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Drift velocity measurements and enhanced Thomson scattering in a magnetic reconnection current sheet

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The release of stored magnetic energy through magnetic reconnection often leads to imbalanced particle energy distributions, however the mechanisms producing non-equipartion are poorly understood.
Thomson scattering measurements in pulsed-power experiments of driven, collisional, super-Alfvenic magnetic reconnection have shown strong heating of ions, with Ti»Te, much greater than can be accounted for by classical shock, resistive and viscous heating mechanisms [1].
We investigate the source of the anomalous ion heating further, performing collective IAW TS measurements sensitive to plasma velocity in the direction of the reconnection electric field [2]. This reveals electron drift velocities exceeding the sound speed of the plasma: a criterion for ion acoustic turbulence (IAT). An assessment of the spectrally integrated TS signal inside the current sheet also shows an enhancement in the scattered intensity, above the expected level of thermally-driven acoustic waves, which is only present for current-aligned K vectors. However, the spectral shape of the observed IAWs is not consistent with previous observations of IAT [3]. We discuss and analyse potential implications of this measurement.
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References

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