A suggestion for investigating electron-muon and electron-pion scattering with electron-positron colliding beams
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Absorption of high-energy cosmic photons through
double pair production in photon-photon collisions

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Abstract. — At photon energies above
7.2 × 10^{19} \text{eV},
absorption by \( \gamma + \gamma' \rightarrow 2 e^+ + 2 e^- \) dominates that
from the lower-order process \( \gamma + \gamma' \rightarrow e^+ + e^- \) for
high-energy photons traversing a 2.8 K blackbody
photons. Existence of the 2 \( e^+ \), 2 \( e^- \) process and
the cosmic blackbody radiation thus guarantees that
the universe is opaque for all photon energies above
10^{14} \text{eV}. The question of single-pair production in
collisions with cosmic radio-wave photons is discussed,
and the uncertainty in our knowledge of the important
low-frequency end of the radio spectrum is emphasized.
Other processes (\( \gamma + \gamma' \rightarrow \muos, \muos, \text{etc.} \))
are discussed briefly, and it is concluded that they
are of minor importance.

A treatment of meson pair production
in \( \gamma\gamma \) collisions including inelasticity
and current algebra

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Abstract. — We have considered two problems
posed by dispersive approaches to \( \gamma\gamma \rightarrow \pi \pi \) and
\( \gamma\gamma \rightarrow \kappa \kappa \) amplitudes, namely the introduction of
inelastic unitarity and the ambiguity in partial wave
dispersion relation subtractions. Introducing an (\( R, \phi \))
representation for \( \pi \pi \) amplitudes, we have transformed
inelastic unitarity into an inhomogeneous Hilbert-
Riemann problem, completely defined by one subtrac-
tion and by the knowledge of meson-meson partial
amplitudes; subtractions have then been fixed impos-
ing off-mass-shell current algebra limits both for one
and two massless external mesons. Predictions on
the S wave amplitudes have also been derived from
the recent analysis of meson-meson scattering by
Protopopescu et al.

The equivalent polarised-photon approximation

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Abstract. — The equivalent photon approximation
is studied for the case where the scattered electron is
detected. The equivalent photon is then polarised.
The region of validity is found to depend on the
virtual photon scattering angle, rather than on the
electron scattering angle, and this distinction is
important. A discrepancy concerning the dependence
on beam energy of the total cross section for \( e^+ \rightarrow e^- + \muos \)
which was noted by Bonneau et al. is resolved.

Particular cases of particle production
in inelastic lepton
(anti) lepton scattering

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Abstract. — As in a previous paper we consider the
inclusive reactions \( e + e \rightarrow e + e + \text{ anything in the}
two photon exchange approximation. We present the
complete calculation of the differential cross section
\( \frac{d\sigma}{dW^2} \) for the production of a state of effective mass
\( W \) and we give the expression of the total cross section.
We apply this to the muon pair and the pseudoscalar
meson (\( \eta^0, \eta \) and \( \eta' \)) productions.

A suggestion for investigating electron-muon
and electron-pion scattering with
electron-positron colliding beams

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Abstract. — We show that it is possible, in principle,
to study the scattering between an « almost real »
muon or pion and an electron in an \( e^- + e^+ \) colliding
beam experiment where one large-angle electron and
one large-angle muon or pion would be measured...
in the final state. In the muon case, the counting rate should be high enough to allow this experiment to be performed with electron-positron storage rings of the next generation.

Nuclei as generators of quasi-real photons
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Abstract. — An equivalent photon approximation is tested for the inelastic scattering of high-energy non-hadronic particles (leptons and photons) in the electromagnetic field of nuclei. Coherent, incoherent elastic and incoherent inelastic contributions are included. As for the coherent (Coulomb) term, various nuclei (\(^{235}U\), \(^{59}Co\), \(^{12}C\)) with different types of form factors are considered. Four processes are considered: a) photoproduction of muon pairs; b) muon bremsstrahlung; c) muon trident production (term with the time-like photon only); d) neutrino production of a vector boson. The comparison of the approximation with the exact calculation is made for \(d\sigma/dW\), where \(W\) is the invariant mass of the non-hadronic system produced. The approximation works well in general. As an application, we show the full calculation of the muon trident process (except for the correction due to the Pauli principle).