Summary of Involvement for the Thomas Metcalf SPD Travel Award

Hinode 12 Meeting: The Many Suns

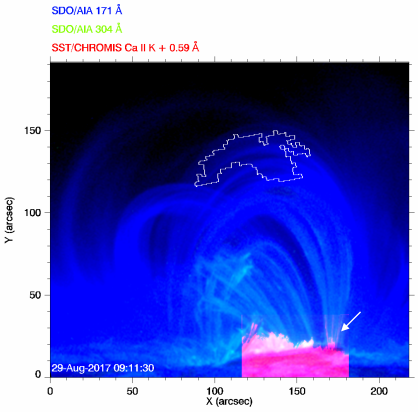
Granada, Spain 10-13 September , 2018

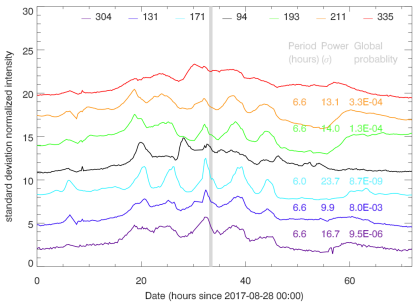
Clara Froment is a Postdoctoral Fellow at the Rosseland Centre for Solar Physics in Oslo, working with Luc Rouppe Van der Voort.

She completed her PhD in 2016 at the Institut d'Astrophysique Spatiale in France, under the guidance of Frédéric Auchère and Karine Bocchialini. She worked on long-period EUV pulsations in coronal loops, using a combination of observations and numerical simulations. Her work showed that these variations are caused by cycles of evaporation and condensation of the plasma due to a quasi-steady heating mainly concentrated at the loop footpoints, providing new constraints for the coronal heating problem. For this work she received the ESPD PhD thesis prize 2017. In Oslo, Clara is working on the link between these intensity pulsations and coronal rain, that is the low atmosphere counterpart of these coronal signatures, using SST, IRIS, Hinode and SDO data.

Oral contribution:

Multi-scale observations of thermal nonequilibrium cycles in coronal loops





These figures from my talk show the combined observations of long period intensity pulsations detected in the EUV channels of AIA in a loop bundle seen in the top figure (white contour) and coronal rain at high spatial resolution in the Ca II K chromospheric line with the SST (white arrow).

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The long-period intensity pulsations reported by Auchere et al. (2014) are very common in the solar corona and especially in coronal loops. Recently, these pulsations have been identified as the coronal counterpart of thermal nonequilibrium cycles (evaporation and condensations) by Froment et al. (2015, 2017). Thermal nonequilibrium can occur in coronal loops when the heating is quasi-constant and highly-stratified. Understanding the characteristics of thermal nonequilibrium cycles is thus essential to understand the circulation of mass and energy in the corona.

Here, we report on combined observations of long-period (6 hours) intensity pulsations in the coronal channels of SDO/AIA and coronal rain with the CRISP and CHROMIS instruments at the Swedish 1-m Solar Telescope (SST) in the same coronal loop bundle. The high-resolution spectroscopic instruments at the SST allowed us to probe the cooling phase of one of the cycles, down to chromospheric temperatures. These current observations are focused on one footpoint of the observed loop bundle and reveal the fine-structured rain strands. We present the thermal analysis of the cycles with the channels of AIA (DEM, time-lag analysis) on three days of off-limb evolution. Further, we also report statistics on the coronal rain blobs that we derive from CRISP and CHROMIS data (temperature, velocities, density, sizes of the blobs). These observations further strengthen that long-period intensity pulsations and coronal rain are two aspects of the same phenomenon. The characteristics of the TNE cycle, derived from the imaging and spectroscopic analysis, can also allow us to constraint the involved mass and energy flux in this loop bundle.

I am very grateful to the AAS/SPD committee and the Hinode 12 meeting SOC for this award. I really appreciated the opportunity to give this lecture in Granada. It was beneficial for me to present my current work, for which a paper is in preparation, while providing extended details about its context, in particular from my PhD thesis work.