SIMULATION OF RELATIVISTIC SHOCKS AND ASSOCIATED SELF-CONSISTENT RADIATION

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Plasma instabilities excited in collisionless shocks are responsible for particle acceleration. We have investigated the particle acceleration and shock structure associated with an unmagnetized relativistic electron-positron jet propagating into an unmagnetized electron-positron plasma. Cold jet electrons are thermalized and slowed while the ambient electrons are swept up to create a partially developed hydrodynamic-like shock structure. In the leading shock, electron density increases by a factor of about 3.5 in the simulation frame. Strong electromagnetic elds are generated in the trailing shock and provide an emission site. These magnetic elds contribute to the electrons transverse deection behind the shock. We calculate the radiation from deected electrons in the turbulent magnetic elds. The properties of this radiation may be important for understanding the complex time evolution and/or spectral structure in gamma-ray bursts, relativistic jets in general, and supernova remnants.