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# Energetic particle generation in CIR with and without magnetic decrease structures

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Corotating interaction regions (CIRs), which are the plasma and field compression regions, are typically bounded by a pair of shock waves (forward/reverse shock) at the heliocentric distance $>$ 2AU. The spacecraft observations have found the increases in energetic particle intensities coinciding with CIR events, especially exhibiting the peaks at its boundaries. This implies that the effective acceleration process is taken place at the forward and reverse shocks. Furthermore, the intensity increase near the reverse shock is mostly larger than than those measured near the forward shock.

We perform one-dimensional hybrid simulations which show the evolution of both forward and reverse shocks simultaneously to account for such an asymmetric feature. The result indicates that the reverse shock becomes a quasi-parallel regime by the reduction of tangential field amplitudes due to the solar wind adiabatic expansion. Thus ion injection into diffusive shock acceleration process is more easily established, resulting in the thermal solar wind possibly accelerated up to the suprathermal range.

On the other hand, the magnetic decrease structures (MDs) are well developed in the reverse shock downstream via the interaction of large-amplitude Alfven waves embedded in the fast solar wind with the shock. Since the MD carries more particles away from the shock front, the temporal development of the reverse shock, such as the transition to a quasi-parallel regime, is suppressed. Therefore, in the presence of MDs, the acceleration efficiency at the reverse shock is declined.

By the meeting, we will further investigate the energetic particle profile throughout a whole CIR and compare the results with observational features.

Keywords: CIR, shock, particle acceleration, magnetic decrease