Session 2

Stratification of physical parameters in a C-class solar flare using multi-line observations

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We present high-resolution and multiline spectropolarimetric observations of a C2-class solar flare (SOL2019-05-06T08:47). The rise, peak, and decay phases of the flare were recorded continuously and simultaneously in the Ca II K, Ca II 8542 Å, and Fe I 6173 Å lines with the CRISP and CHROMIS instruments at the Swedish Solar Telescope. The observations in the chromospheric Ca II lines exhibit intense brightening near the flare footpoints. At these locations, a non-LTE multiline inversion code (STiC) was employed to infer the stratification of temperature, magnetic field, line-of-sight velocity, and microturbulent velocity at the flare footpoints. We also estimated radiative losses in the lower limited chromosphere from the Ly-alpha, singly ionized Ca and Mg atoms using the semi-empirical model atmosphere inferred from the inversion of the CRISP and CHROMIS datasets. The stratification and temporal analysis of the inferred parameters shows the evidence of chromospheric heating, the presence of both chromospheric evaporation and condensation at the flare footpoints. Moreover, we have also obtained a high spatial-resolution map of integrated radiative losses around the flare peak time. The stratification of the net cooling rate suggests that the Ca IR triplet lines are responsible for most of the radiative losses in the flaring atmosphere. The maximum value of integrated radiative losses is reached around the flare peak time, and can go up to 175 kW m−2 for a single pixel located at footpoint. The obtained radiative losses values are also compared with the RADYN flare simulations. Our analysis illustrates that even a less intense C-class flare can heat the deeper layers of the solar chromosphere, mainly at the flare footpoints.