IMPLICATIONS OF NEUTRINOLESS DOUBLE BETA DECAY FOR MODELS OF BARYON ASYMMETRY

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RESEARCH OBJ/HYP

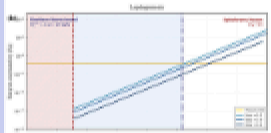
Research Objective:
Can a Type-I seesaw model with heavy Majorana neutrinos simultaneously explain the baryon asymmetry of the Universe while remaining consistent with current $0\nu\beta\beta$ and mixing constraints?

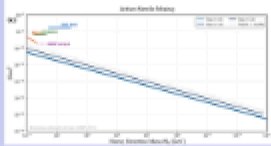
Hypothesis:
There exists a region of heavy neutrino mass and CP-violating parameter space where sufficient baryon asymmetry is generated while avoiding exclusion by present $0\nu\beta\beta$ experiments.

TYPE-I SEESAW SIMULTANEOUSLY CONSTRAINS NEUTRINO MASS, ASYMMETRY, AND MIXING.

RESULTS

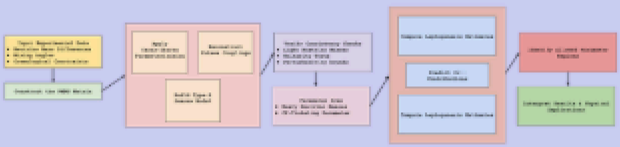
The parameter scan reveals that low-scale seesaw leptogenesis is highly sensitive to CP-violating phases. Successful baryogenesis is restricted to a narrow parameter space, indicating that the observed matter-antimatter asymmetry is not a generic outcome but requires specific alignment with neutrino oscillation data. Current active-sterile mixing and Majorana mass predictions remain within experimental bounds, yet they sit near the sensitivity limits of upcoming high-precision searches, suggesting the model is imminently verifiable.



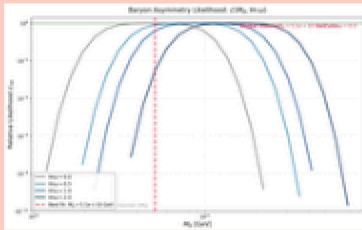


METHODOLOGY

This project uses inputs from established experimental and theoretical neutrino physics. Oscillation parameters come from global fits and Particle Data Group summaries, while baryon asymmetry is based on Planck measurements. Neutrinoless double beta decay constraints use experimental limits and nuclear matrix elements. These inputs are embedded within leptogenesis and Type-I seesaw frameworks to ensure consistency with empirical results.



CONCLUSIONS



This study demonstrates that the Type-I seesaw mechanism can successfully unify neutrino mass generation with the observed baryon asymmetry. While constrained by current laboratory and cosmological data, the model remains viable and provides predictive targets for future neutrinoless double beta decay and mixing experiments. The identified parameter space underscores a profound connection between early-universe evolution and low-energy neutrino observables, establishing a clear experimental roadmap for testing the origins of cosmic matter.