

Calculated cross sections for gamma ray emission from solar flares

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Abstract:

Gamma Astronomy uses γ -ray lines originating from various astrophysical sites as a tool for probing the Universe [1]. One of the astrophysical sites that currently generate this type of nuclear radiation is our Sun via the solar flare processes where strong γ -ray lines may be produced following neutron capture, nuclear reactions and positron annihilation. In particular, the interpretation of the resulting γ -ray spectra observed during solar flares requires a good knowledge of nuclear reaction cross sections implying protons and alpha particles. In this work, we report on the cross sections for de-excitation γ -ray lines from ^{12}C , ^{24}Mg and ^{56}Fe nuclei following their bombardment with energetic protons and alpha particles within the (5-50) MeV/nucleon energy range, calculated using, e.g., the Empire computer code [2]. Several nuclear theories have been considered in dealing with different nuclear reaction mechanisms assumed to occur during the interaction. Especially, we show the necessity of introducing nuclear pre-equilibrium models [3] in view to account for the available cross section data measured by several groups at high energies.

References:

- [1] P.V. Ramana murthy, « Gamma-ray astronomy », 2nd edition, Cambridge University Press (1993).
- [2] www.nndc.bnl.gov/empire-2.18.
- [3] H.Feshbach, A.Kerman, and S.Koonin, Ann.Phys.(N.Y.)125(1980)429.