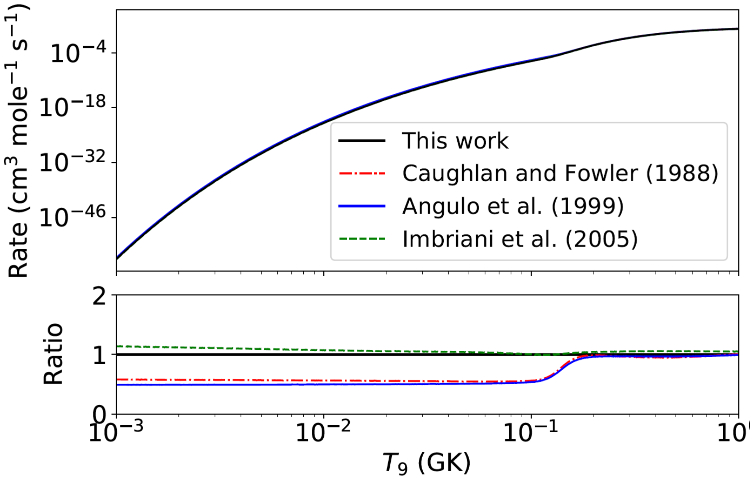
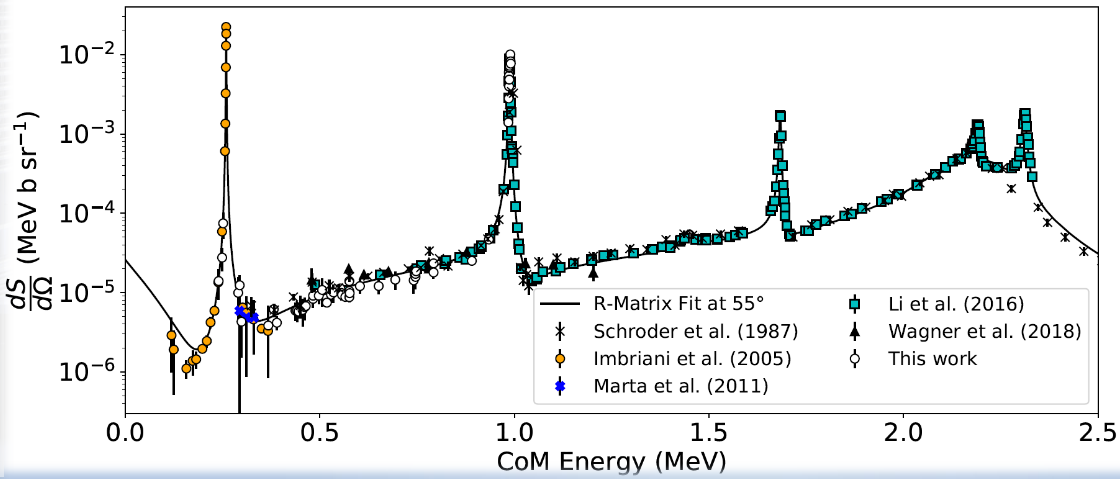
Investigation of the $^{14}N(p, \gamma)^{15}O$ reaction and its impact on the CNO cycle

While the CNO cycle only produces about ≈1% of the energy in our sun, measurements of the CNO solar neutrino flux have been successfully measured by Borexino. These CNO neutrinos result mainly from the $^{14}N(p, \gamma)^{15}O$ reaction, from the β decay of ^{15}O. Solar CNO neutrinos are challenging to detect, but they can provide valuable independent new information on the metallicity of the solar core. There are, however, still considerable uncertainties in the $^{14}N(p, \gamma)^{15}O$ reaction rate at solar temperatures. Thus new measurements have been performed at the CASPAR underground accelerator that span the proton energy range 0.27 and 1.07 MeV, closing a critical gap in the existing data. A multichannel *R*-matrix analysis was performed with the entire new and existing data sets and was used to extrapolate the astrophysical *S* factors to low energies. The results were in agreement with previous work, but find that the discrepancies between measured data and *R*-matrix fits, both past and present, still exist. We examine the possible reasons for these to inform future studies.





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