



Extreme UV quiet Sun brightenings observed by Solar Orbiter/EUI

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16th ESPM 2021-09-06 12:03 Poster session 1.2





Are campfires a new class EUV brightenings?

Abstract

We present results of the first high cadence image sequence of the Extreme Ultraviolet Imager (EUI) taken on 2020 May 30, when Solar Orbiter was 31.5 degrees in solar longitude separated from Earth & SDO, and at 0.56AU from the Sun. At this distance, the two-pixel spatial resolution of EUI's High Resolution EUV Telescope (HRIEUV) was 400 km. HRIEUV observed a quiet Sun region and detected small localised brightenings, nicknamed 'campfires', with length scales between 400 km and 4000 km and durations between 10 sec and 200 sec. The smallest and weakest of these HRIEUV brightenings have not been previously observed. Simultaneous observations from the EUI High-resolution Lyman- α telescope (HRILYA) do not show localised brightening events, but the locations of the HRIEUV events clearly correspond to the chromospheric network. Comparisons with simultaneous AIA images shows that most events can also be identified in the 17.1 nm, 19.3 nm, 21.1 nm, and 30.4 nm pass-bands of AIA, although they appear weaker and blurred. Our differential emission measure (DEM) analysis indicated coronal temperatures. We determined the height for a few of these campfires to be between 1 and 5 Mm above the photosphere. We interpret these events as a new extension to the flare-microflare-nanoflare family. Given their low height, the EUI 'campfires' could stand as a new element of the fine structure of the transition region-low corona, that is, as apexes of small-scale loops that undergo internal heating all the way up to coronal temperatures.

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EUI first light 2020 May 12, @ 0.663 AU

K. Stegen, P. Smith EUI operator team





EUI first light 2020 May 12, @ 0.663 AU ESA Press release "Campfires"





F. Auchère Data reprojected to Carrington coordinates on a sphere of 1.004 Rsun 2.8 Mm above photosphere









F. Auchère wavelet based detection scheme





Explosive Events Innes, Teriaca 2013



R. Aznar Cuadrado campfires live at the edge of the chromospheric network



P. Antolin campfires have coronal temperatures











MURAM simulations

Yajie Chen et al Modelling of campfires Poster Session 8.1 Sept 8 11:52





Campfires. A new class of EUV brightenings?

- no, these are similar as the EUV brightenings seen by EIT, TRACE, AIA, HI-C
- HRIEUV sees them (in the quiet Sun) at smaller scales & better resolved than ever before
- HRIEUV sees them away from the Sun-Earth line allowing triangulation
 - hot coronal loops remarkably low down among cooler UFS loops in the transition region
 - only part of the loops brighten up, we do not see the full length

Open issues

- Relevance to coronal heating?
- Have we reached the minimal flare scale? femto-flares?
- What do campfires look like dynamically? Time-lag? Recurrence? Height evolution? Jets, waves?
- What is the relation of campfires with blinkers, explosive events, active region brightenings, ...?

Olena Podladchikova et al Energy distribution Poster Session 10.2 Sept 9 11:00 Sudip Mandal et al Propagation in campfires Poster Session 4.3 Sept 7 11:00





"Campfire" journal papers

- Extreme-UV quiet Sun brightenings observed by the Solar Orbiter/EUI, AA, Berghmans et al 2021 https://doi.org/10.1051/0004-6361/202140380
- Stereoscopy of extreme UV quiet Sun brightenings observed by Solar Orbiter/EUI, AA, Zhukov et al 2021, submitted
- Transient small-scale brightenings in the quiet solar corona: A model for campfires observed with Solar Orbiter, AA, Chen et al 2021, <u>https://doi.org/10.1051/0004-6361/202140638</u>
- Coronal Microjets in Quiet-Sun Regions Observed with the EUI onboard Solar Orbiter, ApJL, Hou et al 2021, <u>https://doi.org/10.3847/2041-8213/ac1f30</u>
- Capturing transient plasma flows and jets in the solar corona, AA, L.P. Chitta 2021, submitted
- Propagating brightenings in small loop-like structures in the quiet Sun Corona, AA, S. Mandal 2021, submitted