

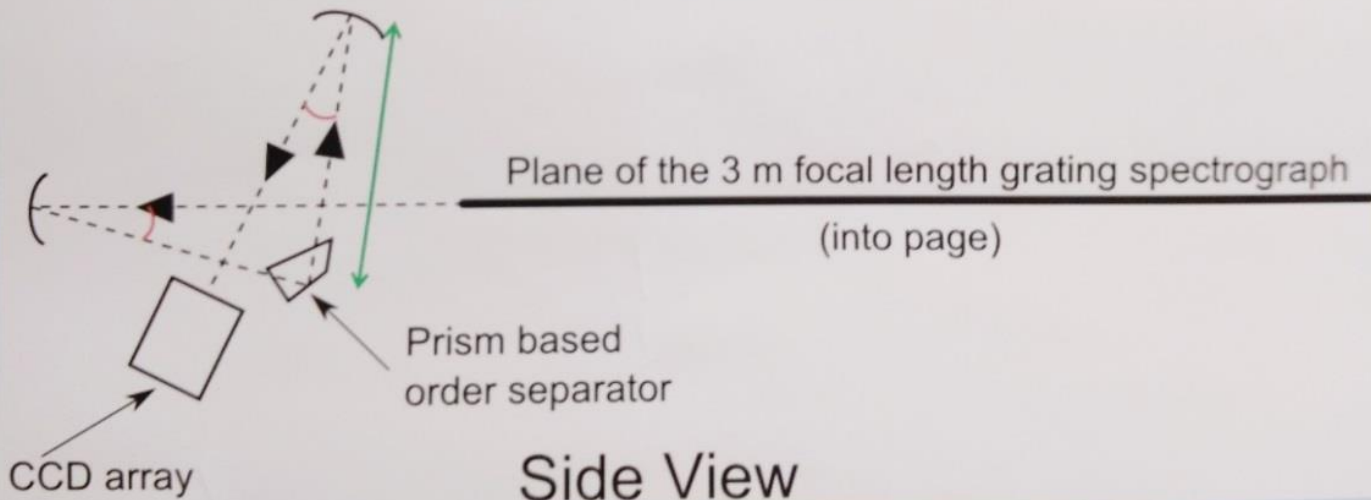
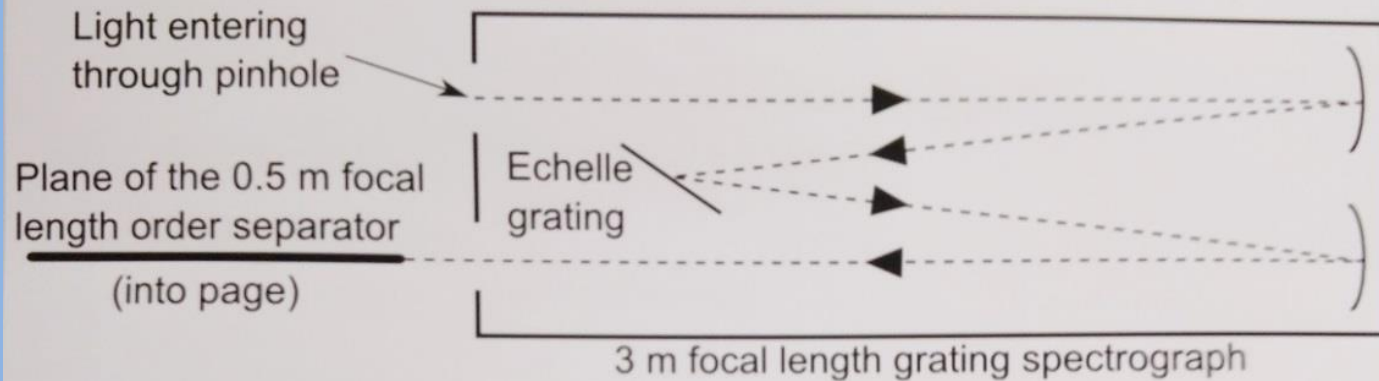
Wisconsin – Madison Üniversitesi Fizik Bölümünde
yaptığım çalışmalardan bir örnek

1. Atmosfer fiziği
2. Güneş benzeri ve beyaz cüce yıldız atmosferlerinde
'Ağır metal grubunun belirlenmesi'

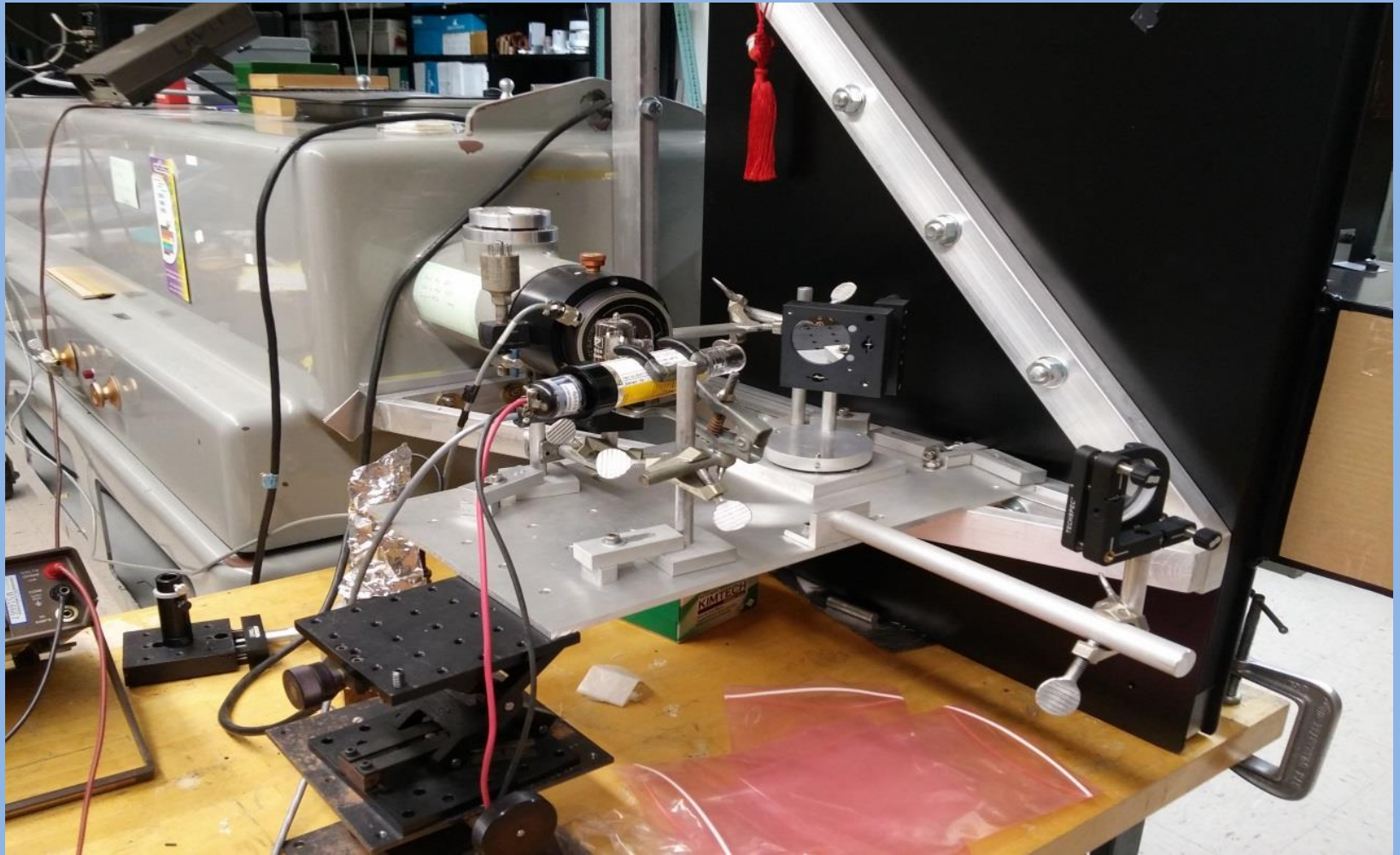
Ağır metal grubunun belirlenmesi

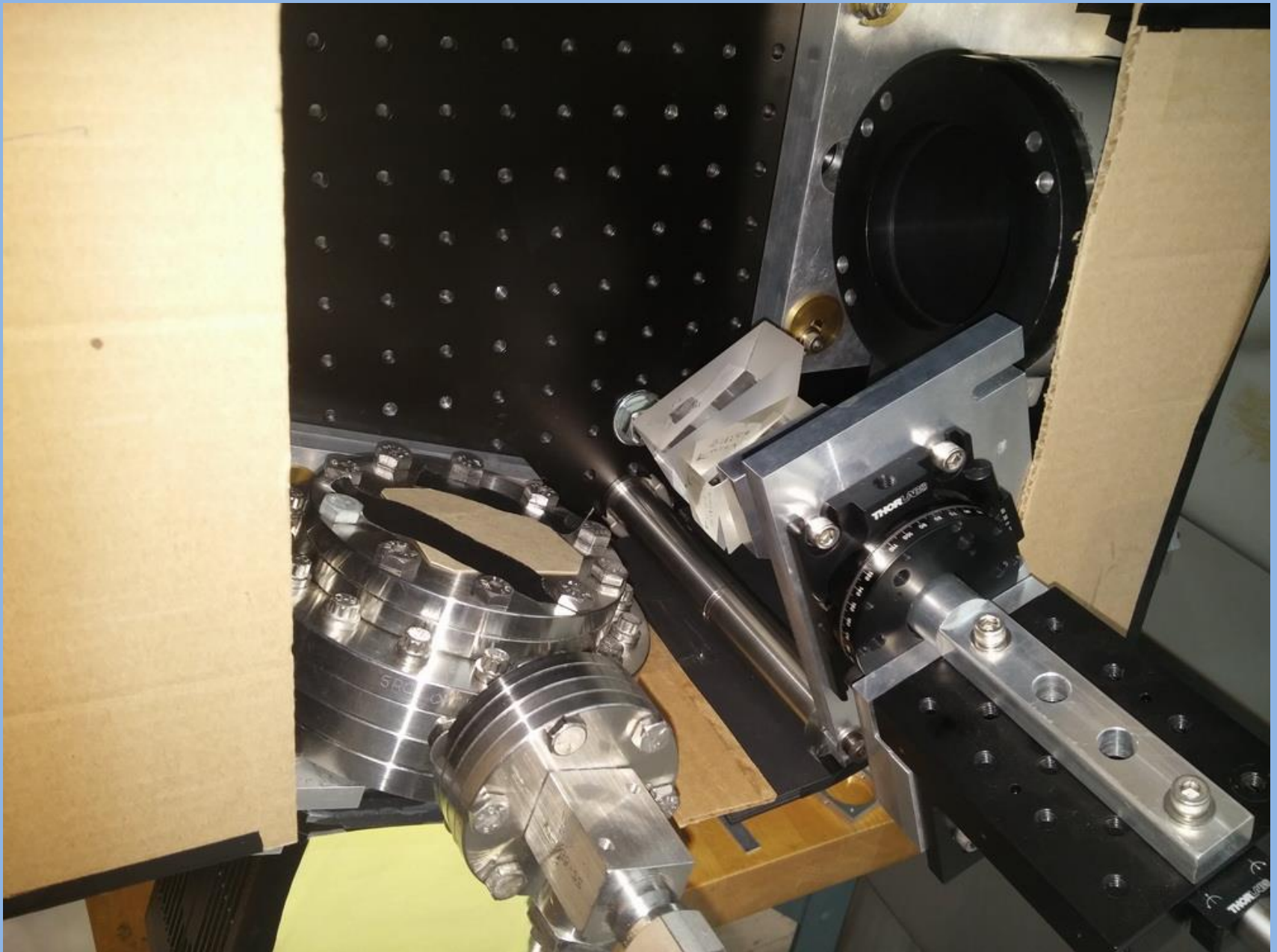
Bu çalışmanın başlangıcı “Oxford Group Fe ” olarak adlandırılan oyuk katot ağır metal ışı nım tüpleri ışı nımı kullanılarak Echelle spektrometresi ile alınan verilerden oluşmaktadır. Daha önceleri ışı nım foton çoğaltıcı tüplerle alınan bu veriler, CCD’ler görüntüleme yöntemlerinde kullanmasıyla foton çoğaltıcı tüplerin yerini almıştır. Echelle ile belirlenen spektrumlar, NASA tarafından yıldız ve gökadalalarında süper nova kalıntılarından elde edilen spektrumlarla karşılaştırılması yapılmaktadır. Echelle spektrometresi UV, Görünür ve IR ışı nım spektrumlarını ayırt edebilmektedir. Aynı zamanda bu atomların ince yapılarını da belirleyebilmektedir. Böylelikle NASA tarafından alınan verileri daha kesin ve doğru olarak belirlemekte ve bolluk hesabı yapılmaktadır.

Top View



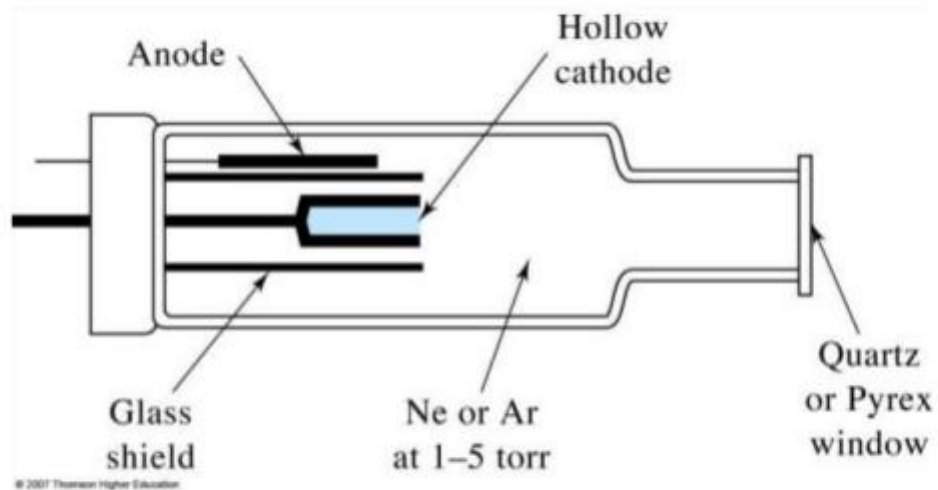




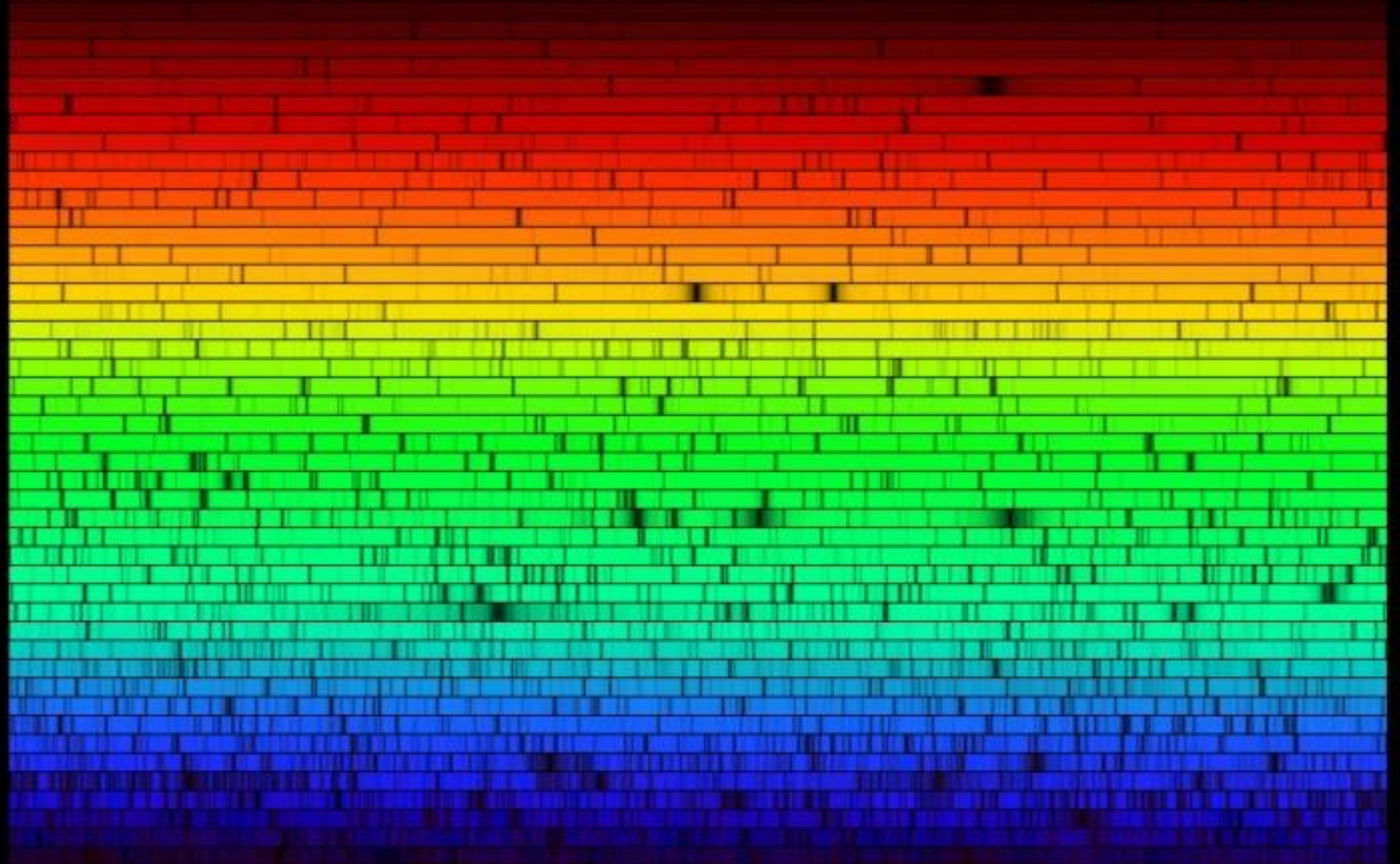




Hollow Cathode Lamp



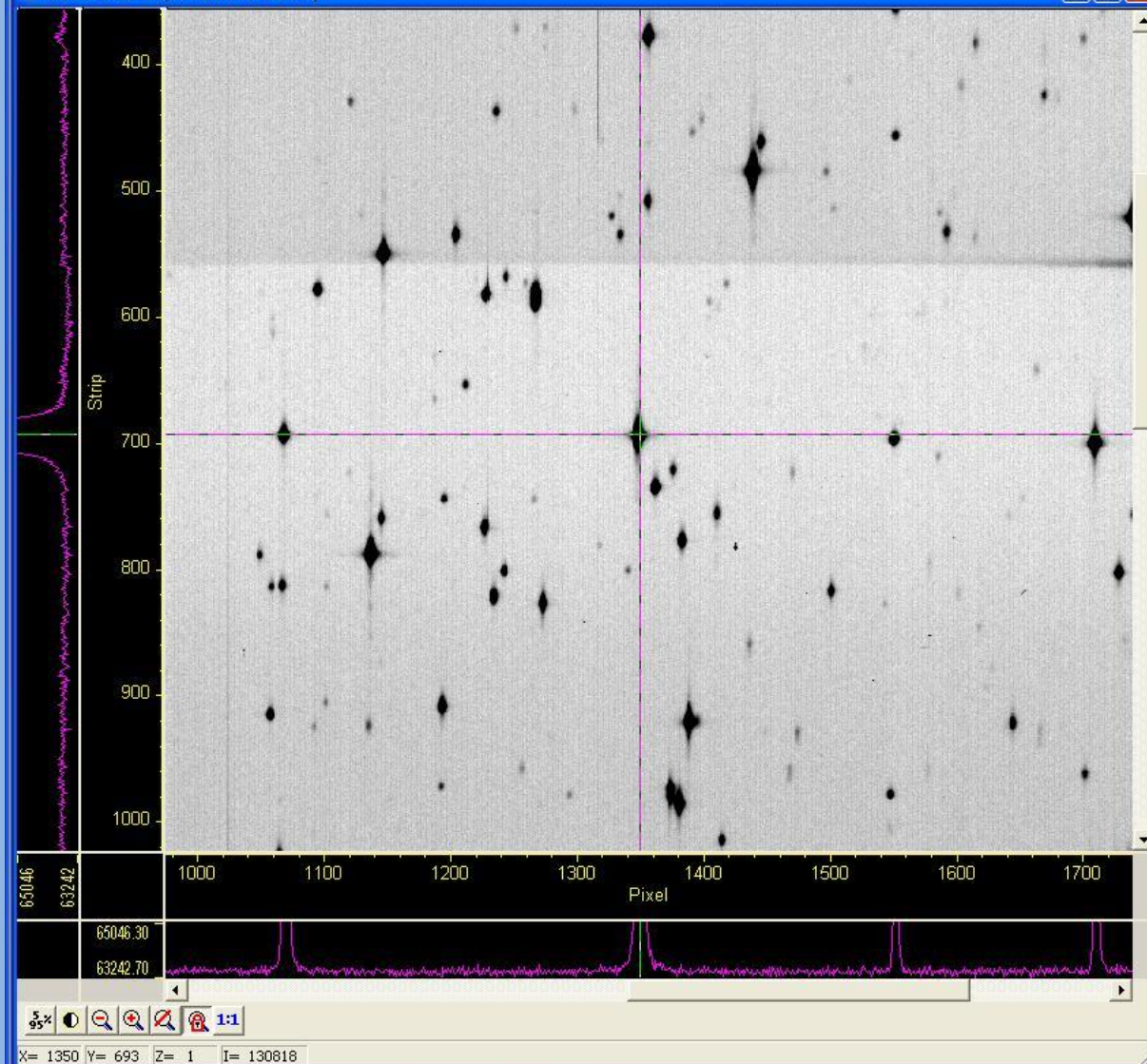




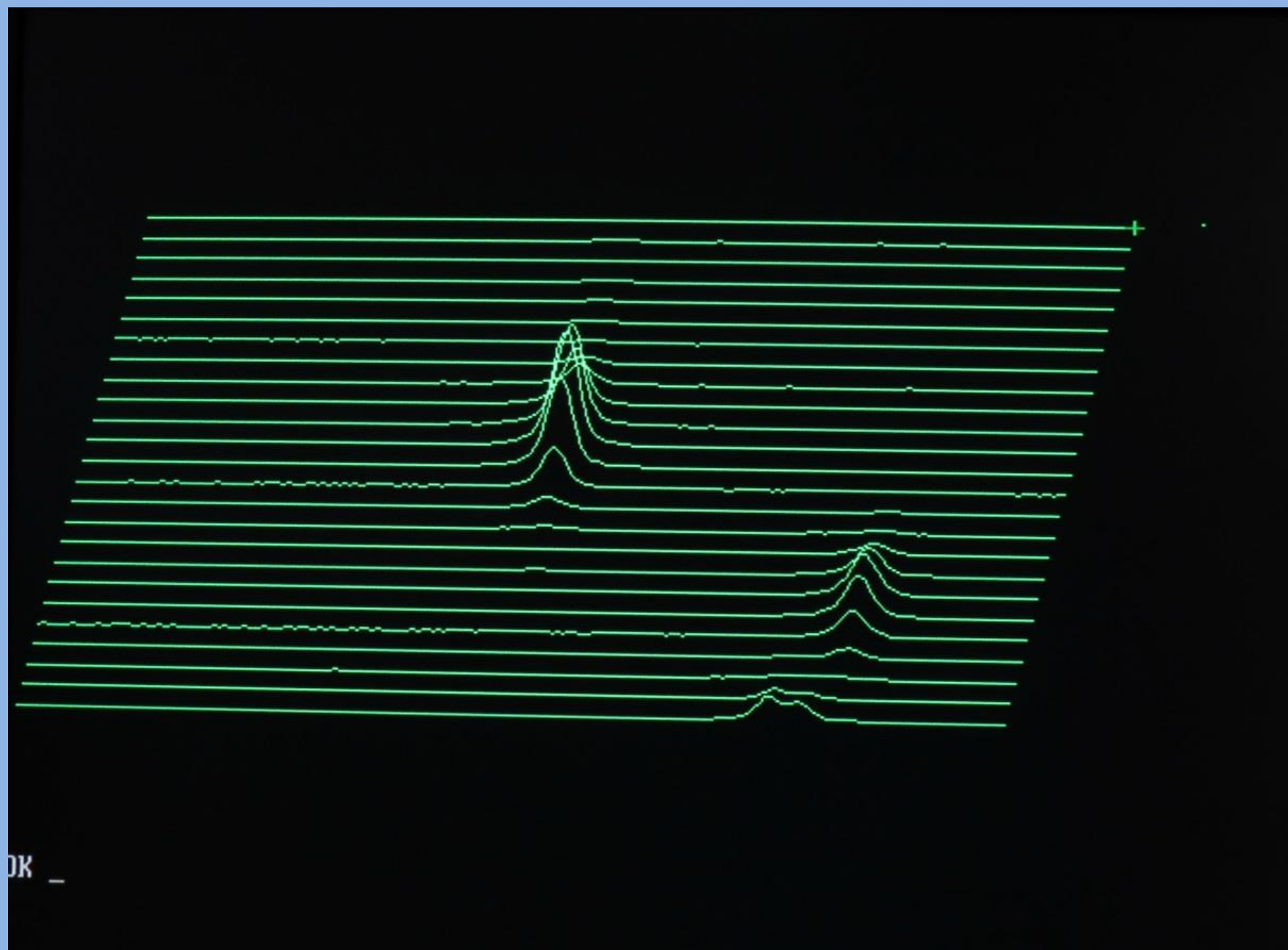
Yukarda şeması verilen Echelle spektrometresi ile alınan CCD verileri Winview programı yardımıyla görüntülenmektedir. Winview programı yardımı ile CCD üzerindeki spektrum çizgilerinin X ve Y konumları, spektrumun şiddeti, arka alan gürültü değerleri belirlenmektedir. Bunu amacı araştırılması istenen elementin referans spektrumu tanımlanmaktadır. Böylece sonraki veri analiz programına gerekli X, Y noktaları belirlenmiş olur.



1511709.SPF (2048 X 2048 X 1)



CCD de ki spektrum çizgileri ASYST analiz programı yardımıyla değerleri, sinyal gürültü oranları, belirlenmekte ve analiz yapılmakta NASA verileri ile karşılaştırma için temel teşkil etmektedir. Bu CCD üzerindeki veriler A,B,C,D,E framelerine bölünerek alınmaktadır Her bir frame için bu referans noktaları belirlenmekte ve analiz programı için hazırlanmaktadır.



M M M M M M M

M

M A

M

M M M M M

M

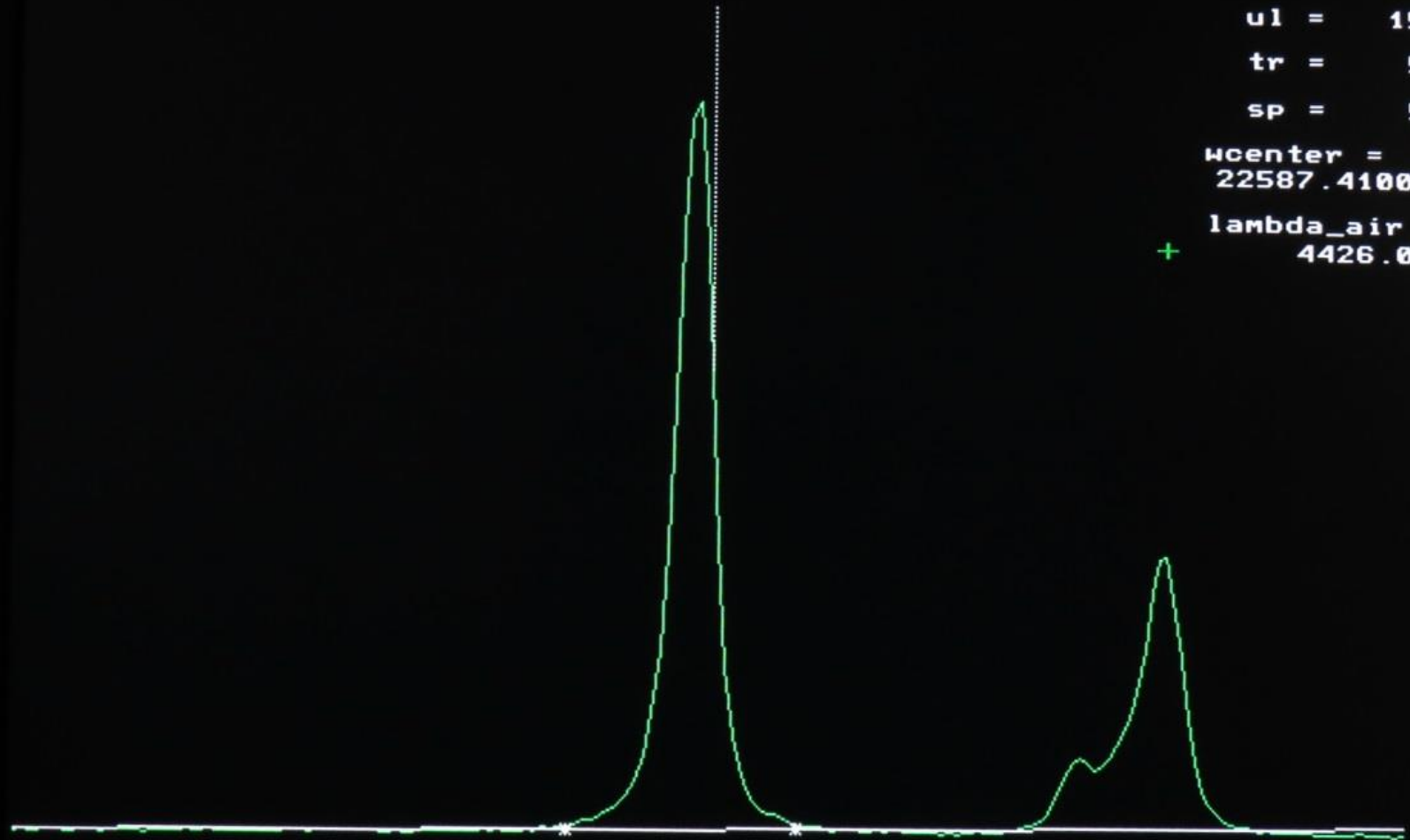
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tr = 5

sp = 5

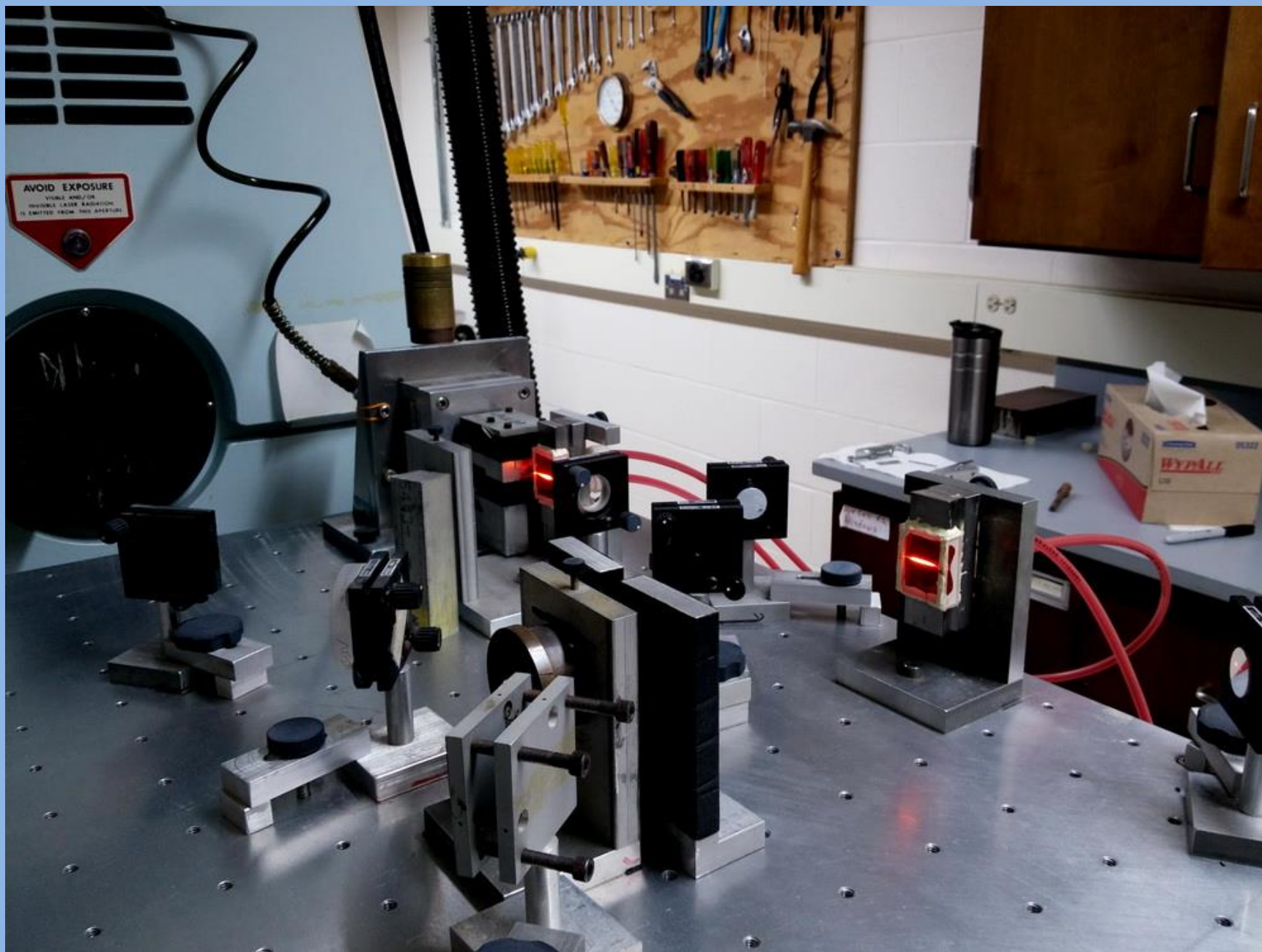
wcenter =
22587.41000

+ lambda_air =
4426.00



OK rp
OK _









Echelle spektrometresiyle aldığımız UV, görünür ve IR emisyon çizgilerinin CCD ve referans noktalarının belirlenmesi verilerinin analizi tamamlandı NIST veri bankasından spektrum kontrolleri yapıldı.

NIST Atomic Spectra Database Lines Form

Best viewed with the latest versions of Web browsers and JavaScript enabled

Spectrum

Fe

e.g., Fe I or Na;Mg; Al or mg i-iii

Lower Wavelength:

230

or Upper Wavenumber (in cm^{-1})

600

Upper Wavelength:

or Lower Wavenumber (in cm^{-1})

Units:

nm

▼

Reset input

Retrieve Data

Dynamic Plots

Line Identification Plot: ☐

Saha-LTE Spectrum: ☐

Electron Temperature T_e (eV):

Electron Density N_e (cm^{-3}):

☐ Doppler-broadened spectrum

Ion Temperature T_i (eV): (if $T_i \neq T_e$)

Grotrian Diagram

Java subwindow size:

☐ 640 x 640 ☐ 800 x 640 ☒ 1024 x 768 ☐ 1280 x 1024

☐ Group by configurations | Term multiplicity

☐ Show only radiatively linked levels

NIST Atomic Spectra Database Lines Data

Fe (all spectra): 29609 Lines of Data Found

Example of how to reference these results:
Kramida, A., Ralchenko, Yu., Reader, J., and NIST ASD Team (2015). *NIST Atomic Spectra Database* (ver. 5.3). [Online]. Available: <http://physics.nist.gov/asd> [2016, September 6]. National Institute of Standards and Technology, Gaithersburg, MD.
[Bibtex Citation](#) (new window)

Wavelength in: vacuum below 200 nm, air between 200 and 2000 nm, vacuum above 2000 nm
Highest relative intensity: 2510000

Query NIST Bibliographic Databases for Fe (new window)

[Fe Energy Levels](#)
[Fe Line Wavelengths and Classification](#)
[Fe Transition Probabilities](#)

Ion	Observed Wavelength Vac (nm)	Ritz Wavelength Vac (nm)	Rel. Int. (?)	A_{ki} (s ⁻¹)	Acc.	E_l (cm ⁻¹)	E_u (cm ⁻¹)	Lower Level Conf., Term, J			Upper Level Conf., Term, J			Type	TP Ref.	Line Ref.
Fe XXVI		0.1391696		1.61e+13	A	0	- (71 854 790)	1s	2S	1/2	5p	2P°	3/2		T7228extrap	L11926
Fe XXVI		0.1424985		3.20e+13	A	0	- (70 180 120)	1s	2S	1/2	4p	2P°	3/2		T7228extrap	L11926
Fe XXV		0.14608		2.54e+13	B	0	- [68 454 800]	1s ²	1S	0	1s5p	1P°	1		T3221	
Fe XXV		0.14612		3.1e+12	E	0	- [68 438 600]	1s ²	1S	0	1s5p	3P°	1		T5298interp	
Fe XXV		0.14946		5.05e+13	B	0	- [66 907 600]	1s ²	1S	0	1s4p	1P°	1		T3221	
Fe XXV		0.14953		6.0e+12	E	0	- [66 875 900]	1s ²	1S	0	1s4p	3P°	1		T5298interp	
Fe XXVI		0.1502350		7.86e+13	A	0	- (66 562 370)	1s	2S	1/2	3p	2P°	3/2		T7228extrap	L11926
Fe XXVI		0.1503496		7.83e+13	A	0	- (66 511 640)	1s	2S	1/2	3p	2P°	1/2		T7228extrap	L11926
Fe XXV		0.15732		1.24e+14	B	0	- [63 565 800]	1s ²	1S	0	1s3p	1P°	1		T3221	

Bu belirleme bittikten sonra Chris Shenden ve ekibi tarafında saęlanan NASA verileriyle karřılařtırma yapıldı ve yıldız atmosferlerindeki Metal bolluęu belirlendi. Bu ise bize řunu tanımlayacaktır; Süper nova kalıntısından olan yıldızların atmosferlerinde bulunan metallerin süpernovanın ürünlerinin ve bolluklarının tahmininde bir sonuca ulaşmamızı saęlayacaktır.

Çalışma tamamlanmış ve yayın haline getirildi

IMPROVED Cr II $\log(gf)$ VALUES AND
ABUNDANCE DETERMINATIONS IN THE PHOTOSPHERES OF THE SUN AND
METAL-POOR STAR HD 84937

J. E. Lawler¹, C. Sneden², G. Nave³, E. A. Den Hartog¹, N. Emrahoğlu^{1,4}, and J. J. Cowan⁵

Diğer çalıştığım konu ise
Dünya atmosferinin üst katmanlarında
Hidrojen bolluğu

Geocoronal Balmer-alpha hydrogen emission observations made with the Turkish Dual Etalon Fabry-Perot Spectrometer (DEFPOS)

Ersoyoglu N., * Sahin M., * Mosaad S., * Mielkiewicz, Edwin L.* (ersoyoglu@gmail.com)

Geocoronal hydrogen Balmer-alpha emission observations were made with a dual etalon Fabry-Perot spectrometer (DEFPOS) from the TUBITAK National Observatory (TNO) between the years 2003-2004. The TUBITAK National Observatory is located on the Belkirtape mountain in Antalya, Turkey (36° 51'N, 30° 20'E, at an altitude of 2547 m). The field of view (FOV) of the DEFPOS instrument is 4.76 degrees. The DEFPOS points in the zenith and observations were taken with 1200 second exposure times. We will describe analysis of the zenith geocoronal hydrogen Balmer-alpha emission observations made using the DEFPOS Fabry-Perot from the TUBITAK National Observatory between 2003-2004.



1. Introduction

Atomic hydrogen in the thermosphere and exosphere is a product of molecules such as water vapor and methane below. Methane is a greenhouse gas with major impact on global warming. It is converted to carbon and hydrogen compounds. Atomic hydrogen in the upper atmosphere is a product of methane and has because it is very light.

Solar Lyman-beta (328 Angstrom) excites hydrogen atoms in the upper atmosphere. When the electron falls from the $n=2$ to the $n=1$ level it results in Balmer-alpha (686.7 Angstrom) radiation (see Figure 1). This Balmer-alpha emission is observed via remote sensing by ground-based Fabry-Perot spectrometers. The intensity of the Balmer-alpha emission obtained by the Fabry-Perot is a measure of the total radiation integrated along the line of sight. Since the Balmer-alpha emission is excited by solar Lyman-beta, most of the Balmer-alpha emissions arise from above the Earth's shadow with the peak in emission coming from the region at the base of the Earth's shadow. Multiple scattering of Lyman-beta radiation below the Earth's shadow also produces Balmer-alpha emission along the observational line of sight. The Balmer-alpha intensity depends strongly on the viewing geometry (see Figure 2).

The atmosphere research group at the TUBITAK National Observatory in Turkey took observations of geocoronal hydrogen emissions throughout the years 2003-2004 using a dual etalon Fabry-Perot Spectrometer (DEFPOS). These observations overlap with the Wisconsin Northern Hemisphere mid-latitude data set.



Figure 1. Earth's Shadow



Figure 2. Hydrogen energy level diagram. The directly excited H-alpha and H-beta transitions are indicated with blue and red lines, respectively. The Lyman-beta transitions are marked with H-gamma. The H-alpha emission components are indicated. Components 1, 2, 3, 4, 5, 6, and 7 are the Lyman-beta emission components 1 and 2 are from direct solar excitation.

2. Methodology

a) Experiment and Observations

Fabry-Perot interferometers offer the advantages of high resolution with high throughput and are thus well suited for studies of faint, diffuse sources such as the hydrogen emissions from the thermosphere and exosphere (see for example, Baudet, 2010).

The Dual Etalon Fabry-Perot Spectrometer (DEFPOS) (see Figure 3) is located at the TUBITAK National Observatory in Antalya, Turkey (Sahin, 2006; Sahin et al., 2007). The resolution of the instrument is 11,000. The field of view is 4.76 degrees and DEFPOS has fixed pointing in the zenith. The Fabry-Perot is coupled to a Charge Coupled Device Camera. Observations were taken with exposure times of 1200 seconds.



Figure 3. Dual Etalon Fabry-Perot Spectrometer (DEFPOS). As shown in the figure, the pressure chamber contains the two etalons and the Fabry-Perot filter is a third element. The system observes in the zenith and has a field of view of 4.76 degrees.

b) Analysis

The DEFPOS instrument is coupled to a Charge Coupled Device Camera and utilizes angular scanning spectroscopy to convert the Fabry-Perot interference pattern to a spectrum. Angular scanning spectroscopy is based on the principle that equal air angles correspond to equal spectral intervals when measured in arcseconds (Gubler et al., 1998). The CCD image of the DEFPOS Fabry-Perot interference pattern is shown in Figure 4.

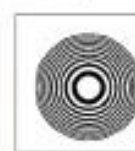


Figure 4. DEFPOS Fabry-Perot interference pattern



Figure 5. DEFPOS CCD image

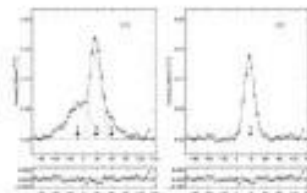


Figure 6 and 8. Sample spectrum obtained on July 30, 2003 around 00:00 UT. The center coordinate of the observed region is $\lambda = 307.5$ and $\lambda = 686.7$. In Fig. 6, there is a prominent feature at $\lambda = 686.7$ is the geocoronal H-alpha line and there are two Galactic features (2, 3) from two images taken with hydrogen clouds along the line of sight (Sahin et al., 2003). It can clearly be seen that the geocoronal emission line is superimposed on the two Galactic emission lines. The intensity of the geocoronal line is 4.76. Its width in the spectrum is about 30 km/s, and is determined by the resolution of the spectrometer. The center features, on the left channel at $\lambda = 307.5$ and on the right at $\lambda = 686.7$, are Galactic emission lines and their observations are 3.22 and 1.30 Å, respectively. Fig. 8 is the resulting pure geocoronal spectrum after removal of the Galactic H-alpha lines is shown in Fig. 8. The results of each fit are plotted at the bottom of the figure (Sahin, 2006).

3. Result

The DEFPOS instrument took observations of the geocoronal H-alpha emission intensity during the 2003-2004 period. Figure 7a and 7b show sample spectra. Figure 8 shows a sample sky map that provides information about the location of the Galactic plane corresponding to which an observation was taken.

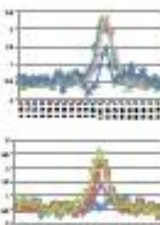


Figure 7. Sample spectra at different air angles (pointed to redshift).

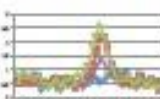


Figure 8. Sample spectra at different air angles (pointed to redshift).



Figure 9. Sky map showing the position of the Galaxies plane (pointed to redshift).



Figure 9a and 9b. Sample spectra obtained on July 30, 2003 around 00:00 UT.

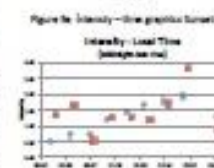


Figure 10. Intensity-time graphs. Midlight - Sunrise

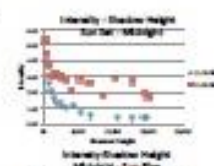


Figure 11. Intensity-time graphs. Sunrise - Midlight

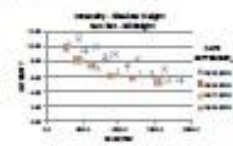


Figure 12. Intensity-time graphs. Sunrise - Midlight

4. Conclusion

The DEFPOS instrument has obtained observations from the TUBITAK National Observatory of the upper atmosphere for hydrogen alpha emission. DEFPOS observes in the zenith direction. There is variability from night to night, along variation between DEFPOS observations obtained during different months. There is ongoing research to investigate whether this variability is geophysical or due to the presence of Galactic emission or possibly due to the field of view of the DEFPOS instrument. A pointing and tracking observation would be useful in pointing in directions away from the Galaxy and would assist the interpretation of the observations.

References

- Baudet, A., 2010. A review of the geocoronal hydrogen alpha emission. *Journal of Geophysical Research*, 115, A00J01.
- Sahin, M., 2006. The geocoronal hydrogen alpha emission. *Journal of Geophysical Research*, 111, A00J01.
- Sahin, M., 2007. The geocoronal hydrogen alpha emission. *Journal of Geophysical Research*, 112, A00J01.
- Sahin, M., 2008. The geocoronal hydrogen alpha emission. *Journal of Geophysical Research*, 113, A00J01.
- Sahin, M., 2009. The geocoronal hydrogen alpha emission. *Journal of Geophysical Research*, 114, A00J01.
- Sahin, M., 2010. The geocoronal hydrogen alpha emission. *Journal of Geophysical Research*, 115, A00J01.
- Sahin, M., 2011. The geocoronal hydrogen alpha emission. *Journal of Geophysical Research*, 116, A00J01.
- Sahin, M., 2012. The geocoronal hydrogen alpha emission. *Journal of Geophysical Research*, 117, A00J01.
- Sahin, M., 2013. The geocoronal hydrogen alpha emission. *Journal of Geophysical Research*, 118, A00J01.
- Sahin, M., 2014. The geocoronal hydrogen alpha emission. *Journal of Geophysical Research*, 119, A00J01.
- Sahin, M., 2015. The geocoronal hydrogen alpha emission. *Journal of Geophysical Research*, 120, A00J01.
- Sahin, M., 2016. The geocoronal hydrogen alpha emission. *Journal of Geophysical Research*, 121, A00J01.
- Sahin, M., 2017. The geocoronal hydrogen alpha emission. *Journal of Geophysical Research*, 122, A00J01.
- Sahin, M., 2018. The geocoronal hydrogen alpha emission. *Journal of Geophysical Research*, 123, A00J01.
- Sahin, M., 2019. The geocoronal hydrogen alpha emission. *Journal of Geophysical Research*, 124, A00J01.
- Sahin, M., 2020. The geocoronal hydrogen alpha emission. *Journal of Geophysical Research*, 125, A00J01.
- Sahin, M., 2021. The geocoronal hydrogen alpha emission. *Journal of Geophysical Research*, 126, A00J01.
- Sahin, M., 2022. The geocoronal hydrogen alpha emission. *Journal of Geophysical Research*, 127, A00J01.
- Sahin, M., 2023. The geocoronal hydrogen alpha emission. *Journal of Geophysical Research*, 128, A00J01.
- Sahin, M., 2024. The geocoronal hydrogen alpha emission. *Journal of Geophysical Research*, 129, A00J01.
- Sahin, M., 2025. The geocoronal hydrogen alpha emission. *Journal of Geophysical Research*, 130, A00J01.

References

- Baudet, A., 2010. A review of the geocoronal hydrogen alpha emission. *Journal of Geophysical Research*, 115, A00J01.
- Sahin, M., 2006. The geocoronal hydrogen alpha emission. *Journal of Geophysical Research*, 111, A00J01.
- Sahin, M., 2007. The geocoronal hydrogen alpha emission. *Journal of Geophysical Research*, 112, A00J01.
- Sahin, M., 2008. The geocoronal hydrogen alpha emission. *Journal of Geophysical Research*, 113, A00J01.
- Sahin, M., 2009. The geocoronal hydrogen alpha emission. *Journal of Geophysical Research*, 114, A00J01.
- Sahin, M., 2010. The geocoronal hydrogen alpha emission. *Journal of Geophysical Research*, 115, A00J01.
- Sahin, M., 2011. The geocoronal hydrogen alpha emission. *Journal of Geophysical Research*, 116, A00J01.
- Sahin, M., 2012. The geocoronal hydrogen alpha emission. *Journal of Geophysical Research*, 117, A00J01.
- Sahin, M., 2013. The geocoronal hydrogen alpha emission. *Journal of Geophysical Research*, 118, A00J01.
- Sahin, M., 2014. The geocoronal hydrogen alpha emission. *Journal of Geophysical Research*, 119, A00J01.
- Sahin, M., 2015. The geocoronal hydrogen alpha emission. *Journal of Geophysical Research*, 120, A00J01.
- Sahin, M., 2016. The geocoronal hydrogen alpha emission. *Journal of Geophysical Research*, 121, A00J01.
- Sahin, M., 2017. The geocoronal hydrogen alpha emission. *Journal of Geophysical Research*, 122, A00J01.
- Sahin, M., 2018. The geocoronal hydrogen alpha emission. *Journal of Geophysical Research*, 123, A00J01.
- Sahin, M., 2019. The geocoronal hydrogen alpha emission. *Journal of Geophysical Research*, 124, A00J01.
- Sahin, M., 2020. The geocoronal hydrogen alpha emission. *Journal of Geophysical Research*, 125, A00J01.
- Sahin, M., 2021. The geocoronal hydrogen alpha emission. *Journal of Geophysical Research*, 126, A00J01.
- Sahin, M., 2022. The geocoronal hydrogen alpha emission. *Journal of Geophysical Research*, 127, A00J01.
- Sahin, M., 2023. The geocoronal hydrogen alpha emission. *Journal of Geophysical Research*, 128, A00J01.
- Sahin, M., 2024. The geocoronal hydrogen alpha emission. *Journal of Geophysical Research*, 129, A00J01.
- Sahin, M., 2025. The geocoronal hydrogen alpha emission. *Journal of Geophysical Research*, 130, A00J01.

Acknowledgements

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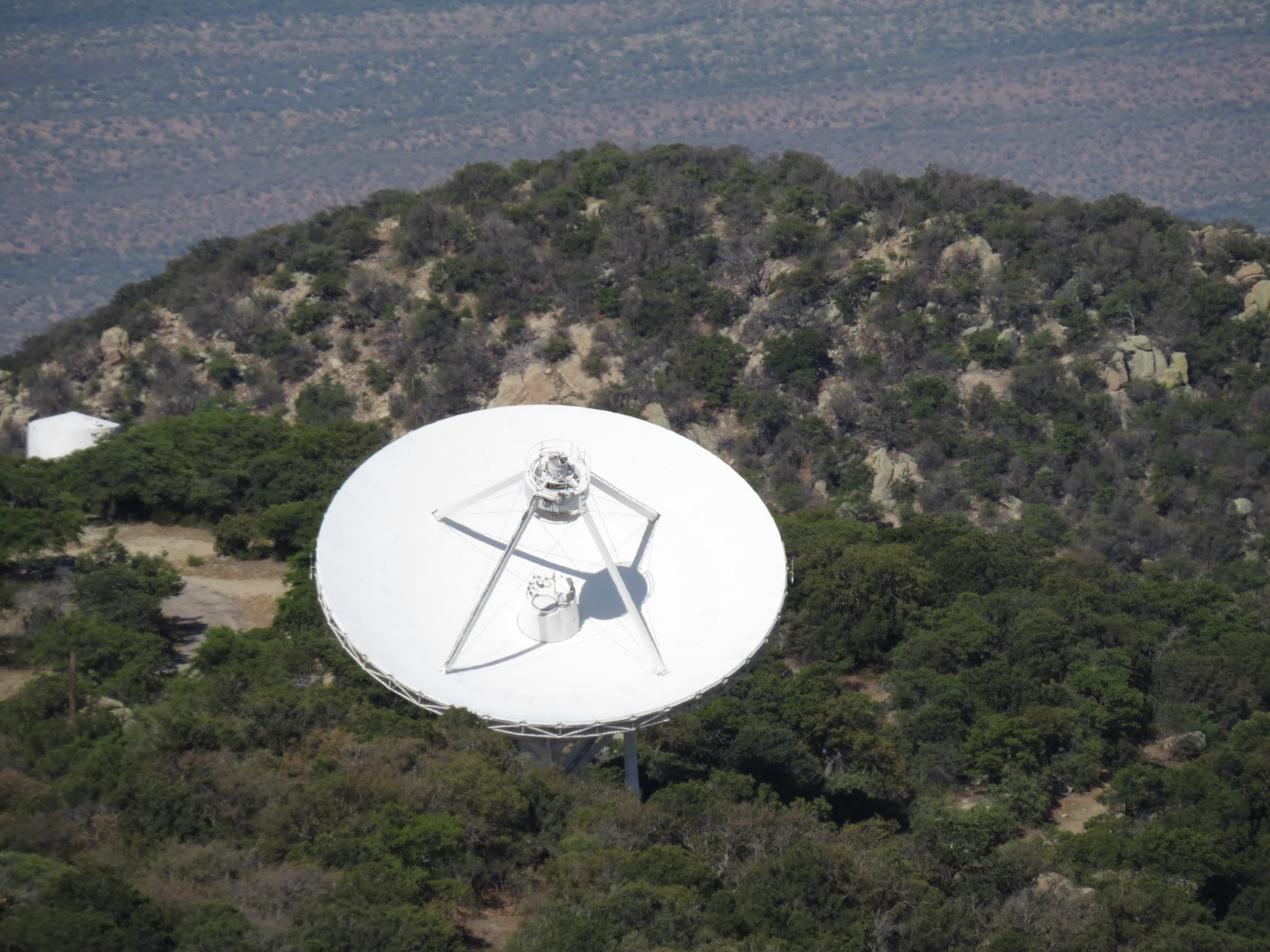
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Coupled Energetics of Atmospheric Regions (CEDAR) workshop.

















Teşekkürler

