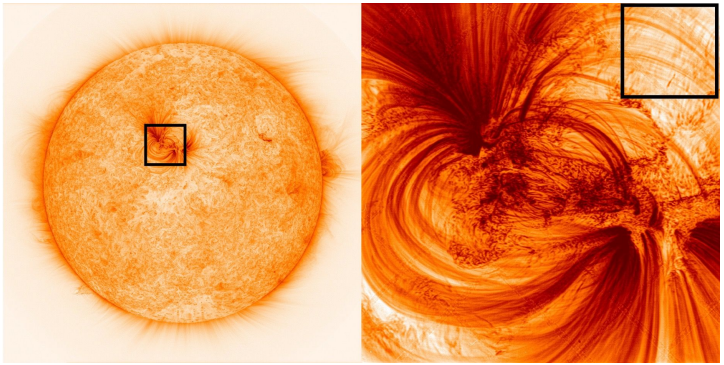
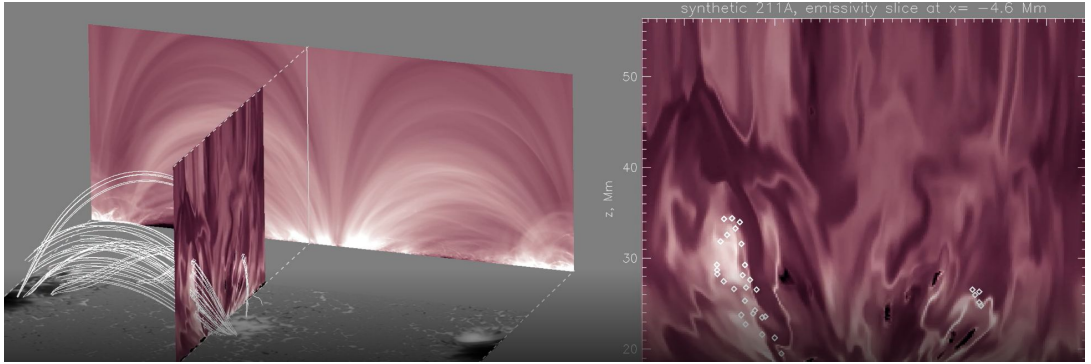
Discovering the causes of fine-scaled coronal structure and the basis of coronal heating

Ground-Based Coronal Physics in the Next Decade: The DKIST View





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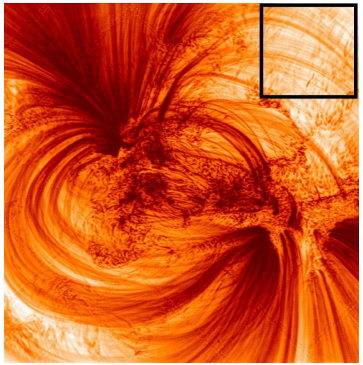
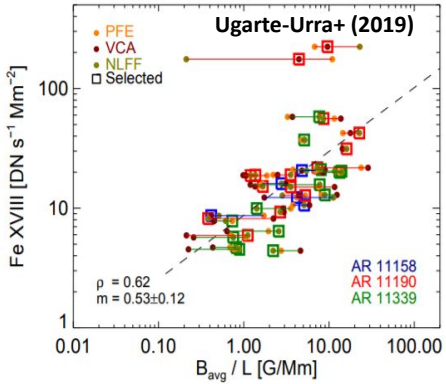
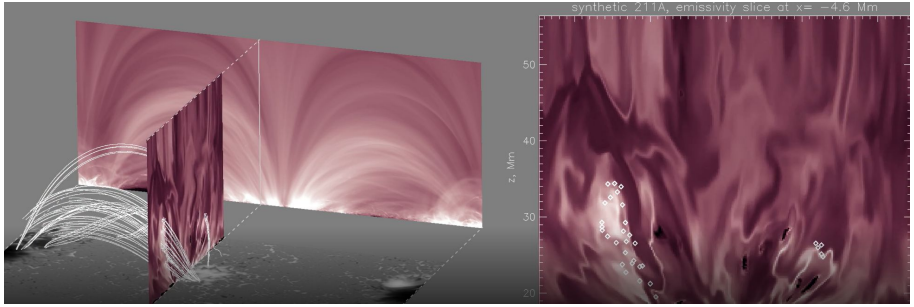
8 July 2022 - NSO Scientists White Paper Meeting

Science Drivers

- *What governs the fundamental structure, composition, and evolution of the corona?*
- *How are the corona and solar wind heated and accelerated?*
- *How is energy stored, released, and propagated during space weather events?*





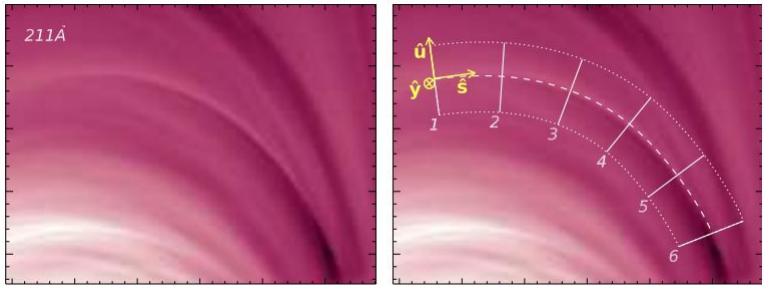


The Coronal "Veil" Malenoshenko+ 2021

Old Questions Renewed

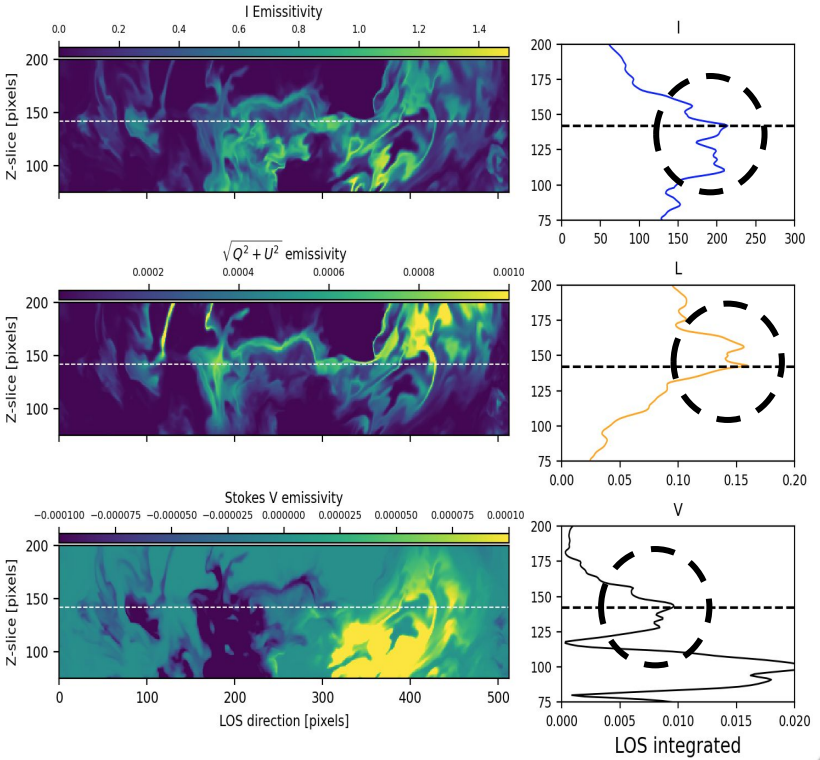
- *The active corona is highly structured in loop-like features (see NASA/Hi-C image top left).*
  - *Are these 1d conduits of magneto-convective energy?*
  - *1d scaling laws and B field extrapolations to constrain heating (see, e.g., Ugrate-Urra+ 2019)*
  - *Are loops heated by nano-flares? Wave dissipation? Other?*
- *Malenoshenko+ 2021 suggests loops are projected corrugated structures.*
  - *Single and multi-vantage point of loops suffers line-of-sight ambiguities*
- *New avenues to address this question:*
  - *High resolution coronal forbidden line polarimetry: Schad & Dima (2021)*
  - *High resolution coronal rain polarimetry (He I + Ca II): Schad+ 2016, 2019, Kurizde+ 2019*

Science highlight: coronal Loops or Veils?



Malenshenko+ (2021)

- Synthetic loops can be traced to wrinkled sheet-like structures in MURAM.
- Loops may not be the circular or elliptical structures we idealize.
- Can be tricky to distinguish observationally.



Synthetic polarized contribution functions at right using techniques of Schad & Dima (2020. High dynamic range polarimetry at near diffraction limited-scales helps constrain simple vs complex structuring.

Decadal Survey White Paper Recommendations

- **DKIST will remain the high resolution coronagraph with the high “effective” coronal aperture for active region targets during the next decade.**

- **Techniques for boosting spectropolarimetric observing efficiency need to be advanced**
  - Additional slit multiplexing for simultaneous spectral coverage.
  - Image slicers and/or IFUs for coronal use cases
  - Infrared Fabry Perot or Lyot Filter instrument
- **Potential in coronal linear polarization imaging**
  - Multi-temperature linear polarization imaging for dynamic field topology constraints
  - Ultra high bandpass filters + large format micro-polarizer cameras
- **Facility maintenance optimization and improvements**
  - In-situ washing operations will continually be improved with experience gained.
  - Alternative cleaning methods/infrastructure TBD?
- **Other related science areas and technologies**
  - Mid-infrared imaging of flare continua [> 5 um]. TIDES [Penn et al.]
  - Low spectral resolution broad-band IFU spectroscopy for flares
- **Advance frontier in coronal spatial resolution**
  - Daytime laser guide stars for adaptive optics [Beckers 2002] / ORCAS