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^{7}Be(p,γ)^{8}B: how EFT and Bayesian analysis can improve a reaction calculation

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The reaction ^{7}Be(p,γ)^{8}B generates most of the high-energy neutrinos emanating from the pp-fusion chain in our Sun. Over the past twenty years there has been a substantial effort to measure its cross section at center-of-mass energies below 500 keV. One goal of this effort was accurate extrapolation of the astrophysical S-factor to solar energies. I will explain our treatment of this problem (Zhang et al., Phys. Lett. B 751, 535 (2015)), which uses an effective field theory (EFT) for ^{7}Be(p,γ)^{8}B and Bayesian methods to perform the extrapolation. We find a zero-energy S-factor S(0)=21.3±0.7 eV–an uncertainty smaller by a factor of two than previously recommended. This improvement occurs because the EFT encapsulates all plausible low-energy models of the process, and so model selection for this problem can be accomplished in a rigorous and statistically meaningful way.

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