

Thomas R. Metcalf SPD Travel Award Conference Report

Hinode-15 / IRIS-12: Multi-messenger physics of the solar atmosphere

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Seray SAHIN

She is a PhD candidate at Northumbria University in Newcastle upon Tyne, under the supervision of Patrick Antolin. She investigates the connection between coronal rain and the hot corona using observations with the SDO and IRIS instruments. The study involves statistical analysis of coronal rain where we aim at determining the fraction of magnetic flux under thermal non-equilibrium (TNE) conditions. She also received the ESPM-16 Poster prize with this work.

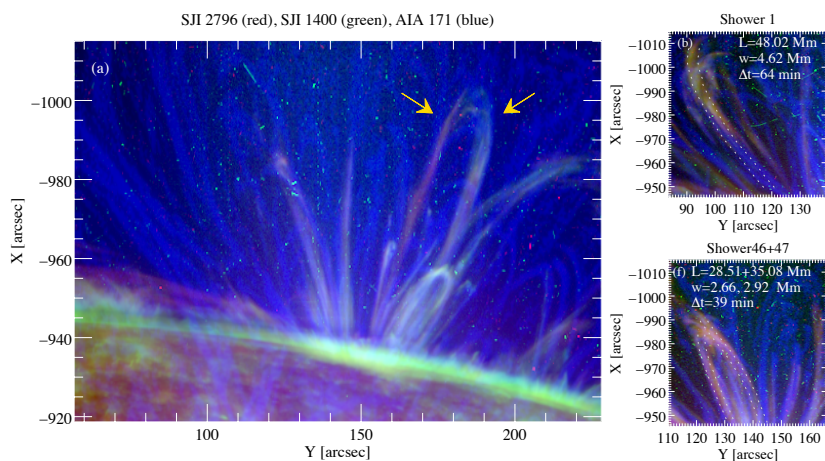


Oral Contribution:

Prevalence of thermal non-equilibrium over an active region

Seray Sahin & Patrick Antolin

Recent observations in the last decade have shown that the corona contains a large amount of cool material called coronal rain, whose clumps are 10 – 100 times cooler and denser than the surroundings and are often organised in larger events termed showers. Thermal instability (TI) within a coronal loop in a state of thermal non-equilibrium (TNE) is the leading mechanism behind the formation of coronal rain but no investigation on showers exists to date. In this study, we carry out a morphological and thermodynamic imaging and multi-wavelength study of coronal rain showers observed in an active region off-limb with IRIS and SDO, spanning chromospheric to transition region and coronal temperatures. Rain showers were found to be widespread across the active region over the 5.4-hour duration of observation time, with average length, width and duration of 27.37 ± 11.95 Mm, 2.14 ± 0.74 Mm, and 35.22 min, respectively. We further find a good correspondence between showers and the cooling coronal structures consistent with the TNE-TI scenario, thereby properly identifying coronal loops in the coronal veil, including the elusive expansion with height in the EUV. We estimate the total number of showers to be 155 ± 40 , leading to a TNE volume of $4.56 \pm [3.71] \times 10^{28} \text{ cm}^3$, i.e. more than 50% of the active region volume. This suggests a prevalence of TNE over the active region indicating strongly stratified and high-frequency heating on average. This study has been published in Sahin & Antolin, (2022), ApJL, 931(2), L27.



Left figure shows the active region under study combining SJI 2796 (red), SJI 1400 (green), and AIA 171 (blue). We manually traced 50 shower events, and two of which are shown on the right panels with their corresponding length, width, and time duration. The dotted lines, based on SJI 2796 contours, match well with the coronal structure, which suggests that showers can be used to correctly identify coronal loops.

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