Experimental Methods in Astroparticle and Particle Physics

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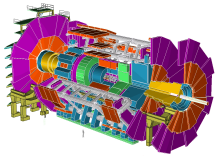
I. Introduction



1.1. Task of particle physics

1.2. Task of a detector

1.3. Basics of particle physics

1.4. Fundamental scattering experiments

a) Electron-positron-scattering, e.g. LEP at CERN
b) Lepton-nucleon-scattering, e.g. HERA at DESY
c) Hadron-nuclei-scattering, e.g. TEVATRON at FNAL

1.5. Accelerators and kinematics

1.5.1. Accelerators

1.5.2. Kinematics

1.5.3. Initial state particles

1.5.4. Particles after collision

II. Interaction of radiation with matter

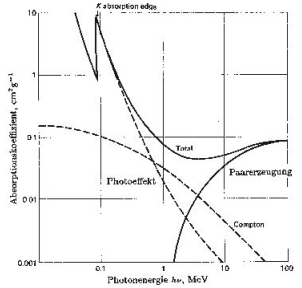
2.1. Preliminary notation and definitions

2.1.1. Cross section

2.1.2. Beam attenuation

2.1.3. Surface density, mass thickness

2.2. Interaction of photons with matter



2.2.1. Photoeffect

2.2.2. Compton scattering

2.2.3. Pair production

2.2.4. Total photon absorption cross section

III. Interaction of heavy charged particles with matter

3.1. Energy loss

3.1.1. Bohr derivation – classical case

3.1.2. Quantum mechanical result – the Bethe-Bloch-formula

3.1.3. Statistical fluctuations of $\frac{dE}{dx}$

3.1.4. Ionization yield

3.1.5. Ranges

3.2. Multiple scattering

3.3. Electron bremsstrahlung

IV. Photomultipliers and scintillation counters

4.1. Photomultiplier (PMT)

4.1.1. Processes in a PMT

a) Photoeffect
b) Thermal emission
c) Secondary electron emission in the dynodes

4.1.2. Linearity

4.1.3. Time response