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Wind Observations of Wave Heating and/or Particle Energization at Supercritical Interplanetary Shocks

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We present the first observations at supercritical interplanetary shocks of large amplitude (> 100 mV/m pk-pk) solitary waves, ~30 mV/m pk-pk waves exhibiting characteristics consistent with electron Bernstein waves, and > 20 nT pk-pk electromagnetic lower hybrid-like waves, with simultaneous evidence for wave heating and particle energization. The solitary waves and the Bernstein-like waves were likely due to instabilities driven by the free energy provided by reflected ions [*Wilson III et al.*, 2010]. They were associated with strong particle heating in both the electrons and ions. We also show a case example of parallel electron energization and perpendicular ion heating due to a electromagnetic lower hybrid-like wave. Both studies provide the first experimental evidence of wave heating and/or particle energization at interplanetary shocks. Our experimental results, together with the results of recent Vlasov [*Petkaki and Freeman*, 2008] and PIC [*Matsukiyo and Scholer*, 2006] simulations using realistic mass ratios provide new evidence to suggest that the importance of wave-particle dissipation at shocks may be greater than previously thought.