\left(\overline{\nu}_\alpha\gamma^\mu P_L\nu_\beta\right)\left(\overline{f}\gamma_\mu P_X f\right)$$

(where X = L,R)

Coefficients quantify the stregth of NSI with respect to the Standard Model.
The vector component of NSI gives rise to a generalised matter potential,

$$V_{NSI} = \begin{pmatrix} \varepsilon^{fV}_{ee} & \varepsilon^{fV}_{e\mu} & \varepsilon^{fV}_{e\tau} \\ \varepsilon^{fV*}_{e\mu} & \varepsilon^{fV}_{\mu\mu} & \varepsilon^{fV}_{\mu\tau} \\ \varepsilon^{fV*}_{e\tau} & \varepsilon^{fV*}_{\mu\tau} & \varepsilon^{fV}_{\tau\tau} \end{pmatrix}$$

which alters neutrino propagation.

Our work focuses on neutral current NSI with d-quarks.

See [1] for a recent review on the status of NSI

HYPER KAMIOKANDE [3]

- Spectral day and night analysis.
- Assuming 1 tank (187 kton) and threshold of 3.5 MeV.
- Uncertainties in the spectral shape of the fluxes, energy resolution, energy scale and overall normalisation of the ^{8}B and hep flux accounted for.
- Non-zero NSI can lead to important changes in the picture of solar neutrinos since they alter:
  (i) the mixing in the production region in the Sun
  ⟶ change position and shape of the transition region

  (ii) propagation through the Earth
  ⟶ differences between day and night spectra

NSI are parametrised with two effective coefficients, ε and ε'.

REFERENCES
[1] Y.Farzan et al. Front. in Phys.6(2018)
[2] JUNO Collaboration. J.Phys.G 43 (2016) 3, 030401
[3] Hyper Kamiokande Collaboration, arXiv:1805.04163
[4] To appear soon on arXiv

JUNO [2]

- Excellent energy resolution and excellent sensitivity to oscillation parameters: $\{\theta_{12}, \theta_{13}, \Delta m^2_{21}, \Delta m^2_{31}\}$
- Systematics included in the analysis as in [2].
- The impact of non-zero NSI would not be large but they could spoil the precision goals of the experiment.

We will consider only ε_{ee} and $\varepsilon_{e\tau}$ to be non-zero.

RESULTS

A combined analysis breaks the existing degeneracies and would ensure a robust and precise determination of the oscillation parameters, even in the presence of NSI.

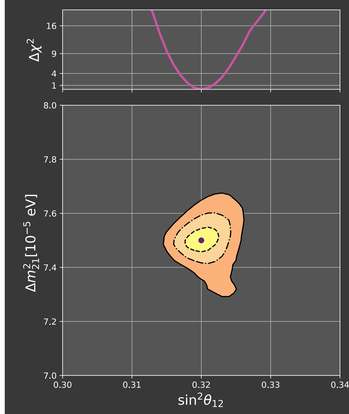

FIG 1.
Combined sensitivity to the oscillation parameters of the solar sector after marginalising over the NSI parameters. Purple dot indicates the true value assumed.

Improved bounds on NSI with d-quarks are also expected.

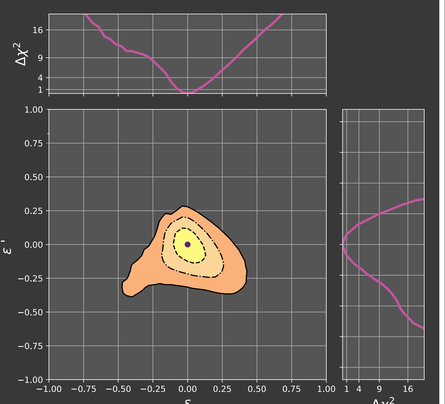

FIG 2.
Combined sensitivity to the NSI parameters after marginalising over the oscillation parameters of the solar sector. Purple dot indicates the true value assumed.

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