



Generation of Collimated Electron Jets from Plasma under Applied Electromagnetostatic Field

Jing Qiu (1) and Shangbin Yang (2)

(1) Shanghai Institute of Optics and Fine Mechanics, State Key Laboratory of High Field Laser Physics, China (ontheair@siom.ac.cn), (2) Key laboratory of Solar Activity, National Astronomical Observatories, Chinese Academy of Sciences

The collimated electron jets ejected from cylindrical plasma are produced in particle-in-cell simulation under the applied longitudinal magnetostatic field and radial electrostatic field, which is a process that can be conveniently performed in a laboratory. We find that the applied magnetostatic field contributes significantly to the jet collimation, whereas the applied electrostatic field plays a vital role in the jet formation. The generation mechanism of collimated jets can be well understood through energy gain of the tagged electrons, and we conclude that the longitudinal momentum of the electrons is converted from the transverse momentum via the transverse induced magnetic field. It has been found that the ejecting velocity of the jets is close to the speed of light when the applied electrostatic field reaches . It is also found that the relative magnetic helicity is exchanged between the plasma region and the vacuum region, indicating that the electron jets could achieve the energy transformation. The present scheme may also give us an insight into understanding the particle acceleration mechanism of space plasma in extreme transient astrophysical phenomena.