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Study of inhomogeneities in the solar atmosphere

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The thesis deals with the study of the dynamical processes leading to the heating of the quiet solar chromosphere at the site of the inhomogeneities.

From a 35-minute long time sequence spectra in the CaII H line obtained (at the Vacuum Tower Telescope (VTT) of the Sacramento Peak Observatory, New Mexico) on a quiet region around the centre of the solar disc we have derived line profiles at the sites of the inner network bright points and the network boundary regions. From the temporal changes seen in these profiles we have studied the dynamical processes associated with the evolution of these structures. We find that the bright points can be grouped into three classes based on their evolution pattern. The class I bright points show very large intensity enhancements in $H_{2V}(I_{H2V})$ at their brightest phase, as high as 4 times or more the normal value. Those of class II show moderate increase (about 2.5 times the normal value) while those of class III show only a marginal increase in I_{H2V}. We have described the similarities and differences in behaviour of the bright points among the three classes. It is argued that the differences in the behaviour of the bright points in the three classes is directly linked with the differences in the underlying photospheric magnetic field cospatial with them. The plots of I_{H2V} versus time (light curves) for the entire 35-min duration of the sequence show that the mode of excitation in the bright points starts with a 'main pulse' which is followed by smaller pulses with exponentially decreasing brightness. The histogram plots and the power spectrum analysis of these pulses show that their intensity oscillate with period around 190 sec. The period of oscillations is independent of the amplitudes of the wave pulses. The network boundary regions exhibit oscillations of longer periods of the order of 5-7 minutes.

We have also estimated the total energy dissipated at the site of the bright points over the entire sun. This energy flux together with that contributed by the network boundary regions work out to 3.4×10^6 ergs/cm^2/sec. This matches well with the emission by the CaII ions estimated as 3.8×10^6 ergs/cm^2/sec in the model calculations by Anderson & Athay (1989, ApJ, 346, 1010). Thus the bright points are the sites where substantial heating takes place and the main pulses transport this energy. We have discussed the physical nature of the wave propagation in the three classes of bright points. The propagation within the bright points of class I which are associated with the strong magnetic field is through a combination of Alfven and acoustic waves with a predominance of Alfven waves whereas the propagation is mainly by acoustic waves in class II and III bright points where the magnetic fields are weak.