Breaking of a relativistic plasma wave in a thermal plasma: Peakons and beyond.

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The use of the waterbag model in the solution of the relativistic Vlasov equation allows us to investigate analytically the structure of the singularity that is formed in a relativistic large amplitude Langmuir wave close to the wavebreaking limit.
At wavebreak the electron density distribution has a typical "peakon" form [1], i.e. the form of the singularity that arises in nonlinear partial differential equations [2, 3] describing waves on shallow water and that has the shape of a soliton with a discontinuous first derivative.
The maximum value of the electric field in a thermal breaking plasma is obtained and compared to the cold plasma limit.

Direct numerical integrations of the Vlasov equation for different initial electron distribution functions are performed and compared to the the analytical results. These numerical integrations allow us to extend our investigation beyond the limit of applicability of the waterbag model.

References

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