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Diffraction mechanisms in $pp \rightarrow pp \pi^0$ reaction at high energies

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The amplitudes for $pp \rightarrow pp \pi^0$ process at high energy discussed given. Both diffractive bremsstrahlung and diffractive π^0 -rescattering (Drell-Hiida-Deck (DHD) type model) as well as photon-photon and photon-omega exchange mechanisms are included in the calculation and discussed in detail. Fairly large cross sections of the order of mb are predicted. The corresponding differential cross sections in rapidities and transverse momenta of outgoing protons and pions as well as relative azimuthal angle between outgoing protons are calculated for ISR, RHIC and LHC energies. The hadronic bremsstrahlung contributions dominate at large (forward, backward) pion rapidities. The diffractive non-resonant background contributes at small $\pi^0 p$ invariant mass and could be therefore misinterpreted as the Roper resonance. We predict strong dependence of the slope on the mass of the excited system. At high energies and midrapidities the photon-photon contribution dominates over the diffractive components, however, the corresponding cross section is rather small. Our predictions are ready for verification at RHIC and LHC. The bremsstrahlung mechanisms discussed here contribute also to $pp \rightarrow p(n\pi^+)$ reaction. Both channels give a sizeable contribution to the low-mass single diffractive cross section and must be included in extrapolating measured experimental single diffractive cross section.

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