Abstract Submitted
for the DPP06 Meeting of
The American Physical Society

Wave-breaking limits for relativistic electrostatic waves in a warm plasma RAOUL TRINES, PETER NORREYS, CCLRC Rutherford Appleton Laboratory — The propagation of electrostatic plasma waves having elativistic phase speed and amplitude has been studied. The plasma is described as a warm, relativistic, collisionless, nonequilibrium electron fluid. Wave breaking limits for the electrostatic field are calculated for non-relativistic initial plasma temperatures and arbitrary phase velocities. Particular care is given to the ultra-relativistic regime ($\gamma_\varphi^2 kT_0/m_e c^2 \gg 1$), since conflicting results for this regime have been published in literature. It is shown here that the ultra- relativistic wave-breaking limit will reach arbitrarily large values for $\gamma_\varphi \to \infty$ and fixed initial temperature. Previous studies claiming that this limit is bounded even in the limit $\gamma_\varphi \to \infty$ are shown to suffer from incorrect application of the relativistic fluid equations and higher, more realistic wave breaking limits are appropriate. These results will have important consequences for the study of background electron trapping and acceleration in laser-plasma and beam-plasma interactions.

Raoul Trines
CCLRC Rutherford Appleton Laboratory

Date submitted: 21 Jul 2006 Electronic form version 1.4