Conventions for the use of the propagation functions $P(T)$

The **propagation function** $P(T)$ is defined as a conversion factor between an injection spectrum $\frac{\mathrm{d}N}{\mathrm{d}T}$ of antinuclei (normalized per DM annihilation) and the interstellar flux at the position of the solar system. More precisely, the differential particle flux $\frac{\mathrm{d}\Phi}{\mathrm{d}T}$ (particles per unit area, time, solid angle and kinetic energy per nucleon) is given by

$$\frac{\mathrm{d}\Phi}{\mathrm{d}T}(T) = P(T) \cdot \frac{\mathrm{d}N}{\mathrm{d}T}(T) \tag{0.1}$$

Note that T always refers to the kinetic energy **per nucleon**!
$P(T)$ itself is defined by

$$P(T) = \left(\frac{\rho_{\mathrm{loc}}}{0.39\,\mathrm{GeV/cm^3}}\right)^2 \left(\frac{100\,\mathrm{GeV}}{m_{\mathrm{DM}}}\right)^2 \left(\frac{\langle\sigma v\rangle}{3\cdot 10^{-26}\,\mathrm{cm^3/s}}\right) \cdot P_{\mathrm{num}}(T) \tag{0.2}$$

Here ρ_{loc} is the local Dark Matter mass density, m_{DM} is the Dark Matter mass and $\langle\sigma v\rangle$ is the thermally averaged annihilation cross section. $P_{\mathrm{num}}(T)$ is the quantity which is contained in the provided data files; thereby each table contains two columns:

- Column 1: kinetic energy per nucleon T in units of GeV
- Column 2: $P_{\mathrm{num}}(T)$ in units of $\mathrm{m^{-2}\,s^{-1}\,sr^{-1}}$

As an alternative to using the numerical data tables, we also fitted the propagation functions with a simple five-parameter curve:

$$P_{\mathrm{num}}(T) = \exp\left[a_0 + a_1 x + a_2 x^2 + a_3 x^3 + a_4 x^4\right] \tag{0.3}$$

where $x = \ln\left(\frac{T}{1\mathrm{GeV}}\right)$ and P_{num} is given in units of $\mathrm{m^{-2}\,s^{-1}\,sr^{-1}}$. The values of the fit parameters a_i are displayed in the table below; in addition you can find a short Mathematica notebook in the appendix which already contains the interpolating functions for all propagation setups. The difference between the numerical data tables and the interpolating functions is always less than 3.5%; note however that these functions are only valid for $0.1\,\mathrm{GeV} < T < 50\,\mathrm{GeV}$ and should not be used outside this range.

The naming convention for the data files (and for the interpolating functions in the Mathematica notebook), in the example of 3He_ann_NFW_MED_MethodAnn.dat is as follows:

- 3He: particle name (3He or 4He)
- ann: ann for DM annihilation (in principle, we could also look at decaying DM, then this would be dec)
- NFW: name of the halo profile
- MED: this encodes which propagation parameters were used in the computation. Currently, we have implemented the usual MIN, MED or MAX parameters (the values of these can be found e.g. in our paper 1209.5539)

Setup	a_0	a_1	a_2	a_3	a_4
MIN, MethodAnn	-6.44093	0.780775	-0.2235946	-0.020549	0.00557444
MIN, MethodInel	-6.76322	0.71512	-0.192509	-0.0129952	0.00356495
MED, MethodAnn	-4.38746	0.667013	-0.215212	-0.00941013	0.00440343
MED, MethodInel	-4.77336	0.576683	-0.175307	0.000634924	0.00165159
MAX, MethodAnn	-2.72768	0.0328706	-0.108132	0.00660771	0.000639246
MAX, MethodInel	-3.08096	0.0357084	-0.081369	0.00729373	-0.000417183

Table 1: Values of the fit parameters a_i (see text) for the propagation of $^3\overline{\mathrm{He}}$ produced in annihilations of Dark Matter following a NFW halo profile.

- MethodAnn: this can either be MethodAnn or MethodInel. In the first case, the annihilation rate of the antinuclei with the hydrogen in the interstellar matter is calculated by using an estimation of the annihilation cross section of antihelium with protons, following essentially the prescription described in Moskalenko et. al. (arXiv:0106567v2). When using MethodInel, one instead uses the full inelastic anthelium + proton cross section for the calculation of the annihilation rate, which corresponds to the approximation that all antinuclei which rescattered on the interstellar matter without having been destroyed are removed from the flux. This gives a more conservative (i.e. lower) flux.

In addition to the explanations above, the propagation is done exactly as described in our antideuteron paper (1209.5539). In particular, energy losses of the antinuclei are not included in this formalism, which is usually a good approximation for primaries.
Finally note that the fluxes obtained in this way are interstellar fluxes, i.e. no solar modulation is included.