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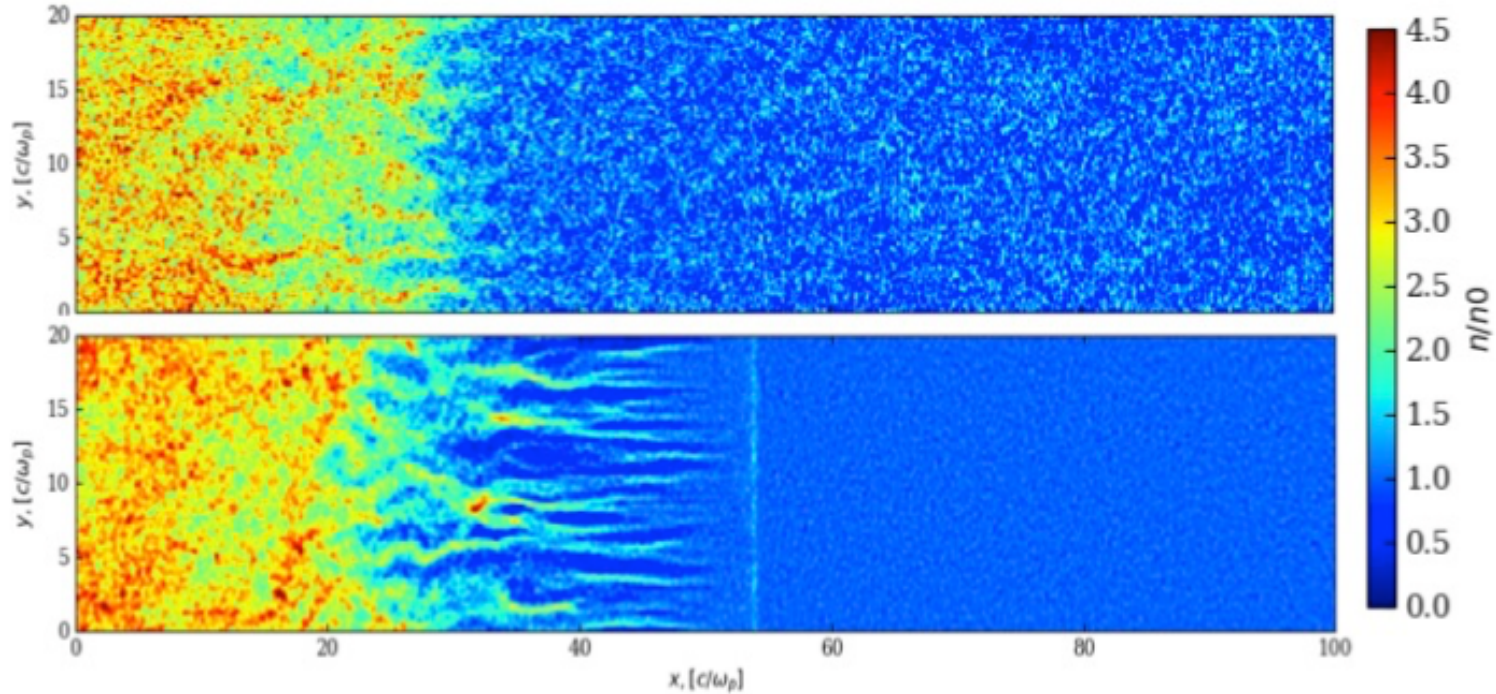
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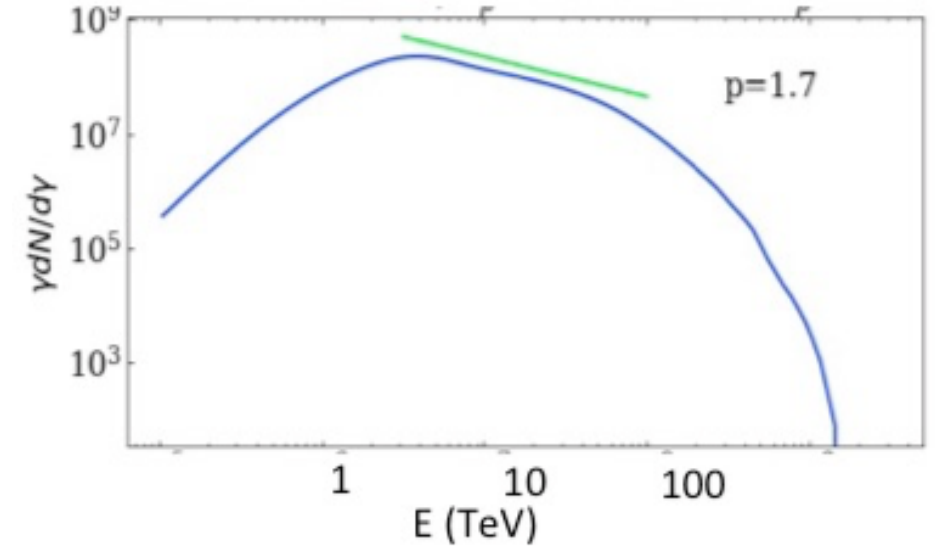
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# First Principles Kinetic Simulations of Relativistic Collisionless Shocks and Their Particle Acceleration

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Plasma density distributions in test 2D kinetic shock simulations ( $\Gamma \sim 10^6$ ) without (upper) and with numerical instability control (lower). The lower panel clearly shows physical modes (Weibel instability in this case), which are destroyed by unphysical high frequency noise in the simulations without numerical instability control.



Particle energy distribution  $\gamma dN/dy$  for electrons and positrons. We observe a clear power-law energy distribution as an outcome of particle acceleration at shocks.