Abstract Submitted
for the DPP07 Meeting of
The American Physical Society

The role of thermal and runaway electrons in lightning initiation[1]

M. BAKHTIARI, J. R. DWYER, H.K. RASSOUL, Z. SALEH, Florida Institute of Technology — Relativistic runaway breakdown acting on extensive cosmic-ray air showers is one of the proposed mechanisms for solving the mystery of lightning initiation. In this mechanism an air shower creates an avalanche of runaway electrons in neutral air, leaving behind a weakly ionized plasma with a tiny population of thermal electrons. Some researchers have suggested that this weakly ionized plasma produces enough conductivity to develop a lightning leader. In this presentation, we revisit the dynamics of runaway electrons in electrified air, and we obtain a pitch angle scattering term in the single-particle trajectory in momentum- space. This term considerably changes the picture of the single-particle runaway electron trajectory in neutral gases, illustrating the importance of elastic scattering for runaway electron calculations. In addition, we have used a Monte Carlo simulation to investigate whether the number of thermal electrons generated during a runaway electron avalanche is enough to induce the necessary conductivity for developing the lightning leader.

[1]This work was supported by the NSF under Grant No. ATM 0133773.

M. Bakhtiari
Florida Institute of Technology

Date submitted: 20 Jul 2007 Electronic form version 1.4