2. Landau theory

For a particle of mass \( m_x \) traversing a thickness of material \( \delta x \), the Landau probability distribution may be written in terms of the universal Landau function \( \phi(\lambda) \) as[1]:

\[
 f(\epsilon, \delta x) = \frac{1}{\xi} \phi(\lambda)
\]

where

\[
\phi(\lambda) = \frac{1}{2\pi i} \int_{c-i\infty}^{c+i\infty} \exp (u \ln u + \lambda u) \, du \quad c \geq 0
\]

\[
\lambda = \frac{\epsilon - \bar{\epsilon}}{\xi} - \gamma' - \beta^2 - \ln \frac{\xi}{E_{\text{max}}}
\]

\[
\gamma' = 0.422784 \ldots = 1 - \gamma
\]

\[
\gamma = 0.577215 \ldots \text{(Euler’s constant)}
\]

\[
\bar{\epsilon} = \text{average energy loss}
\]

\[
\epsilon = \text{actual energy loss}
\]

2.1. Restrictions

The Landau formalism makes two restrictive assumptions: