

Lunar and Solar models

The Fermi Solar System Tools require models of the solar and lunar emission as input (see the tutorial page

http://fermi.gsfc.nasa.gov/ssc/data/analysis/scitools/solar_template.html).

Two models are provided with the Solar System Tools. These samples can be used for creating the solar and lunar templates. They are based on the lunar and quiet solar emission as derived in [2011ApJ...734..116A](#) and [2012ApJ...758..140A](#). Note that these models do not take into account possible variations given by changing solar activity.

Model characteristics

Models are stored in a FITS file with three table extensions. Extensions are named: ANGLES, ENERGIES, and SST PROFILE. The first extension lists the angles in degrees from the lunar or solar center used in the profile. The second extension lists the energies in MeV. The third extension contains the model profile. The model profile is stored in a vector column, where each row contains the profile as a function of angle for a specific energy. The units of the profiles are the ones of the intensity ($\text{cm}^{-2}\text{sr}^{-1}\text{s}^{-1}\text{MeV}^{-1}$). The FITS file extends from 1 MeV to 10^6 MeV.

Lunar model

The model provided with the Solar System Tools is based on the Fermi-LAT observations of the lunar emission as described in Abdo et al 2012 (ApJ 758 140). Please note that in the paper, clear detection is reported only for energies from 100 MeV to few GeV. The model covers the energies above 100 MeV with the extrapolation at higher energies according to the paper. The spectral flux is averaged over the first 24 months of observations. The formulation is a fit to the data as a log-parabolic function with a cutoff at few GeV with the parameters defined in the Fermi-LAT paper. The angular extension of the Moon is taken into account in the model.

The FITS file of the lunar emission model included in the Solar System Tools package is named `lunar_profile_v2r0.fits`

Solar model

The model provided with the SST is based on the Fermi-LAT observations of the solar emission in the quiet state as described in Abdo et al 2011 (ApJ 734 116). Please note that in the paper, clear detection of the Sun is reported only for energies from 100 MeV to 10 GeV. The model includes the sum of the solar disc and the extended inverse Compton emission. The emission is averaged over the first 18 months of observations. The disc emission extends from 100 MeV to 10 GeV, with spectral index -2.11 as described in the paper. The spectrum is assumed to have a softer spectral index above 10 GeV, where no detection was reported in that paper. The solar inverse Compton emission reflects model 1 in that paper and extends to the full energy range and is calculated with the stellarics software (<http://sourceforge.net/projects/stellarics/>). The angular extension of the Sun is taken into account in the model.

The FITS file of the solar emission model included in the Solar System Tools package is named `solar_profile_v2r0.fits`