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On the Response of the Transition Region and the Corona to Rapid Excursions in the Chromosphere

Spicules are the thin, hair/grass-like structures prominently observed at the chromospheric solar limb. It is believed that fibrils and Rapid Blue and Red Excursions (RBEs and RREs; collectively referred to as REs) correspond to on-disk counterparts of type I spicules & type II spicules, respectively. Our investigation focuses on observing the response of these REs alongside similar spectral features in the chromosphere, transition Region (TR), and corona, utilizing space-time plots derived from coordinated observations from SST/H α , IRIS, and SDO. Our analysis reveals upflowing REs, promptly reaching temperatures characteristic of the TR and corona, indicating a multi-thermal nature. Similarly, downflowing features exhibiting similar spectral signatures over the disk display plasma motion from the corona to chromospheric temperatures, demonstrating a multithermal nature. In addition to distinct upflows and downflows, we observe sequential upflow and downflow along the same path, depicting a distinctive parabolic trajectory in space-time plots of observations sampling TR and various coronal passbands. Similar to isolated upflows and downflows, these REs also exhibit a multi-thermal nature throughout their trajectory. Furthermore, our results reveal a more intricate motion of the REs in which both upflow and downflow coexist at the same spatial location. On a different note, our analysis, utilizing coordinated IRIS spectral observations, shows spatio-temporal redshifts/downflows in both the TR and chromosphere, suggesting that at least subsets of the strong redshifts/downflows observed in TR temperature spectra result from the returning, from the upper atmosphere flow of plasma in the form of bundles of spicules or features exhibiting similar spectra.

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