

# REPORT ON JHEP\_283P\_0822

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Title: Solar  $\bar{\nu}_e$  flux: Revisiting bounds on neutrino magnetic moments and solar magnetic field

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## Referee report

In this work, the authors revisit the implications of a non-zero neutrino magnetic moment in solar neutrino propagation. They focus mainly on the expected electron anti-neutrino signal that would arise in the presence of a strong magnetic field in the Sun interacting with the neutrino flux.

In their analysis, they carefully consider the corresponding evolution equations for this scenario and solve them analytically and numerically. The authors consider two different solar models for their study. They compare the results from numerical and analytical computations and find the region of validity for the analytical analysis. Their analysis is quite complete and the most up-to-date on this particular subject.

After these computations, the results are compared with the current limits on solar anti-neutrinos from the Sun reported by Borexino, KamLAND and Super-Kamiokande. The reported limits depend on the value of the magnetic field inside the Sun, which is unknown. Therefore, the limits are shown as a product of the neutrino magnetic moment times the magnetic field. Although some constraints are less stringent than previously reported by the experimental collaborations, they are correct and more reliable. Therefore, the main results of the article are quite relevant.

There is one point that I would like the authors to discuss before the article can be published: in Equation (2.42), the authors show the magnetic field profile they use in their computations. However, I didn't find any reference or explanation for using this profile. Is this profile known from previous studies? How do the results depend on the profile selection? An additional discussion about this point is necessary.

Another minor point is the discussion (in the conclusions, page 29) about the constraints on  $\mu_{12}$  for given constraints on the solar magnetic field strength (quoting Refs. 77-80). These limits on  $\mu_{12}$  would be valid only if the magnetic field takes its maximum allowed value, but there is no need for this to happen. Therefore, they don't have a limit on  $\mu_{12}$  for the whole allowed range of values for  $B$ , but only for its maximum value. The authors must rewrite this paragraph to clarify this point.