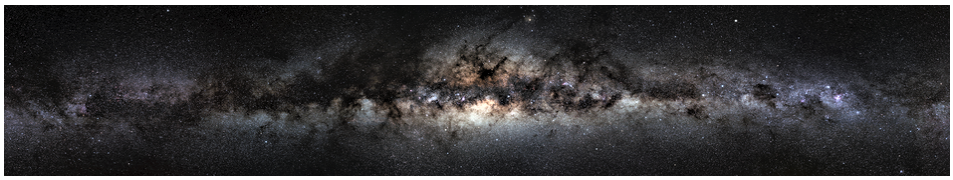

Contribution ID: **49** Type: **Oral**

A Closer Look at the pp-chain Reaction in the Sun: Constraining the Coupling of Light Mediators to Protons

Tuesday, 7 December 2021 12:14 (18 minutes)

The pp-chain of nuclear reactions is the primary route for energy production in the Sun. The first step in that reaction sequence converts two protons to a deuterium nucleus with the emission of a positron and electron neutrino. This reaction is extremely slow because it is a weak interaction, and significantly, it involves quantum tunneling through the Coulomb barrier. Though the reaction rate can be calculated with high confidence in the Standard Model, it has not been measured at solar energies. If there exist interactions that are engendered by non-standard mediators then the rate of this reaction in the Sun could be altered. We probe such non-standard interactions by comparing calculations of solar evolution to the current solar system age in the presence and absence of the non-standard mediators. These reveal ranges of non-standard mediator mass and couplings that are inconsistent with measured properties of the Sun, including solar neutrino results. Our constraints on these non-standard parameters, in many cases overlapping those derived via other considerations, could be extended further with better confidence in the value of the metalicity of the Sun and the solar neutrino CNO flux. Intriguingly, our work reveals a degeneracy between the solar metalicity and the presence of the invoked non-standard mediators.

Primary authors: SULIGA, Anna M. (University of California, Berkeley and University of Wisconsin-Madison); FULLER, George M.; SHALGAR, Shashank

Presenter: SULIGA, Anna M. (University of California, Berkeley and University of Wisconsin-Madison)

Session Classification: Parallel 2: Neutrinos