IRIS Observations of Magnetic Reconnection and Chromospheric Evaporation in a Solar Flare

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NASA's IRIS mission has observed signatures of the Fe XXI 1354 line in tens of solar flares. In many of them, large blue shifts were identified, supporting the scenario of chromospheric evaporation in postflare loops. In the standard CSHKP flare model, the postflare loops are a natural consequence of magnetic reconnection occurring at the flare site. The CSHKP model also predicts downflow (and upflow) plasma having a speed close to the Alfven speed. Yet, to date there were no observations of fast moving downflow plasma in flares. Here, we report the first detection of large red shift (~200 km/s along line of sight) of the Fe XXI line with IRIS. Combined imaging and spectroscopic observations of IRIS, together with SDO/AIA and RHESSI observations, reveal that the redshifted Fe XXI feature co-located with the loop-top hard X-Ray source and above the retracting loops. We interpret this large redshift as signature of downward moving reconnection outflow/retracting loops. Possible flux rope eruption and reconnection inflows are also observed. Furthermore, we found that the entire Fe XXI line is blueshifted by ~250 km/s at the loop footpoints. Cool lines of Si IV, O IV, C II and Mg II all show obvious redshift at the same locations, consistent with the scenario of chromospheric evaporation. The map of electron temperature reconstructed from SDO/AIA observations shows that the locations of ~10MK temperature generally coincide with the observed Fe XXI feature very well. Hard X-rays up to ~100keV were found from RHESSI observations, indicating an efficient electron acceleration process in this event.