

# Logs and spectra

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So PPC gives us a function for

$$\text{Log}_{10} \frac{dN}{d\text{Log}_{10}x} = \text{dNdlxIEW}[m_{\text{DM}}, x]$$

where  $x = \text{KE}/m_{\text{DM}}$ . For photons this is just  $x = E/m_{\text{DM}}$ . Let's sort out what this means in terms of  $dN/dE$ .

$$d \ln N = \frac{1}{N} dN$$

Then recall that

$$\begin{aligned} \log_b x &= \frac{\log_a x}{\log_a b} \\ \ln x &= \frac{\text{Log}_{10} x}{\text{Log}_{10} e} \\ d \text{Log}_{10} N &= \frac{d \ln N}{\ln 10} \\ &= \frac{1}{\ln 10} \frac{1}{N} dN \end{aligned}$$

For the denominator:

$$\begin{aligned} d \text{Log}_{10} x &= \frac{1}{\ln 10} \frac{1}{x} dx \\ &= \frac{1}{\ln 10} \frac{m}{E_\gamma} d \frac{E_\gamma}{m} \\ &= \frac{1}{\ln 10} \frac{1}{E_\gamma} dE_\gamma \end{aligned}$$