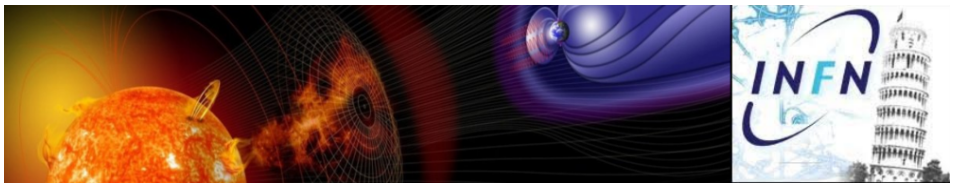

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Development of FLUKA Templates for the Modelling of Nuclear De-Excitation Gamma-Ray Line Spectra from Solar Flares

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The modelling of gamma-ray emission spectra observed in solar flares is generally carried out via the best-fit of data using a set of independent templates and functions for the several spectral components produced by the relevant physical processes (bremsstrahlung of electrons and positrons, nuclear de-excitation, neutron capture, positron annihilation and decay of pions). In recent works (Tusnski et al., 2019; MacKinnon et al., 2020), we have demonstrated the potential of the Monte Carlo package FLUKA as an effective tool for the simulation of nuclear processes in the context of solar flares, as well as its capability to implement a self-consistent treatment of the several spectral components in the energy range from 100's keV to 100's MeV. In this work we use FLUKA to calculate nuclear de-excitation gamma-ray line spectra expected from solar flare accelerated ion distributions. We implement a simulation strategy which allows to synthesize photon spectra for primary accelerated ions with arbitrary energy distributions and chemical abundances. We show model spectra obtained from a range of assumed primary accelerated ion distributions which exhibit reliable statistics and energy resolution and are in good agreement with those obtained using the code developed by Murphy et al. (2009). From these model spectra we build templates which can be incorporated into the software package Objective Spectral Executive (OSPEX) and used in the analysis of solar flare gamma-ray data.

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