HEATING THE QUIET CORONA BY EXPLOSIVE EVENTS IN UV: RESULTS FROM “SUMER” ON BOARD SOHO

Juan Pablo Torres-Papaqui, and Eduardo Mendoza

Instituto Nacional de Astrofísica, Optica y Electrónica, México

Abstract

We present SUMER observations of UV explosive events (EE) in a range which contains lines from about 750 to 790 Å. The strongest spectral lines of this range have temperatures of maximum abundances in the range $0.8 \times 10^5 - 6.3 \times 10^5$ K and therefore are expected to be formed in the Transition Region (TR). The aim of this work is to investigate whether the EE originate in lines of a limited range of temperatures or indistinctly at lines of any temperature. We identified the times when the flux of a line attained the 3 and 5-$\sigma$ levels. Moreover a considerably number of the events attained first a flux of 3 and 5-$\sigma$ levels at a temperature of $1.5 \times 10^5$ K. We interpret the above results as an indication that most of the EE could be originated in the intermediate layers of the TR.

Introduction

The UV explosive events (EE) have been observed at spectral lines at temperatures from about $2 \times 10^5$ to $10^6$ K Brueckner and Bartoe (1983). They represent a way in which the high magnetic energy of the lower layers of the solar atmosphere may be transformed to heat the Corona. However, up to now it has not been established whether the EE originate in the lower or in upper layers of the TR. Chae et al. (1998) and Brekke et al. (1997) found that the largest red shift take place for lines at about $1.5 \times 10^5$ K. In this work we attempt to estimate whether the onset of explosive events has a preferential altitude of the TR or they begin at any altitude. With this purpose we analyzed EE at lines formed at different TR temperatures.

1. Data

The data were acquired with SUMER/SoHO Wilhelm et al. (1997) during 1996 November 14, 15 and 16. The solar radius, from the SoHO location, was 980"
so one arcsecond corresponded to 715 Km. The spectral resolution was 0.045 Å and the spectral range contains lines from about 750 Å to 790 Å. At each day the slit was directed towards different locations. In each of them it was not adjusted to the solar rotation. A region was observed first with a slit of 4" width and 300" length in a 30 seconds cadence. After that the same region was observed with a 1" width and 300" length slit in a 570 seconds cadence. At the end of this last set of observations another target was observed, first with the 4" slit (with a 30 s cadence) and then with the 1" slit (in a 570 s cadence) and so on. Several EE were either partially or fully recorded. From them we selected those observed from the beginning. The lines that showed the most considerably flux enhancement during each event were selected.

2. Results and Discussion

We found that the 3-σ flux was predominantly first attained at the 1.5 \times 10^5 K lines indicates that the EE preferentially begin at mid altitudes of the TR. An energy source located around the altitude with this temperature could be the responsible for the flux enhancement at these lines faster than at the other lines. The possibility that the origin of EE is around the layer with a temperature of 1.5 \times 10^5 K does not considerably disagrees with Teriaca et al. (1999) assumption that magnetic reconnection, and therefore the energy release, during EE take place around 3 \times 10^5 K. These results seem to indicate that between the height responsible for the emission at the 1.5x10^5 K line and those for the neighboring lines the physical conditions could considerably differ. Probably a sharp thermal/turbulent velocity gradient around these lines is the responsible for this difference. We consider that these results support the possibility that the region of energy release is around the layer with 1.5x10^5 K which is in the intermediate layers of the TR.

References