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A Data-Driven Analytical Model for Proton Acceleration at Remotely Observed Low Coronal Shocks

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We have recently studied the development of a large-scale off-limb coronal bright front (OCBF) low in the solar corona (Kozarev et al., 2015), by using remote observations from the Solar Dynamics Observatory's Advanced Imaging Assembly EUV telescopes, combined with several data-driven models. Similar to previous studies (Kozarev et al., 2011; Downs et al., 2012), we determined that the observed feature is a driven magnetohydrodynamic (MHD) wave, which steepens into a shock within the AIA field of view (FOV). In that study, we obtained high-temporal resolution estimates of parameters of the OCBF, which regulate the efficiency of acceleration of charged particles within the theoretical framework of Diffusive Shock Acceleration (DSA). These parameters include the time-dependent shock radius R_{sh}, speed V_{sh} and strength r, as well as the upstream (in the shock frame) potential coronal magnetic field orientations with respect of the shock surface normal, θ_{BN}. Because of the very high cadence of the AIA telescope, we were able to obtain estimates of these quantities for every 12 seconds of the approximately 8 minutes, which the OCBF spent in the AIA field of view. Here we present a simple analytical model for the particle acceleration from low in the corona, which has been developed to incorporate the remotely observed OCBF properties described above. We showcase the model by applying it to the event studied in Kozarev et al. (2015), and show that it can produce significant increase in the particle energies during the short passage of the OCBF in the AIA field of view.