Capitol Graduate Research Summit

SIMULATING DETECTOR FLIGHTS OF THE NASA NIAC NSOL SOLAR ORBITING NEUTRINO DETECTOR TO CONSTRAIN SOLAR MODELS

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The νSOL project is working towards building a space-based neutrino detector orbiting close to the sun. Neutrinos are sub-atomic particles that are the product of fusion inside the sun. Unlike the helium, light, and other particles produced during fusion, neutrinos are very weakly-interacting. Neutrinos directly escape the sun without interacting, unlike photons which can take thousands of years to escape the sun's core. By studying neutrinos, we can explore fundamental physics and unanswered questions about the universe. The weakly-interacting nature of neutrinos provides a unique window into the sun's core. Through this window is the largest fusion reactor in the solar system. Studying the sun's fusion could provide insights into fusion reactors here.

This work focuses on simulating the signals that the spacecraft might be able to measure during its solar orbit. I use the results from the Standard Solar Model (SSM), and from those I calculate the number of neutrinos from each of the neutrino-producing fusion processes in the sun. I put a simulated detector in an orbit around the sun, and at each time step I calculate the fraction of a neutrino that could be measured. Using random number generation to simulate real detection, I determine if a neutrino has been measured at that point in the orbit. I take the results from a simulated mission to calculate how many total neutrinos there were, and use that to calculate the luminosity of the sun. This luminosity constraint can then be input to a modified version of the SSM.