Erratum: Probing a diffuse flux of axionlike particles from Galactic supernovae with neutrino water Cherenkov detectors [Phys. Rev. D 111, 083019 (2025)]

David Alonso-González, David Cerdeño, Marina Cermeño, and Andres D. Perez

(Received 18 June 2025; published 7 July 2025)

DOI: 10.1103/f9c2-bl84

A mistake was made in Eq. (10), where a factor 4π was missing in the denominator. The corrected equation reads

$$\frac{d\Phi_a}{dE_a^{\rm Earth}} = \frac{dN_a}{dE_a^{\rm Earth}} \int_{-\infty}^{\infty} \int_0^{2\pi} \int_0^{\infty} \frac{dn_{SN}}{dt} \frac{r}{4\pi(\vec{r}-\vec{R}_E)^2} dr d\theta dz. \tag{10}$$

This implies that the axionlike particle (ALP) flux reaching Earth is smaller than the one presented in this paper. In particular, Eq. (12) must be replaced by

$$\frac{d\Phi_a}{dE_a^{\rm Earth}} = 1.3 \times 10^{-55}\ {\rm cm}^{-2}\,{\rm s}^{-1} \frac{dN_a}{dE_a^{\rm Earth}}. \tag{12}$$

Therefore, the numerical results are affected. Here, we include the corrected versions of Figs. 1, 3, 4, and 6.

Finally, ALP masses in the range of 1–70 MeV and ALP-proton couplings between $\sim 2 \times 10^{-5}$ and 2×10^{-4} are excluded, while the future Hyper-Kamiokande (HK) will be able to probe couplings as small as $\sim 10^{-5}$. Although the numerical values are modified, the overall conclusions of the paper remain the same.

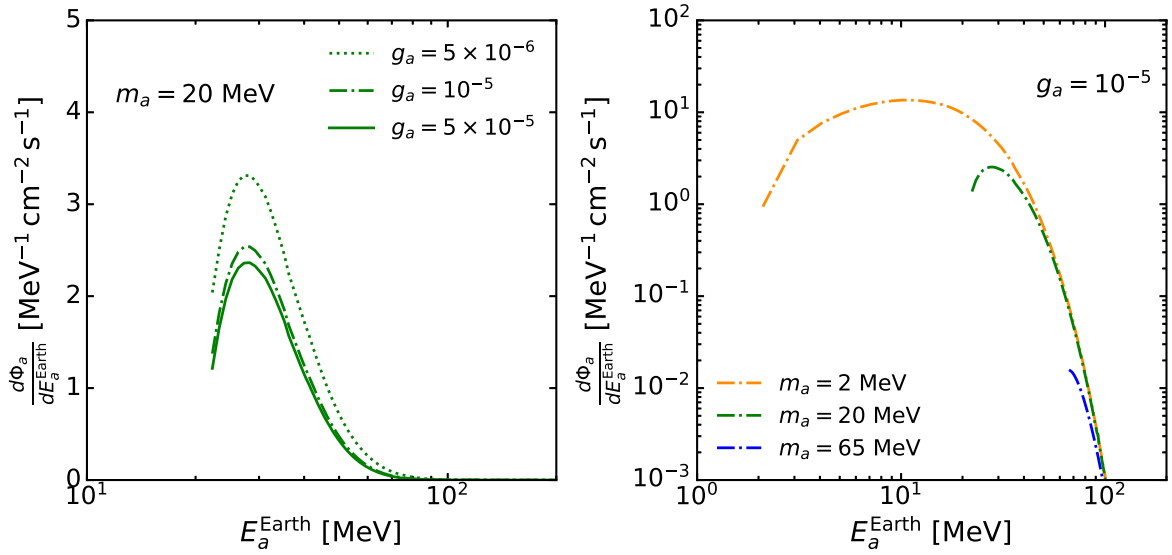


FIG. 1. ALP flux from Galactic supernovae that reaches Earth as a function of the ALP energy. In the left plot, for $m_a = 20$ MeV and $g_a = 5 \times 10^{-6}, 10^{-5}, 5 \times 10^{-5}$ in dotted, dash-dotted, and solid lines, respectively. In the right plot, $g_a = 10^{-5}$ is fixed and $m_a = 2$, 20, 65 MeV, in orange, green, and blue, respectively.

Published by the American Physical Society under the terms of the Creative Commons Attribution 4.0 International license. Further distribution of this work must maintain attribution to the author(s) and the published articles title, journal citation, and DOI.

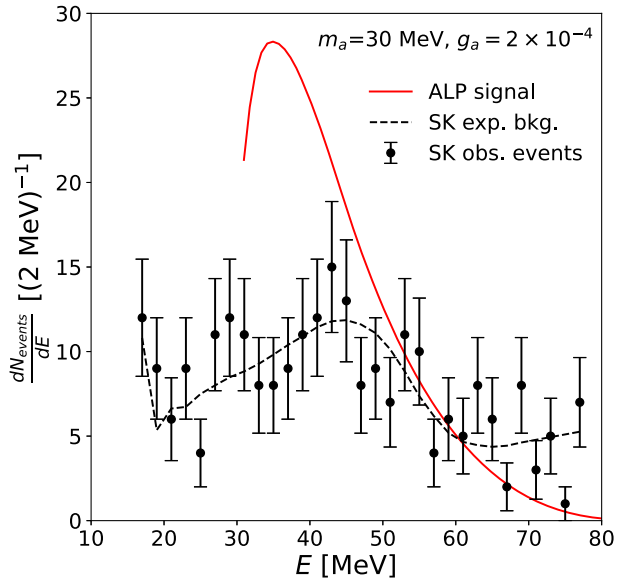


FIG. 3. Expected event rate in Super-Kamiokande phase IV via $ap \to p\gamma$ (red solid line) for $g_a = 2 \times 10^{-4}$ and $m_a = 30$ MeV and for the expected events from SM processes taken from [1] (black dashed line). The observed events are shown with their error bars.

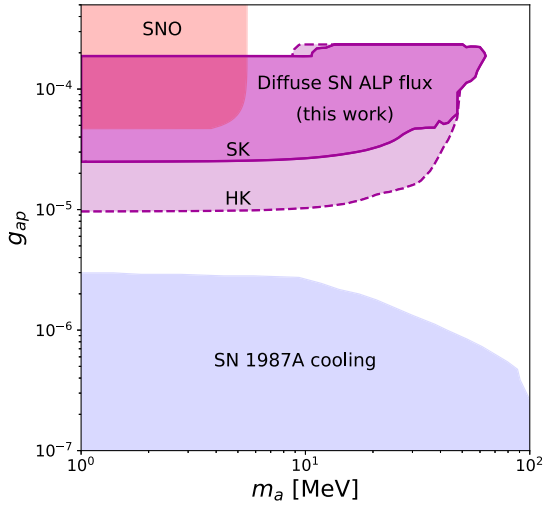


FIG. 4. Bounds on the ALP parameter space, ALP-proton coupling constant vs ALP mass. The pink region is excluded by the expected events in SK of ALPs from the Galactic diffuse SN flux scattering on free protons. The light pink region is the projected excluded region for HK. Complementary bounds from expected solar axion events in SNO [2] (red region) and from SN 1987A cooling [3] (blue region).

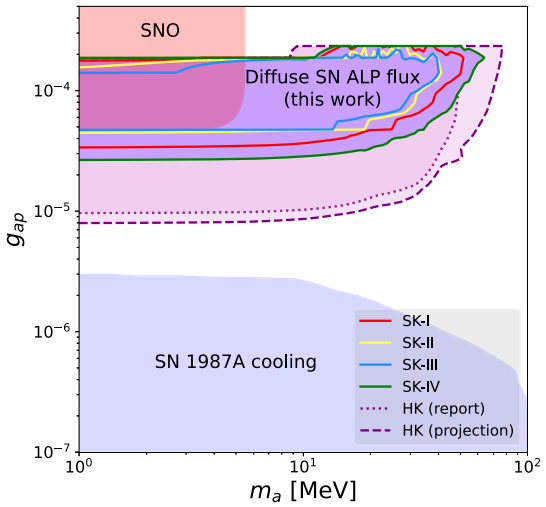


FIG. 6. Same as Fig. 3, but for each SK phase independently and HK using the expected background published in a design report [4] or the projected background assuming the same response and data reduction used in a recent SK analysis [1].

[1] Super-Kamiokande Collaboration, Diffuse supernova neutrino background search at Super-Kamiokande, Phys. Rev. D **104**, 122002 (2021).
[2] A. Bhusal, N. Houston, and T. Li, Searching for solar axions using data from the Sudbury Neutrino Observatory, Phys. Rev. Lett. **126**, 091601 (2021).
[3] A. Lella, P. Carenza, G. Co', G. Lucente, M. Giannotti, A. Mirizzi, and T. Rauscher, Getting the most on supernova axions, Phys. Rev. D **109**, 023001 (2024).
[4] Hyper-Kamiokande Collaboration, Hyper-Kamiokande Design Report, arXiv:1805.04163.