# Spectroscopic study of $^{27}$Al from the $^{26}$Al(d,p)$^{27}$Al reaction, implication for the destruction of $^{26}$Al in WR and AGB stars.

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The observations of the radioactive decay of $^{26}$Al by satellites, the first observation of ongoing nucleosynthesis in the galaxy, has triggered an intense need for understanding the mechanisms responsible for its production and destruction in galactic phenomena. All-sky maps tracking $\gamma$-rays associated with its decay have shown that it was produced by several astrophysical sites such as core collapse supernovae, Wolf-Rayet (WR) stars and Asymptotic Branch Giant (AGB) stars. A relatively small network of reactions is responsible for the observed $^{26}$Al quantities. In explosive hydrogen-burning environment, 0.06 GK $\leq$ T $\leq$ 0.1 GK, the destruction rate is mainly determined by the $^{26}$Al(p,$\gamma$)$^{27}$Si reaction at the corresponding excitation energies. The occurrence of resonances above the $^{26}$Al+p threshold in $^{27}$Si has a large impact on the galactic $^{26}$Al abundance inherent to each of these astrophysical sites. Resonant states have been identified in $^{27}$Si by two spectroscopic studies [1, 2]. However, the strength of two of those states, at 7532 and 7589 keV (resp. 68 and 127 keV) excitation (resonance) energy, remains mainly unknown. These low energy resonances are currently not reachable via direct measurement as the cross section fall of dramatically with energy. In this study, this obstacle is overpassed via a state of the art spectroscopic study of the mirror nucleus $^{27}$Al with the $^{26}$Al(d,p)$^{27}$Al transfer reaction. Such study allows for an indirect measurement of the 127 keV resonance in $^{27}$Si by measuring the spectroscopic factors of the states in $^{27}$Al. It is currently understood (see, for example, Ref. [1]) that the state in $^{27}$Al, equivalent to this resonance, is at 7806 keV, state for which we provide a measurement, while our resolution allows for a stringent limit on the strength of the 68 keV resonance.

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[1] G. Lotay *et al., Phys. Rev. C* **84**, 035802 (2011).
[2] A. Parikh *et al.,, Phys. Rev. C* **84**, 065808 (2011).