Electromagnetic Waves in Born Electrodynamics

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We study two counter-propagating electromagnetic waves in the vacuum within the framework of the Born-Infeld theory in quantum electrodynamics. By choosing the crossed field case $\mathbf{E}\cdot\mathbf{B} = 0$, *i.e.* $\mathfrak{G}^2 = 0$, the Born–Infeld Lagrangian reduces to the Born Lagrangian, therefore for this special case we present study which is identical for the Born–Infeld and the Born electrodynamics.

In this paper, we show that the non–linear field equations decouple for ordinary wave case using self-similar solutions and we investigate the shock wave steepening. We show that the only solutions are exceptional traveling wave solutions which propagate with constant speed and which do not turn into shocks. We discuss the phase shift and the cross section of the process to be measured together with the our proposed direct detection of the photon–photon scattering. This work serves as a preliminary study towards analyzing the waves in the more general case in the Born-Infeld theory.