LPM-Effect

Bachelor Thesis 2017

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1 Introduction:

En etse apartado buscamos plantera nuestro problema principal, que como ya sabemos es que una partícula rodeada de un determinado material tiene un bremsstrahlung diferente al que preicen Bethe-Heitler en ausencia de él. Descibrir algunos de los conceptos fundamentales como la formation length y estas cosas. En resumen, la primera parte del artículo.

2 Bethe-Heitler Bremsstrahlung Theory:

To begin with we will start by discussing the problem of electromagnetic radiation for charged particles in the presence of a heavier and fixed particle. As we can guess this is the simplest case of our LPM effect, which we will get to in the next section.

These charged particles acelerate due to the presence of these other particles, emitting a radiation named Bremsstrahlung. This radiation will be the fundamental study throughout all our thesis. It is also important to figure out that this radiation emission is only important at relativistic speeds, non relativistic particles can neglect this kind of process.

2.1 Low Frequency Limit:

To begin with we will consider that our incoming particle (charged particle) has low frecuencies, and therefore a low energy, that way we can use a classical approach to the problem. Having also in mind that the amplitud in non relativistic radiation depends on the product between charge and aceleration, we can safely neglect the radiation effect that our atomic particle produces.

The radiation emitted during the colission time by a particle of charge ze is expressed as[1]:

[1] To follow the demonstration of this formula please check Apendix 1

Apendix 1: Deduction of lowfrequencyradiation

It is not easily demonstrated that the electric field of an accelerated charged paricle has the following form:

$$\mathbf{E}(\mathbf{x},t) = \frac{e}{4\pi\epsilon_0}\left[\frac{\mathbf{n}-\beta}{\gamma^2(1-\beta\mathbf{n})^3R^2}\right]_{ret} + \frac{e}{4\pi\epsilon_0 c}\left[\frac{\mathbf{n}\times(\mathbf{n}-\beta)\times d\beta/dt}{(1-\beta\mathbf{n})^3R}\right]_{ret} \tag{1}$$