Evaluated (n,γ) excitation functions and the prediction of the mean GCR particle flux

Daniel Kollar[1], Rolf Michel[2], Jozef Masarik[1]

[1] *Department of Nuclear Physics, Comenius University Bratislava, Slovak Republic*
[2] *Center for Radiation Protection and Radioecology, University Hannover, Germany*

For an accurate modeling of the production rates of cosmogenic nuclides in extraterrestrial matter the availability of reliable excitation functions is essential. For the (n,γ) reactions there exist excitation functions for most target isotopes relevant in the cosmic ray applications within the nuclear evaluated data files.

Here we report on the calculations of the n-capture produced cosmogenic nuclides ^{36}Cl, ^{41}Ca, ^{60}Co, ^{59}Ni, ^{80}Kr, ^{82}Kr, and ^{129}I in stony meteorites. The transport of the galactic cosmic ray (GCR) particles was simulated using the LAHET Code System [1,2]. The excitation functions were taken from the ENDF/B-VI [3] and JEF-2.2 [4] libraries. The results show that for some nuclides there are cosiderable differences between production rates calculated using the excitation functions from the two libraries (up to 30%).

From the comparison of calculated and measured production rate depth profiles of cosmogenic nuclides the value of the mean GCR particle flux can be determined. For the (n,γ) reactions this was done by comparing the calculations to the ^{41}Ca depth profile from the Apollo 15 drill core [5] leading to the value of 2.99 cm^{-2} s^{-1} at meteoroid orbits. This value significantly differs from the values obtained from similar models for spallation production 4.8 [6] and 4.06 cm^{-2} s^{-1} [7]. The reasons for this difference are not clear and further investigation is needed especially with respect to the excitation functions for both (n,γ) and spallation reactions.

References: [1] Prael R., Lichtenstein H., LA-UR-89-3014 (1989), [2] Breismeister J. F., LA-12625-M (1997), [3] ENDF/B-VI Summary Documentation, BNL-NCS-17541 (1991), Rowlands J., JEFF report 17 (2000), [5] Nishiizumii K. et al., EPSL 148, 545 (1997), [6] Reedy R. C. et al., LPSC 24, 1195 (1993), [7] Leya I. et al., MAPS 35, 259 (2000)

Email: daniel.kollar@fmph.uniba.sk