Are we resolving coronal strands? Analysis of substructure within coronal plasma loop crosssectional profiles observed by NASA's Hi-C



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Are we resolving coronal strands? HiC vs SDO/AIA I



Are we resolving coronal strands? HiC vs SDO/AIA II



Are we resolving coronal strands? HiC vs SDO/AIA IV



Are we resolving coronal strands? Substructure analysis I















• Even at these superior spatial scales there may be evidence for further sub-structuring within the HiC strands themselves

Are we resolving coronal strands? Substructure analysis II



 The width profile intensity variations are reproduced by simultaneously fitting multiple Gaussian profiles using a nonlinear least-squares curve-fitting method.





Are we resolving coronal strands? Substructure analysis III



- In total, 183 Gaussian profiles are examined and the full width at half maximum determined.
- Most frequent structural widths were about 450–575 km with 47% of the strand widths beneath SDO/AIA 17.1nm resolution.
- These appear to be the result of multiple strands along the integrated line of sight that can be resolved, rather than being the consequence of even finer sub-resolution elements.

• Use the QR code to download Williams, Walsh et al 2020, ApJ, 902, 90.



Are we resolving coronal strands? Possible strand expansion I



Are we resolving coronal strands? Possible strand expansion II



Are we resolving coronal strands? Possible strand expansion III



Are we resolving coronal strands? Possible strand expansion IV





- It is found that whilst the magnetically closed loops and their sub-element strands do not expand along their observable length, open fan structures may expand an additional 150 % of their initial width.
- Along with Klimchuk & DeForest (2020), and nine of the thirteen structures analysed by McCarthy *et al* (2021) indicate that the relationship between intensity and width may be positively correlated and thus their cross sections are approximately circular.

• Use the QR code to download Williams, Walsh et al, 2021, ApJ, accepted.



Are we resolving coronal strands? Summary

- Hi-C is resolving a key spatial scale of the corona, observing coherent structures than SDO cannot detect – see table for comparative observations.
- High-resolution data is required, such as from Solar Orbiter's Extreme Ultraviolet Imager (EUI;≈100km pixel-1at 0.28 AU) instrument.



Study	Wavelength (nm)	Strand Width (km)
Peter et al. 2013	19.3	1450-2175 ≤200 (short loops)
Brooks et al. 2013	19.3	640
Brooks et al. 2016	139.3755	266-386
Aschwanden & Peter 2017	19.3	550
Low-Emission Loops	17.2	325-450
Gaussian Fitted Loops	17.2	450-575

Hi-C 2.1 4.4`×4.4` FOV 0.129` plate scale ≈ 93 km/px.

EUI at 0.28 AU 1.72`×1.72` FOV ≈ 100 km/px.

