Statistical analysis of small UV brightenings observed with AIA : signature of short time scale coolings.

Antoine Dolliou*[1], Susanna Parenti[2], Frédéric Auchère[2], Karine Bocchialini[1], and Gabriel Pelouze[1]

[1]Institut d'astrophysique spatiale – CNRS : UMR8617, INSU, Université Paris Sud - Paris XI – France
[2]Institut d'astrophysique spatiale – CNRS : UMR8617, INSU, Université Paris Sud - Paris XI – France

Résumé

In the context of the solar corona heating, we will present our measurements of short time scale cooling of small UV brightenings derived from a multi-wavelength observation with SDO/AIA and SolO/EUI-HRI.
On May 2020, the high resolution UV imager EUI-HRI, onboard Solar Orbiter, made its first observation of the quiet solar corona at the highest resolution (200 km in the corona) and cadence (5 s) up to this day. This observation is of particular interest, because it falls within the context of small scale heating, potentially explaining the temperature of the solar corona in the order of MK (Parker, 1988). During this 5 minutes sequence, 1467 small brightenings of variable sizes (400 to 4000 km) and lifetimes (10 to 200 s) have been detected (Berghmans et al. , 2021) ; their temperature has been estimated to peak between 1.2 and 1.4 MK.

In order to study the thermodynamics of these events, we measure their time lags between the multichannel light curves of SDO/AIA. These time lags can be a consequence of heating or cooling processes of plasma along the line of sight (Viall & Klimchuk 2011, 2012).

Cross-correlation between two AIA sequences pixel by pixel results in a map of time lags and their associated maximum correlation values. We use couples between 6 EUV channels of AIA to cover a large range of coronal and transition region temperatures, while taking into account the effects of coronal red noise and background variations. We compare the pixel-by pixel distributions of time lags and maximum correlation values between the events and the background in the quiet sun.

As a result, we measure the time lags of these brightenings to be mostly inferior to 12 s, which is the AIA cadence. Moreover, the **positive** asymmetry in the time lag distributions detected for the couples the AIA 193 – 171 and AIA 211 – 171 can be interpreted as a signature of short time scale **cooling**.
As of now, time lags have only been compared with models of nanoflares in large coronal loops (Viall & Klimchuk, 2013). In this context, short time lags are a consequence of nanoflares peaking at transition region temperatures, not coronal temperatures. That being said, this model is adapted for small events in active regions, not in the quiet sun. This is why we are currently investigating time lags from models more consistent with our observations, such as small scale loops or flares.

*Intervenant