Coherent Meson and Gamma Production via Cherenkov Effects in High-Energy Nucleus-Nucleus Collisions ◇

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We present numerical results on the refractive indices and phase velocities of pions inside a nuclear medium using a multiple scattering approach starting from experimental data on pion-nucleon forward scattering amplitudes. Our special concern is the possibility of pion radiation through Cherenkov mechanisms in relativistic nucleus-nucleus collisions. Three pionic Cherenkov bands are predicted in the energy ranges 190-320 MeV, 900-960 MeV and 80-1000 GeV. The quantum mesonic Cherenkov coherence condition as well as the thresholds and the rate of emission (and differential cross sections) for Cherenkov mesons are derived. Density and absorption effects are taken into consideration.

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Nuclear Mesonic Cherenkov-like Radiation from High Energy Nucleons ◇

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Generalized Cherenkov–like effects based on four fundamental interactions are investigated and classified. Two general Cherenkov–like coherence conditions are found as two natural limiting extremes of the same spontaneous particle emission process in nuclear media. Nuclear pionic and nuclear kaonic Cherenkov–like radiation (NPICR and NKCR) produced by high–energy nucleons passing through a nuclear medium are systematically studied using a quantum theoretical approach. The pion and kaon refractive indices, the pion and kaon phase velocities as well as the NPICR and NKCR thresholds are calculated via the Foldy-Lax multiple scattering formalism having as input the experimental data for the elementary pion–nucleon and kaon–nucleon forward scattering amplitudes. The differential cross sections, the angle–energy correlations, as well as some other essential signatures of coherent pion and kaon production via a Cherenkov mechanism with high–energy proton beams are presented. Compressed nuclear media with densities up to five times normal nuclear matter density are taken into account.

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Nuclear Pionic Cherenkov-like Radiation from High Energy Nucleons ◇

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The possibility of nuclear pionic Cherenkov–like radiation (NPICR) produced by high energy nucleons passing through a nuclear medium is investigated using a quantum theoretical approach. The pion refractive indices and the NPICR thesholds are calculated. Three pionic Cherenkov–like bands, in the regions 190–315 Mev, 910–960 Mev, 80–1000 GeV, are predicted. The cross sections as well as other essential signatures of coherent pion production via NPICR with high energy proton beams are presented.

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