



Mauna Loa Solar Observatory (MLSO)

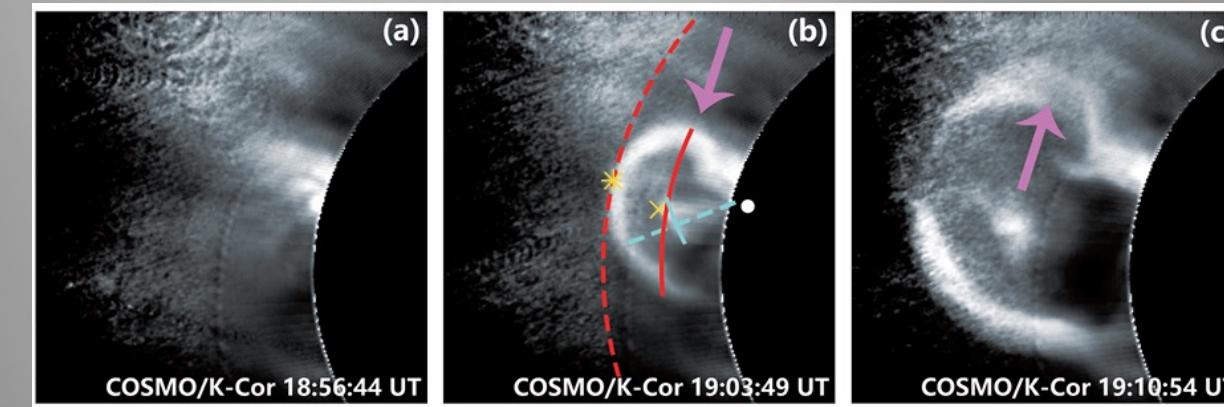
Michael Wiltberger on behalf of the MLSO TEAM



Mauna Loa Solar Observatory is an NSF facility that acquires observations of the Sun's corona needed to improve our understanding of explosive solar events and their space weather impacts. Operated by the National Center for Atmospheric Research (NCAR), MLSO observes the Sun with coronagraphs designed and built by NCAR, with community input, to maximize scientific return. We present examples of community science using MLSO data and highlight best practices of community engagement to optimize data collection, data products, and tools.

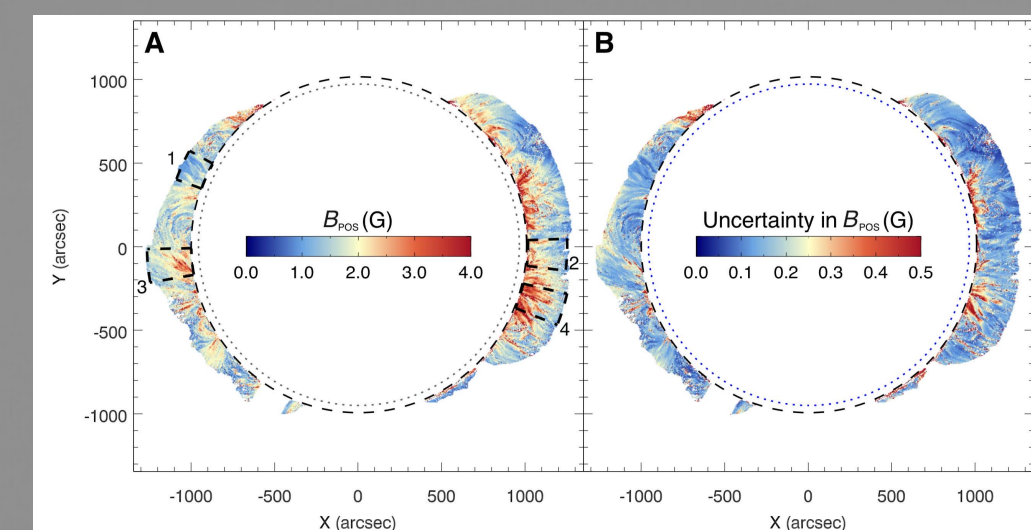
Coronal Mass Ejection (CME) over-expansion and shock formation using MLSO K-Cor

MLSO K-Cor observations are ideally suited to study the onset and dynamics of Coronal Mass Ejections (CMEs). Wang et al. 2022 used K-Cor, (see Figure right), to measure the overexpansion of a CME and posited the possibility of shock formation as the cause of the detected Type II and Type III radio bursts. This CME also generated Solar Energetic Particles (SEPs).



K-Cor CME on May 7, 2021 from Wang et al. 2022

Coronal Magnetic Field Plane-of-Sky maps from MLSO CoMP & UCoMP

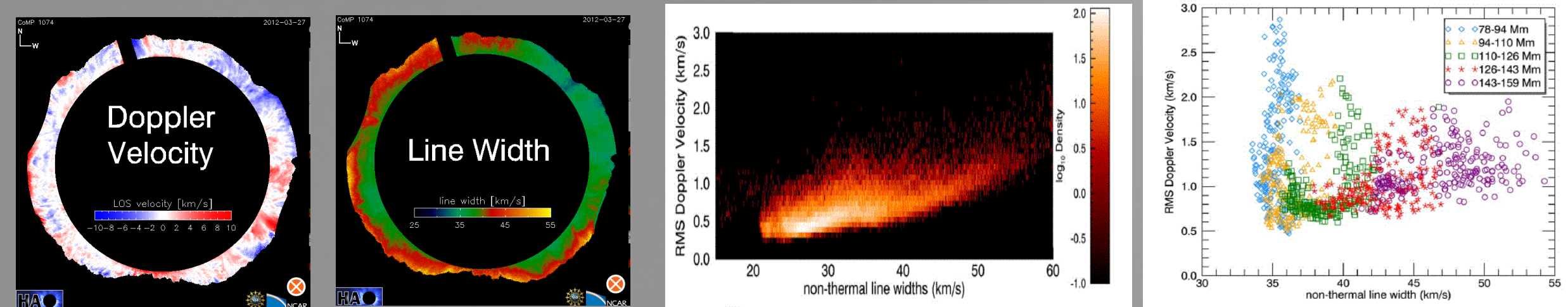


The coronal magnetic field drives solar activity that results in space weather. Coronal magnetic field observations are necessary for understanding and forecasting space weather. Yang et al. use CoMP observations to create Plane-of-Sky maps of the coronal magnetic field.

From Yang et al. Science, 2020, Fig. 3

Waves as a Source of Coronal Heating using MLSO CoMP

Understanding how the corona is heated is a fundamental open question in solar physics. Pant et al. 2019 compared CoMP Doppler and line width variations with height to synthetic data from simulations of transverse MHD waves. They found that superposition of observed structures greatly reduces Doppler velocity amplitudes and increases non-thermal line widths, leading to an underestimate of wave energy into the corona by factors of 100 to 1000. This suggests wave energy is the major source of 'hidden' or 'dark' energy in the corona.

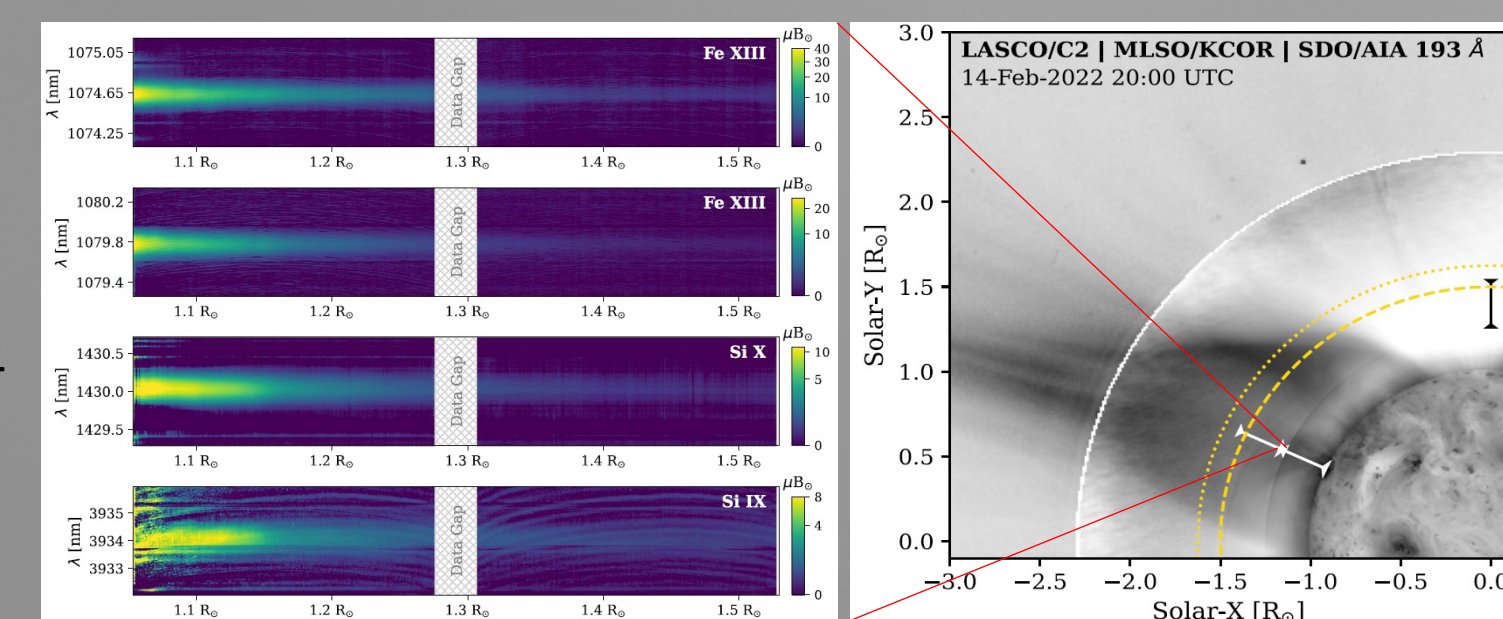


Adapted Fig. 1 from Pant et al. 2019. At left: CoMP Doppler and Line Width on March 27, 2012. Center and far right show variations of CoMP Doppler velocities vs. line width as a function of height.

Validation of DKIST CryoNRSP observations using MLSO K-Cor

Schad et al. 2022 used MLSO K-Cor calibrated polarized brightness data and MHD coronal models from PSI-MAS to validate spectra acquired from four coronal emission lines observed by DKIST CryoNRSP on February 14, 2022. In addition to data validation, the K-Cor data provide context imaging of the global corona.

From Schad et al. Far right: Composite of AIA/K-Cor/LASCO and CryoNRSP slit location. Near right: CryoNRSP coronal spectra.



Community Engagement – UCoMP data user workshop

The High Altitude Observatory (HAO) at NCAR is hosting a UCoMP data workshop for our beta-users from Aug 29 through Sept 1, 2023 at NCAR. Most UCoMP beta-users are graduate students and early career scientists. HAO is providing travel support to these users. The workshop is a combination of tutorial presentations from the UCoMP team, discussions between the UCoMP team and users, presentations by users, and hands-on activities for attendees. The tutorials will be recorded for the benefit of those not able to attend and will be made available to the community from the MLSO web pages. The UCoMP instrument can select from 9 different emission lines in intensity and full polarization. Because of the flexibility in the type of data collected, HAO has been soliciting input from users to identify the UCoMP data products, cadences and other requirements needed for a variety of research goals, as well as tools and models users need to maximize science results from MLSO data.

What MLSO provides the Community

The MLSO web page serves: <https://www2.hao.ucar.edu/mlso>

- All MLSO solar coronal and chromospheric Images and movies in a variety of wavelengths going back to 1980 (five sunspot cycles).
- Solar Activity listings going back to the 1970s.
- Analysis Tools
- Solar eruptions Event Gallery
- Support for Community Observing Campaigns and Initiatives
- Public access to latest data calibration and processing pipelines [GitHub]
- Documentation on instruments, data products and tools
- Observer Logs
- Publication Listings

Latest Images

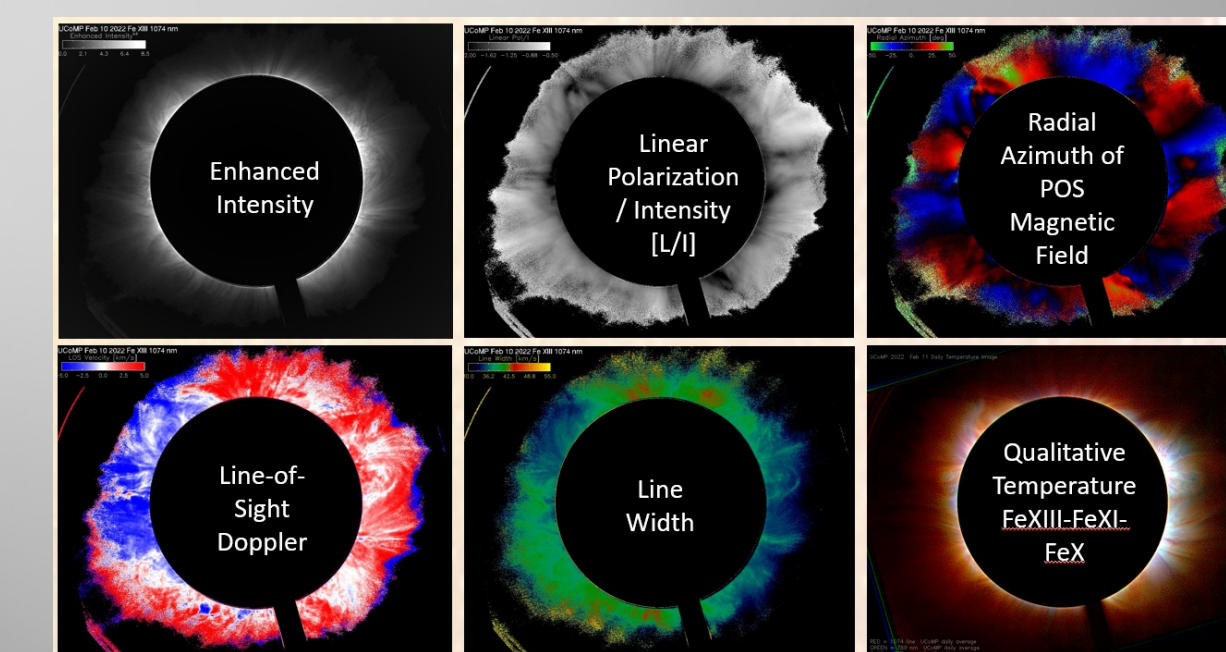
<p>K-Cor pB</p> <p>GET DATA</p> <p>Movie: Cropped Movie: Full Res</p>	<p>CoMP Intensity</p> <p>GET DATA</p> <p>Movie: Full Res</p>	<p>GONG H-alpha</p> <p>Full-Resolution FITS GONG movie GONG H-alpha Network</p>
<p>K-Cor NRGF</p> <p>GET DATA</p> <p>Movie: Cropped Movie: Full Res</p>	<p>UCoMP</p> <p>PREVIEW DATA</p>	<p>Featured Event</p> <p>EVENT GALLERY</p> <p>2022-06-13 CME</p>

More Data

Access All Data

CoMP 2013-2018	PSPT 1998-2015	Mk4 1998-2013	CHIP 1996-2013	Coronado 2010-2011	PICS 1997-2010
Mk3 1980-1999	SMM 1980, 1984-1988				

MLSO data available are also available from the Virtual Solar Observatory (VSO), FORWARD modeling IDL community tool, NASA Helioviewer, and NCAR DASH



Above: A sample of some of the data products from the new UCoMP coronagraph