Experimental study of the β-decay of ^{46}Mn and its connection to ^{44}Ti nucleosynthesis

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The ^{44}Ti nucleosynthesis is considered to be, due to its characteristic gamma decay chain, a good gamma tracer for Supernovae events of the type of Core Collapse Supernova (CCSN) explosions. These are the final process experienced by stars with an initial mass greater than 8 $M_{\odot}$, where the nucleosynthesis takes place. In addition, the comparison between observations and models of the synthetized ^{44}Ti in CCSN gives important constraints to the latter, such as the explosion energy and duration as well as the remnant and ejected masses. In this context, reaction networks are used for modelling nucleosynthesis occurring in the last stages of those stars, using thermonuclear reaction rates as its inputs [1, 2, 3], among others (mass, half-lives, etc.).

Reaction rates of astrophysical relevance are very difficult to study in a direct way by the current nuclear laboratories. Therefore, indirect methods such the search of resonant contributions by means of β-delayed proton emission may help. This is the case for the ^{45}V(p,γ)^{46}Cr reaction, one of the candidates to which the nucleosynthesis of ^{44}Ti is sensitive in CCSN explosions [1,4,5].

In this work, we present the analysis of the ^{46}Mn β^+ decay channel. For doing so, and to study excited states of the daughter nucleus ^{46}Cr, we have selected ^{46}Mn among other species in the cocktail beam delivered by the LISE fragment separator at GANIL (Caen, France). As part of our preliminary results, we present the proton and gamma emission peaks related to the ^{46}Mn decay and we compare them with previous work from references [6,7]. Also, we present novels p-γ and γ-γ coincidence studies used to identify the processes linked to γ emission, which has allowed us to see new links between γ peaks and the corresponding excited states of ^{45}V from which they de-excite. Furthermore, with this methodology we have obtained evidence of a possible larger number of proton transitions from the IAS of ^{46}Cr to ^{45}V excited states than those previously seen [6].

[1] C. Illiadis, *Nuclear Physics of Stars,* Wiley-VCH (2007).
[2] A. Heger, C.L. Fryer, S.E. Woosley, N. Langer, and D.H. Hartmann, *ApJ* **591**, 288-300 (2003).
[3] C. Giunti, and K.C. Wook, *Fundamentals of Neutrino Physics and Astrophysics*, Oxford University Press (2007).
[4] L. Trache, E. Simmons, et. al., *AIP Conference Proceedings* **1409**, 67-70 (2011).
[5] L.-S. The, D.D. Clayton, L. Jin, and B.S. Meyer, *ApJ* **504**, 500-515 (1998).
[6] C. Dossat, N. Adimi, et. al., *Nuclear Physics A* **792**, 18-86 (2007).
[7] J. Giovinazzo, B. Blank, et. al., *Eur. Phys. J. A* **10**, 73-84 (2001).

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