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On the coherent inelastic binary and multiparticle processes in the ultrarelativistic hadron – nucleus, photon – nucleus and nucleus –nucleus collisions

The coherent inelastic processes of the type a –> b, which
may take place in the interaction of hadrons and \gamma quanta with
nuclei at very high energies (the nucleus remains the same), are
theoretically investigated. For taking into account the influence of
the nucleus matter, the optical model, based on the concept of
refraction index, is used . Analytical formulas for the effective
cross section \sigma_{coh} (a –> b) are obtained,
taking into account that at ultrarelativistic energies the
main contribution into \sigma_{coh} (a –> b) is provided by very
small transferred momenta in the vicinity of the minimum longitudinal
momentum transferred to the nucleus. It is shown that the cross
section \sigma_{coh} (a –> b) may be expressed through the
“forward” amplitudes of inelastic scattering
f_{a + N –> b + N} (0) and elastic scattering
f_{a + N –> a + N} (0) , f_{b + N –> b + N} (0) on a separate nucleon,
and it depends on the ratios L_a / R and L_b / R , where L_a, L_b are
the respective mean free paths in the nucleus matter for the particles
a and b , and R is the nuclear radius . The above formalism may be
generalized also for the case of coherent inelastic multiparticle
processes on a nucleus of the type
a –> { b_1, b_2, b_3 .... b_i } and for the case of coherent
processes at collisions of two ultrarelativistic nuclei .

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