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# Supernova limit on a light CP-even scalar and implications for the KOTO anomaly

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A light CP-even scalar $S$ can be produced abundantly in the supernova core, via the nucleon bremsstrahlung process $NN \to NNS$ due to its mixing with the standard model (SM) Higgs boson. Taking into account the decay and re-absorption of $S$, we obtain the supernova luminosity constraints on the scalar mass $m_S$ and mixing angle $\sin\theta$ of $S$ with the SM Higgs. $\sin\theta$ is excluded in the range of $3.5 \times 10^{-7}$ to $2.5 \times 10^{-5}$, depending on the scalar mass up to around 270 MeV. Such a light scalar can be used to explain the KOTO anomaly in flavor-changing rare decay $K_L \to \pi^0 \nu\bar{\nu}$.

## Summary

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