Collisions of Solitons

Fully kinetic simulation of plasmas

M. Jenab

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Marseille, France

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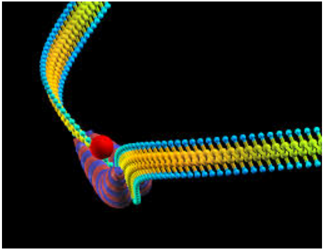

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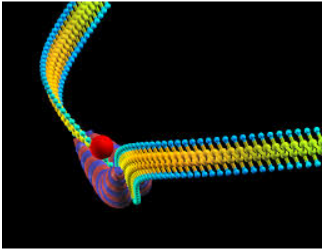
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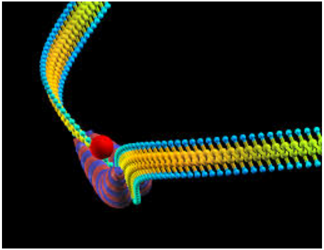

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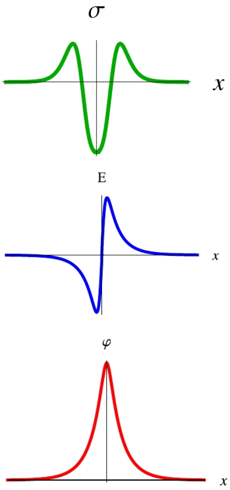

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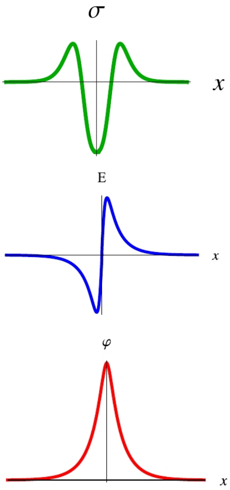

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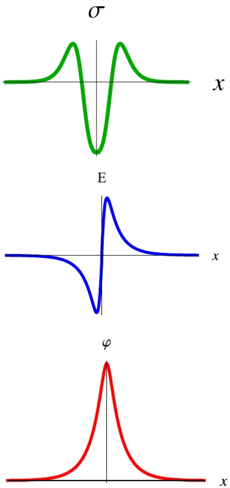

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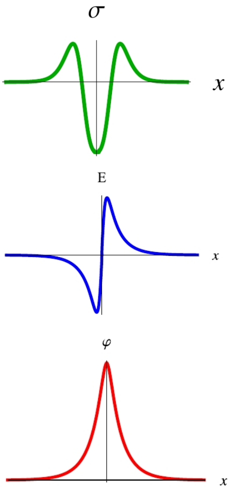

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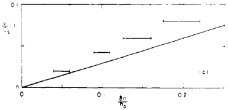

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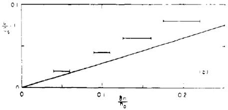

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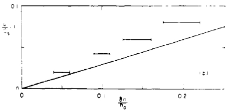

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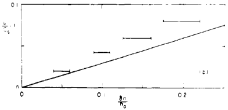

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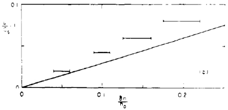

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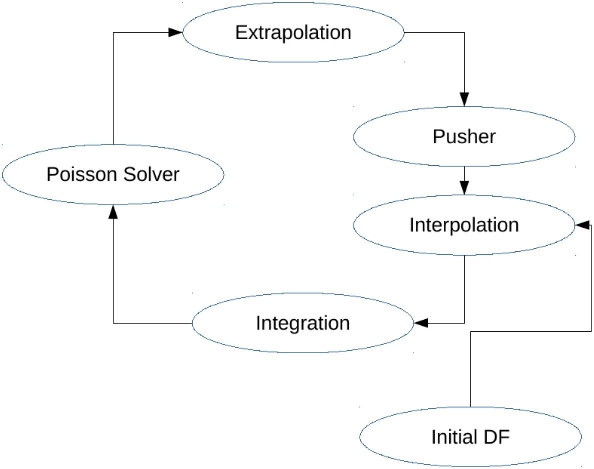

Schematic representation of one time step.

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Schamel Distribution Function

♦ Definition:

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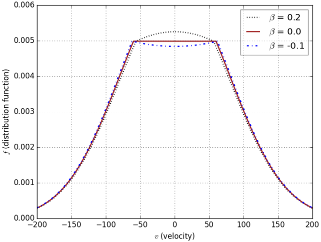

cross section of distribution function on the velocity direction.

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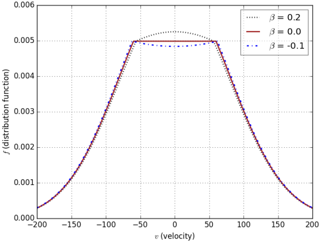

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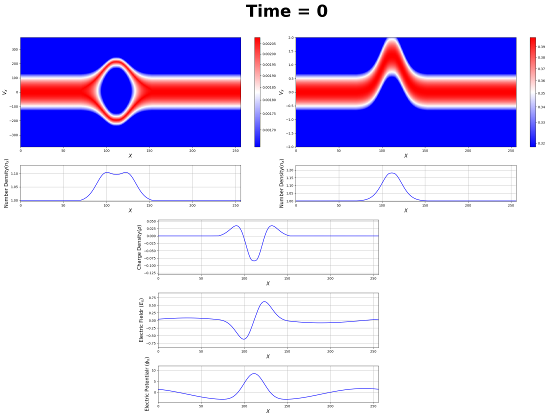
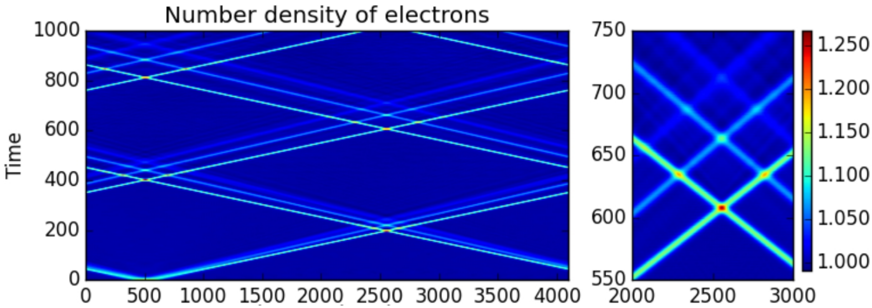


what soliton looks like on kientic and fluid level.

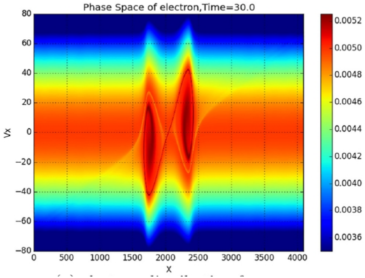
2_one_soliton_propgation.avi

Chain formation process

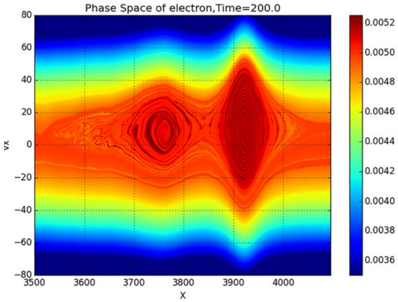


Chain formation process creates 3 ion-acoustic solitons.

Evolution in Phase Space



First Step: break up of the stationary hole into two counter-propagating holes

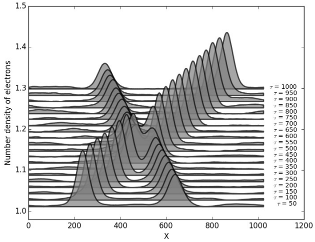


Second Step: break up of the moving hole into number of holes (chain formation)

1) Overtaking Collisions

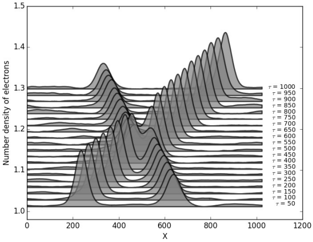
◆ Scenario:

Collision of solitons propagating in the same direction with large relative velocity.



temporal evolution of number density.

1) Overtaking Collisions



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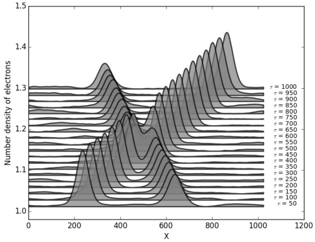

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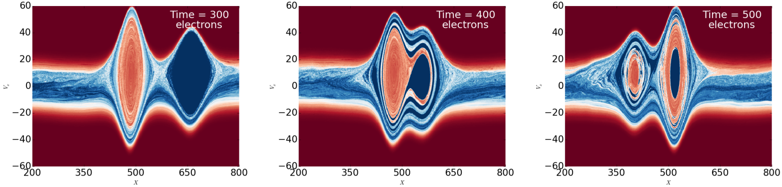
Evolution of electron holes



temporal evolution in phase space during overtaking collision.

2) Head-on Collisions

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Collision of solitons propagating in the opposite direction

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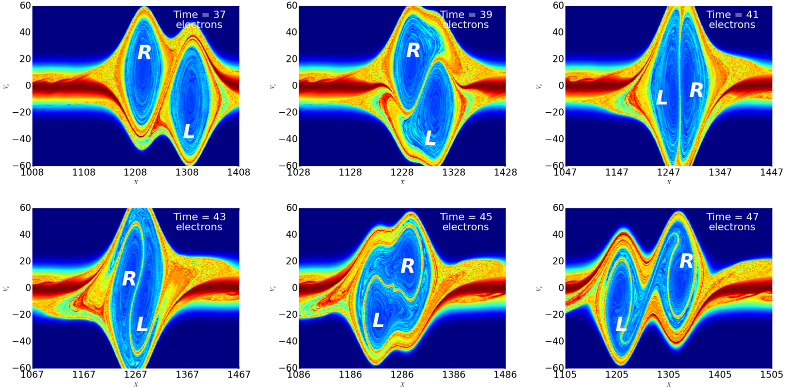
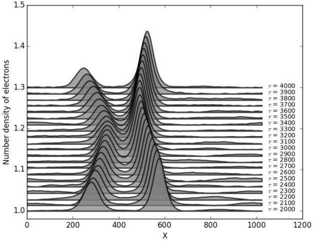


Trapped populations rotate around each other during head-on collisions, some parts of trapped populations being exchanged [3].

Scattering Collisions



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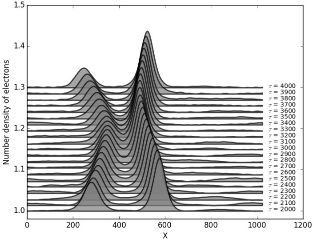

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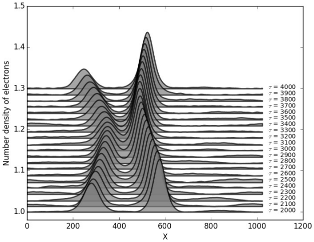

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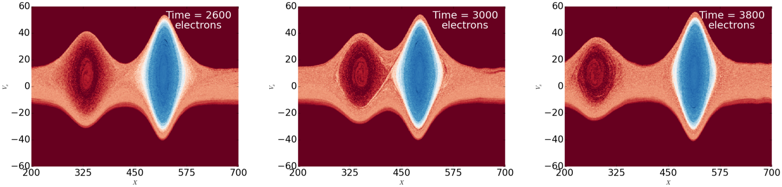

In case of overtaking collisions and **small relative velocity** the effect of trapped population cause two solitons to repel each other. **Solitons scatter** from each other instead of passing through.

Future steps:

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- usual soiltons: dust-ion-acoustic solitons, and ...
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