EGU22-10833
https://doi.org/10.5194/egusphere-egu22-10833
EGU General Assembly 2022

Can the ultraviolet bursts be generated in the low solar chromosphere?

Lei Ni
(leini@ynao.ac.cn)

Ultraviolet (UV) bursts and Ellerman bombs (EBs) are small scale magnetic reconnection events in the highly stratified low solar atmosphere. The plasma density, reconnection mechanisms and radiative cooling/transfer process are very different at different atmospheric layers. EBs are believed to form in the up photosphere or low chromosphere. It is still not clear whether UV bursts have to be generated at a higher atmospheric layer than the EBs or UV bursts and EBs can actually both appear in the low chromosphere. We numerically studied the low beta magnetic reconnection process around the solar temperature minimum region (TMR) by including more realistic physical diffusions and radiative cooling models. We aim to find out if UV bursts can be formed in the low chromosphere and investigate the dominant mechanism that transfer the magnetic energy to heat in an UV burst.The single-fluid MHD code NIRVANA was used to perform simulations. The time dependent ionization degrees of Hydrogen and Helium are included in the code, which lead to the more realistic magnetic diffusion caused by electron-neutral collision and ambipolar diffusion. The more realistic radiative cooling model from Carlsson& Leenaarts 2012 is included in the simulations. The high resolution simulation results indicate that the plasmas in the reconnection region can be heated above 20,000 K as long as the reconnection magnetic fields reach above 500 G, which further proves that UV bursts can be generated in the dense low chromosphere. When the reconnection magnetic fields are stronger than 900 G, the width of the synthesized Si IV 1394 A line profile with multiple peaks can reach above 100 km s^{-1}, which is consistent with the usually observed broad-line-width UV bursts. The dominate mechanism that converts magnetic energy to heat in an UV burst in the low chromosphere is Joule heating that is contributed by magnetic diffusion caused by electron-ion collision in the reconnection region. The average power density that is converted to the thermal energy in the reconnection region is about 100 erg cm^{-3} s^{-1}, which is comparable to the average power density of the released heat in an UV burst.