Self-Consistent Regimes of Vacuum Breakdown in Extreme Fields of an M-Dipole Wave

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Perspective 10 PW-class lasers in the near future will be able to explode the vacuum giving rise to dense electron-positron plasma. The creation of a dense matter in the vacuum by means of light heavily relies on maximizing laser field intensity. Ultimately, the maximum electric or magnetic field at given power can be achieved in the focal spot of a dipole wave [1] which can be effectively mimicked by the multi-beam laser system. Vacuum breakdown by means of an e-dipole wave, including different self-consistent regimes of interaction, has been studied previously [2,3]. In this report, we consider self-consistent nonlinear regimes of vacuum breakdown in the field of an m-dipole wave maximizing magnetic field in the center [4]. Electron-positron pair plasma structure, in this case, has the form of concentric rings lying in the central plane. It is shown that maximum compression is achieved at the transient stage between linear and nonlinear regimes, and unlike the case of an e-dipole wave, there is no singular behavior at the later stages of dynamics. Angular and spectral properties of emitted charged particles and photons are considered.

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