Low energy cross section of ^{18}O(p,γ)^{19}F

Andreas Best[1,2] and Francesca Pantaleo[3,4]

[1] *University of Naples "Federico II", Italy*

[2] *INFN, Sezione di Napoli, Italy*

[3] *University of Bari "Aldo Moro", Italy*

[4] *INFN, Sezione di Bari, Italy*

For the LUNA collaboration

The observation of oxygen isotopes in giant stars sheds light on mixing processes operating in their interiors. Due to the very strong correlation between nuclear burning and mixing processes it is very important to reduce the uncertainty on the cross sections of the nuclear reactions that are involved. In this paper we focus our attention on the reaction ^{18}O(p,γ)^{19}F. While the ^{18}O(p, α)^{15}N channel is thought to be dominant, the (p,γ) channel can still be an important component in stellar burning in giants, depending on the low energy cross section. So far only extrapolations from higher-energy measurements exist and recent estimates vary by orders of magnitude. These large uncertainties call for an experimental reinvestigation of this reaction. We present a direct measurement of the ^{18}O$(p,\gamma)^{19}$F cross section using a high-efficiency 4π BGO summing detector at the Laboratory for Underground Nuclear Astrophysics (LUNA). The reaction cross section has been directly determined for the first time from 140 keV down to 85 keV and the different cross section components have been obtained individually. The previously highly uncertain strength of the 90 keV resonance was found to be three orders of magnitude lower than an indirect estimate based on nuclear properties of the resonant state and a factor of 20 lower than a recently established upper limit. This result excludes the possibility that the 90 keV resonance can contribute significantly to the stellar reaction rate. In addition the strengths and branching ratios of resonances between 150 and 400 keV have been determined with much improved precision and sensitivity using a HPGe detector, including a first measurement of branching ratios of the 216 keV resonance.