



The formation of the ion seed population at quasi-parallel shocks

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Collisionless shocks in space plasma are known to be capable of accelerating particles to very high energies through Fermi acceleration. However, this process requires an injection of a suprathermal ion seed population. The process of how the ion seed population is formed is still not fully understood. In this work, we studied the formation of the ion seed population as a result of solar wind ions being reflected off short large amplitude magnetic structures (SLAMS) in the quasi-parallel bow shock of Earth. For our analysis, we used field and particle data from the four Cluster satellites. In order to follow the ion dynamics at fast temporal scales we used ion subspin data from times when the separation of the satellites was ~ 100 km. We have found that SLAMS nearly specularly reflect solar wind ions through magnetic mirroring. We have also performed test particle simulations of ions encountering a SLAMS using field data from the satellites. The simulations show that solar wind ions with lower energy are more likely to be reflected off the SLAMS while high energy ions pass through the SLAMS, which is consistent with observational ion data. Additionally, high energy ions are observed upstream of the shock. These are most likely ions that were reflected off a SLAMS and energy conservation in the solar wind frame causes an increase of energy in the spacecraft frame.