Session 2

Traits of a quiet Sun Ellerman Bomb

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The focus of this investigation is to quantify the conversion of magnetic to thermal energy initiated by a quiet Sun cancellation event and to explore the aspect of current dissipation resulting from the interaction of the opposite polarity magnetic features. Using a quiet Sun disk center observation acquired with the Swedish Solar Telescope (SST), we studied a reconnection-related cancellation and the appearance of a quiet Sun Ellerman bomb (QSEB). The data has imaging spectroscopy in the Balmer $H\alpha$ line at 656 nm, along with spectropolarimetry in the Fe I 617 nm, Ca II 854 nm lines. The event that we studied involves a pre-existing magnetic feature of positive polarity reconnecting with an emerging negative polarity feature of a relatively smaller size. In addition to enhancements in the wings of $H\alpha$, and both the core and the wings of the Ca II line profile, we also observe an increase in both the wings and core of the Fe I spectral line as well. To the best of our knowledge, this is the first time a QSEB leaving its imprint in the Fe I 617 nm spectral line is reported. From FIRTEZ-dz inversions of the spectropolarimetric data, we obtained a flux cancellation rate of 5.9 × 1014 Mx/s which is comparable to that reported for EBs, and a temperature enhancement of 882.0 K at the photospheric height ($\log \tau = -1.5$) and that of 854.3 K at the chromospheric height ($\log \tau = -5.0$). We also derived total magnetic energy within the height between $\log \tau = -1.5$ and $\log \tau = -5.0$ and found it to be in the range of [1019 − 1022] erg and thermal energy in the range of [1018 − 1021] erg, implying that the magnetic energy released during the flux cancellation event can support heating in the range of heights covering photosphere and chromosphere. The inversion results also showed the presence of a current sheet between the cancelling magnetic features and it points to a significant contribution of current dissipation to heating from the photosphere to the chromospheric heights.