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Very High Resolution Structures of a Coronal Active Region using Hi-C: Moss Cells and Filament Channels

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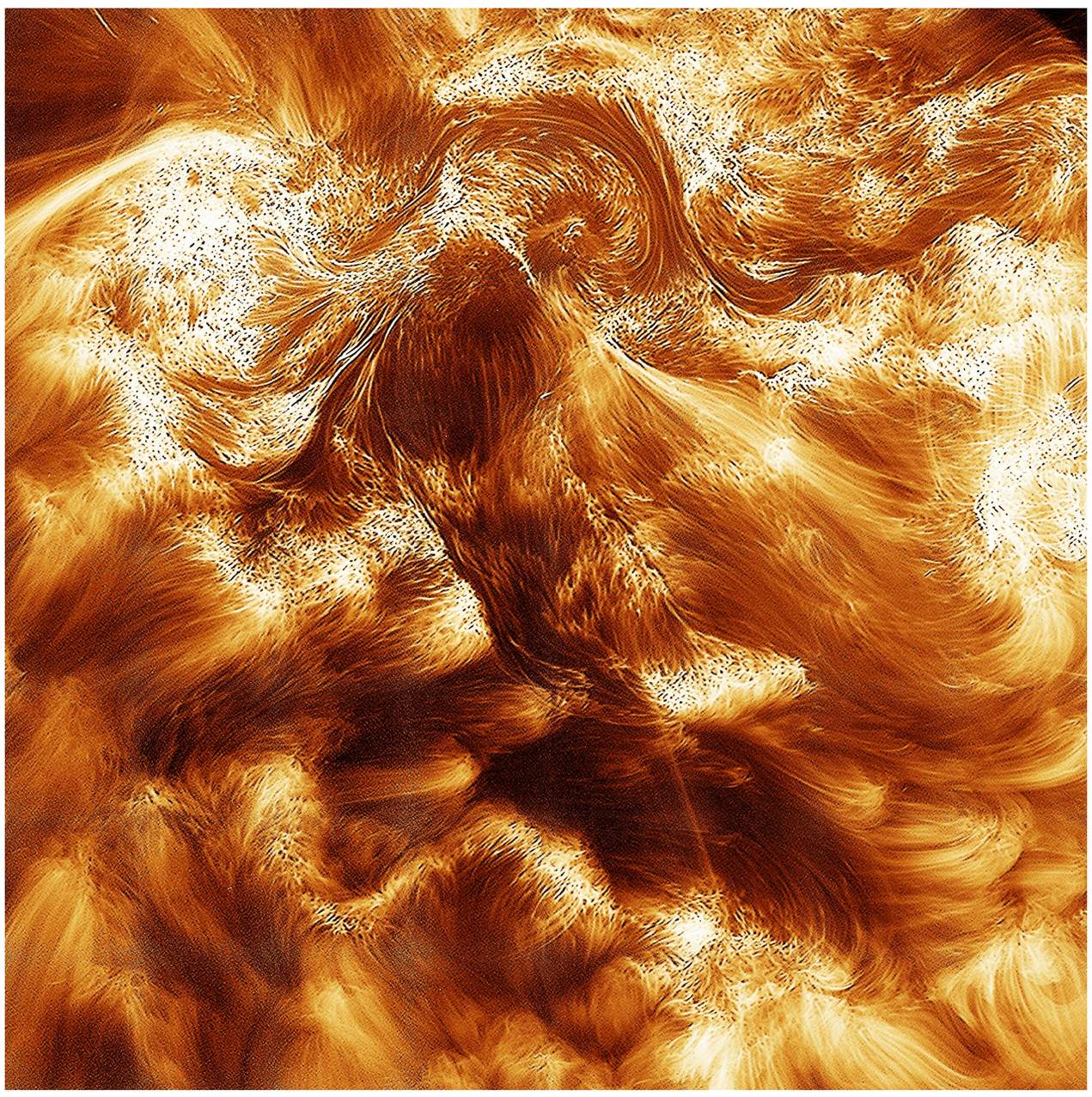
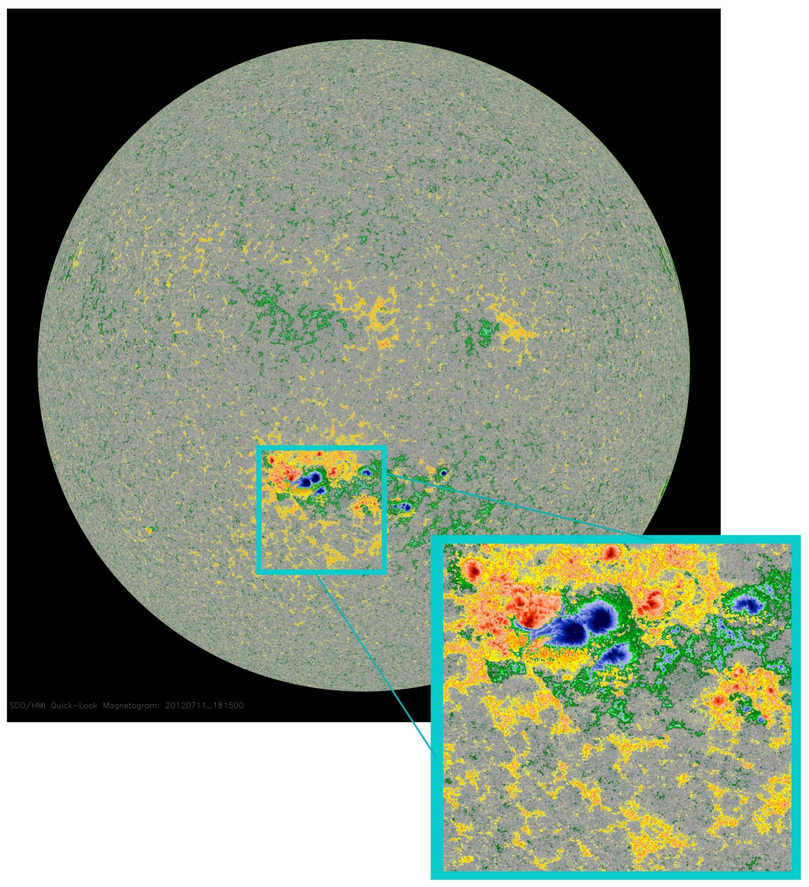
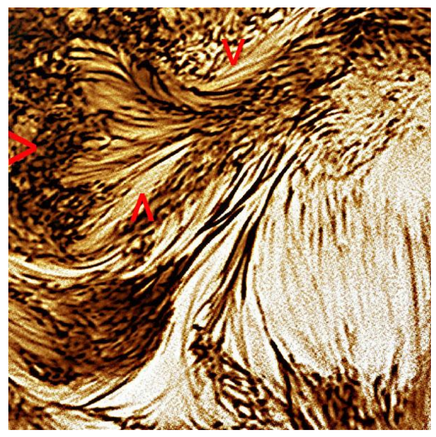
Abstract: ***The highest resolution images of the solar EUV corona were obtained recently during the sounding rocket flight of the Hi-C experiment in 2012 (Cirtain et al. 2013) which acquired images in a Passband centered on the 193A Fe XII emission line. A rather large portion of the Sun, 6.8 arc minutes square, was observed around an active region of the South hemisphere, near the central meridian. Although the pixel size permits a theoretical resolution of 0"2, as usual the effective resolution is limited by the Signal/Noise ratio. By summing images some improvement can be achieved in the visualization of the finest scale features, at the expense of the details of the temporal variations. This technique is therefore useful for quasi-stationary phenomena such as confined flows and cell like structures. In addition to the summation, we used the so-called Madmax algorithm to enhance these features having a presumably coherent spatial behavior. The result of the processing of 27 frames and printed at a poster scale is striking. In particular we call attention to:***
-The cell structure appearing in plage regions called in the past « moss »
-The filament channels with evidence of flows and twisted structures
-Very fine and extended threads overlying the background
We substantiate these findings using the magnetic field maps and AIA full disk images from SDO as well as the lower resolution ground-based Hα observations .



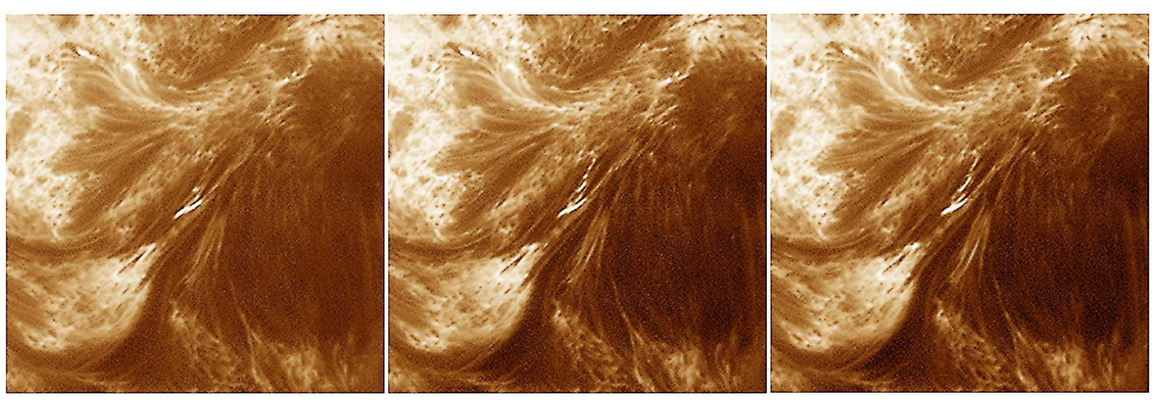
Hi-C field summed over 2.5 min (27 consecutive images) after processing with the Madmax operator (Tavabi & Koutchmy, 2013). The flow lines are enhanced and the plage and moss structures at the granular scale are slightly smeared due to their variations during the time lapse but the S/N ratio is greatly increased.



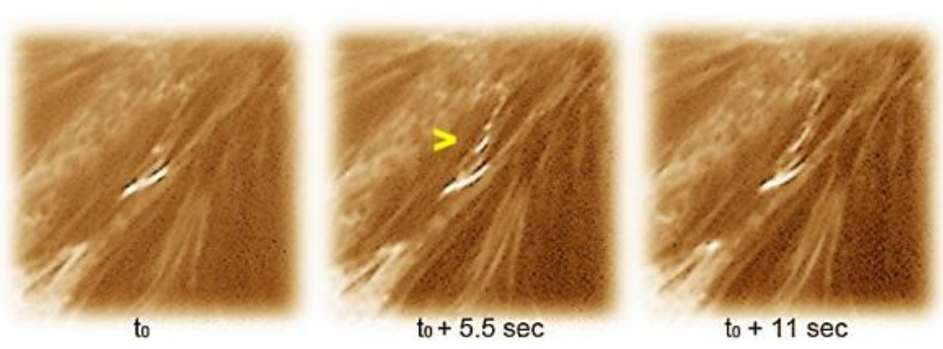
HMI (SDO) simultaneous magnetogram showing the region imaged during the flight of Hi-C



Zoom taken from the summed image processed with Madmax and shown in negative to emphasize:
i/ a twisted filament region (V)
ii/ granular size cell structures (>)
iii/ multi- strand loops at the limit of resolution (~150 km).



Temporal variations over a sub- field of 100 "x100 " illustrated using consecutive original frames shown with enhanced contrast. The cadence is 5.5 sec. The central region was discussed in Cirtain et al. 2012 using AIA complementary observations.



Zoom over the central region of the region shown at left. Note the noise appearing when ultimate resolution of individual images are evaluated using a greatly enhanced viewing.

References:
Brooks et al. 2013, ApJL. In press, in arXiv 1305.2246
Cirtain et al. 2013, Nature V493, 501
Testa et al. 2013, ApJ, 770, L1
Peter et al. 2013, Astr. Astrophys. In press, arXiv 1306.4685
Tavabi and al. 2013, Solar Phus. 283, 187, arXiv:1104.5580