We present high-resolution and multi-line observations of a C2-class solar flare, occurred in NOAA AR 12740 on May 6, 2019. The rise, peak, and decay phases of the flare were recorded continuously and quasi-simultaneously in the Ca II K line with the CHROMIS instrument, the Ca II 8542 Å and Fe I 6173 Å lines with the CRISP instrument at the Swedish 1-m Solar Telescope. A non-LTE STIC inversion code was employed to infer the temperature, magnetic field, line-of-sight (LOS) velocity, and microturbulent velocity stratification in the flaring atmosphere. The temporal analysis of the inferred temperature at the flare footpoints shows that the flaring atmosphere from log(T) ~ −2.5 to ~3.5 is heated up to 7 kK, whereas from log(T) ~ −3.5 to ~5 the inferred temperature ranges between ~7.5 kK and ~11 kK. During the flare peak time, the LOS velocity shows both upflows and downflows around the flare footpoints in the upper chromosphere and lower chromosphere, respectively. Moreover, the temporal analysis of the LOS magnetic field at the flare footpoints exhibits maximum changes of ~300 G. After the flare, the LOS magnetic field decreases to the non-flaring value, exhibiting no permanent or step-wise change. Our analysis suggests that a fraction of the apparent increase in the LOS magnetic field at the flare footpoints may be due to the increase in the sensitivity of the Ca II 8542 Å line in the deeper layers, where the field strength is relatively stronger. The rest can be due to magnetic field reconfiguration during the flare. In the photosphere, we do not notice significant changes in the physical parameters during the flare and non-flare time. Our observations illustrate that even a less intense C-class flare can heat the deeper layers of the solar chromosphere, mainly at the flare footpoints, without affecting the photosphere.

**Abstract**

We present high-resolution and multi-line observations of a C2-class solar flare, occurred in NOAA AR 12740 on May 6, 2019. The rise, peak, and decay phases of the flare were recorded continuously and quasi-simultaneously in the Ca II K line with the CHROMIS instrument, the Ca II 8542 Å and Fe I 6173 Å lines with the CRISP instrument at the Swedish 1-m Solar Telescope. A non-LTE STIC inversion code was employed to infer the temperature, magnetic field, line-of-sight (LOS) velocity, and microturbulent velocity stratification in the flaring atmosphere. The temporal analysis of the inferred temperature at the flare footpoints shows that the flaring atmosphere from log(T) ~ −2.5 to ~3.5 is heated up to 7 kK, whereas from log(T) ~ −3.5 to ~5 the inferred temperature ranges between ~7.5 kK and ~11 kK. During the flare peak time, the LOS velocity shows both upflows and downflows around the flare footpoints in the upper chromosphere and lower chromosphere, respectively. Moreover, the temporal analysis of the LOS magnetic field at the flare footpoints exhibits maximum changes of ~300 G. After the flare, the LOS magnetic field decreases to the non-flaring value, exhibiting no permanent or step-wise change. Our analysis suggests that a fraction of the apparent increase in the LOS magnetic field at the flare footpoints may be due to the increase in the sensitivity of the Ca II 8542 Å line in the deeper layers, where the field strength is relatively stronger. The rest can be due to magnetic field reconfiguration during the flare. In the photosphere, we do not notice significant changes in the physical parameters during the flare and non-flare time. Our observations illustrate that even a less intense C-class flare can heat the deeper layers of the solar chromosphere, mainly at the flare footpoints, without affecting the photosphere.

**Overview of observations**

- Location: NO0E48
- Time of observations: 08:34 to 09:33 UT
- Simultaneous observations performed with the CHROMIS and the CRISP instruments at the Swedish 1-m Solar Telescope (SST).
- The CRISP recorded full polarimetric observations in the Ca II 8542 Å and Fe I 6173 Å lines at 17 and 15 wavelength positions, respectively.
- The CHROMIS recorded Ca II K intensity profiles at 28 wavelength positions.
- The CRISP and CHROMIS data obtained with a cadence of 21 sec and 15 sec, respectively.

**Inversion of Stokes Profiles**

- The physical parameters such as temperature, magnetic field, line-of-sight velocity, and microturbulent velocity are inferred by inverting three lines (Fe I 6173 Å and Ca II 8542 Å) using the STIC code.

**Temporal evolution of physical parameters**

- The mean temperature increases from ~5 kK up to ~11 kK at the footpoint in the upper chromosphere, whereas in the lower chromosphere it changes from ~5 kK to ~7 kK.
- The upper chromosphere is dominated by upflows (evaporation) and the lower chromosphere by downflows (condensation), mainly at the flare footpoints.
- The LOS magnetic field in the chromosphere shows changes at the flare peak time, but that change is not permanent or step-wise. No significant change observed in the photosphere.

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

- A C-class flare was observed simultaneously in the Ca II K, Ca II 8542 Å and Fe I 6173 Å lines, with the CRISP and CHROMIS instruments at the SST.
- State-of-the-art inversion code employed to infer the physical parameters during the flare.
- In the footpoints, we reconstruct the simultaneous presence of chromospheric condensation and evaporation. At that location the temperature rises up to approximately 11 kK.
- The sensitivity of the Ca II lines analyzed in this study shifts to larger optical depth in the footpoints and their surroundings. However, the Fe I 6173 Å line shows insignificant changes during the flare.
- The time evolution analysis yields changes in the magnetic field stratification, mostly above the photosphere, but those changes are not step-wise as reported in previous studies.

**References**