M41a Various Chromospheric Heating Events in Emerging Flux Regions

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Emerging flux regions (EFRs) are known to exhibit various sporadic local heating events in the chromosphere. In order to investigate the characteristics of such events, particularly of their relation with magnetic context, we analyzed Hinode-IRIS coordinated observation data of a newly emerging flux region in NOAA AR 12401 (August 19, 2015). Out of 151 small brightenings identified in Hinode/SOT Ca images, we show the analysis results of 29 events that were overlapped by an SOT/SP scan. Here, 7 events were found to possess mixed polarity backgrounds. The Mg II h&k and other UV spectra of the mixed-polarity events obtained by IRIS had enhanced and broadened profiles that are highly suggestive of bi-directional jets. Their light curves showed flare-like, fast-rise-extended-decay patterns with durations of 10–15 minutes. Moreover, the high-resolution vector field data by SOT/SP revealed that most of these events were dominated by "bald patches," the dipped curvature field lines. The other 22 events, on the other hand, were found in unipolar regions, mostly at the periphery of the EFR. These events were generally weaker in UV intensity and exhibited systematic redshifts with Doppler speeds up to about 35 km/s (Si IV), which is approximately the local sound speed. In both types of events, the Mg II triplet showed enhanced intensities in emission, indicating a sudden temperature increase in the lower chromosphere. These observational results support the picture that heating events in the EFR center are due to magnetic reconnection between colliding magnetic elements of opposite polarities (i.e. Ellerman bombs), while the peripheral heatings are caused by fast downflows along the arch filament systems.