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## Limit of Alfvénic Heating in ICME Magnetic Clouds: An Observational Perspective

We investigate the temperature distribution for Alfvénic and non-Alfvénic regions in Interplanetary Coronal Mass Ejections (ICMEs). Our analysis reveals that approximately 63% of the ICME magnetic cloud regions are non-Alfvénic, while 37% exhibit Alfvénic characteristics, predominantly outward fluctuations. We observe significant temperature enhancements in Alfvénic regions, with the most notable heating occurring around 20 eV, whereas heating extends up to 40 eV. These findings align with theoretical models and simulations of Alfvén wave dissipation mechanisms. Our observations also show distinct parallel and perpendicular heating behavior, with outward Alfvénic regions exhibiting higher parallel heating and both inward and outward regions showing perpendicular heating. This study highlights the crucial role of Alfvénic fluctuations in ICME plasma heating and may offer potential constraints on their contribution to other space plasma environments.

### Contribution Type

### Theme

Energetic Phenomena

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