Spectroscopic observations of an M1.5 flare from IRIS & CHASE

Li, Ying (李瑛；yingli@pmo.ac.cn)

Liu, Xiaofeng (刘骁锋)

Purple Mountain Observatory, Nanjing, China

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Outline

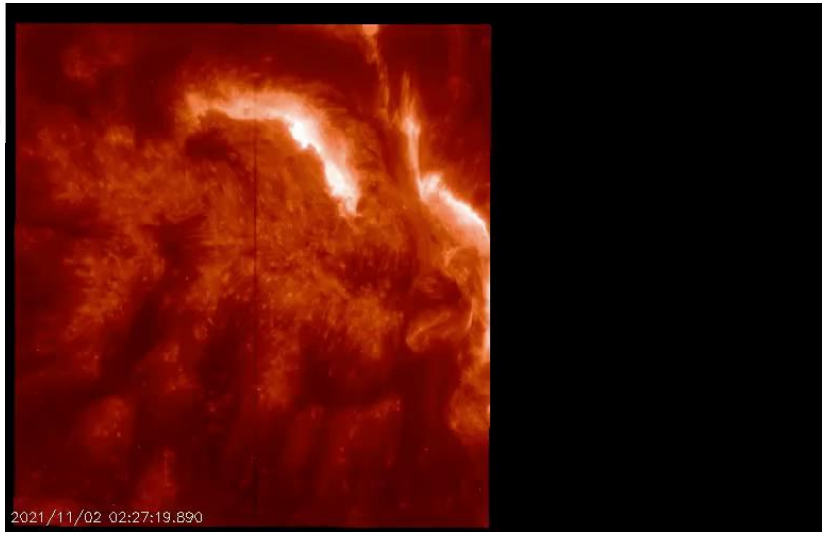
- ❑ Overview of IRIS & CHASE
- ❑ Observations of an M1.5 flare from IRIS & CHASE
- ❑ CHASE flare list (with IRIS)
- ❑ Summary & Perspective

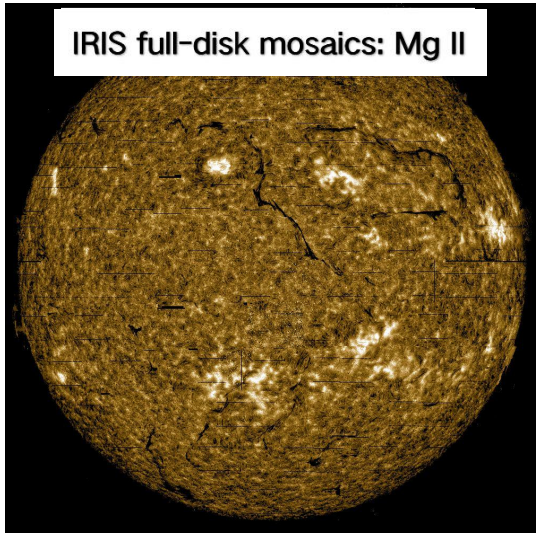
Overview of IRIS & CHASE: instrument parameters

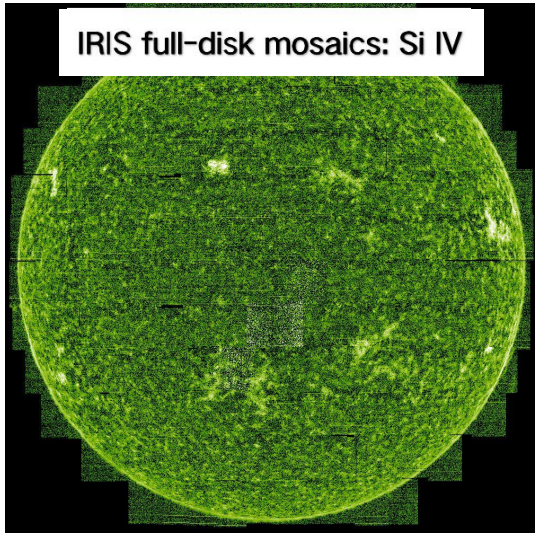
	IRIS (Interface Region Imaging Spectrograph)	CHASE 羲和(Xihe) (Chinese Hα Solar Explorer)
launch date	June 27, 2013	October 14, 2021
wavelength	FUV (~1400 Å) & NUV (~2800 Å)	visible (~6563 Å)
data	spectra & slit-jaw images	spectra (-> images)
primariy lines	Mg II, C II, Si IV, Fe XXI, ...	Hα, Fe I, Si I
field of view	175''*175'' (SJI)	40'*40' (full-disk)
time cadence	a few seconds	~60 s
spatial pixel	0.167''	0.52''
spectral pixel	0.013 Å (FUV) & 0.026 Å (NUV)	0.024 Å
modes	raster scan, sit-and-stare	raster scan (sit-and-stare)

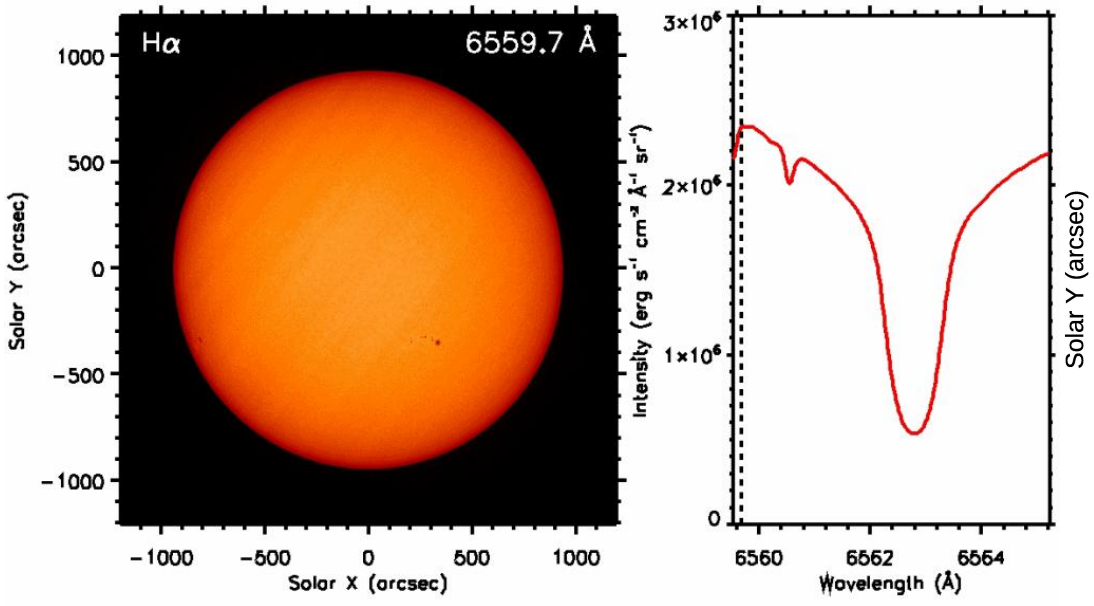
Overview of IRIS & CHASE: data examples

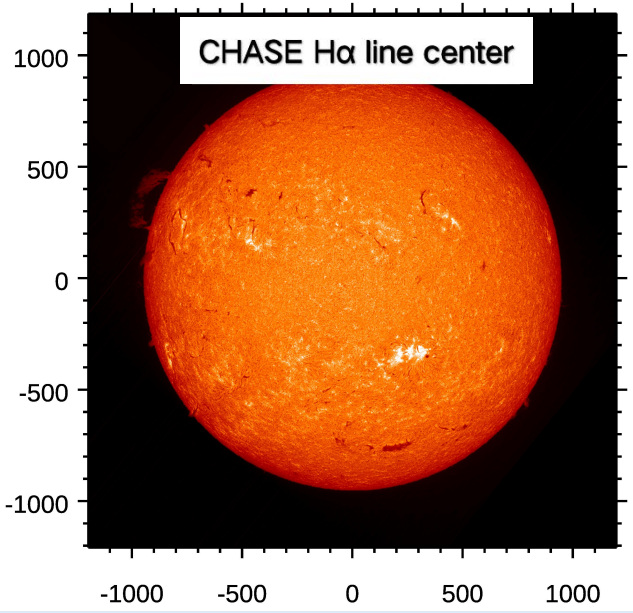
IRIS movie of the day (M1.7 flare)

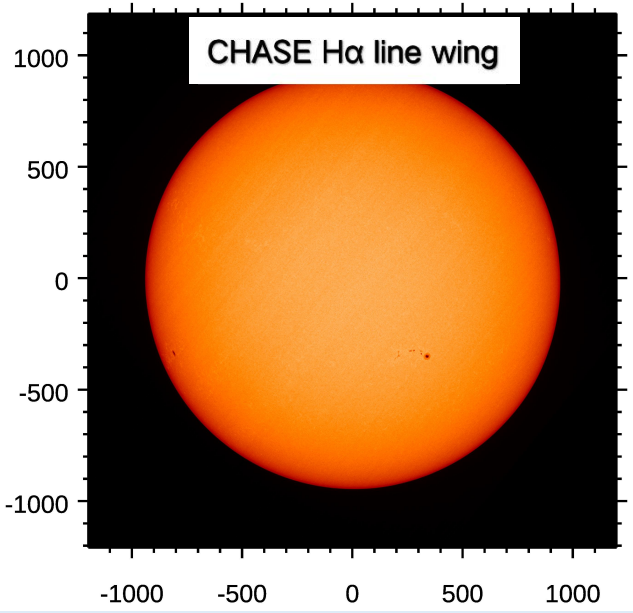












Overview of IRIS & CHASE: related science

- **formation heights of the primary lines from IRIS & CHASE**

  CHASE **Hα:** photosphere (line wing) to chromosphere (line core)

  IRIS **Mg II & C II:** chromosphere

  IRIS **Si IV:** transition region

  IRIS **Fe XXI:** (flaring) corona

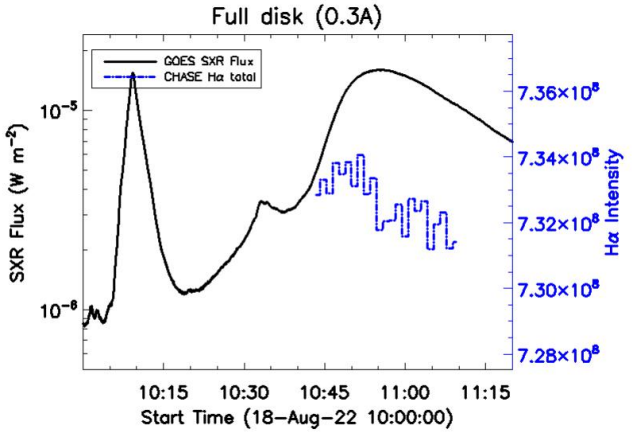
- **dynamics of the solar atmosphere from low to high layers**

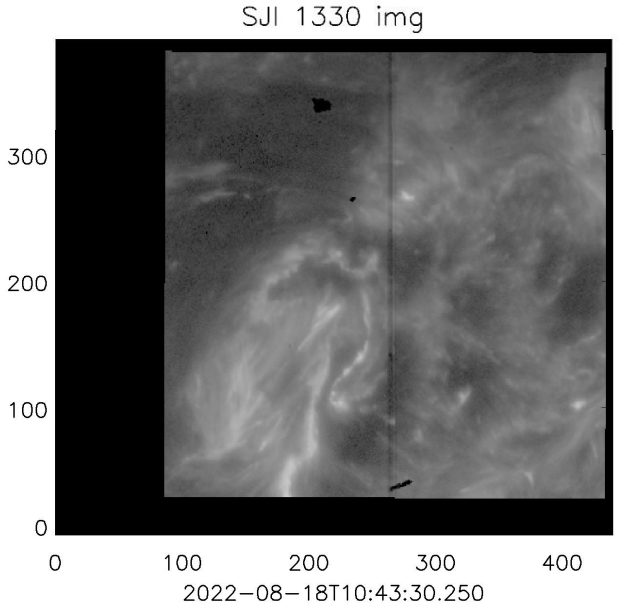
  for different solar features: **flares** for example

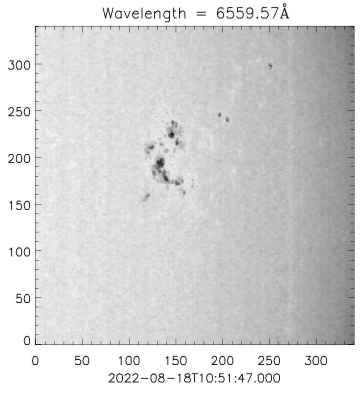
Observations of an M1.5 flare from IRIS and CHASE: overview

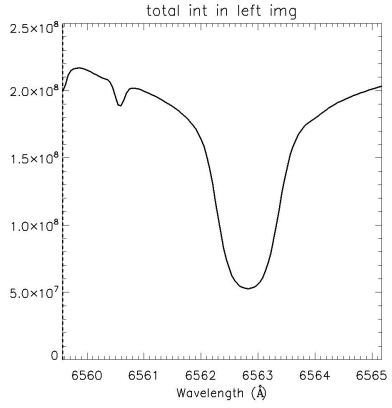
GOES M1.5 flare (SOL2022-08-18T10:55)

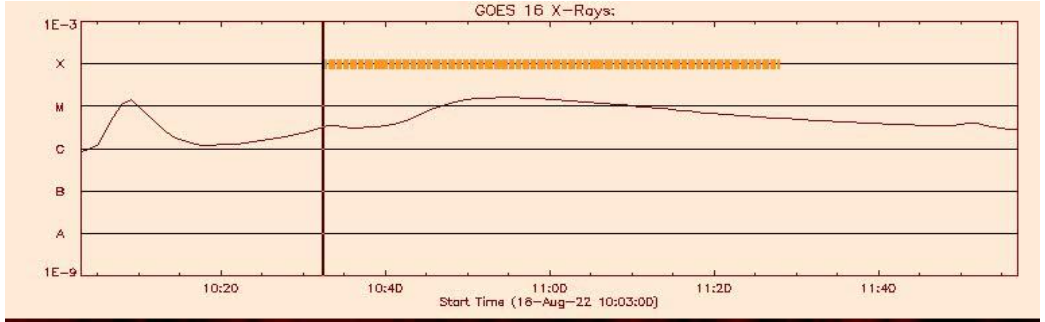
- **IRIS:** medium coarse 8-step raster scan; entire flare time
- **CHASE:** full disk raster scan, only rise & decay of the flare

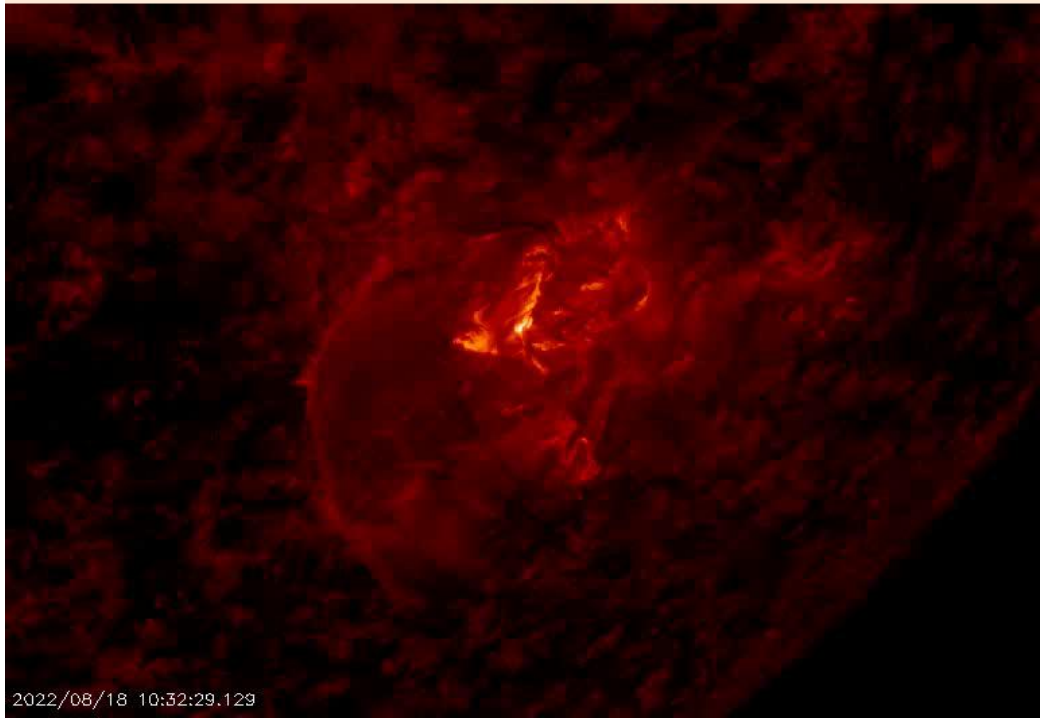








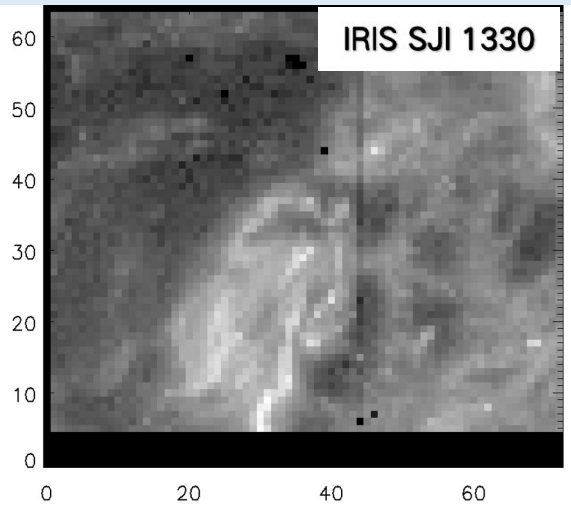


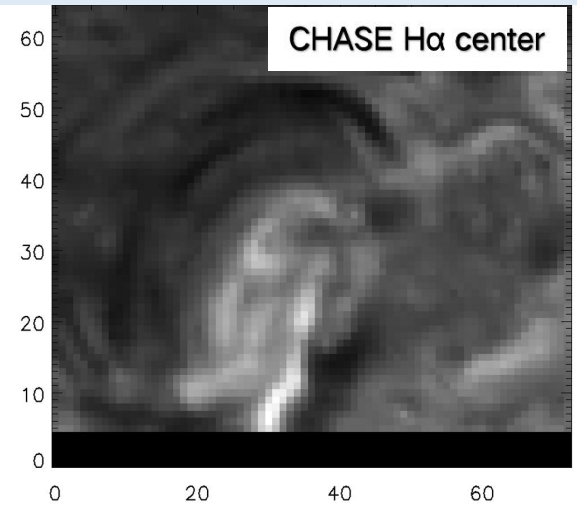


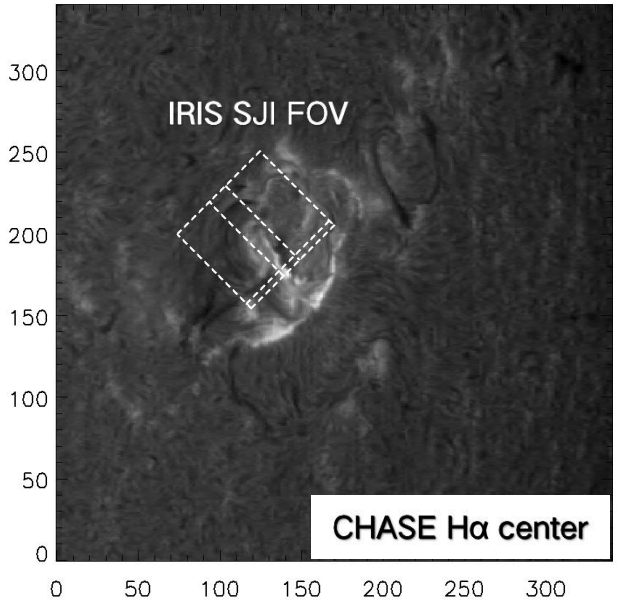
Observations of an M1.5 flare from IRIS and CHASE: coalighment

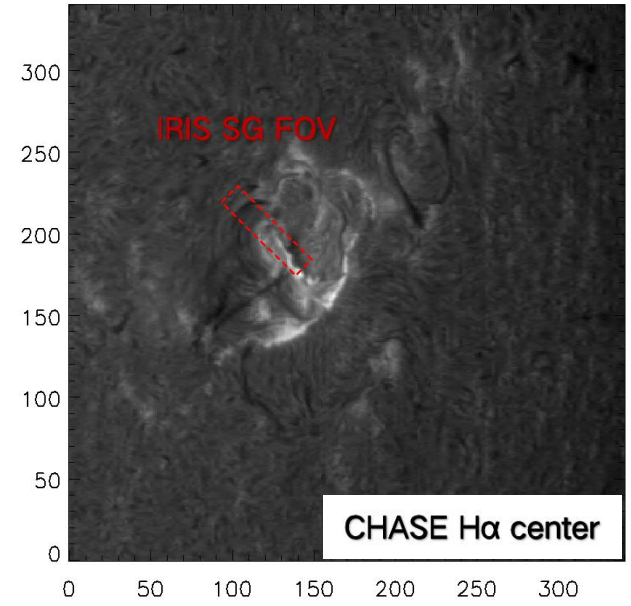
Coalignment between IRIS & CHASE

- IRIS SJI 1330 & CHASE Hα line center
- CHASE slit has an angle with solar north





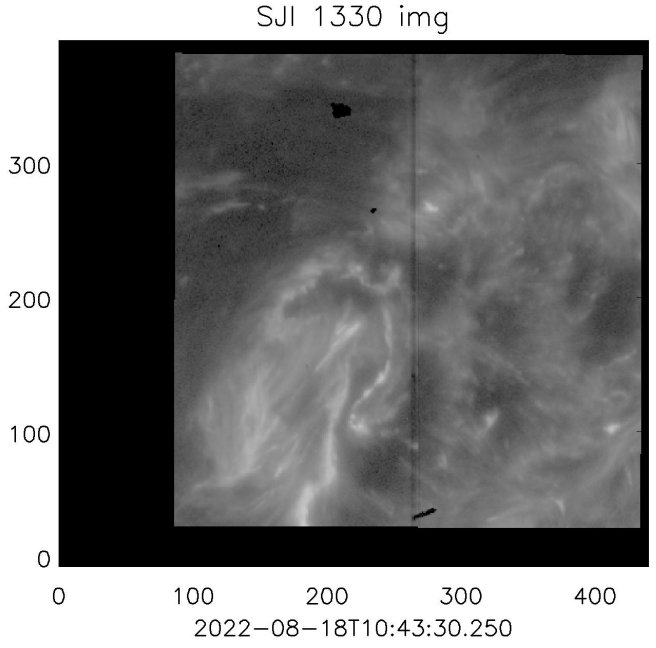


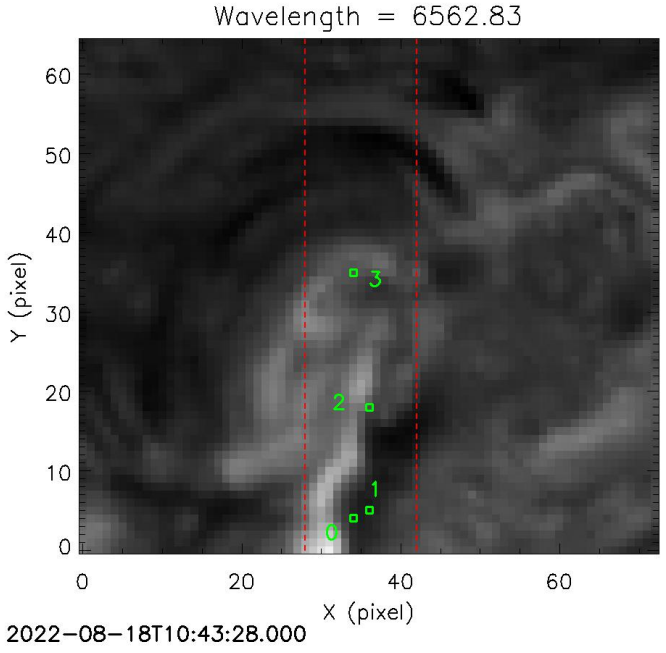


Observations of an M1.5 flare from IRIS and CHASE: features

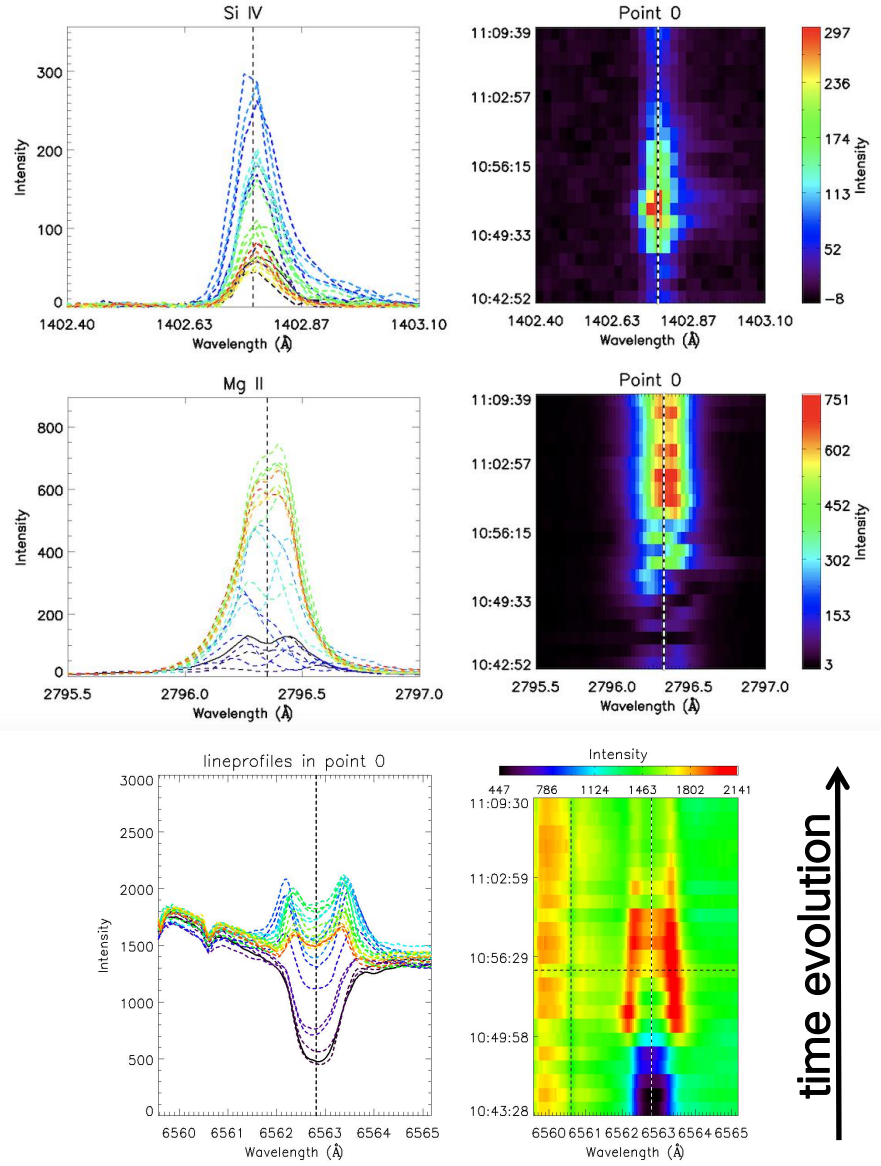
CHASE Hα & IRIS Mg II, Si IV line profiles at P0

- ❑ enchancements of core & wings (Hα & Mg II; to emission)
- ❑ red & blue asymmetries or a little shifted (Si IV)
- ❑ likely plasma heating at flare ribbon with small velocities





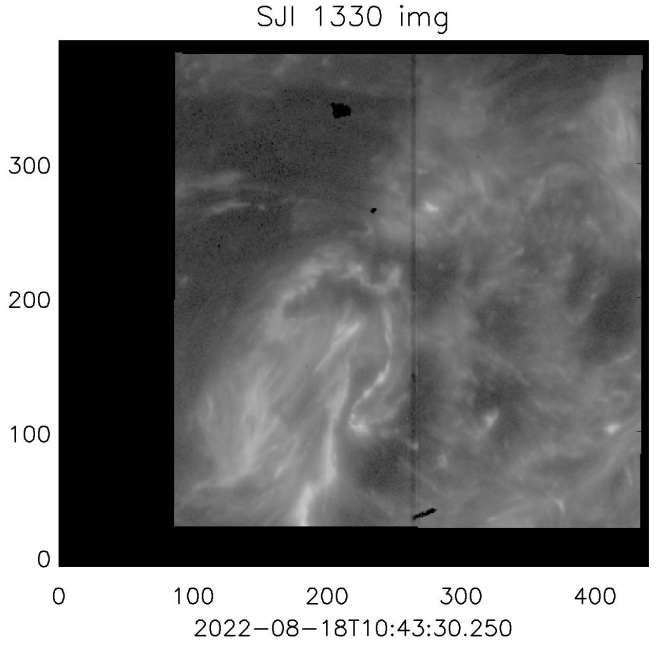
from low to high layers (Hα, M II, Si IV)

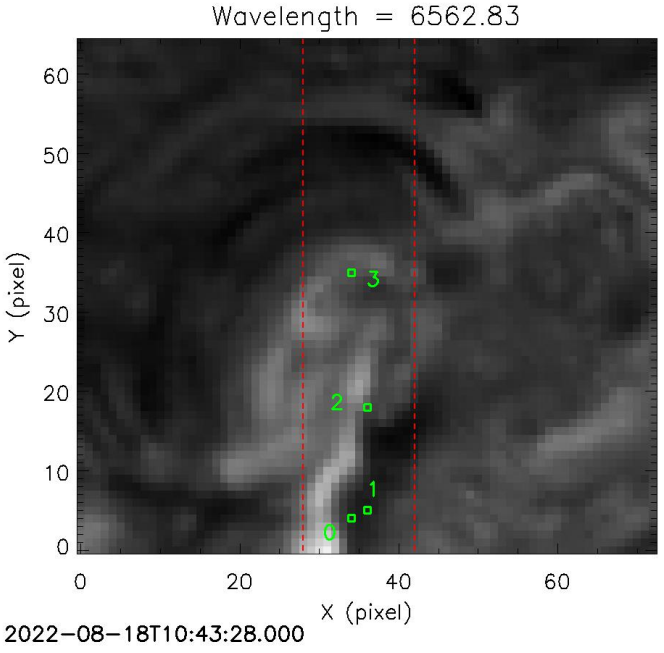


Observations of an M1.5 flare from IRIS and CHASE: features

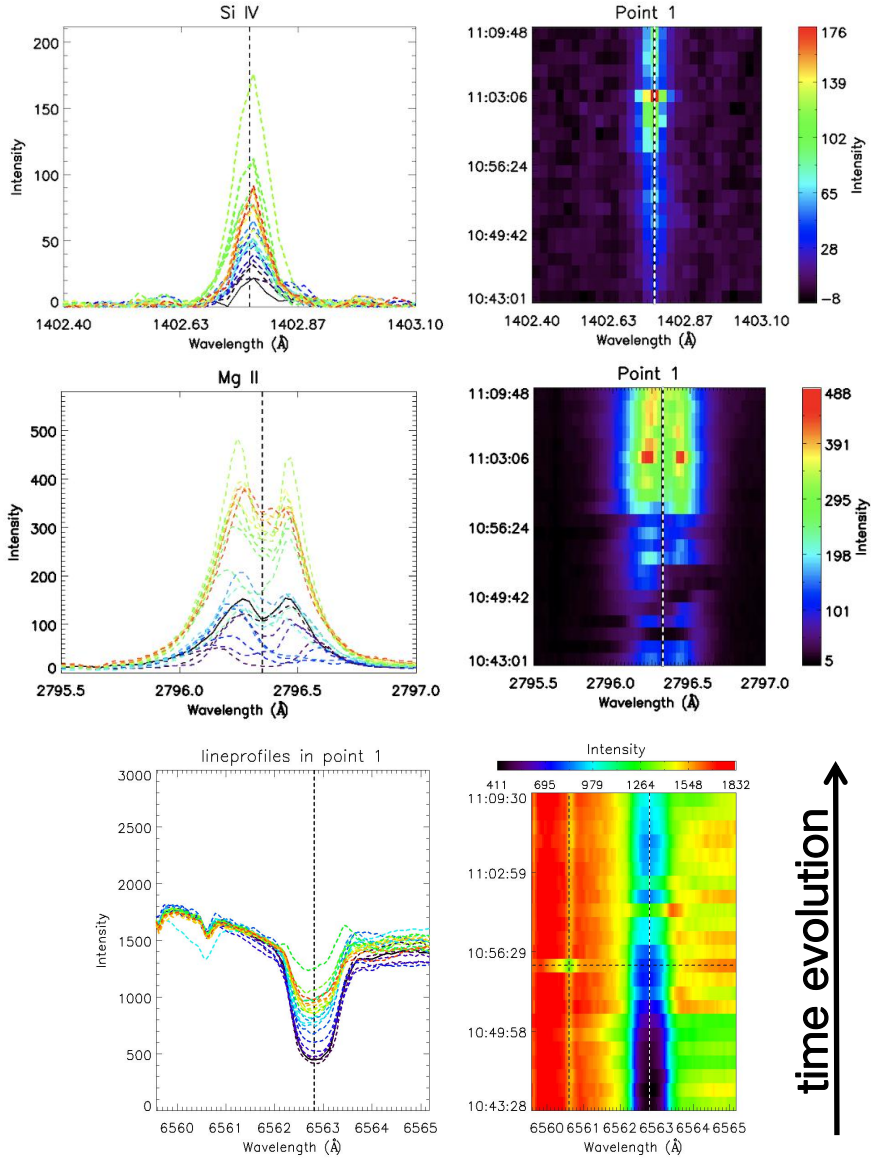
CHASE Hα & IRIS Mg II, Si IV line profiles at P1

- ❑ enchancements of core & wings (Hα & Mg II; still absoption)
- ❑ red & blue asymmetries or a little shifted (Si IV)
- ❑ likely plasma heating near flare ribbon with small velocities





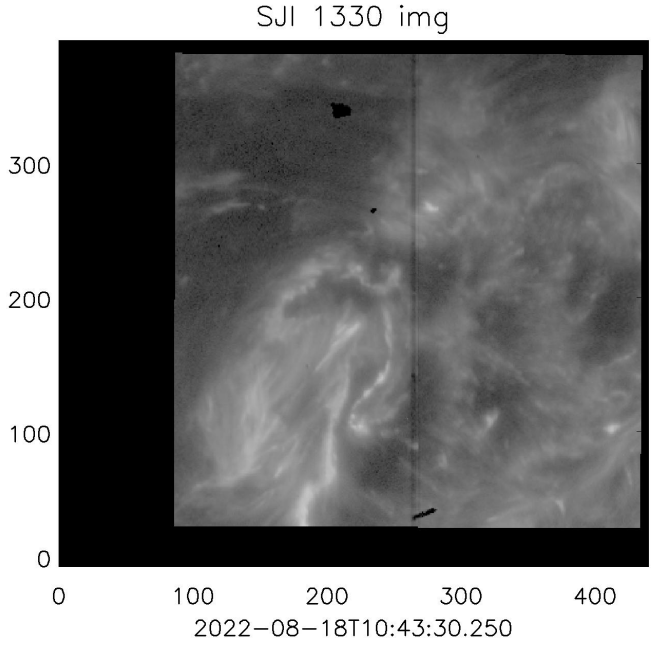
from low to high layers (Hα, M II, Si IV)

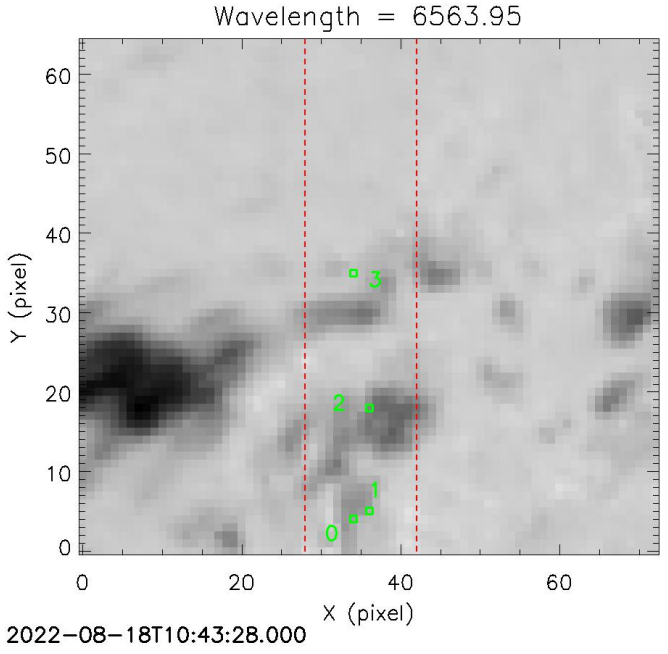


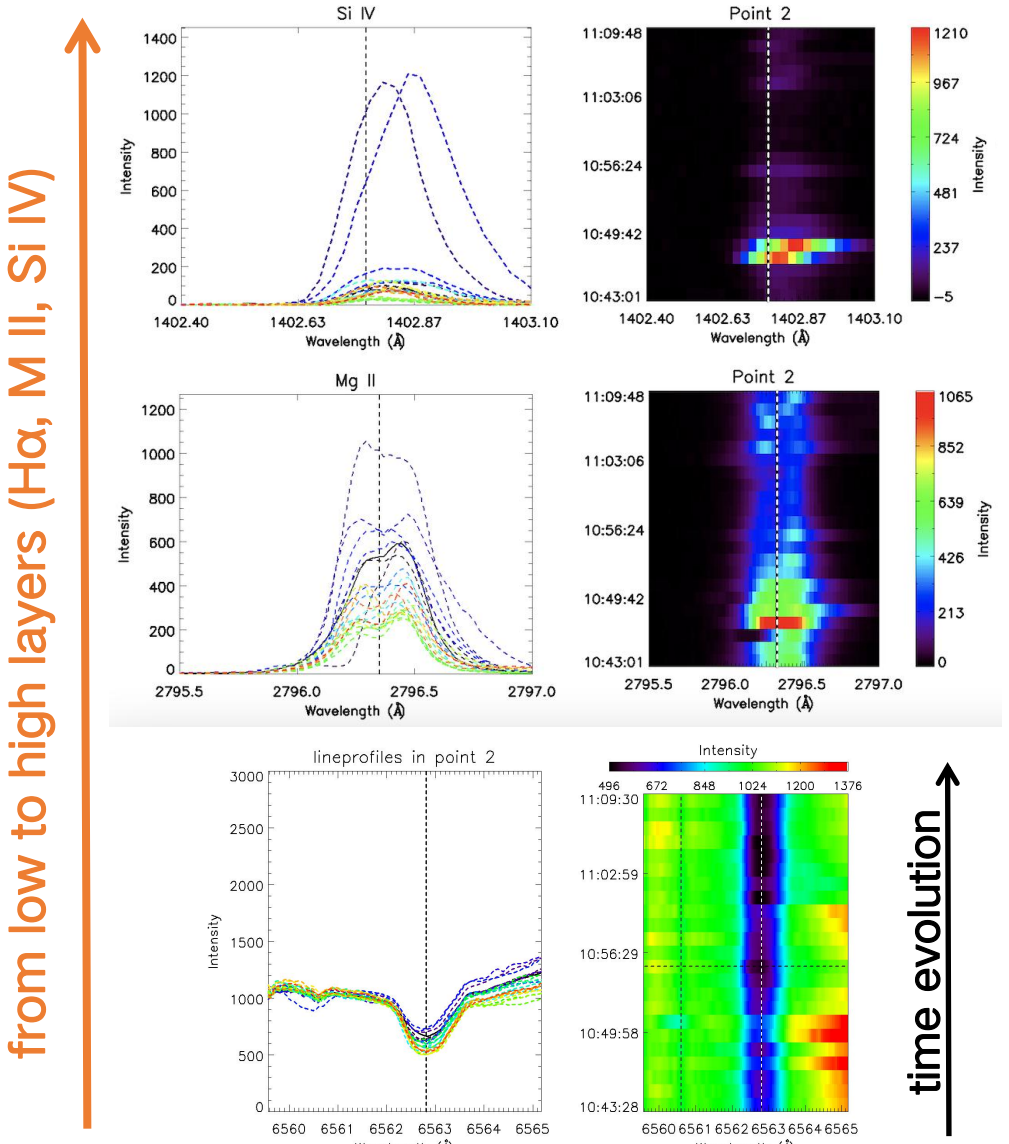
Observations of an M1.5 flare from IRIS and CHASE: features

CHASE Hα & IRIS Mg II, Si IV line profiles at P2

- 'dimming' of red wing & core (Hα & Mg II)
- red(blue) asymmetries or entirely redshifted (Si IV)
- relatively cool plasma falling down (a few tens of km/s)



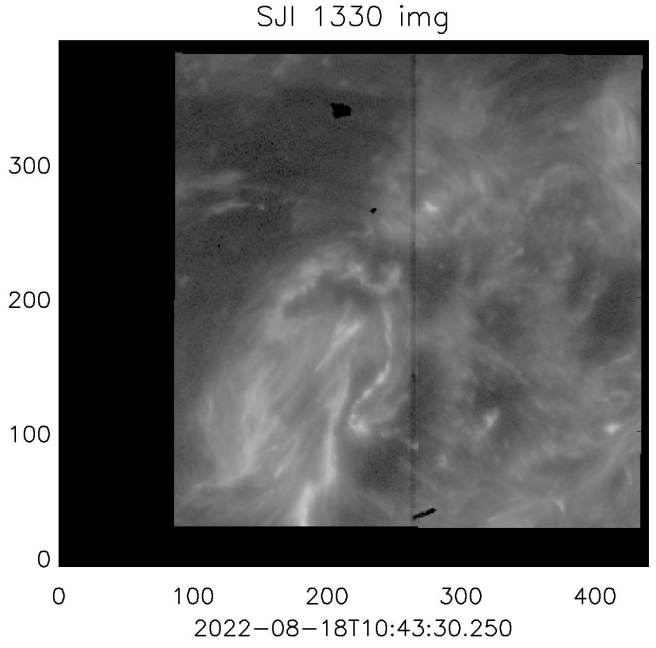


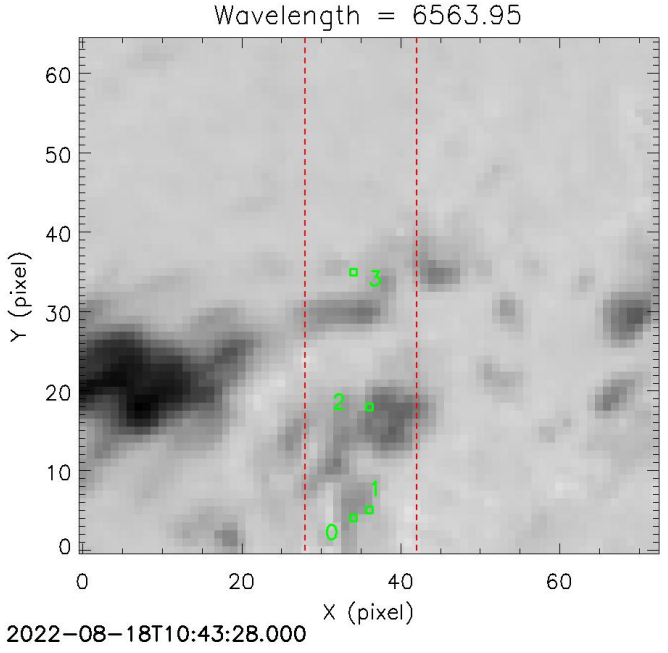


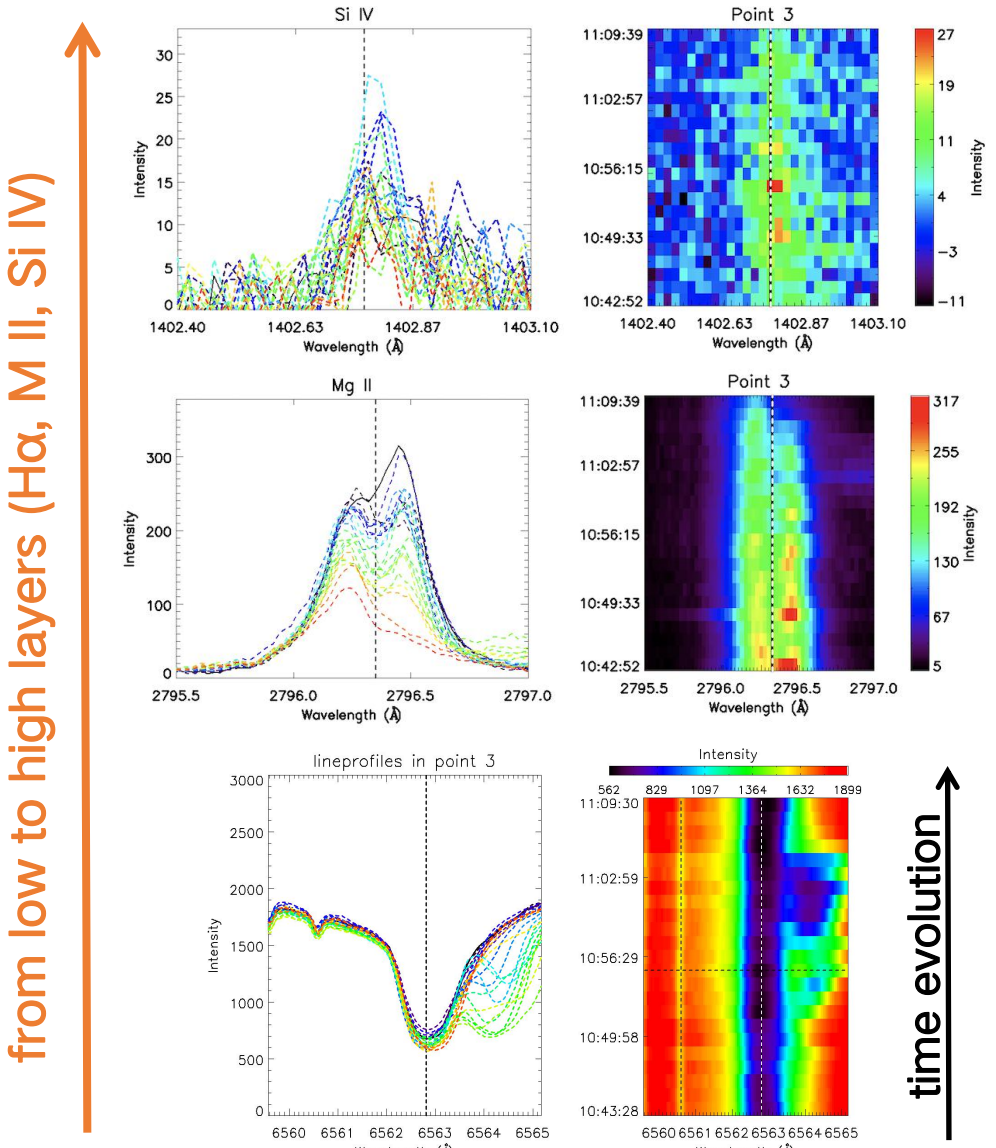
Observations of an M1.5 flare from IRIS and CHASE: features

CHASE Hα & IRIS Mg II, Si IV line profiles at P3

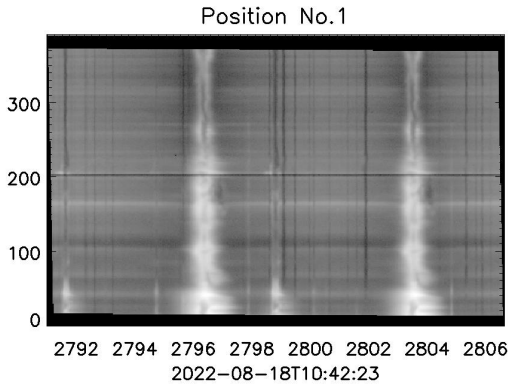
- 'dimming' of red wing & core (Hα & Mg II)
- red(blue) asymmetries or redshifted (Si IV)
- relatively cool plasma falling down (a few tens of km/s)

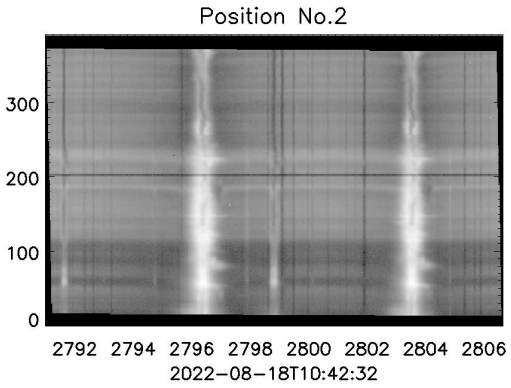


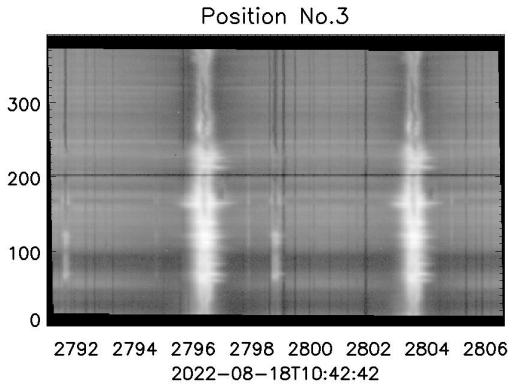


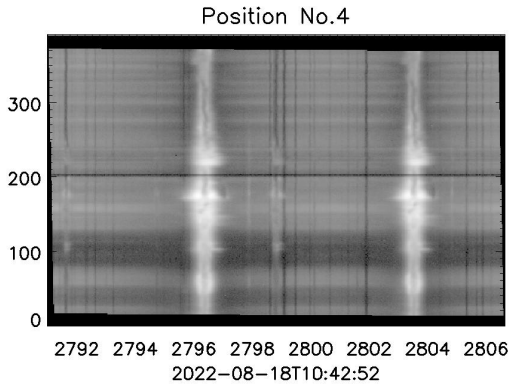


Observations of an M1.5 flare from IRIS and CHASE: features

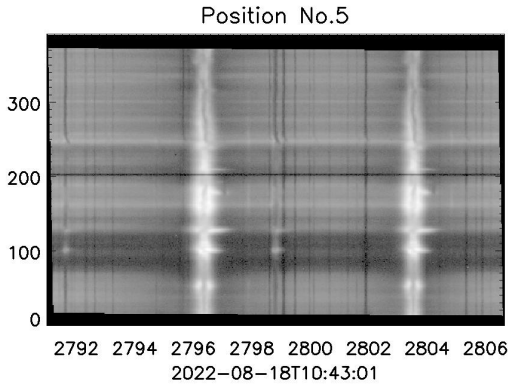


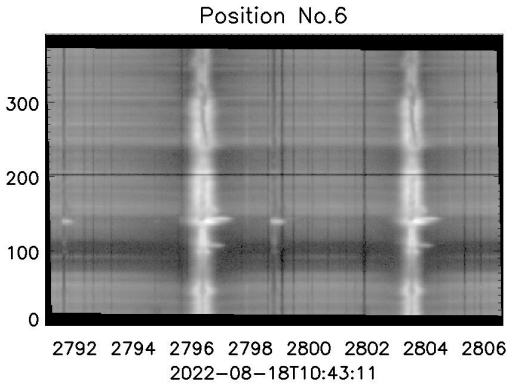


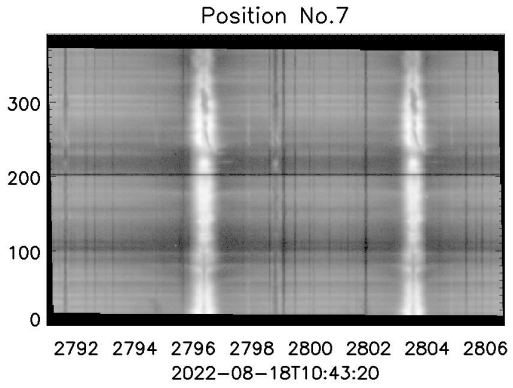


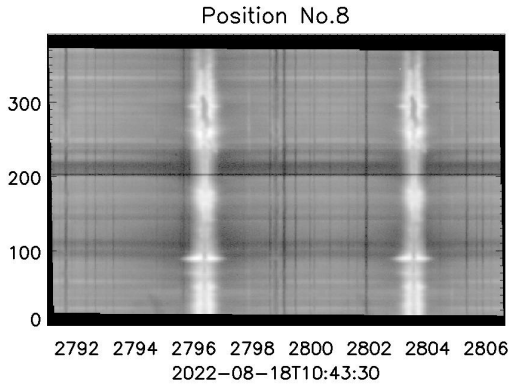


some interesting features in Mg II



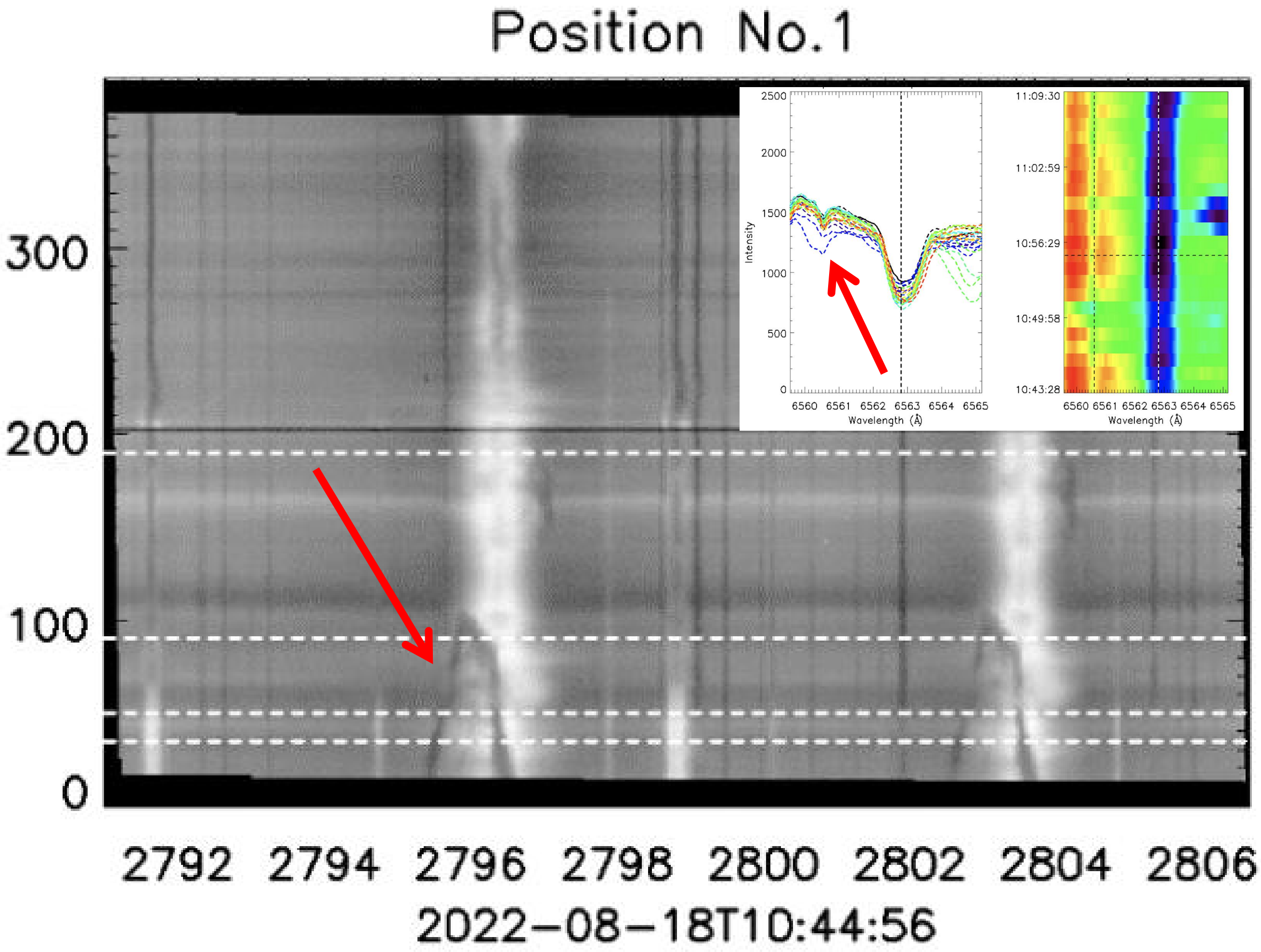


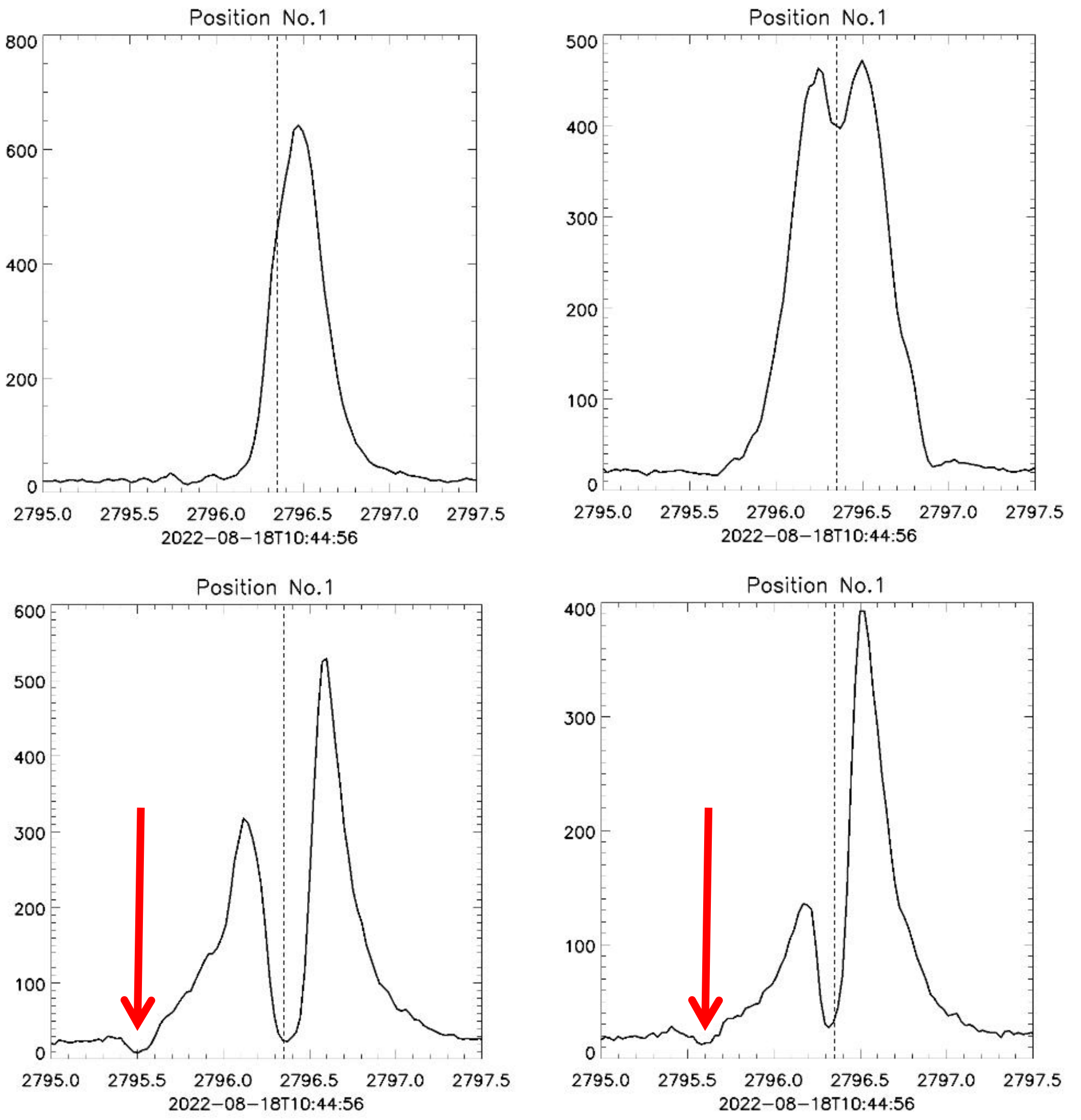




Observations of an M1.5 flare from IRIS and CHASE: features

far-blue-wing absorption in Mg II (also in Hα) with a velocity of ~100 km/s (with/o in Si IV)





CHASE flare list (with IRIS)

- **excel table** (also see CHASE wetsite: https://ssdc.nju.edu.cn/NdchaseSatellite)

  flare begin, peak, end, class, location, with/o IRIS, NVST, STIX, etc.

1	CHASE flare list (maintained by Shihao Rao (NJU), Wenbo Wang (NJU), Xiaofeng Liu (PMO), Qiao Li (PMO), Yi-An Zhou (NJU), Ying Li (PMO), Chuan Li (NJU), ... contributed by .....)										
2	Date (yyyy-mm-dd)	GOES Start (UT)	Peak (hh:mm)	End (hh:mm)	Class	Location (NOAA AR)	CHASE observing time (flare phase)	IRIS observations	NVST observations	STIX observations (since 2022-08-03)	Notations
268	2022-08-18	04:18	04:29	04:33	C4.5	S23W32 (3078)	04:23-04:49(rise, decay)	N	Y(01:59 - 05:09; Sunspot)	N	
269		04:35	04:39	04:46	C2.2	N11W09 (3081)	04:23-04:49(prelfare, rise, decay)	N	N	N	
270		05:54	06:02	06:06	C5.7	S23W33 (3078)	05:58-06:24(rise, decay)	Y (05:54-07:57)	Y(01:59 - 05:09; Sunspot)	N	
271		09:13	09:20	09:27	C1.7	S24W38 (3078)	09:08-09:34(preflare, rise, decay)	N	Y(07:57 - 09:29; Sunspot)	N	
272		10:37	10:55	11:13	M1.5	S27W37 (3078)	10:43-11:09(rise, decay)	Y (10:14-13:18)	Y(07:57 - 09:29; Sunspot)	Y	
273		12:27	12:35	12:43	C2.7	N19W74 (3075)	12:17-12:42(preflare, rise, decay)	N	N	N	
274	2022-08-19	04:14	04:44	05:18	M1.6	S27W48 (3078)	04:06-04:32(preflare, rise)	N	N	Y	
275		06:05	06:10	06:14	C3.2	S24W46 (3078)	05:41-06:07(preflare, rise)	Y (04:54-06:57)	N	N	
276		08:55	09:01	09:13	C1.9	N09W33 (3081)	08:51-09:16(preflare, rise, decay)	N	Y(02:13 - 05:10; Sunspot)	N	
277		15:16	15:26	15:34	C1.2	S28W54 (3078)	15:11-15:37(prelfare, rise, decay)	N	N	Y	
278		20:09	20:16	20:20	C1.6	S24W54 (3078)	19:55-20:19(preflare, rise, decay)	N	N	N	
279		20:19	20:31	20:42	C6.7	S26W55 (3078)	19:55-20:19(preflare)	N	N	Y	
280	2022-08-21	04:48	04:59	05:10	C2.9	N09W58 (3081)	05:08-05:34(decay)	N	N	Y	
281		17:58	18:14	18:26	C2.0	S22W86 (3078)	17:47-18:13(preflare, rise)	N	N	N	

first M-class flare captured by both

CHASE flare list (with IRIS)

❑ some statistics on the flare list (as of 2022-09-13)

400+ C- & M-class (23) flares captured by CHASE since 2021-12-14

(no X-class flares captured yet by CHASE)

among them, 3 M-class flares captured by CHASE & IRIS

60+ C-class flares captured by CHASE & IRIS

Summary & Perspective

- IRIS and CHASE observations (some very preliminary results)

  significant enhancements of Hα/Mg II core & wings during flare: plasma heating

  obvious red and also blue asymmetries: cool plasma eruption and falling down

- CHASE flare list (with IRIS)

  useful to select flares when including more spectral lines

- perspectives: coordination observations

  CHASE partial-region scan & sit-and-stare modes will be available in the future.

  also coordination with Hinode/EIS & ASO-S/LST (to be launched in October 2022)

Thanks for your attention!