
GST Data Processing and Access



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- Broadband Filter Imager (BFI, photosphere)
(TiO 7059 Å , G-band 4305 Å)
- Visible Imaging Spectrometer (VIS, chromosphere)
(6563 Å)
- Near InfraRed Imaging Spectropolarimeter (NIRIS)
(10830 Å, 15648 Å)
- Fast Imaging Solar Spectrograph (FISS, chromosphere)
(6563 Å, 8542 Å)
- 4.6 Tb/day raw data – Level 0 data ;
300-400 Gb/day processed data – Level 1 & 2 data

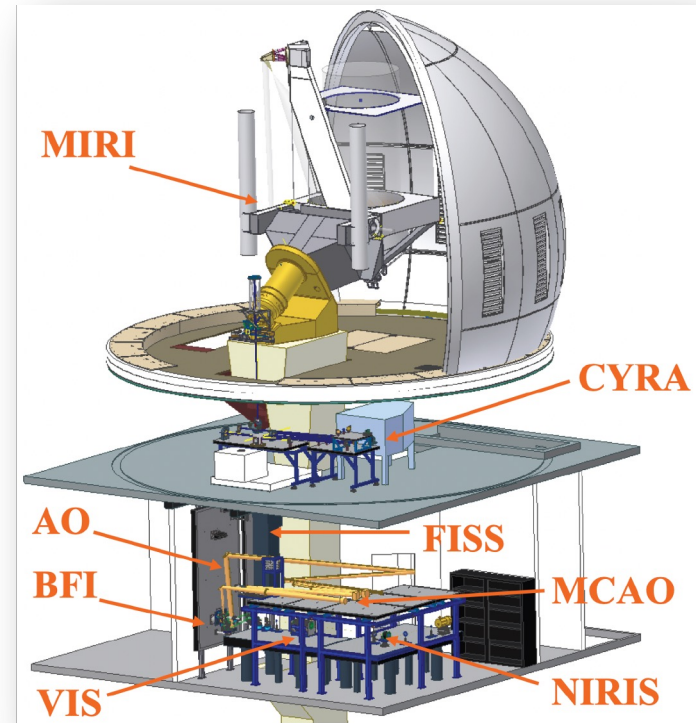
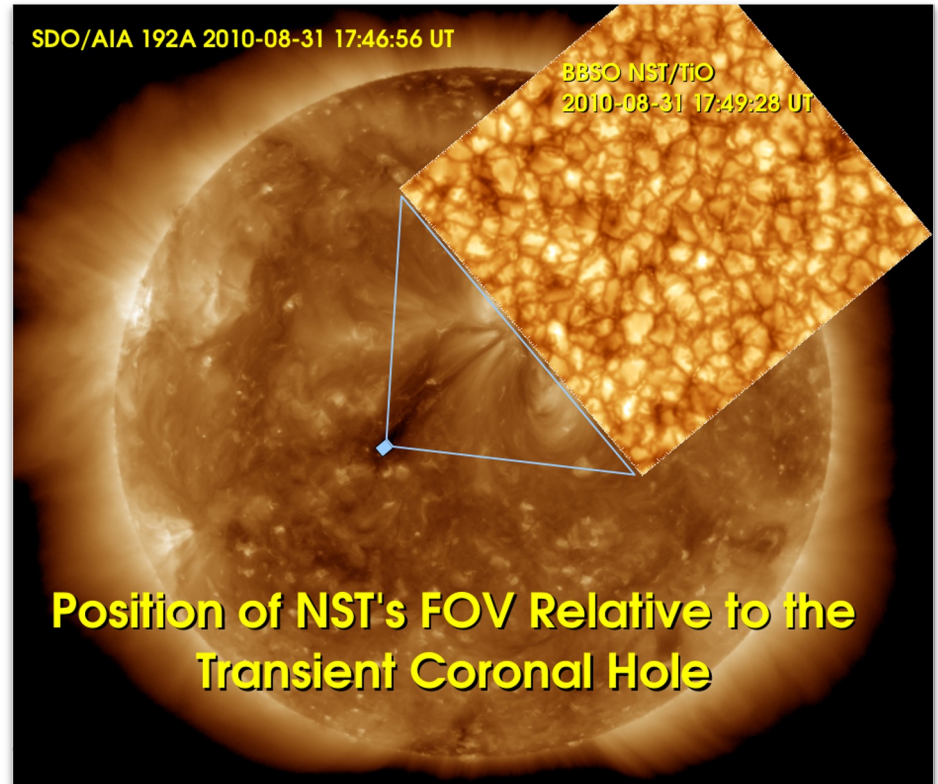


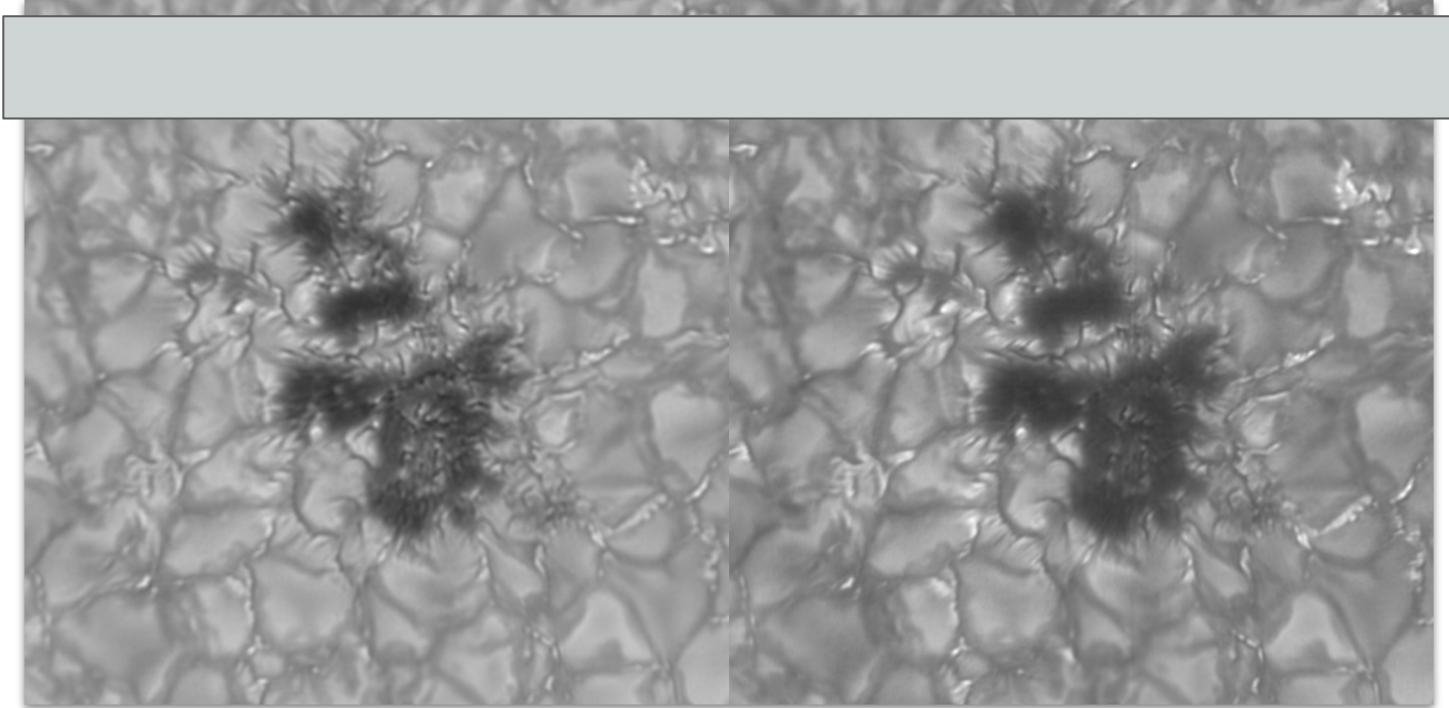
Table 1: *GST Instruments and their Specifications.*

Instrument	Dispersing System	Fore-Optics	Wavelength Coverage	Interest of Spectrum	Resolution	FOV
BFI	Interference Filter	Beam Splitter	380-900 nm	TiO 706.7 nm and G-band	< 0.1" with AO and speckle reconstruction	70"×70"
VIS	Visible Tunable Narrow-band Filter	Single Visible Fabry-Pérot Interferometer (FPI)	550-860 nm	H α , D2, D3 ...	< 0.1" with AO and speckle reconstruction	75"×64"
NIRIS	Near-IR Tunable Narrow-band Filter	Dual Near-IR FPIs and Polarization Analyzer	1.0-1.7 μ m	Fe I 1565 nm He I 1083 nm	~ 0.2": Fe I polarimetry ~ 0.14": He I spectroscopy	85" (Round)
FISS	Medium Dispersion Spectrograph	Warm Optics and Grating	550-860 nm	H α 656.3 nm Ca II 854.2 nm	0.1"- 0.2" with AO correction $R_0 = \lambda/\Delta\lambda > 10^5$	60" (Slit)
CYRA	Medium Dispersion Spectrograph	Cryogenic Optics and Cold Grating	1.0-5.0 μ m	Ti I 223.1 nm Fe I 4063.7 nm Si I 4142.5 nm MgI 3681.6 nm CO 4.6 μ m	0.3" – 0.6" with tip/tilt correction $R_0 = \lambda/\Delta\lambda > 10^5$	75" (Slit)

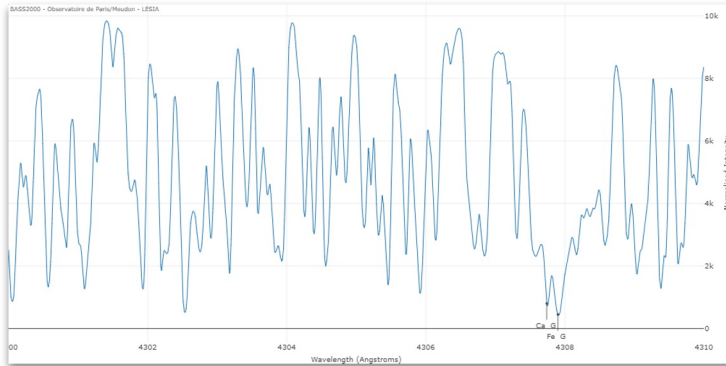


- Solar Diameter
 - ~1940 arcsec
- Field Of View
 - 70 x 70 arcsec
 - (51,000 x 51,000 km)
- Smallest Feature We Typically Observe
 - 0.1 x 0.1 arcsec
 - (75 x 75 km)



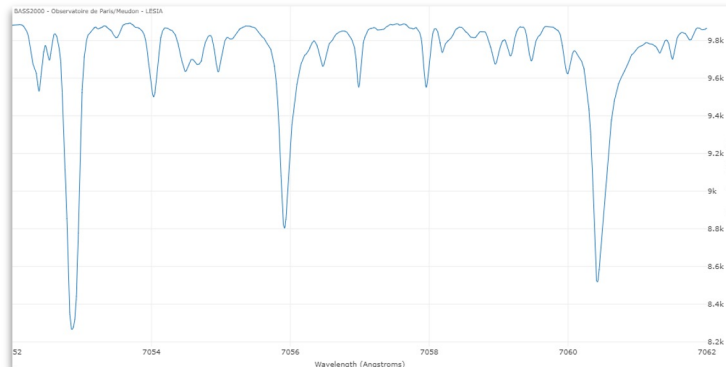


G-band vs TiO: which is which?



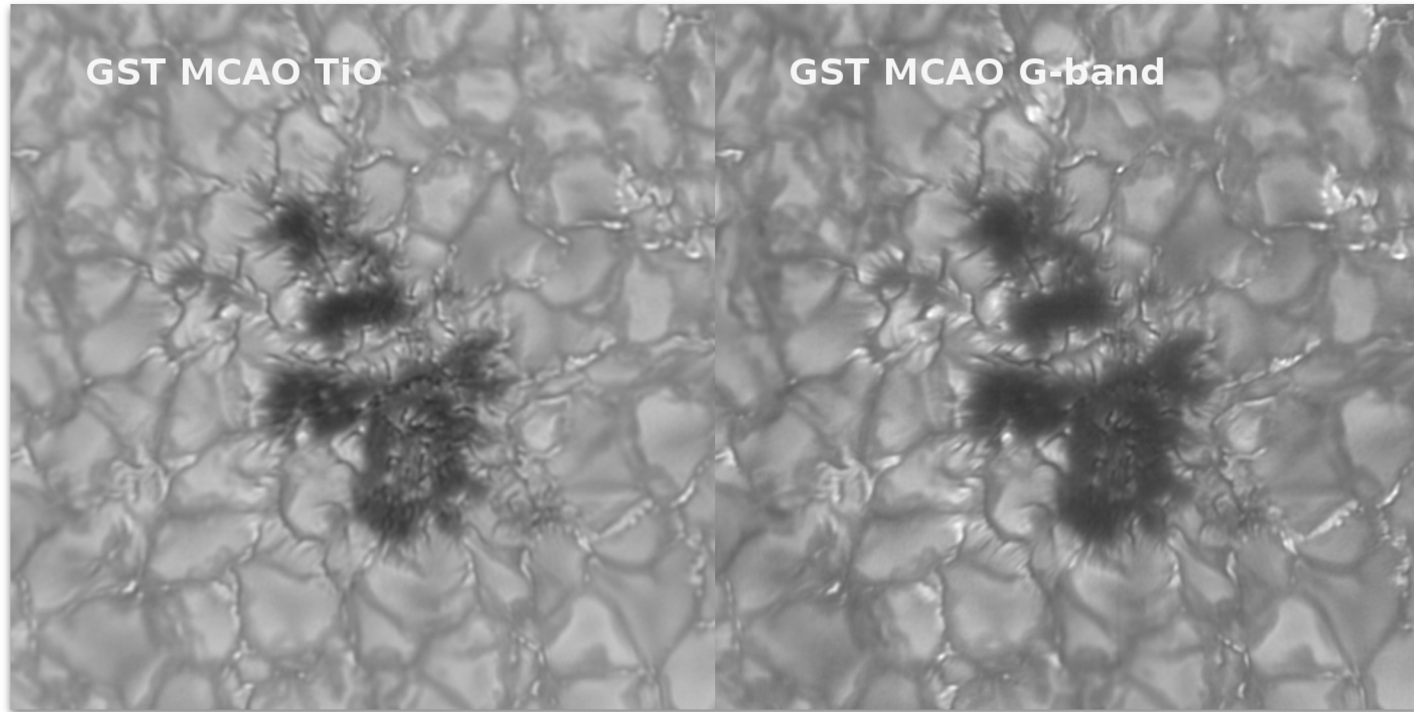
G-band is a molecular bandhead in the solar spectrum at around 430 nm, mainly consisting of electronic transitions between rotational and vibrational sublevels of the CH molecule.

The CH molecule dissociates at higher temps (e.g., above bright points) so that the line weakens (or disappears) which leads to increased brightness of photospheric bright points.



705.7nm TiO band is a TiO γ -system. The TiO band does not appear in quiet sun (too hot), only in cooler sunspots. Thus it is sensitive to temp variations within sunspot umbra, therefore better suited for sunspot observations.

Broadband Filter Imager (BFI)

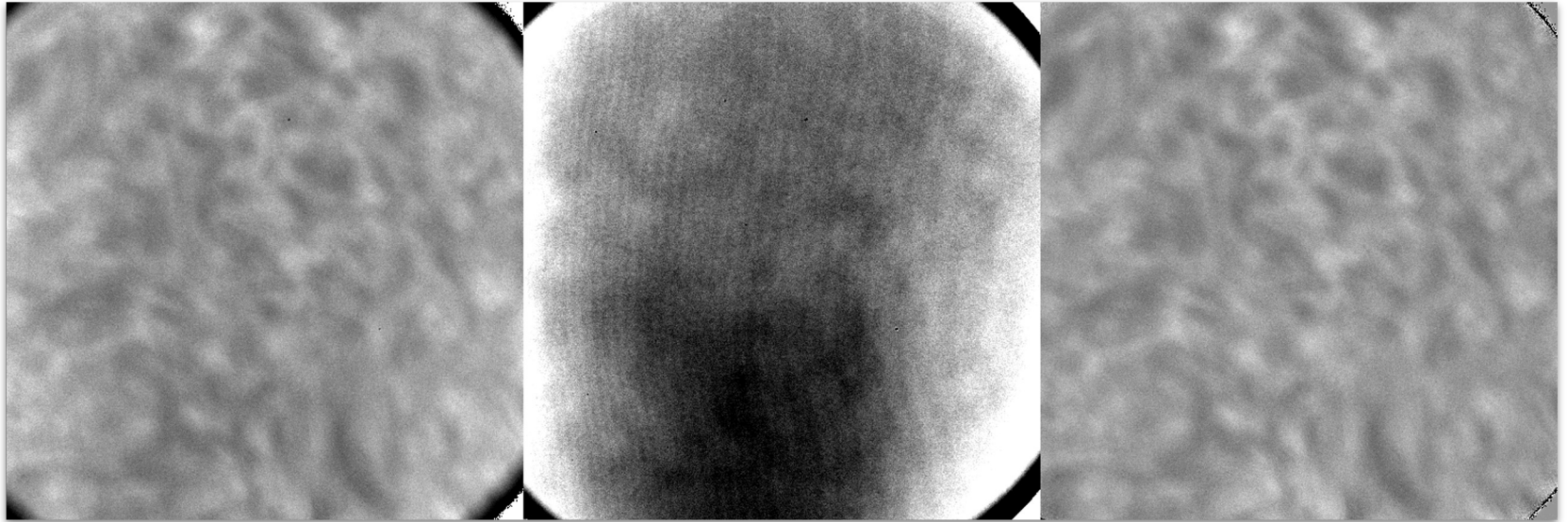


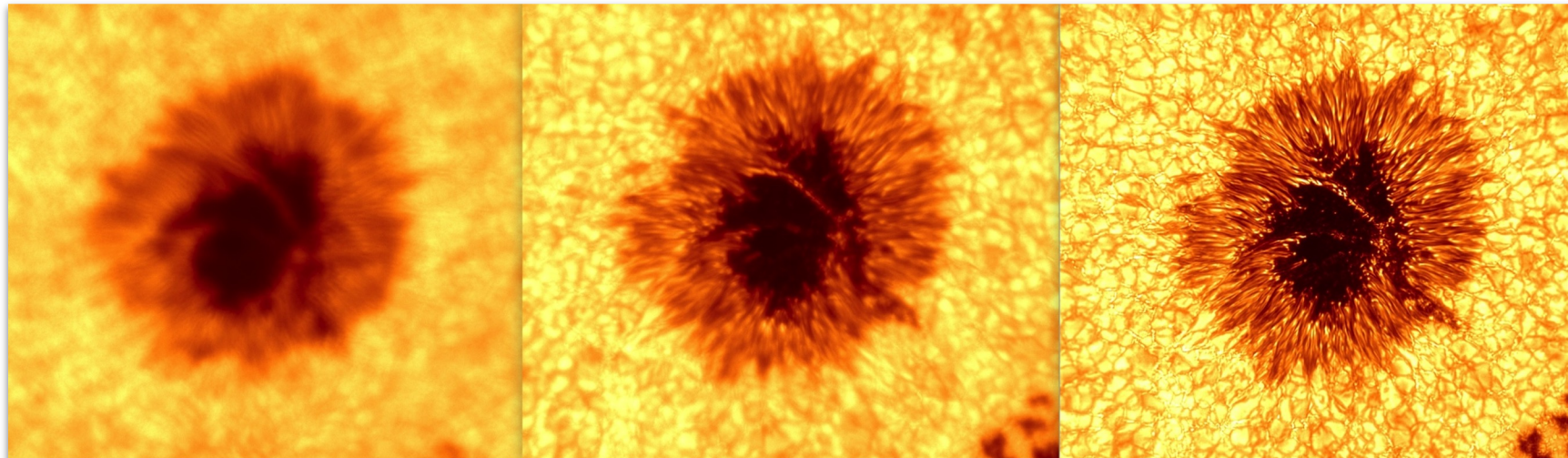
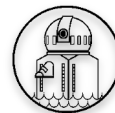
G-band vs TiO: which is which?

NSF BFI Data Structure



- Filename Convention: bbso_tio_pcosr_YYYYMMDD_HHMMSS.fts
- Data are taken as a burst of 100 images; 70 best images are selected and saved
- Each image in the burst is then flatfielded and speckle reconstructed (*Wöger & von der Lühe, 2008; Wöger, von der Lühe, Reardon, 2008*)



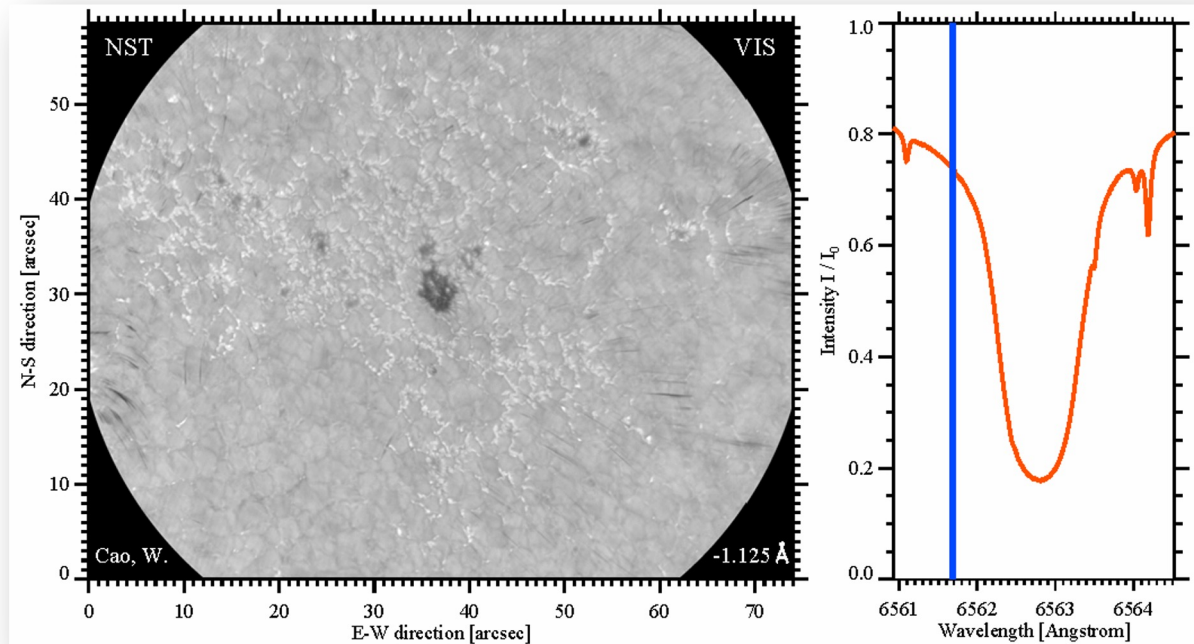


Adaptive Optics Off

Adaptive Optics On

AO On with image post processing

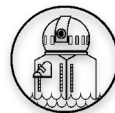
All GST data are AO corrected. In addition, TiO and VIS data are also speckle reconstructed (*Wöger & von der Lühne, 2008; Wöger, von der Lühne, Reardon, 2008*)



Speckle reconstructed images taken at 13 preset H α line positions:
 $\pm 1.2\text{\AA}$, $\pm 1.0\text{\AA}$, $\pm 0.8\text{\AA}$, $\pm 0.6\text{\AA}$, $\pm 0.4\text{\AA}$, $\pm 0.2\text{\AA}$, and the line center
or any combination of these positions. Cadence ranges from 0.8s (one position) to 25s (13
positions). Image scale is $0.029''/\text{pixel}$.



VIS Data Structure



Filename Convention: bbso_ha[rb]XXX_vissr_YYYYMMDD_HHMMSS.fts. Examples:

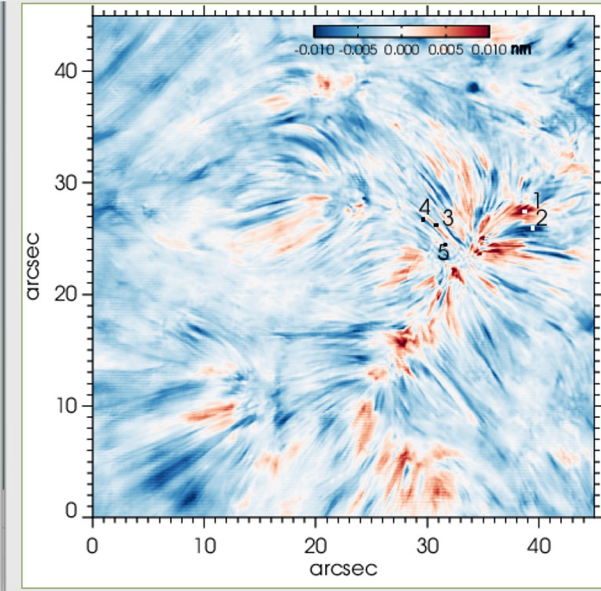
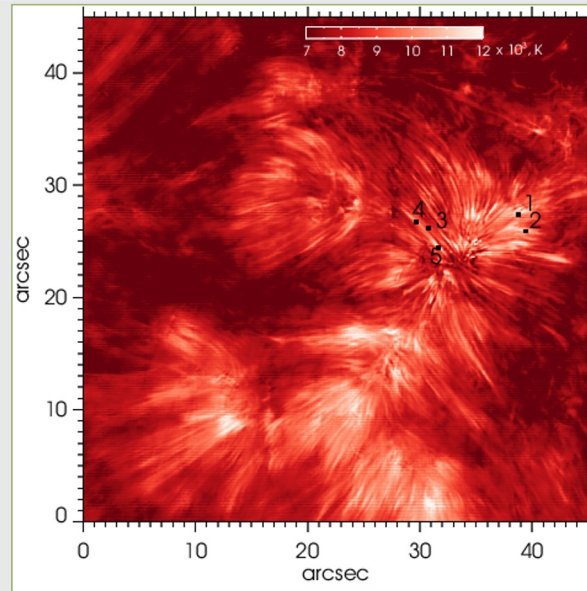
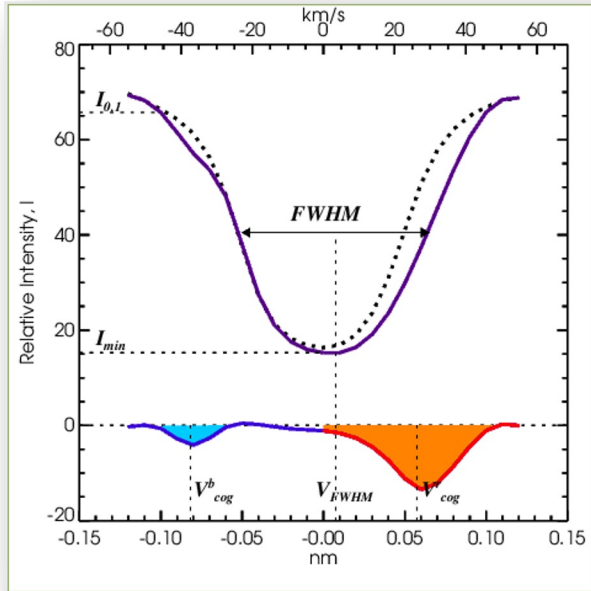
bbso_har000_vissr_YYYYMMDD_HHMMSS.fts - H α line center

bbso_hab120_vissr_YYYYMMDD_HHMMSS.fts - H α -1.2Å

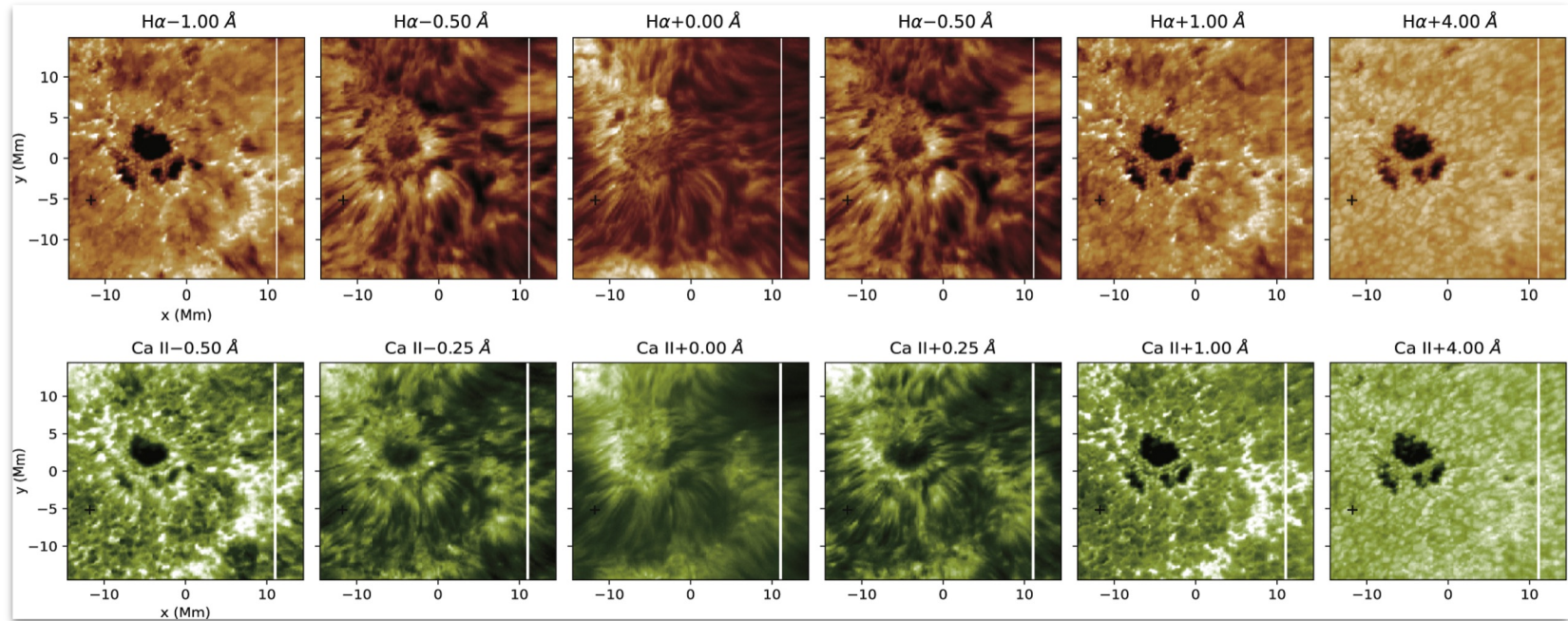
bbso_har020_vissr_YYYYMMDD_HHMMSS.fts - H α +0.2Å

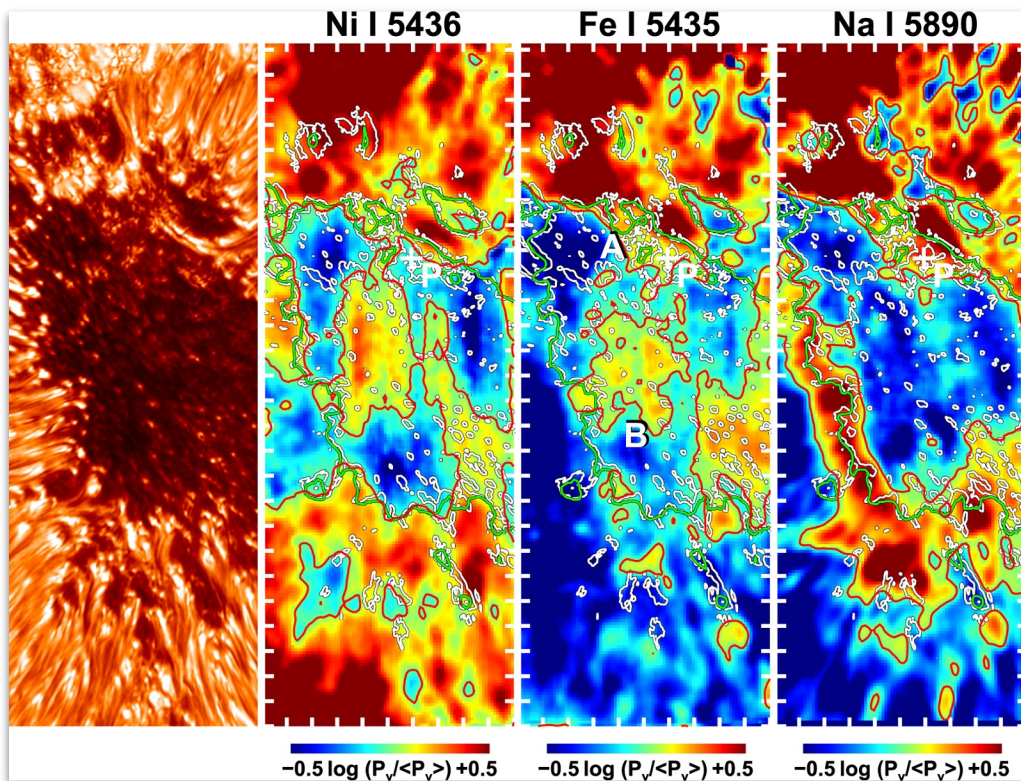
Data are taken as a burst of 60 images; 25 best images are selected and saved

Each image in the burst is then flatfielded and speckle reconstructed (*Wöger & von der Lühe, 2008; Wöger, von der Lühe, Reardon, 2008*)



Temperature maps were derived using brightness temp observed in ALMA Band 3 and H-alpha core width (Molnar et al 2019). Note: very few instances when we observe a tightly positioned RBE/RRE pair



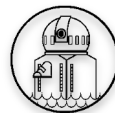


TiO broadband high-resolution image (left) and power maps integrated over periods from 2 to 4 minutes and over 40 minutes in three lines. "A" and "B" mark two subregions of strong power. The TiO intensity contours (white lines) of 50% show the UD in the umbra. The red contours indicate the average power level of the umbra. (from Chae et al. 2017)

FISS data processing routine was developed by Chae et al from Seoul National University.



FISS Catalog



← → ↻ fiss.snu.ac.kr

FISS **Home** Instrument ▾ Data ▾ Guide ▾ Publication People ▾ Partners Contact

Data Structure
Calibration Process
Analysis Routine (IDL)
Analysis Routine (Python)
Observation Guide
Observation Guide (Korean)

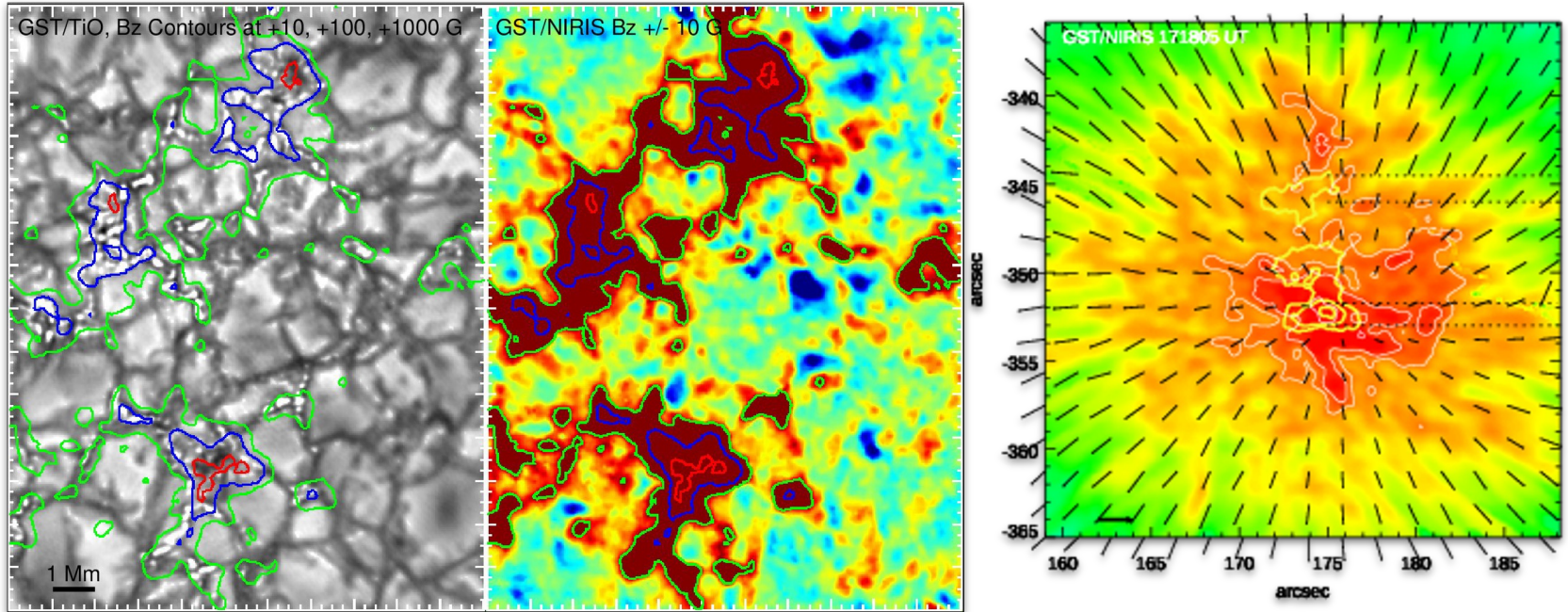
Fast Imaging Solar Spectrograph

Featured Publication (Chae+ 2022)

Title: Propagating Alfvénic Waves Observed in the Chromosphere around a Small Sunspot: Tales of 3-minute Waves and 10-minute Waves

[Abstract](#) [ADS](#)

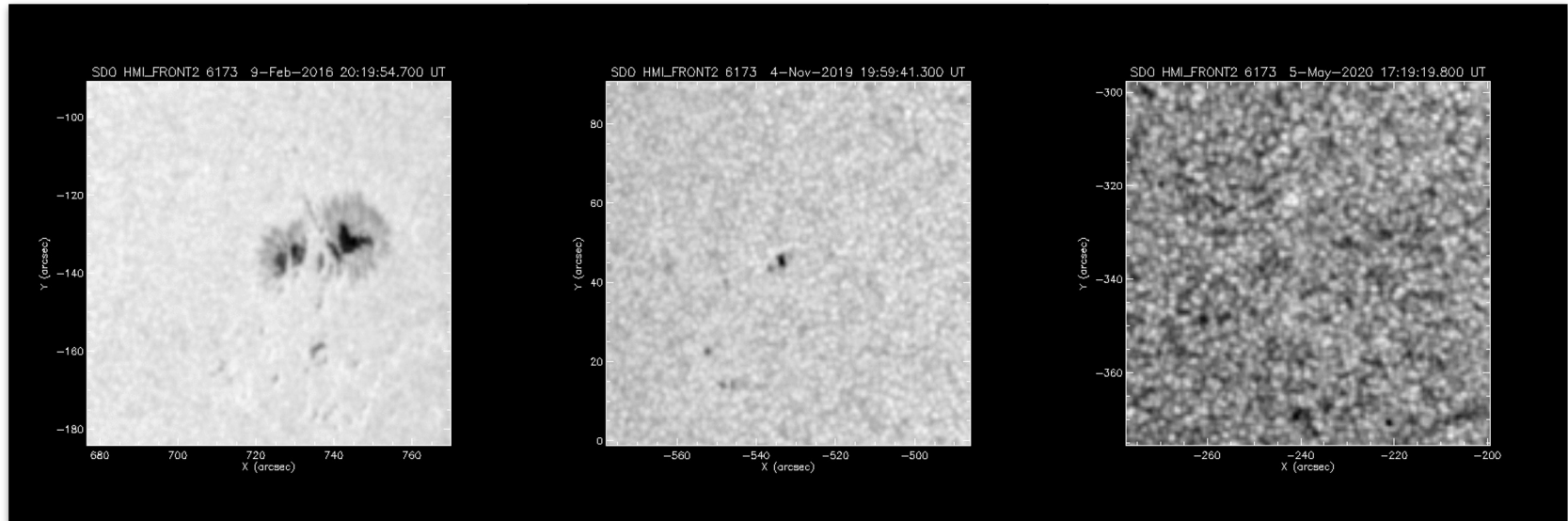
The diagram illustrates wave propagation in the chromosphere. It features three horizontal lines representing different physical boundaries: the top red line is the *Alfvénic wave (transverse)* boundary, the middle blue line is the *slow waves (longitudinal)* boundary, and the bottom yellow line is the *acoustic cutoff acoustic resonator* boundary. Three wave modes are shown as curves starting from the bottom boundary and moving upwards. The blue curve, labeled *slow-to-Alfvénic mode conversion*, starts at $x=1$ and crosses the blue boundary. The green curve, labeled *fast-to-slow mode conversion*, starts at $x=2$ and crosses the blue boundary. The yellow curve starts at $x=3$ and crosses the blue boundary. Red double-headed arrows indicate the direction of wave propagation for each mode.



Full Stokes Polarimetry. We provide imaging spectropolarimetry measurements as well as inverted data (per request). Detail of NIRIS data processing will be given by Taylor Baildon

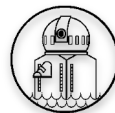


- Co-alignment with scale-invariant feature transform (SIFT) method works for all GST imaging data and for various features such as sunspots, pores, and granulation (Details will be given by Xu Yang).
- Accurate information on image scale, FOV center and FOV rotation angle can be derived so that `fits2map.pro` routine may be directly used with these images.
- De-Stretching and Rotation





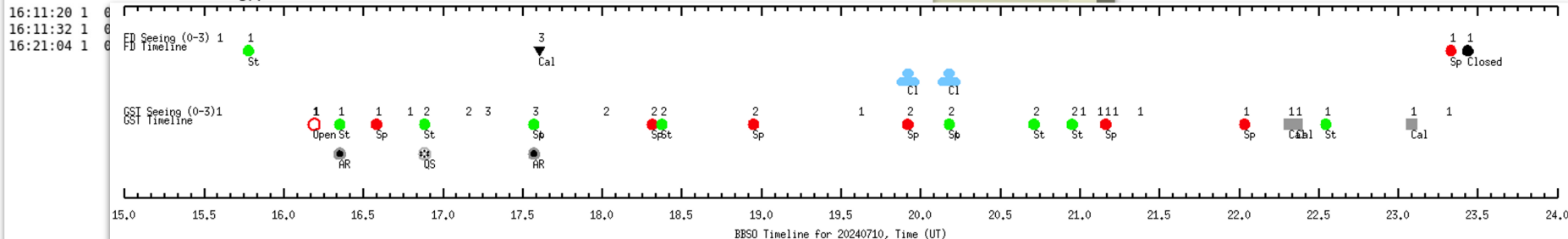
Observing Logs



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New Jersey Institute of Technology
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GST

Time	S	Mtr	X	Y	Remarks
15:34:43	1	0.01	0W	0N	On opening the shutter, a loud bang at an Alt of 37.



0.2A 17ms
0.0A 20ms
NIRIS: polarimetry scan from -1000 to +1000 step50
delay 30s

16:34:54	1	0.78	43E	192S	#Stop observations (move away from IRIS pointing).
16:46:42	1	0.70	803W	26S	Guider calibration.
16:52:59	2	0.70	185W	31N	#Start observations using Sunrise positioning (?). #QS quiet sun observation with good seeing at start.
17:08:54	2	0.70	187W	31N	Changing VIS settings - frame selection off, burst size 25 with delay set to 0.
17:16:04	3	0.71	188W	26N	Better seeing.
17:34:12	3	0.72	191W	25N	#stop and moving to #AR13738, #start observation with VIS 10 s delay and frame selection ON.
18:00:34	2	0.72	25E	204S	seeing not as good
18:18:52	2	0.72	22E	204S	#stop observations - Issue with guider, brightness low despite being on the sun
18:22:28	2	0.18	22E	204S	#Start observations at the same position, forcing

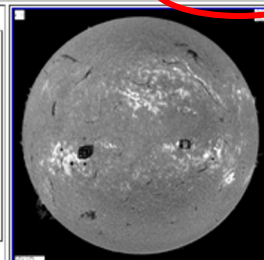
BBSO GST Data Page- 2024-05-19

[Previous Day](#)

[BBSO Archive and Observing Log](#)

[Next Day](#)

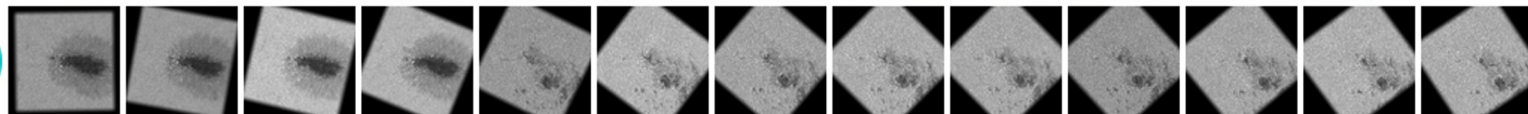
DATE: 2024/05/19	OBS TIME: 161414 - 222738 UT	TARGET: AR13679
INSTRUMENTS: TIO, VIS, NIRIS	OBSERVER: NG	NOTE: PI - Open
OBS COMMENTS:	SEEING, DATA QUALITY ->	2 (chromospheric network, limb)
GST Data Request Form	Solar Monitor Page	Observer Log
	Joint GST&IRIS ObsID: 3622606133;	Heliviewer.org
	NIRIS 1565nm QL Movie	



16:14:37

GST TIO Observations Coverage

22:26:34

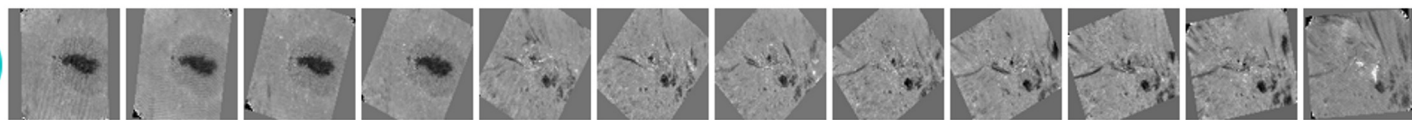


16:14 16:58 17:10 17:46 18:02 18:45 18:59 19:16 19:19 19:27 19:39 19:52 20:03

16:14:13

GST VIS hab100 Observations Coverage

22:27:36



16:14 16:48 17:22 17:56 18:18 18:50 19:22 19:55 20:28 21:00 21:34 22:01

16:14:16

GST VIS hab080 Observations Coverage

22:27:36



GST Data Request Form



Check Data Availability

Data Preview

Request Form

Final Step

GST Data Request

Using Date: 2024-05-19, Using Universal Time

Drag the sliders below to adjust the time range (ATTN: Hit Reload if NaN appear in the window below)

16:14 - 22:26



If you are PI of an Observing Run and data are less than 9 month old, Enter your Lastname and Access Key

Last Name

Access Key

An Email Address is Required

Email Address

Choose your desired set of Cameras:

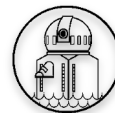
All Cameras | TiO Camera | VIS H-alpha Camera | NIRIS Mag

FISS Cameras

Submit Form



After Submission



E-mail notification will be sent after the data were staged for ftp

This is an Automated Message

Dear ghn.njit,

Your <TIO> data for 20200607 Time Interval 1616-2214 are now available at: ftp://ftp.bbso.njit.edu/pub/nst_data_requests/nst_20200607_1616_2214_20200827802

----- IMPORTANT -----

The VIS and NIRIS data are packed into tar files. 100 VIS files and 30 NIRIS files each. Make sure you download them all

The data will be available for 1 week and will be later removed from the FTP server.

Data Policy

The use of BBSO Ha images for public education efforts and non-commercial purposes is strongly encouraged and requires no expressed authorization.

If you use the data or some product based on the data we ask that you include an acknowledgment of the Big Bear Solar Observatory, New Jersey Institute of Technology.

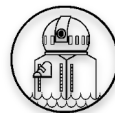
Since we are interested in the work that other people do with our data, we also would like to request a sample copy, reference, URL, etc., depending on the type of publication.

Thank you,
Vasyl Yurchyshyn and BBSO Staff

Index of ftp://ftp.bbso.njit.edu/pub/nst_data_requests/nst_20200607_1616_2214_20200827802/

[Up to higher level directory](#)

Name	Size	Last Modified ↓
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In case of any problems with the request form, data download, processing, etc. contact `vasyl.yurchyshyn@njit.edu`

References

- Goode, P. R. & Cao, W., 2012, *The 1.6 m Off-axis New Solar Telescope (NST) in Big Bear*, Proc. SPIE, 8444, 844403
- Cao, W., Gorceix, N., Coulter, R., Ahn, K., Rimmele, T. R., & Goode, P. R. 2010a, *Scientific instrumentation for the 1.6 m New Solar Telescope in Big Bear*, *Astronomische Nachrichten*, 331, 636
- Chae, J., Park, H., Ahn, K., Yang, H., Park, Y., Nah, J., Jang, B., Cho, K., Cao, W., & Goode, P., 2013, *Fast Imaging Solar Spectrograph of the 1.6 Meter New Solar Telescope at Big Bear Solar Observatory*, *Solar Physics*, 288, 1