

Wave-Particle Interaction: Lessons from the Sun and the Heliosphere for Galactic Acceleration Processes

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Turbulent plasma waves are an indispensible ingredient for both the ion acceleration in impulsive flares at the Sun and for first-order Fermi acceleration at interplanetary traveling shocks. This is demonstrated on theoretical and observational grounds for both impulsive and gradual solar energetic particle events. In particular, the process of self-consistent Alfven wave amplification and ion acceleration upstream of CME-driven interplanetary shocks has been studied in data from the ACE magnetometer and from the SOHO/CELIAS/STOF sensor. Data from the latter sensor also suggest that the preferential 3He++ acceleration in impulsive events is consistent with a model on direct acceleration of ions in electron firehose waves in the source plasma of impulsive flares. The implications of these observations for Galactic acceleration processes are discussed.