ICRC
The Astroparticle Physics Conference
34th International Cosmic Ray Conference
July 30 - August 6, 2015
The Hague, The Netherlands

Contribution ID: **155** Type: **Poster contribution**

ELECTRON HEATING IN A RELATIVISTIC, WEIBEL-UNSTABLE PLASMA

Tuesday, August 4, 2015 4:00 PM (1 hour)

The dynamics of two initially unmagnetized relativistic counter-streaming homogeneous ion-electron plasma beams are simulated in two dimensions using the particle-in-cell (PIC) method. It is shown that current laments, which form due to the Weibel instability, develop a large scale longitudinal electric eld in the direction opposite to the current carried by the laments as predicted by theory. This eld, which is partially inductive and partially electrostatic, is identied as the main source of net electron acceleration, greatly exceeding that due to magnetic eld decay at later stages. The transverse electric eld, though larger than the longitudinal one, is shown to play a smaller role in heating electrons, contrary to previous claims. It is found that, in 1D, the electrons become strongly magnetized and are not accelerated beyond their initial kinetic energy. Rather, the heating of the electrons is enhanced by the bending and break-up of the laments, which releases electrons that would otherwise be trapped within a single lament and slow the development of the Weibel instability (i.e. the magnetic eld growth) via induction as per Lenz's law. In 2D simulations electrons are heated to about one quarter of the initial kinetic energy of ions. The magnetic energy at maximum is about 4 percent, decaying to less than 1 percent by the end of the simulation. The ions are found to gradually decelerate until the end of the simulation by which time they retain a residual anisotropy less than 10 percent.

Collaboration

– not specified –

Registration number following "ICRC2015-I/"

168

Primary author: KUMAR, Rahul (Ben Gurion University)

Presenter: KUMAR, Rahul (Ben Gurion University)

Session Classification: Poster 3 CR

Track Classification: CR-TH