Cosmogenic Production of ^{26}Al

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The natural fall-out of ^{26}Al ($T_{1/2} = 7.2 \cdot 10^5$ y) is due to atmospheric production by spallation reactions on argon as well as to the influx of interplanetary dust and production in the dust. In order to calculate the atmospheric production of ^{26}Al, cross sections of the reaction ^{40}Ar(p,6p9n)^{26}Al were measured in the energy range from 100 to 590 MeV.

1. Irradiation experiment at PIF

Argon gas targets were irradiated at the **P**roton **I**rradiation **F**acility (PIF) at PSI, Villigen (CH). The target chambers were filled with gas at a pressure of 3 bar corresponding to $2 \cdot 10^{21}$argon atoms/cm^{-2} and irradiated with typical fluences around several 10^{13} protons. The produced ^{26}Al was absorbed on the surface of polypropylene foils inside the chambers. The foils and a ^{26}Al-free standard were given into hydrochloric acid to dissolve the aluminium. The acid was neutralized with NH_3OH to precipitate $Al(OH)_3$ which was oxidized at $900\,^\circ$C to Al_2O_3. The ^{26}Al/Al-ratio was measured by AMS at the Garching accelerator laboratory. The results are given in fig. 1, together with previously measured cross sections by Reyss *et al.* [1].

2. Atmospheric production of ^{26}Al

With the assumption of identical cross sections for the reactions ^{40}Ar(n,5p10n)^{26}Al and ^{40}Ar(p,6p9n)^{26}Al the atmospheric production of ^{26}Al was calculated, using the differential flux of neutrons in the atmosphere [2,3]. The total average production rate of ^{26}Al was obtained to be 0.33 ^{26}Al m^{-2} sec^{-1}.

Another estimate for the atmospheric production of ^{26}Al can be obtained from air filter measurements of ^{26}Al and ^{10}Be which give ^{26}Al/^{10}Be=$3.8\cdot10^{-3}$ and from atmospheric production rate of ^{10}Be being 201 m^{-2}s^{-1} [4]. From this a production rate of 0.76 m^{-2}s^{-1} is deduced. Other authors estimate an atmospheric production rate of 1.4 [5] and 1.1 [1] ^{26}Al m^{-2}s^{-1}.

The influx of ^{26}Al by interplanetary dust can be estimated using measured cross sections on Mg, Al, Si, Fe and Ca [6], the flux of solar cosmic radiation at 1 A.U., the elemental composition of C1 chondrites for the dust and an assumed influx of dust 40 t/d [7]. The obtained result is 0.17 ^{26}Al m^{-2}s^{-1}, about half of the atmospheric production of ^{26}Al.

References

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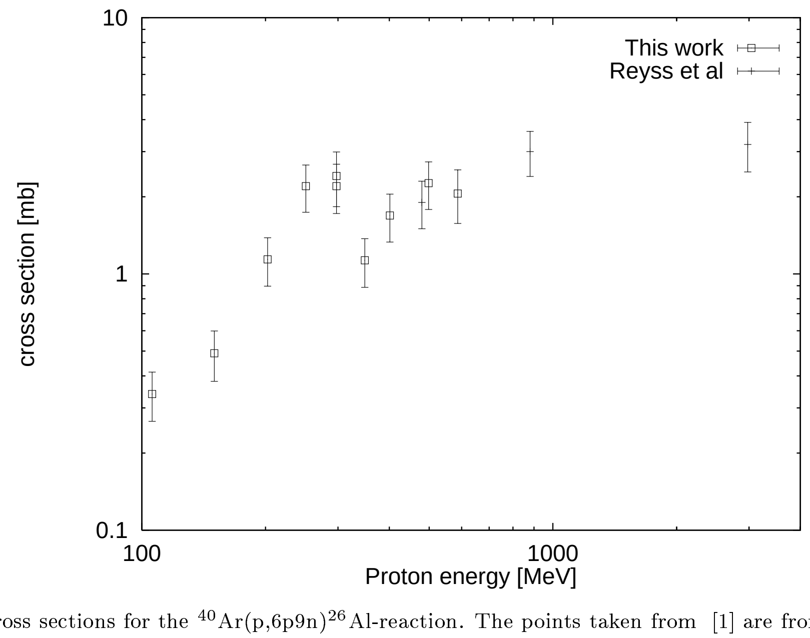

Fig. 1: Measured cross sections for the ^{40}Ar(p,6p9n)^{26}Al-reaction. The points taken from [1] are from irradiation on liquid argon.