GONG, H-α, and Space Weather

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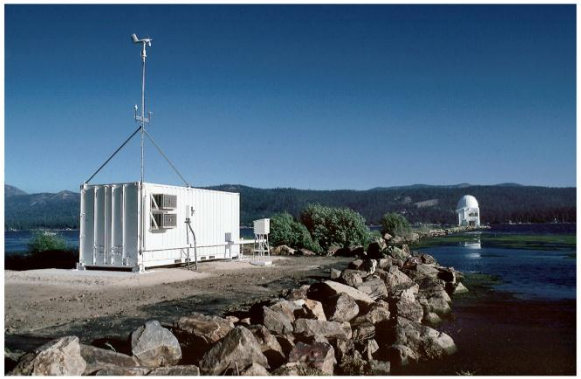
What is GONG?

- Global Oscillation Network Group
- Six-site network of instruments around the world
- Deployed in 1995 for helioseismology
- Also provides data needed for space weather forecasts

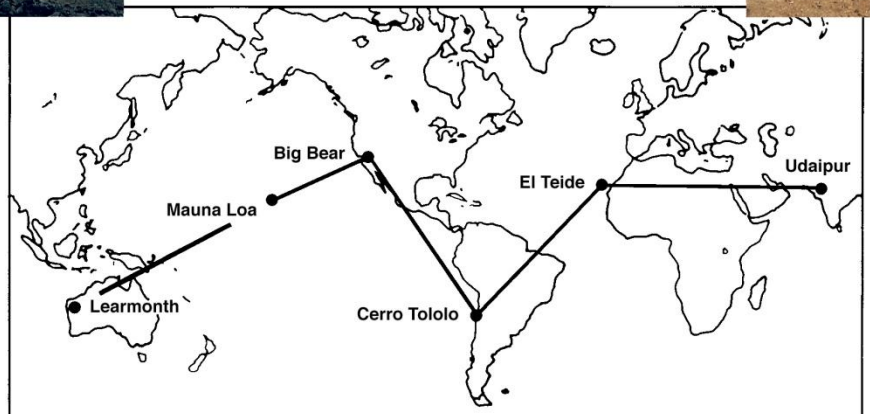
Mauna Loa



Big Bear

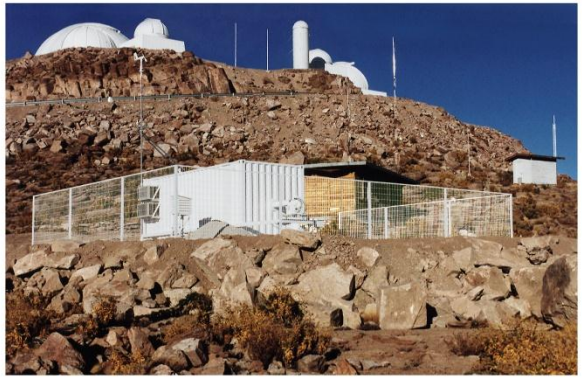
Udaipur

Global Oscillation Network Group



Learmonth

Cerro Tololo

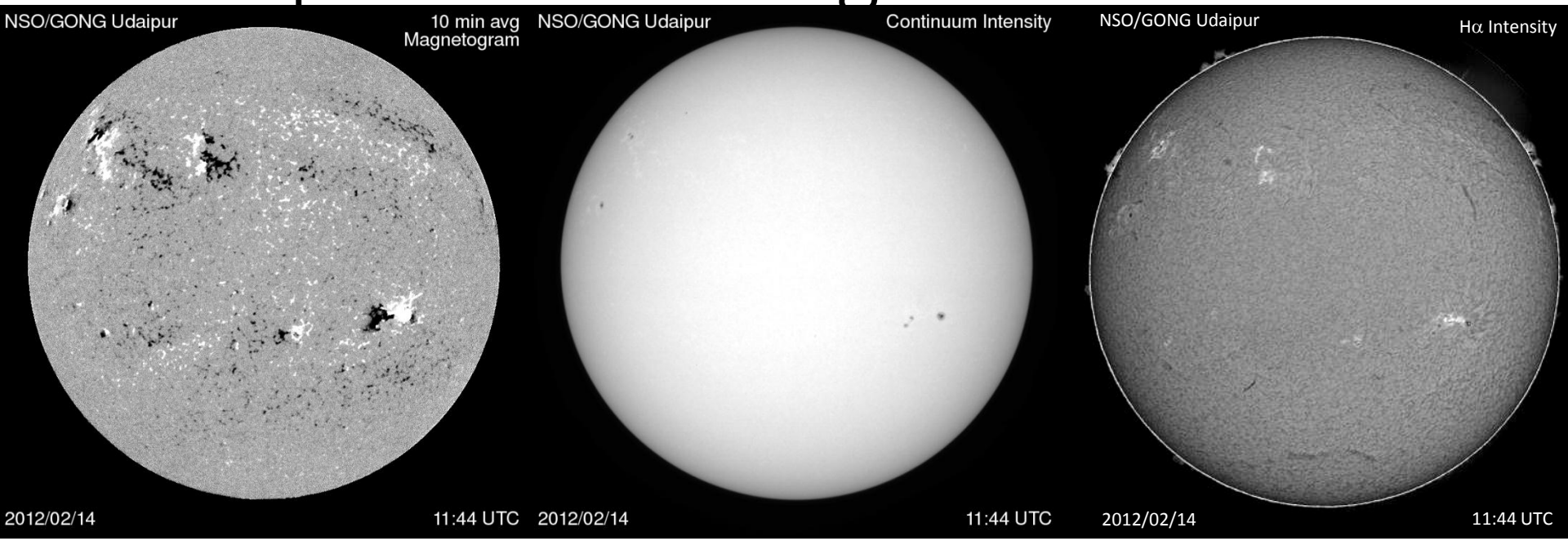


El Teide

GONG Instrumentation

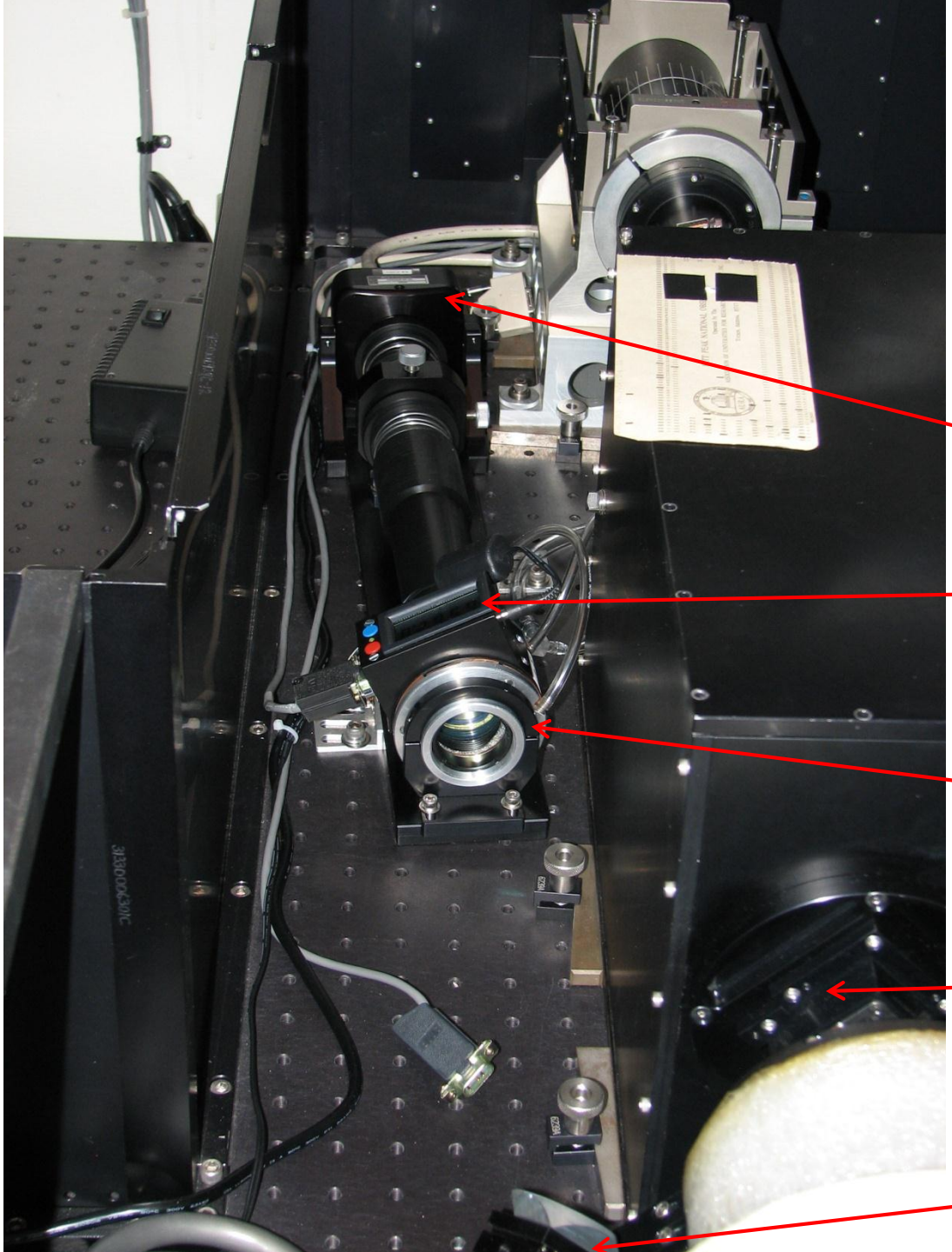
- Two instruments:
  - Michelson Interferometer
    - helioseismology Doppler velocity, intensity and LOS magnetic field
    - 1k x 1k full-disk images in Ni I 676.8 nm
    - 60-sec cadence
  - Air Force-funded filter system
    - H-α intensity
    - 2k x 2k full-disk images
    - 60-sec cadence at a given site, 20-sec cadence from network
    - Deployed in 2010

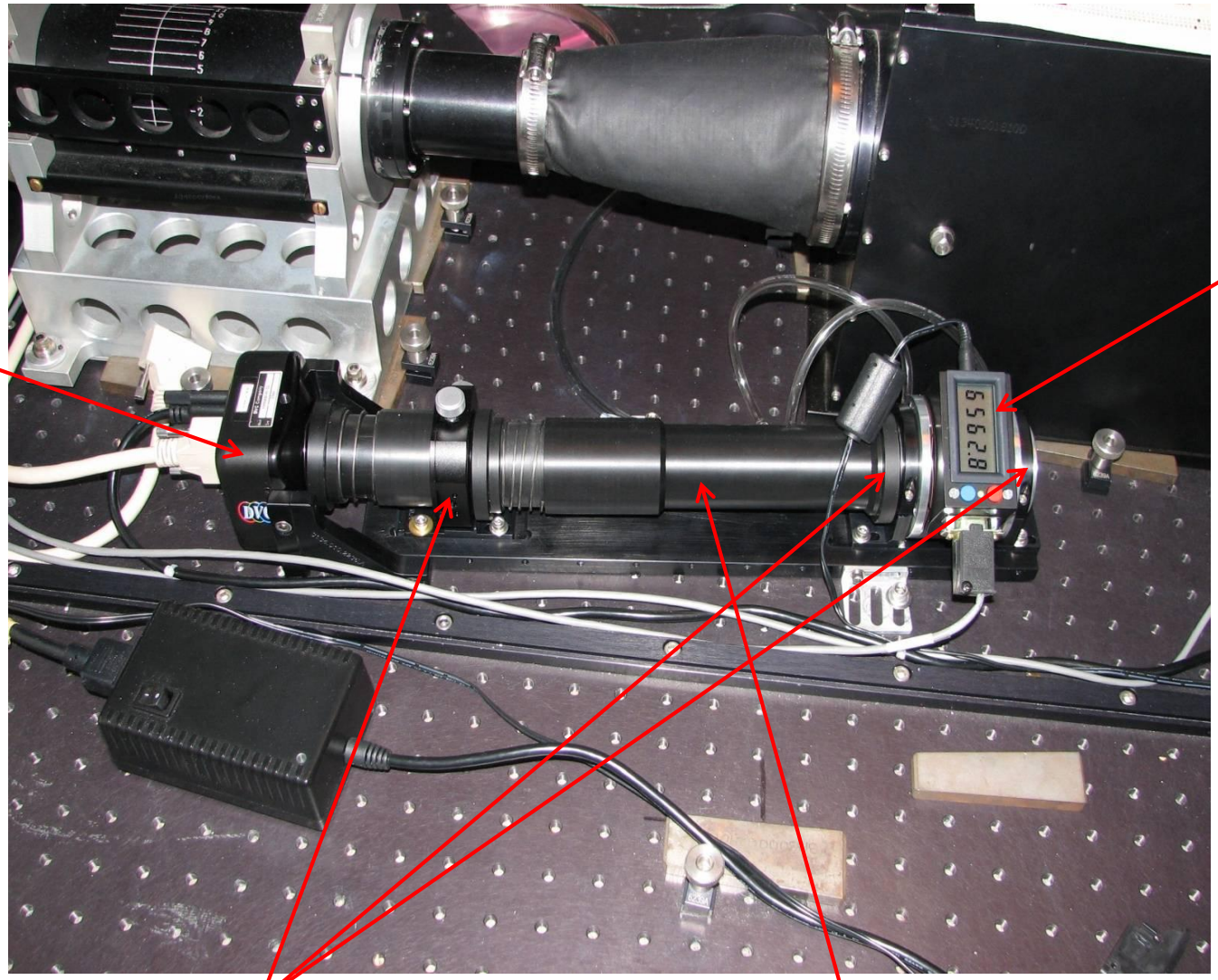
Sample GONG images



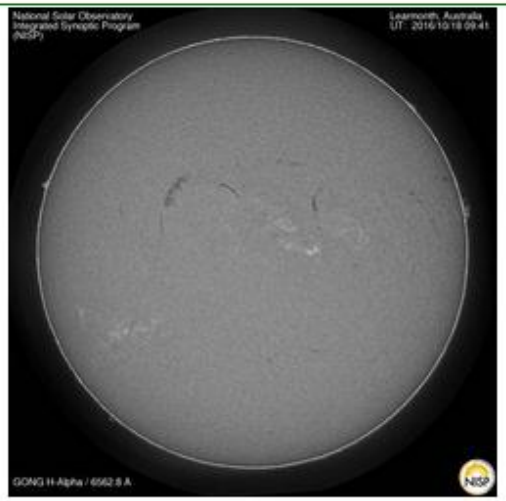
These images are returned in near-real time and are available on the Internet

The H-α system




CCD
Camera
Filter
Optics
Light Baffle

GONG H-Alpha data



434 Learmonth
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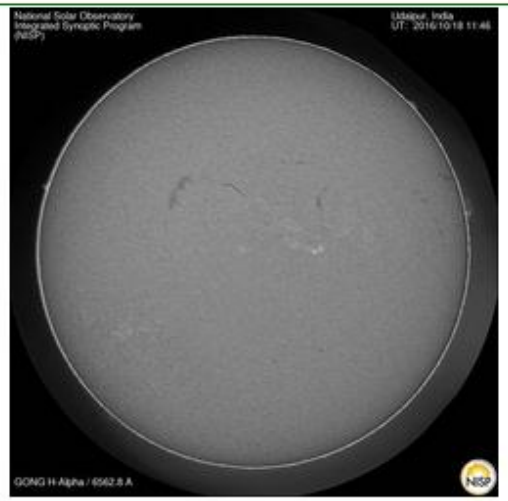
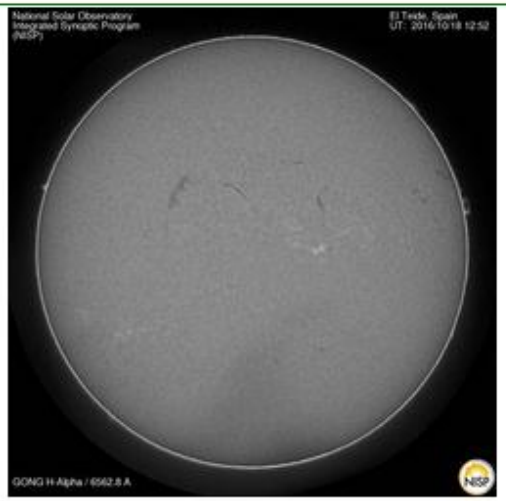
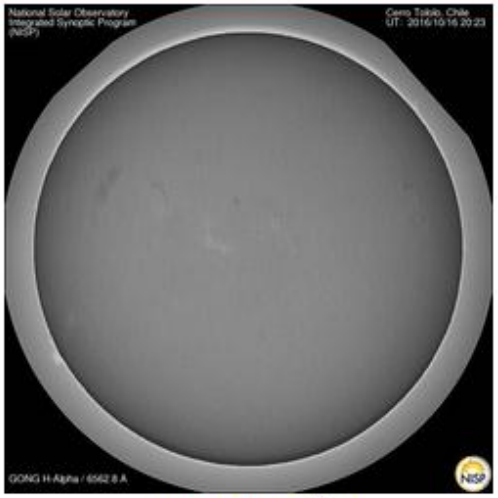
6 hour(s) 41 minute(s)



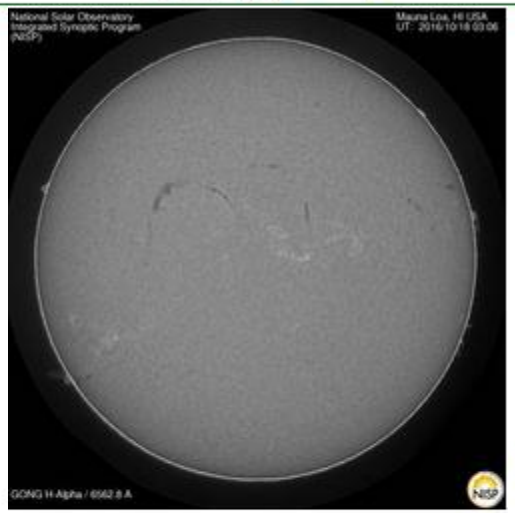
562 Udaipur
2016/10/18 11:46:54
4 hour(s) 36 minute(s)



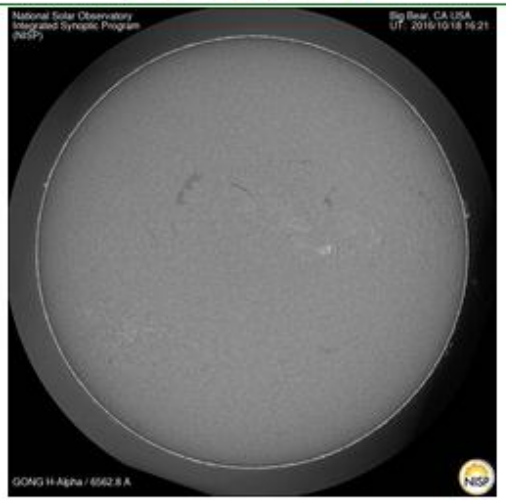
252 El Teide
2016/10/18 12:52:14
3 hour(s) 31 minute(s)



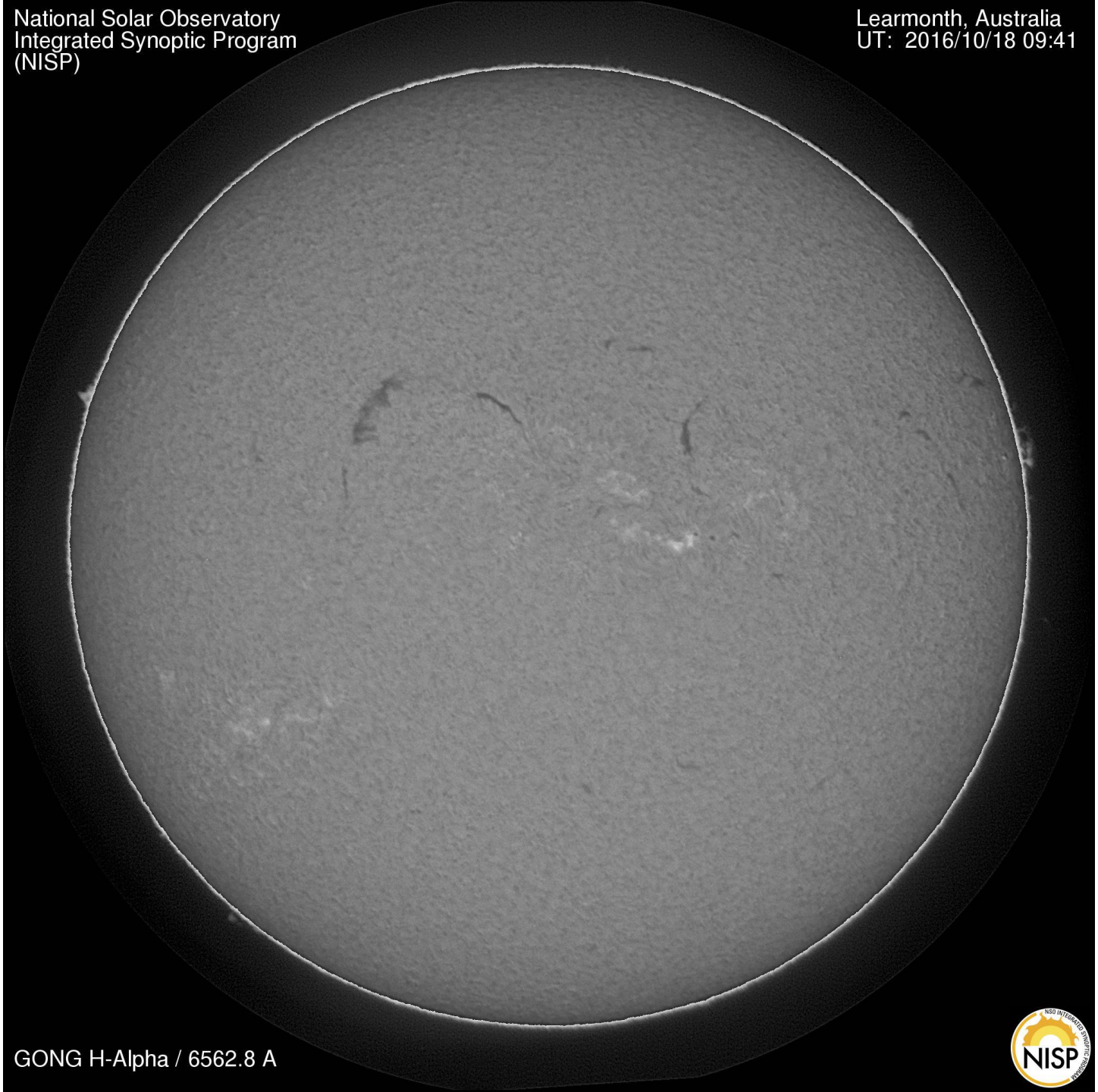
169 Cerro Tololo
2016/10/16 20:23:34
1 day(s) 19 hour(s)



137 Mauna Loa
2016/10/18 03:06:14
13 hour(s) 18 minute(s)



99 Big Bear
2016/10/18 16:21:54
1 minute(s) 35 second(s)


National Solar Observatory
Integrated Synoptic Program
(NISP)
Learmonth, Australia
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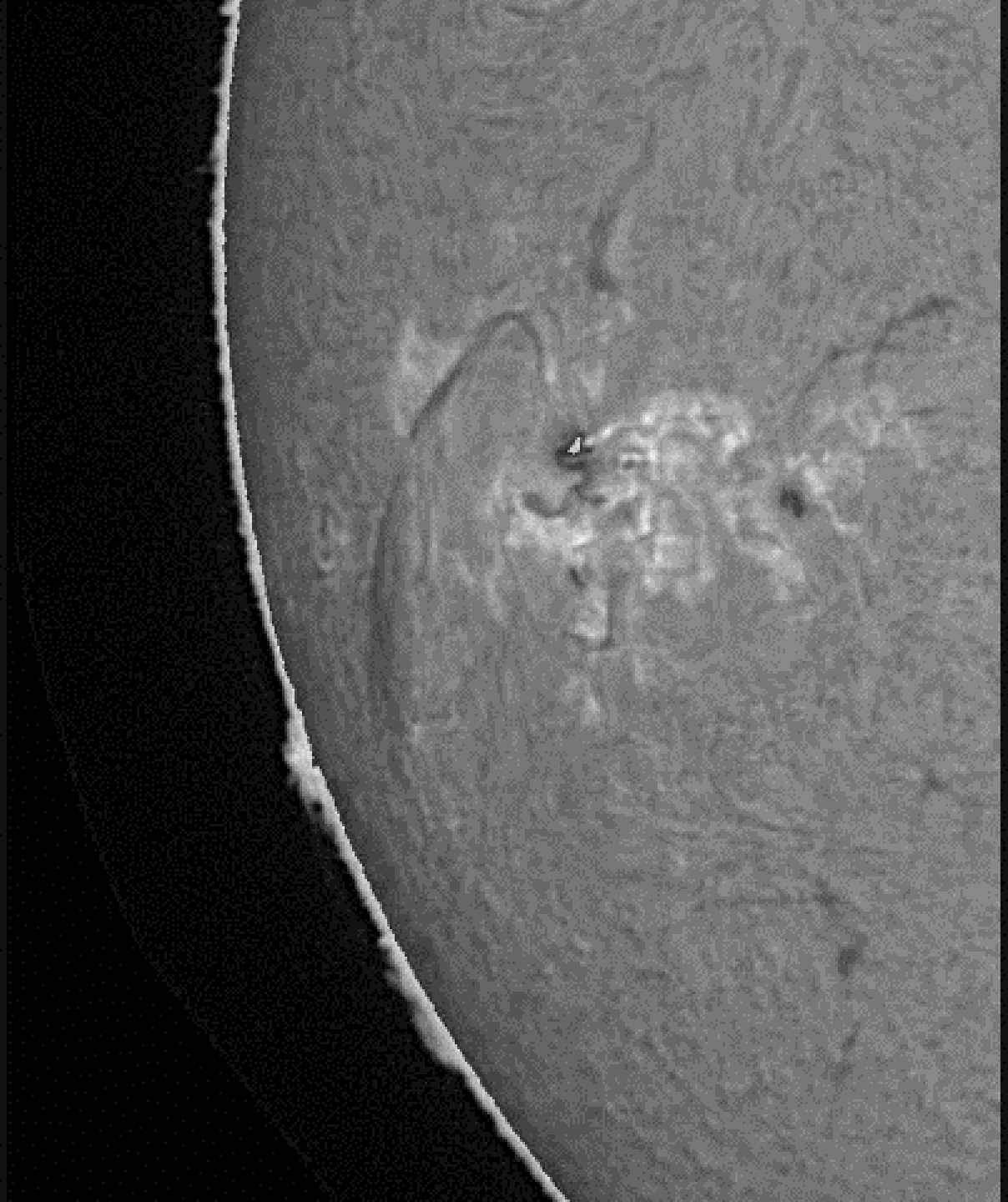
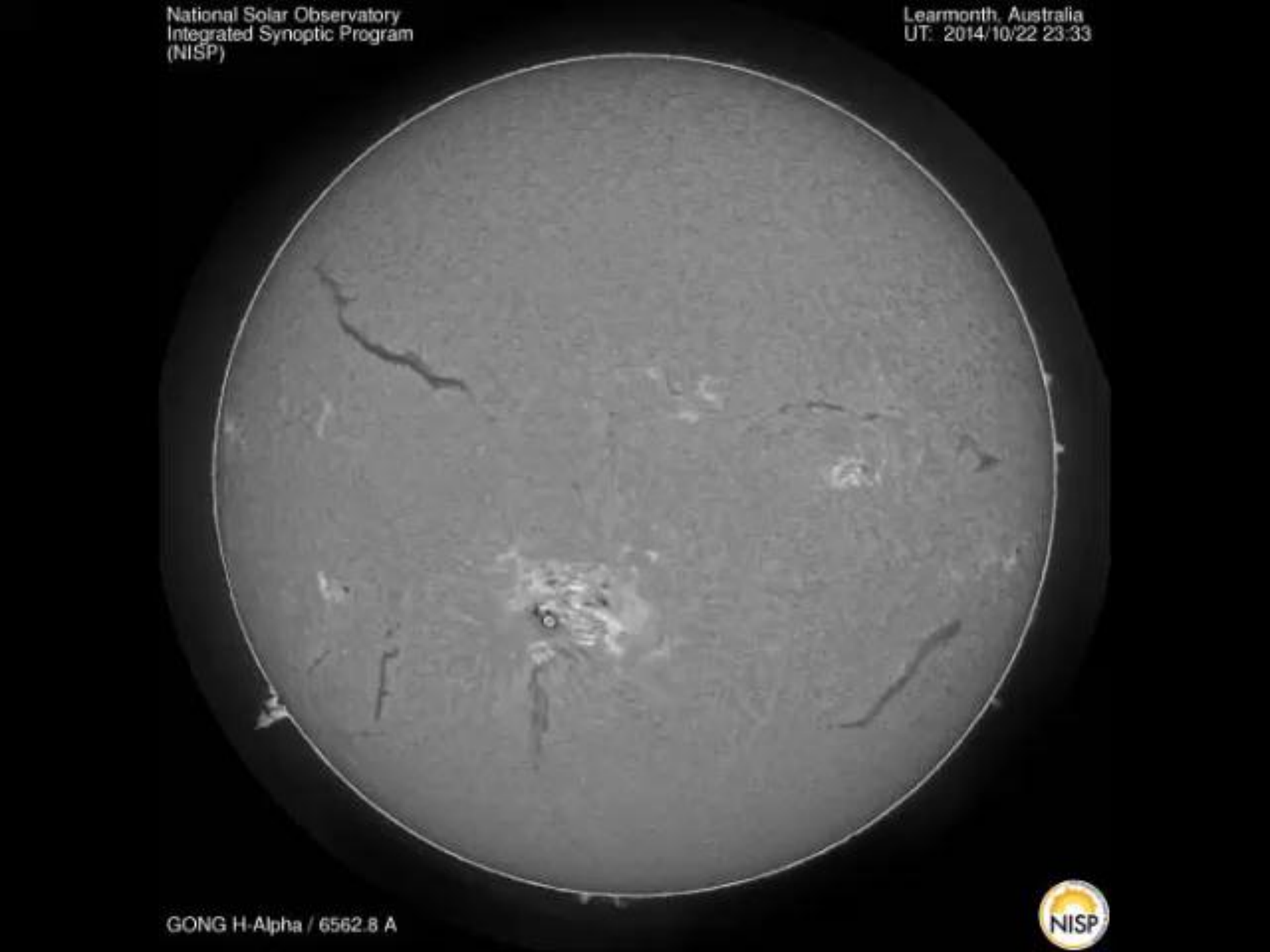
GONG H-Alpha / 6562.8 A
NISP

CTIO
Jan 30, 2014




National Solar Observatory
Integrated Synoptic Program
(NISP)
Learmonth, Australia
UT: 2014/10/22 23:33
GONG H-Alpha / 6562.8 A
NISP

Future developments

- NSF has provided $2.5M to refurbish GONG
- Goal is to continue to provide GONG data for Space Weather over the next 10-15 years during SPRING development
- One part of the plan is to replace current H-α filter
- Current filter has 0.4 Å bandpass centered on line, controlled by temperature
- Will replace with a pressure-tuned Fabry-Perot etalon to also provide red and blue wings
- This will give Doppler shift measurements of erupting filaments underlying CMEs

GONG and Space Weather

- High-cadence continual magnetograms used as input to NOAA/SWPC WSA+Enlil geomagnetic storm forecast, AFRL/ADAPT data assimilation, and NASA/CCMC models
- H-α images used by NOAA/SWPC and 557th Weather Wing (formerly know as AFWA)
- NOAA/SWPC supporting development of farside maps for forecasting

Ground vs Space

- Ground advantages:
  - Low cost
  - Long life
  - Maintainable, upgradable
  - High bandwidths
  - Lower vulnerability to SpcWx
  - Can develop technology pathways for future space platforms
- Space advantages:
  - No atmosphere
  - Location, location, location
  - In situ