Compare Simulation Data with Theory

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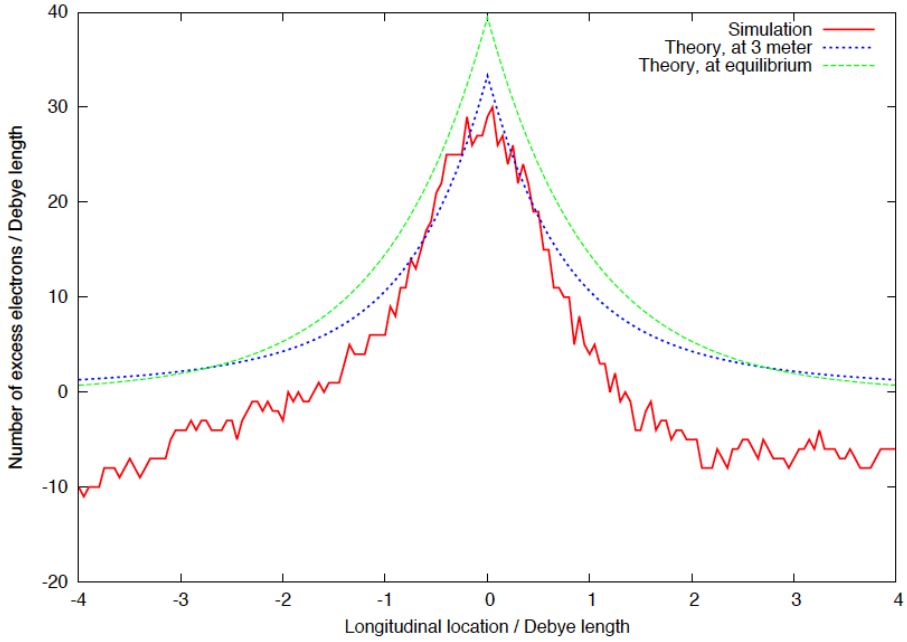
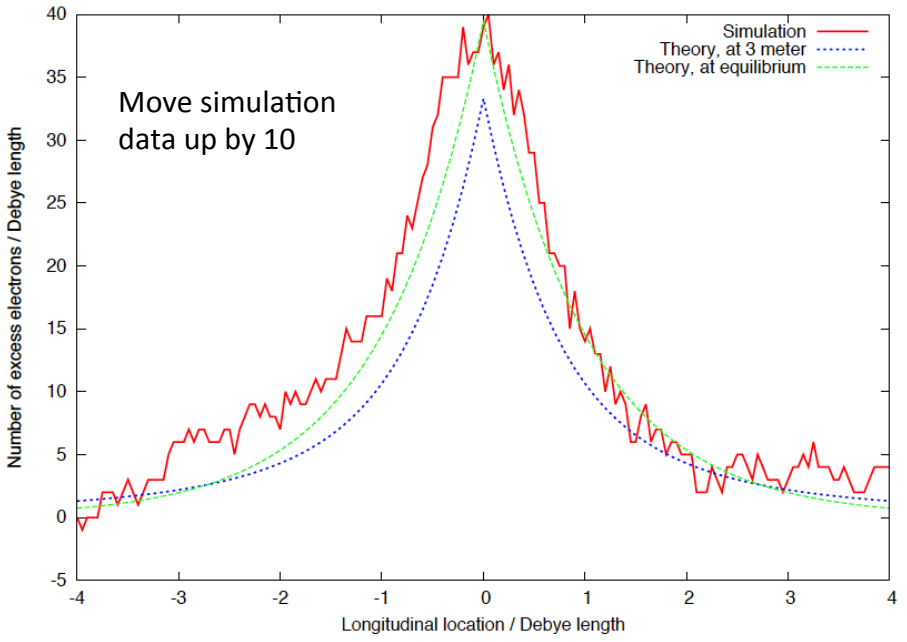
Analytical Results

The theory assumes Kappa-2 distribution of background electrons' velocities and uniform spatial density. Electrons' line number density distribution due to the modulation reads

$$\lambda_1(z) = \int_0^{\omega_p t} d\tau \int_{-\infty}^{\infty}\int_{-\infty}^{\infty} n(\vec{x},\tau)\,dx\,dy = \frac{Z_i}{\pi a_z}\int_0^{\omega_p t} \frac{\tau\sin(\tau)}{\left(\overline{z}+\overline{v}_z\tau\right)^2+\tau^2}\,d\tau$$

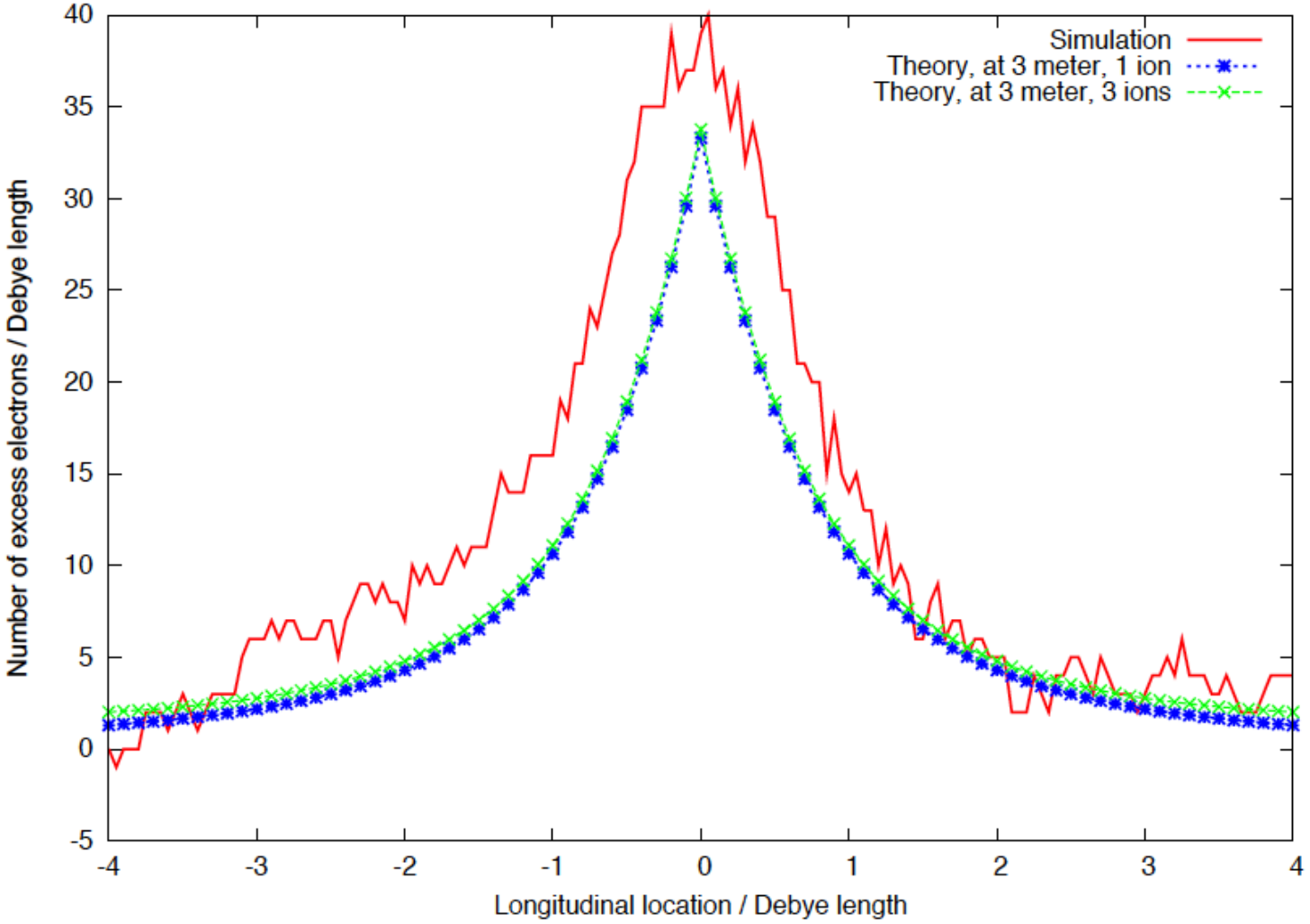
$$\text{For } v_z = 0, \text{ above formula reduces to } \lim_{t\to\infty}\lambda_1(z) = \frac{Z_i}{2a_z}\exp\left(-\frac{|z|}{a_z}\right)$$





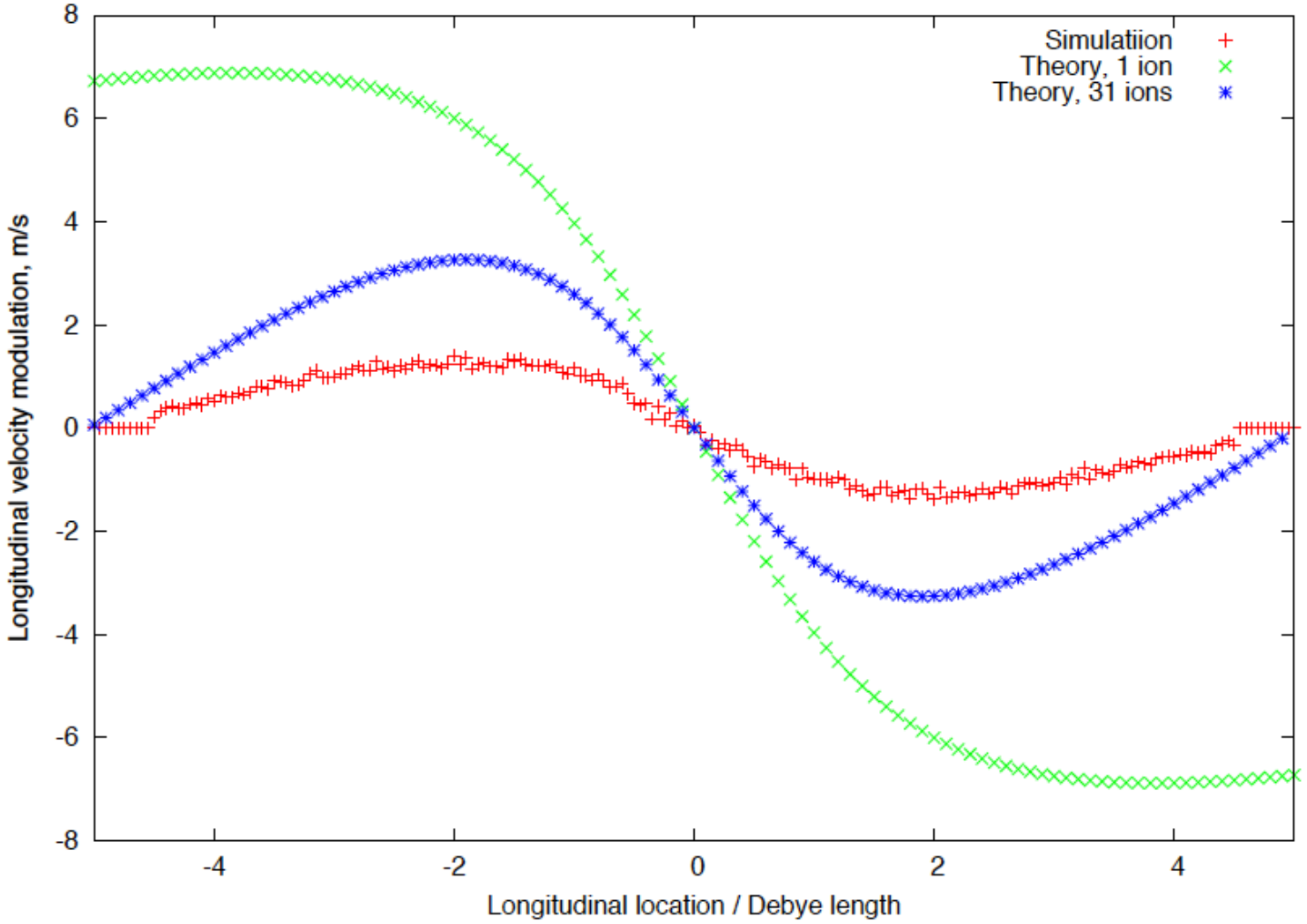
Superposition of ions?

Superposition of multiple ions does not seem to explain the discrepancy between theory and simulation.



Velocity Modulation

Super-position of multiple ions give better agreement on the overall shape, but the amplitude is off...



... by a factor of 2.5 ?