Measurements and Comparisons of Diffuse Interstellar Bands around the MBM12 Interstellar Cloud

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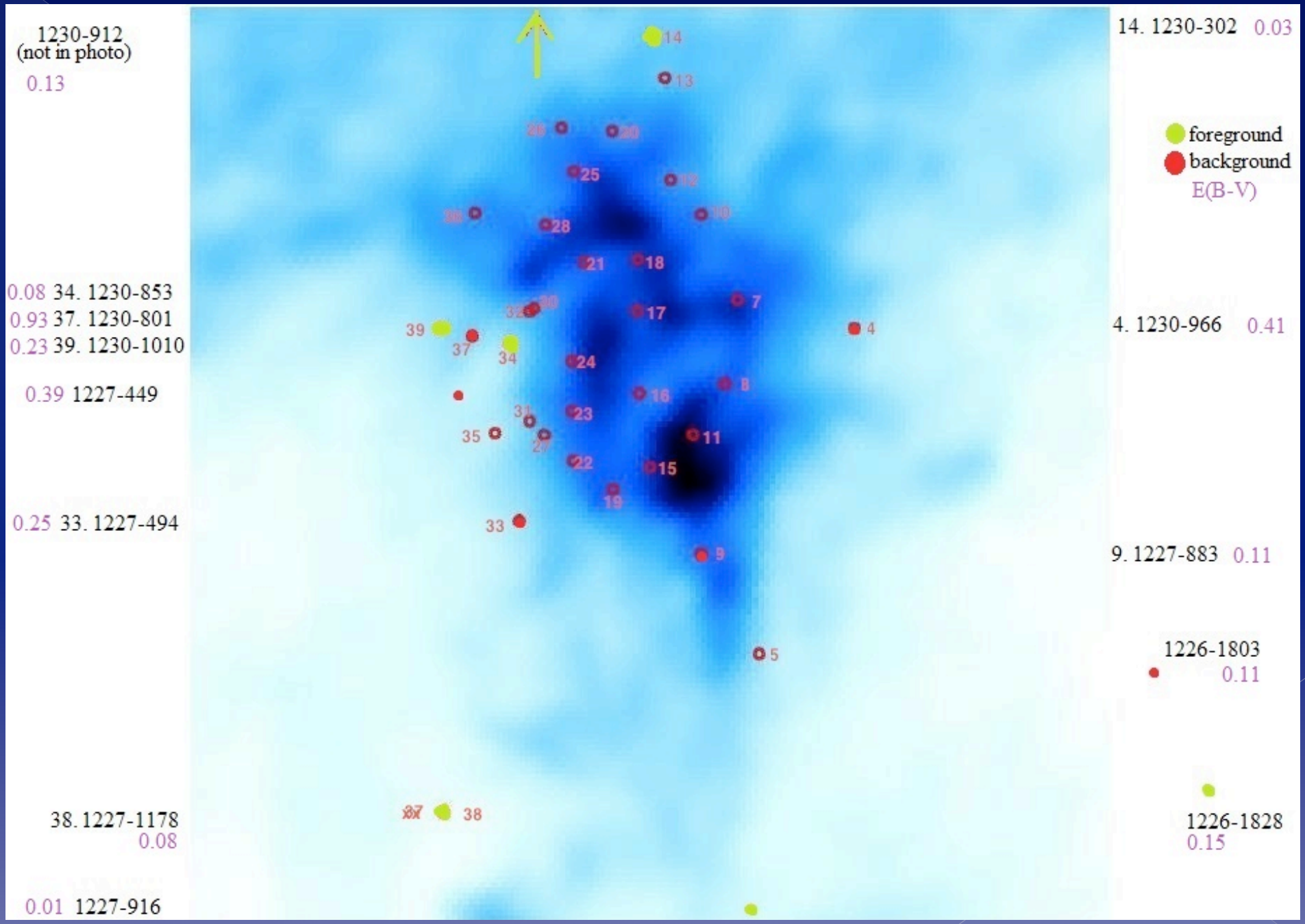
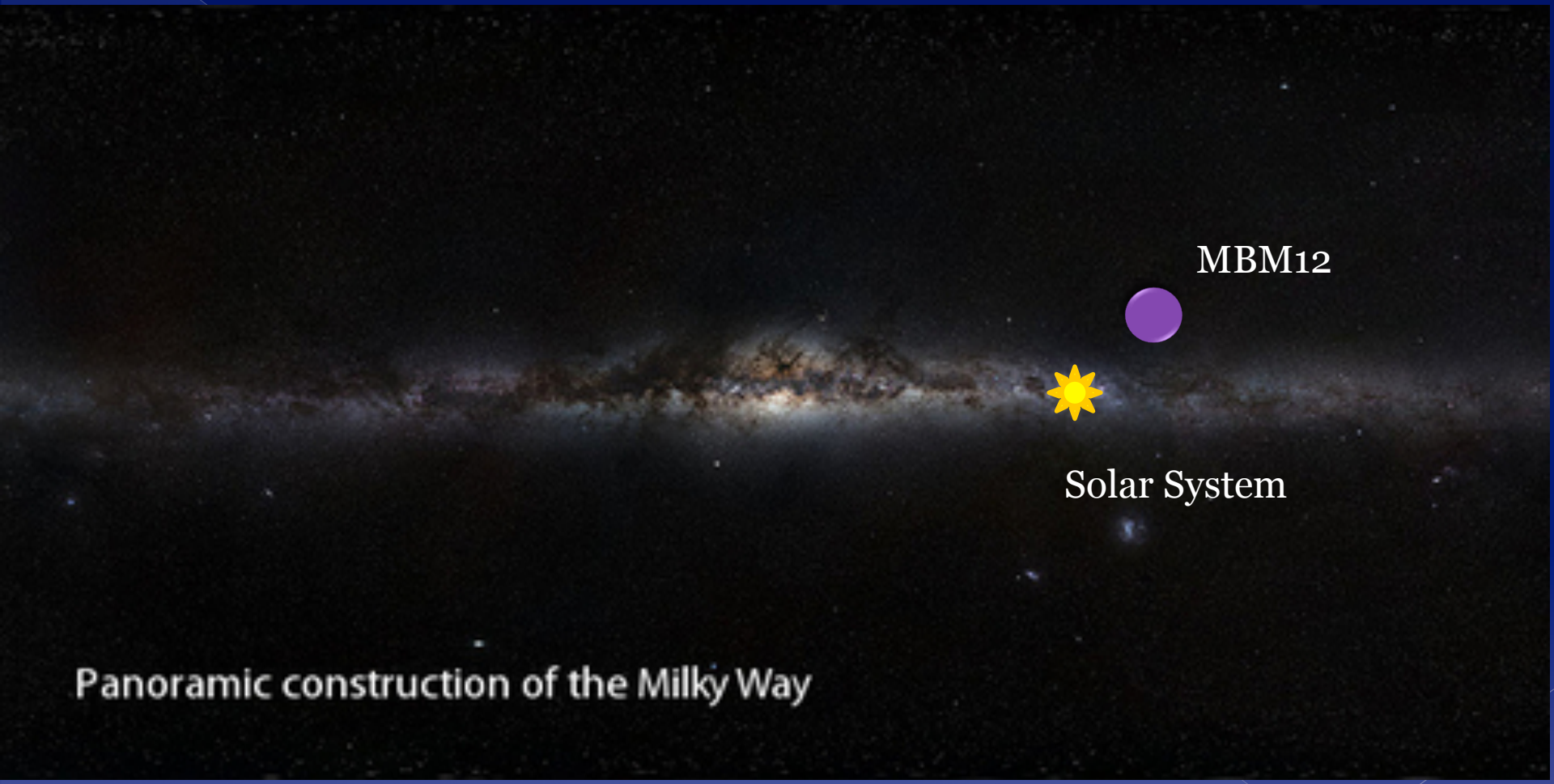
MBM12 Interstellar Cloud

- Studied 13 stars around
- Made of dust and gas
- ~100x50 pc

(Figure provided by Adolf Witt)



(Figure provided by Adolf Witt)



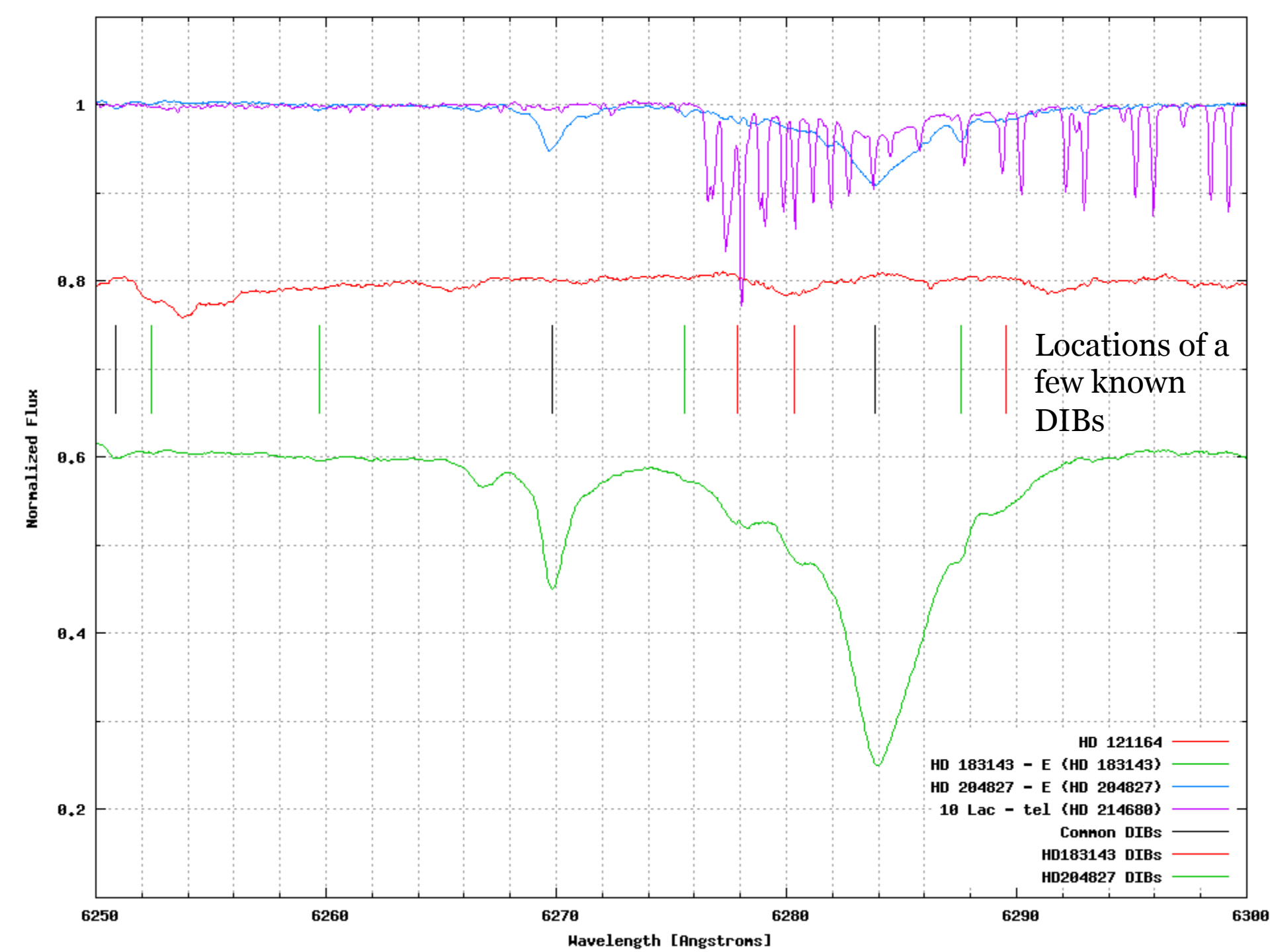
http://io9.gizmodo.com/5956960/how-to-take-pictures-of-the-milky-way-without-leaving-the-galaxy

Diffuse Interstellar Bands

- Absorption in a star's spectrum
- Caused by materials between the star and the viewing point
- Not fully understood
  - Found in most diffuse gas
- Do not correlate with each other
- Profiles have the same shape in different stars, despite having different strength
  - Very broad compared to atomic lines
- Slightly more than 600 found since discovery in 1922

Eyeball Estimates

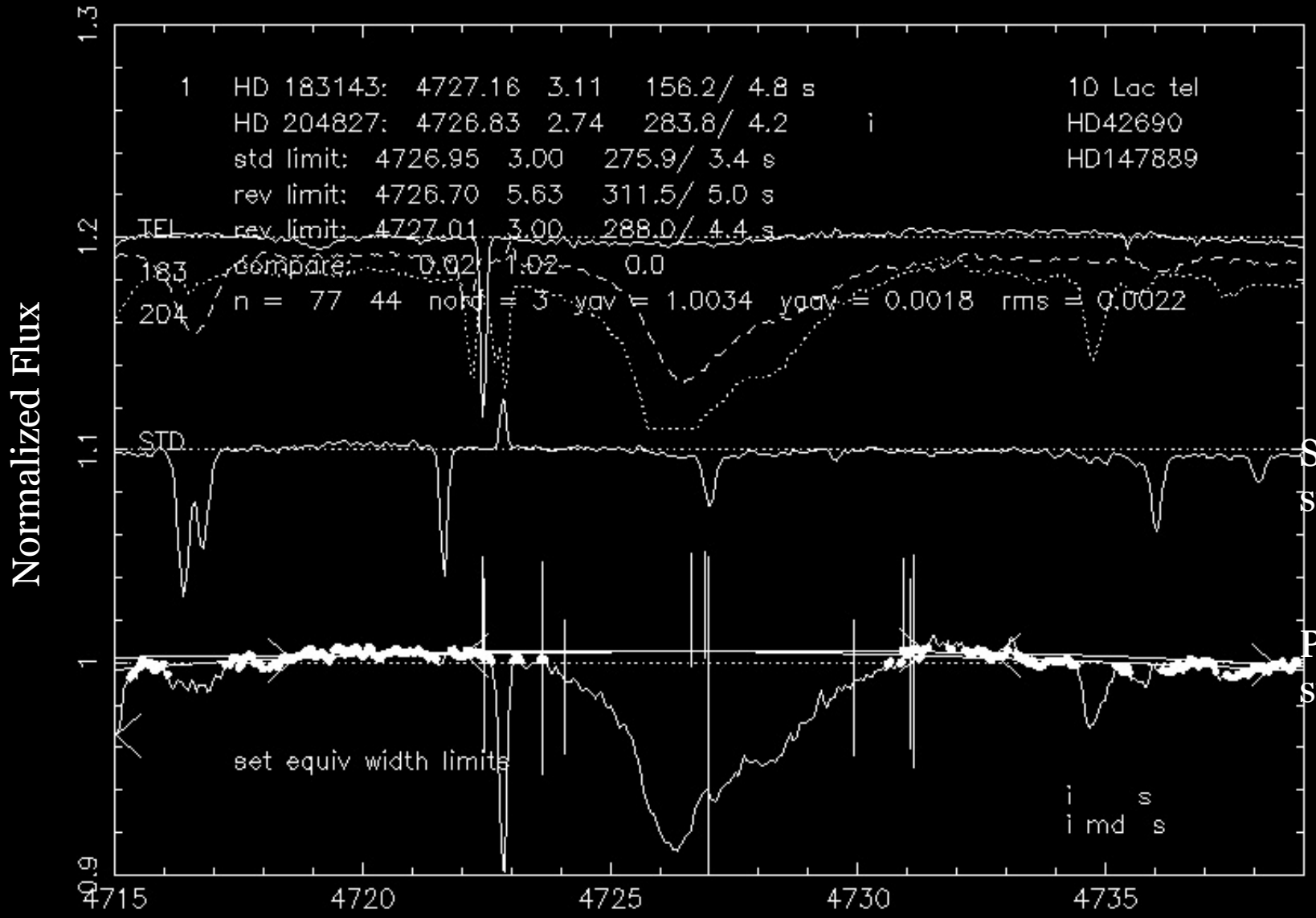
- Plot spectrum of standard star side by side with program star
- Telluric lines are eliminated by website
- Velocity shift had to be accounted for so that the spectra would line up
- Look for DIBs
  - No absorption in standard star, DIB absorption in program star
  - Standard star has similar spectral type and less reddening
  - Create a list with all the suspected DIBs for the star


Locations of a few known DIBs
HD 121164
HD 183143 - E (HD 183143)
HD 204827 - E (HD 204827)
10 Lac - tel (HD 214680)
Common DIBs
HD183143 DIBs
HD204827 DIBs
Normalized Flux
1
0.8
0.6
0.4
0.2
6250
6260
6270
6280
6290
6300
Wavelength [Angstroms]

arcexam

- Presents the inputted standard star and program star, and reference telluric star, two reference DIB stars
- Measure continuum
- Can flag measurements for stellar lines and contamination by other DIBs, etc

Example of arcexam presentation at 4725 angstroms



Normalized Flux

Standard star

Program star

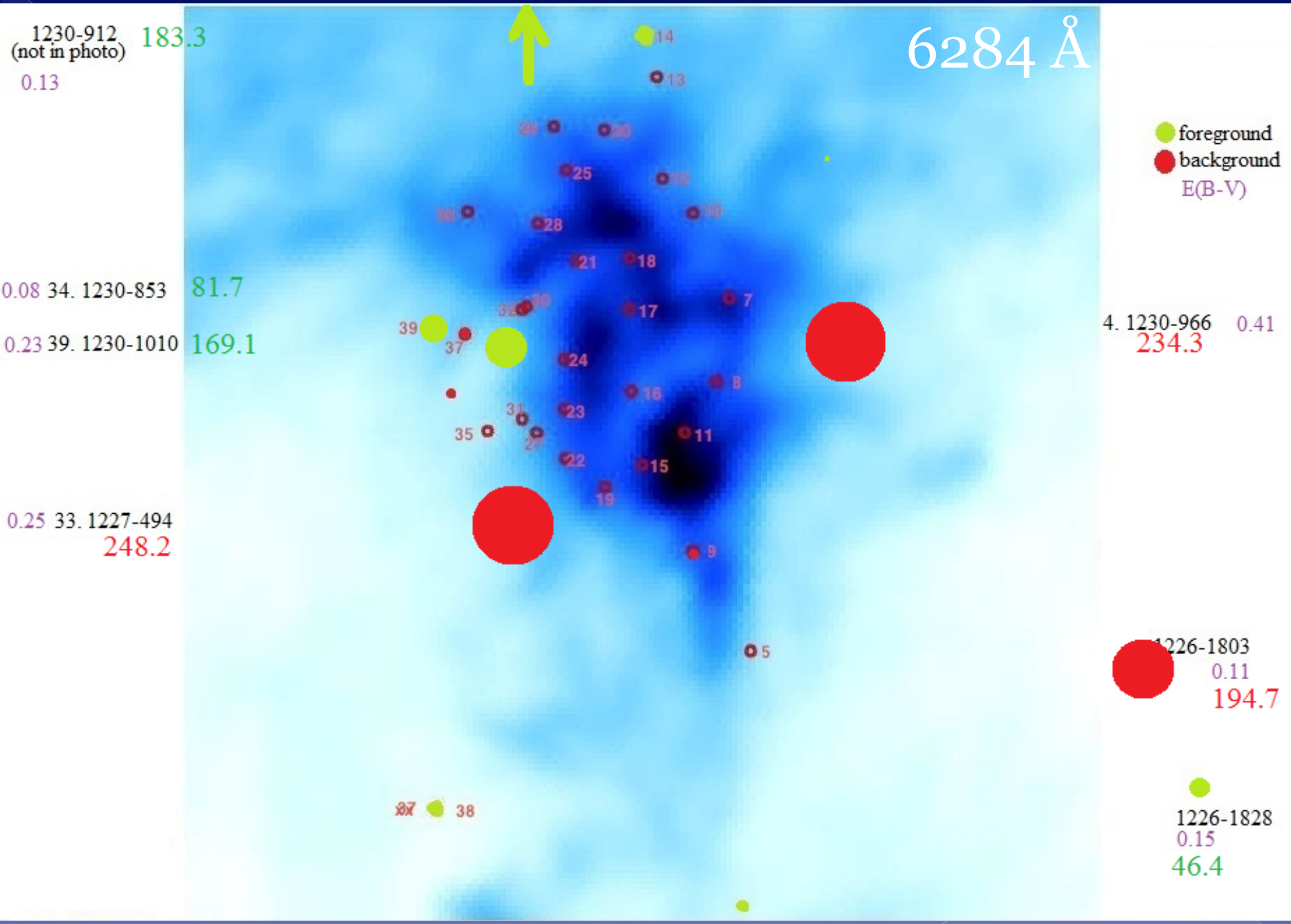
Wavelength

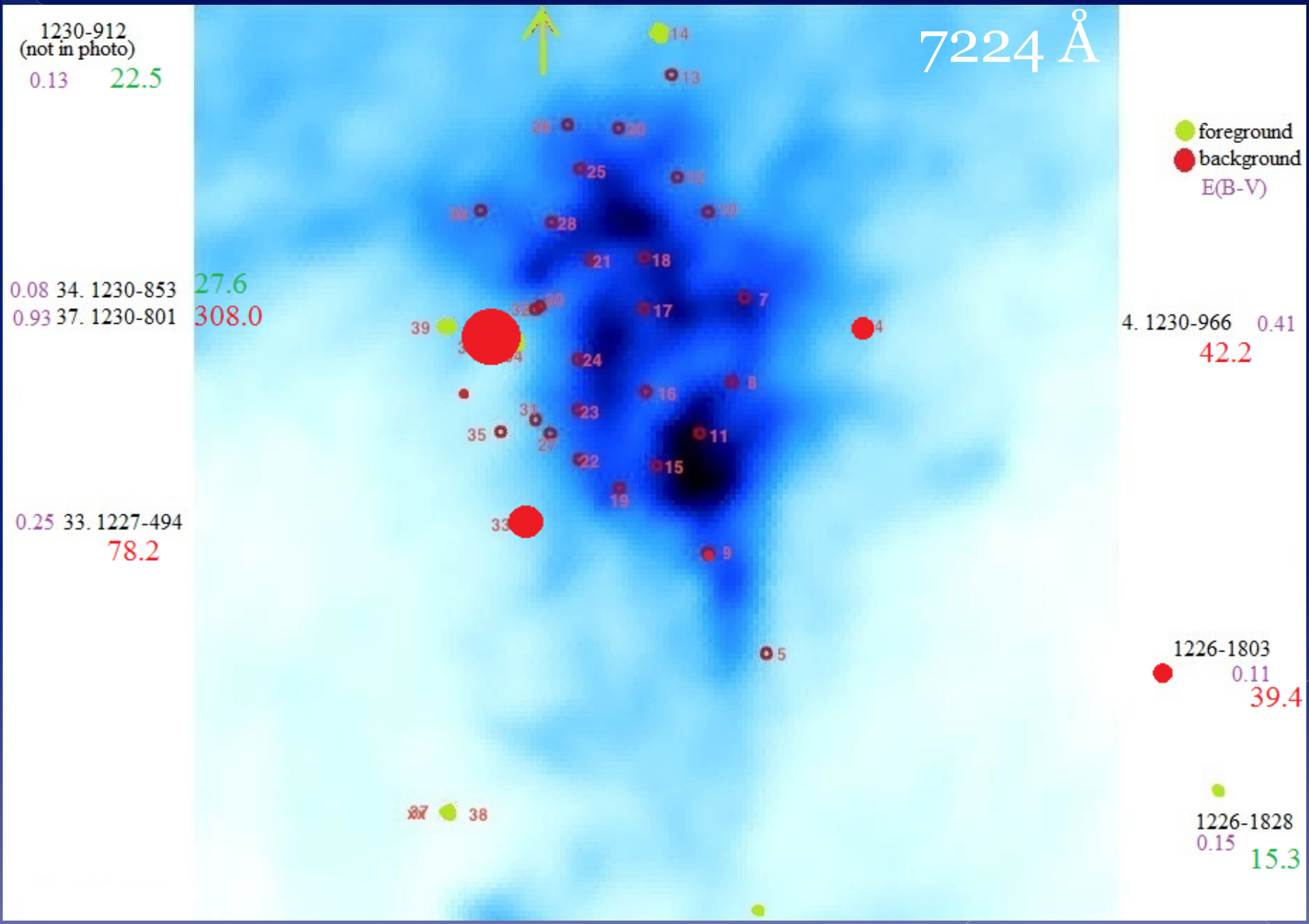
Foreground by strength (mÅ)

Star	1227-1178	1230-1010	1226-1828	1230-912	1230-853	1227-916	1230-302
Spectral Type	A0V (fore/ off)	A9V (fore/ on)	A7V (fore/off)	A3III (fore/ on)	A7V (fore/ on)	A9V (fore/ off)	A8III (fore/ on)
6284		169.1 (10.5)	46.4 (3.6)	183.3 (14.1)	81.7 (7.4)		
5780		241.6 (4.4)	57.3 (3.8)	93.9 (2.4)	69.0 (2.9)		54.5 (2.7)
6613		94.2 (2.8)	13.7 (1.8)	41.1 (0.6)	25.9 (1.4)		
6203	6.8 (0.5)	25.6 (2.0)	10.3 (0.9)	23.7 (1.6)	15.6 (1.8)		<3.7
6269		35.5 (1.2)		14.2 (0.9)	12.7 (1.8)	12.2 (1.5)	
7224			15.3 (1.9)	22.5 (0.8)	27.6 (1.5)		
6196	1.6 (0.2)	23.1 (0.9)		8.9 (0.2)	4.9 (1.0)		
5797			14.0 (1.6)	25.5 (0.6)			

Background by strength (mÅ)

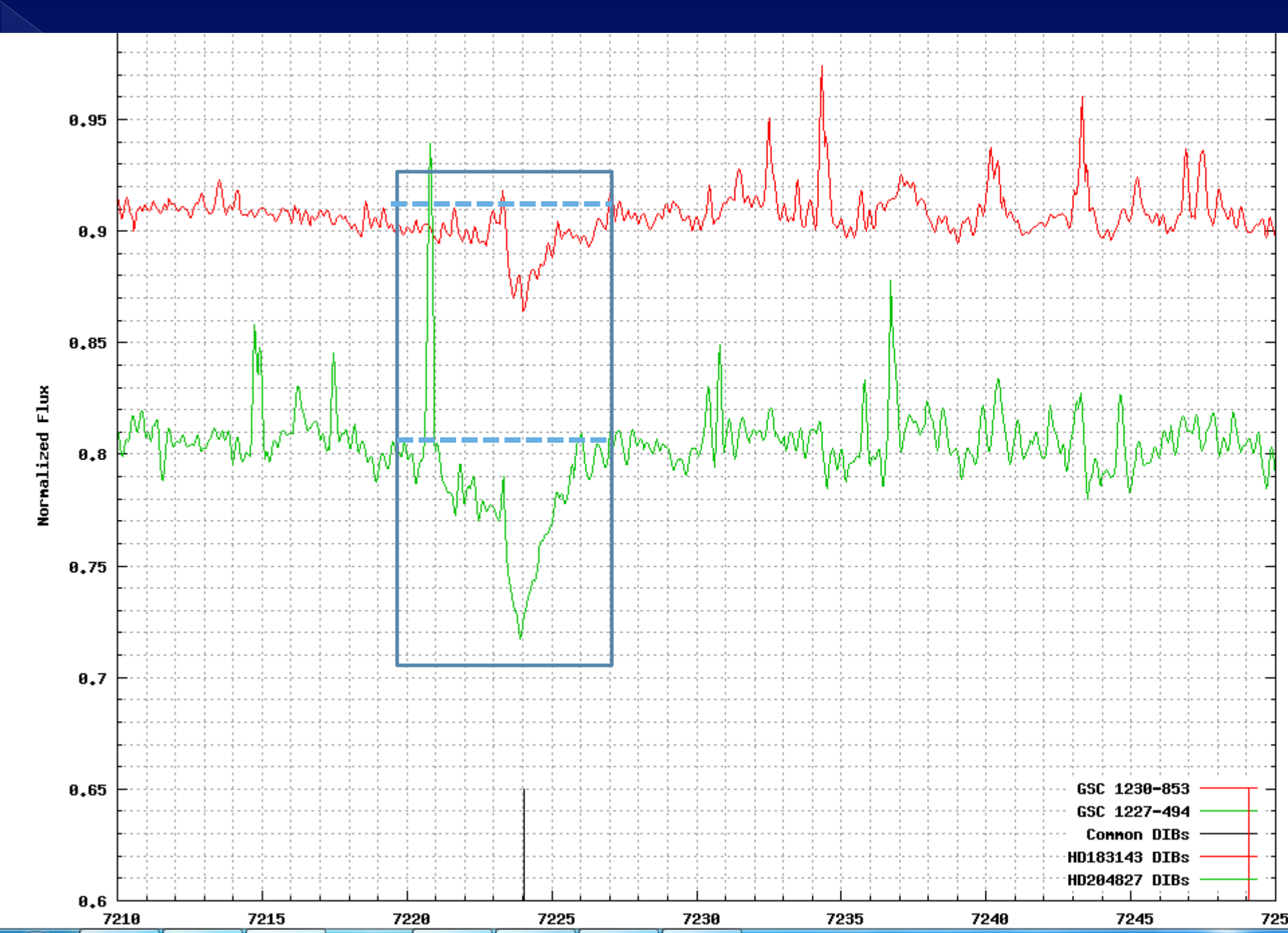
Star	1226-1803	1230-966	1230-801	1227-494	1227-883	1227-449
Spectral Type	A3V (back/off)	A5V (back/on)	A0V (back/on)	A8V (back/on)	A9V (back/on)	A2III (back/on)
6284	194.7 (13.1)	234.3 (14.7)		248.2 (18.6)		
5780	120.4 (5.0)	129.6 (4.9)			86.6 (5.0)	
6613	97.7 (3.0)	61.6 (1.8)		87.4 (2.6)		
6203	25.5 (3.6)	32.6 (3.2)		32.1 (4.1)		
7224	39.4 (3.8)	42.2 (1.1)	308.0 (14.1)	78.2 (5.0)		
6269	15.3 (2.2)	12.1 (1.7)		69.0 (4.9)	19.1 (1.3)	
6196	18.5 (1.3)		12.0 (1.5)	16.7 (1.4)		
5797	39.3 (2.9)			35.6 (2.5)		


6284 Å
1230-912
(not in photo)
183.3
0.13
foreground
background
E(B-V)
0.08 34. 1230-853
81.7
0.23 39. 1230-1010
169.1
4. 1230-966
0.41
234.3
0.25 33. 1227-494
248.2
1226-1803
0.11
194.7
1226-1828
0.15
46.4

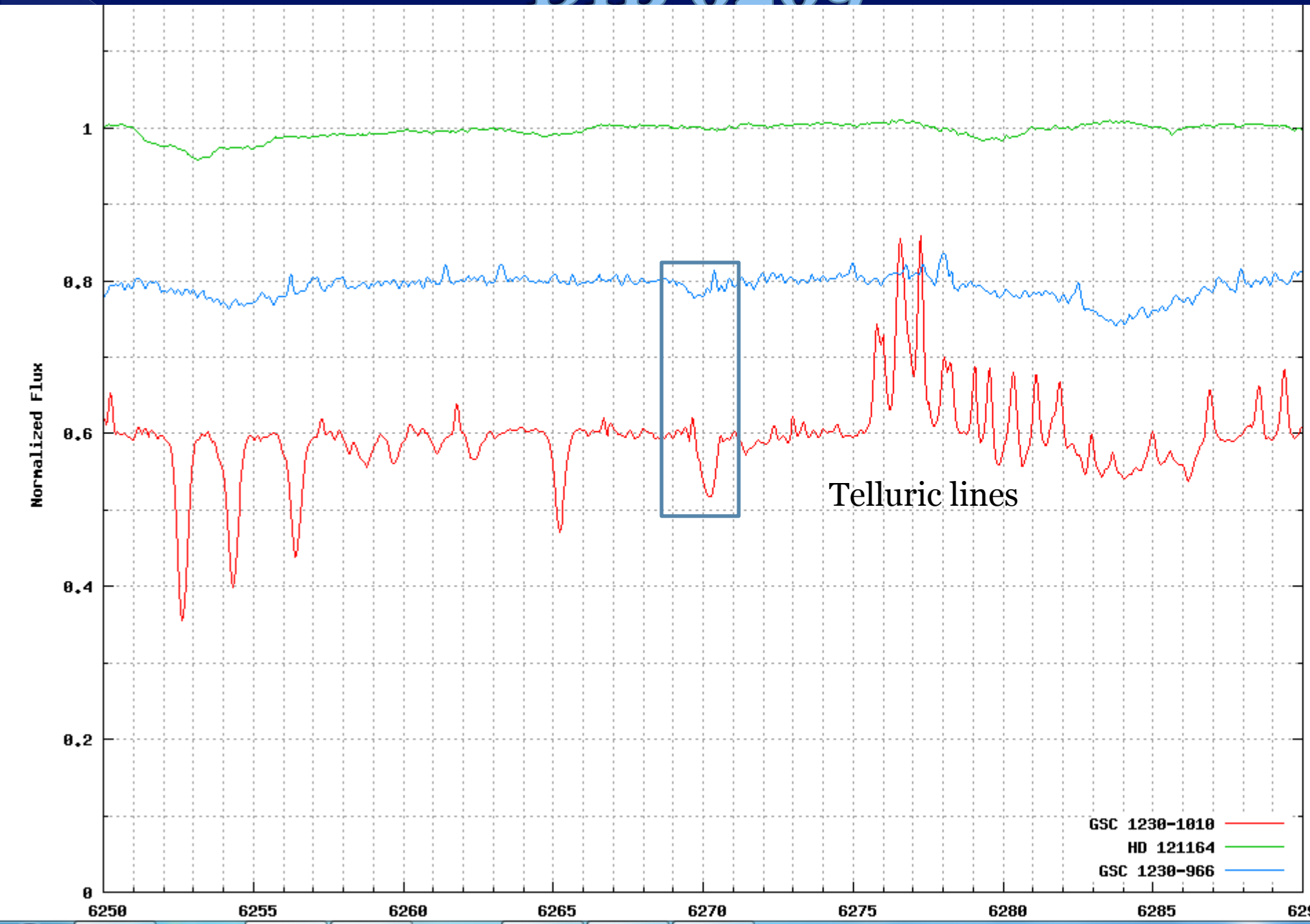

7224 Å
1230-912
(not in photo)
0.13
22.5
foreground
background
E(B-V)
0.08 34. 1230-853
0.93 37. 1230-801
27.6
308.0
4. 1230-966
0.41
42.2
0.25 33. 1227-494
78.2
1226-1803
0.11
39.4
1226-1828
0.15
15.3

Conclusions

- The strength of the DIBs doubled in the background stars
- 1230-1010, has DIB strength of a background star, but the low reddening of a foreground star
- Stars in center of cloud are too faint, so more observations with a bigger telescope are needed
  - Project proves that this is possible and worth looking into
- DIB at 7224 Å is prominent in the cloud
  - 1230-853 (foreground) is 27.6
  - 1230-801 (background) is 308.0


Normalized Flux
0.95
0.9
0.85
0.8
0.75
0.7
0.65
0.6
7210
7215
7220
7225
7230
7235
7240
7245
GSC 1230-853
GSC 1227-494
Common DIBs
HD183143 DIBs
HD204827 DIBs

DIB 6269


Normalized Flux
1
0.8
0.6
0.4
0.2
0
6250
6255
6260
6265
6270
6275
6280
6285
6290
Telluric lines
GSC 1230-1010
HD 121164
GSC 1230-966

Remaining Questions

- What is the distance of 1230-1010?
- What elements does the cloud consist of?
- Stars in the heart of the cloud?
  - Their DIB strengths
- What causes DIBs?
  - They do not correlate strongly to dust or atoms

Acknowledgements

- SIR Program and staff
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- DIB Database

Questions?

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