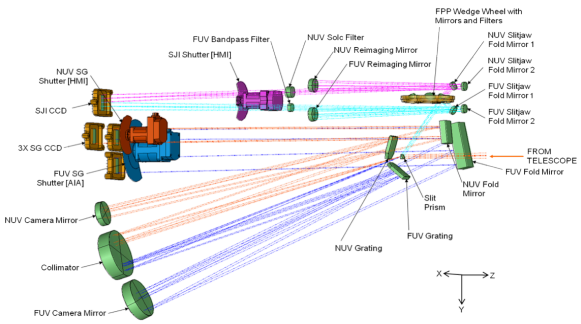
Initial Calibration and Performance of the IRIS Instrument

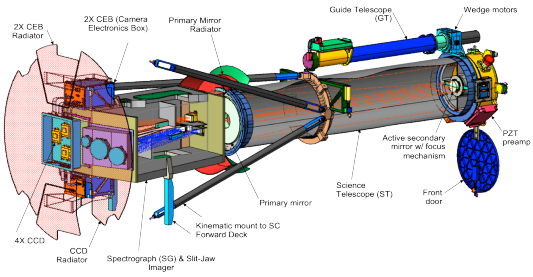
J-P. Wülser[1], T. Tarbell[1], B. De Pontieu[1], J. Wolfson[1], P. Boerner[1], J. Lemen[1], N. Hurlburt[1], A. Title[1], C. Schrijver[1], R. Bush[2], L. Kleint[3], B. Lites[4], S. McIntosh[4], S. Jaeggli[5], C. Kankelborg[5], E. DeLuca[6], L.Golub[6], S.McKillop[6], K.Reeves[6], S.Saar[6], P.Testa[6], H.Tian[6], M.Weber[6], V.Hansteen[7], M.Carlsson[7]

[1]Lockheed Martin Solar & Astrophysics Laboratory, [2]Stanford University, [3]BAERI, [4]High Altitude Observatory, [5]Montana State University, [6]Harvard-Smithsonian Center for Astrophysics, [7]University of Oslo

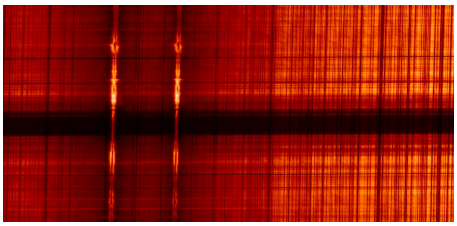
- NASA Small Explorer mission
- Primary objective: Understand how the solar atmosphere is energized
- Successful launch 2013 June 27
  - IRIS performs very well on orbit
- High resolution spectra
  - FUV: 1332 – 1358 Å
    1389 – 1407 Å
  - NUV: 2783 – 2835 Å
- Slit-jaw images
  - FUV: 1330 Å (C II)
    1400 Å (Si IV)
  - NUV: 2796 Å (Mg II k)
    2832 Å (Mg II wing)
- Field of view: 3 arcmin
- Spatial resolution: 0.4 arcsec

Interface Region Imaging Spectrograph (IRIS)

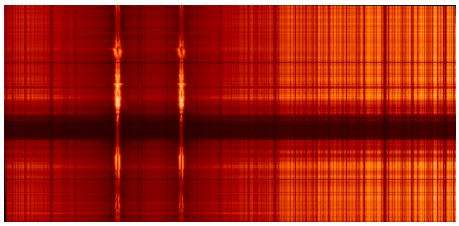




Flat-field, distortion correction, common plate scale



Raw NUV spectrum at the slit location shown in the image on the right



Corrected NUV spectrum: Mg II k & h; dark horizontal band is sunspot

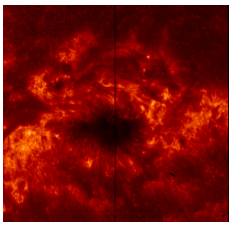
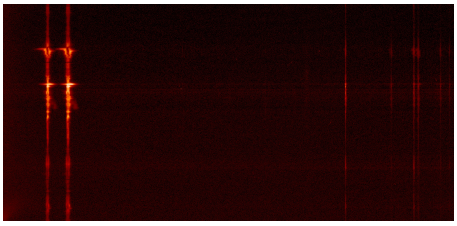
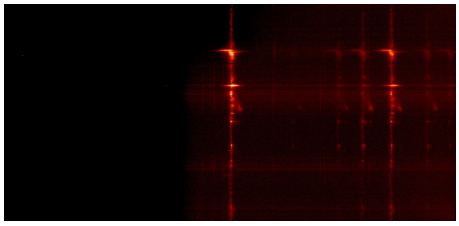


Image in Mg II k showing slit





Corrected FUVspectra taken simultaneously with NUV above. Left: 1332-1358 Å with CII doublet, right: 1389-1407 Å with prominent Si IV lines

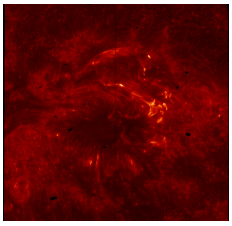
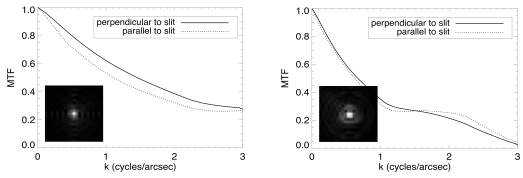


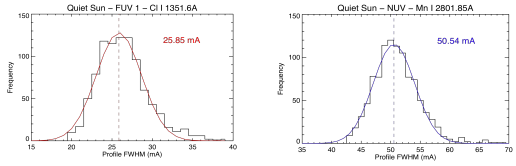
Image in 1400 Å Si IV channel

- Images and spectra taken at 05:38 UT on 2013-Oct-25
- Processing with SSW iris_prep.pro
- Dark subtraction
- Flat-field
- Geometric distortion correction
- Common plate scale
- Spatial alignment using two fiducial marks (gaps) in slit
- Wavelength calibration via photospheric NUV line
  - Correct for orbital shifts
  - Correct for thermally induced shifts
- Absolute spatial alignment via AIA 1600 Å images

Spatial & spectral resolution, modulation transfer function



MTF and PSF derived from phase diversity measurements for the FUV slit-jaw imager (left) and NUV slit-jaw imager (right)



Histogram of the FWHM of photospheric lines in the FUV spectrograph (left) and NUV spectrograph (right). The spectral resolution is effectively Nyquist limited

Absolute throughput: stellar calibration

- Results of the pre-launch (component-wise) calibration are shown in the four panels on the right
- FUV throughput verified post-launch by observing Rho Leonis:
  - Bottom left: IRIS spectrum (solid line) and IUE reference spectrum from IUE folded with pre-launch IRIS response
  - IRIS measurements of Si IV lines agree very well with IUE+ IRIS prelaunch calibration
  - IRIS short FUV (1330-1358 Å) response is about 30% lower than pre-launch calibration
- NUV throughput verified by comparison with SOLSTICE / SORCE measurements in July 2013 (bottom right)
  - Mg II wing measurements agree very well with pre-launch calibration (discrepancy near line core due to solar activity)