Telescopio Nazionale Galileo Instrumentation

Spettrografo ad Alta Risoluzione Galileo (SARG)

Thorium - Argon Atlas

Red Cross Disperser (red CCD)

Spectral Range: λ (7529 – 10119)Å

DOCUMENT SARG – D036 VIII

Claudi R.U.
Astronomical Observatory of Padova, vicolo Osservatorio, 5 35122 Padova
Marino G.
Centro Galileo Galilei, Calle Alvarez de abreu, 70
38700 Santa Cruz de la Palma

FORWARD

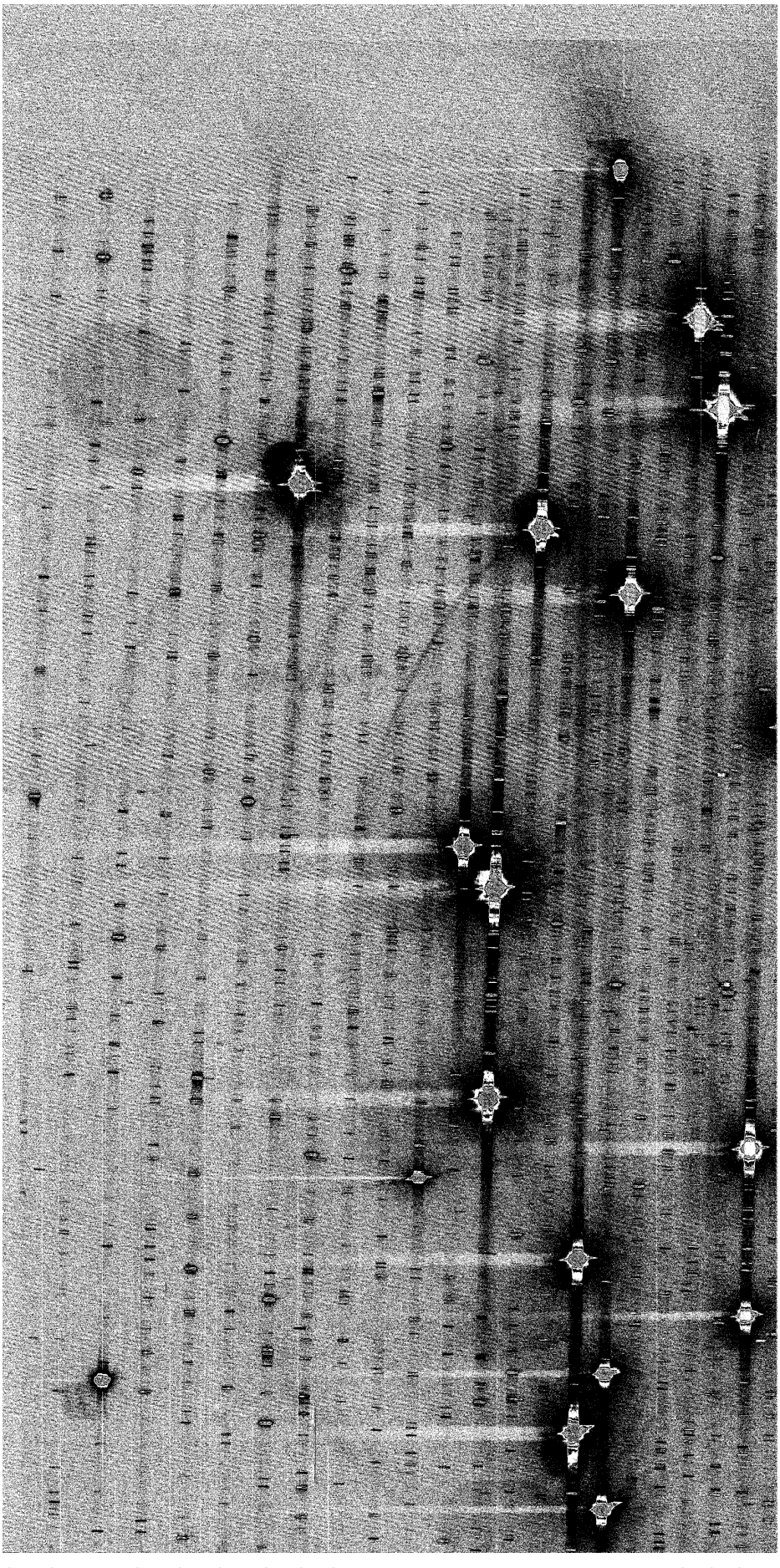
The Th-Ar atlas in the region ranging between the wavelengths 7529 Å and 10119 Å as imaged on the SARG red CCD with the red grism (cross disperser 4) is presented.

The spectra were made exploiting the R= 164,000 slit , a 1×1 CCD binning and the FW5 order sorting filter. The trimming section of the red CCD was:

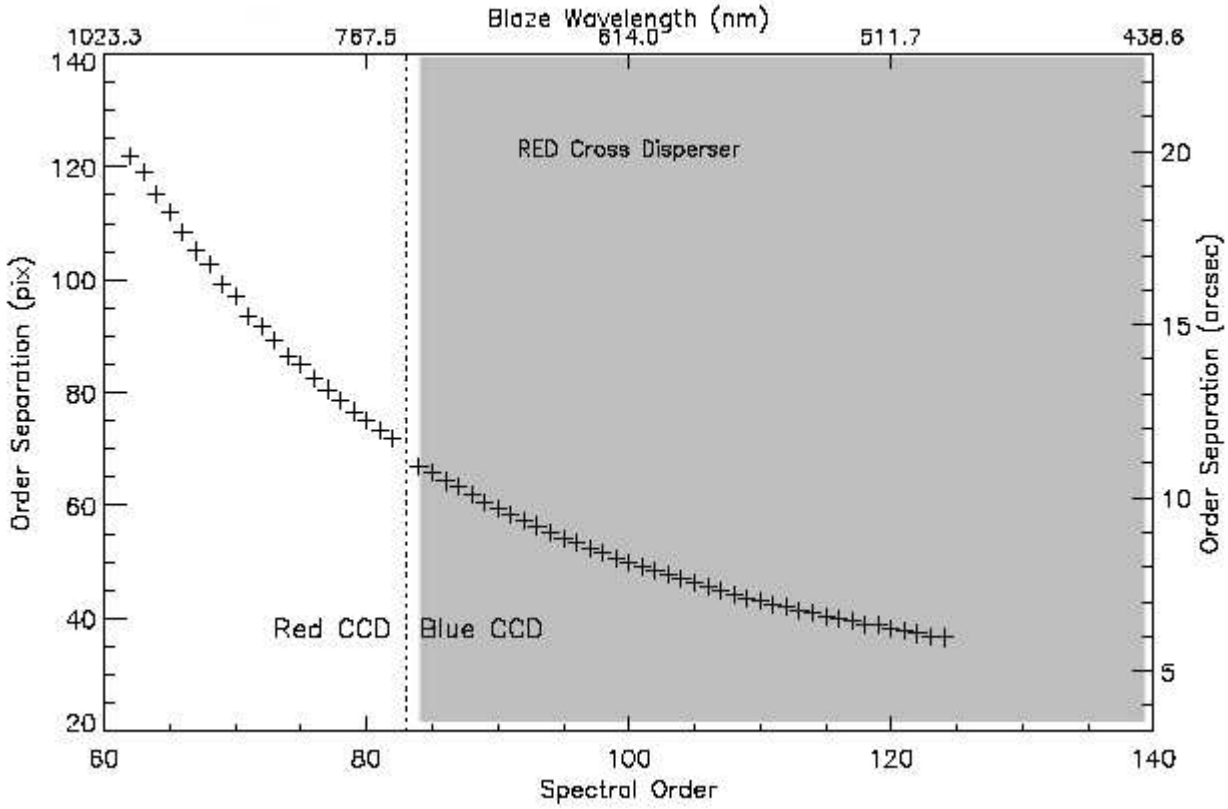
`[1:2097;1:4199]`

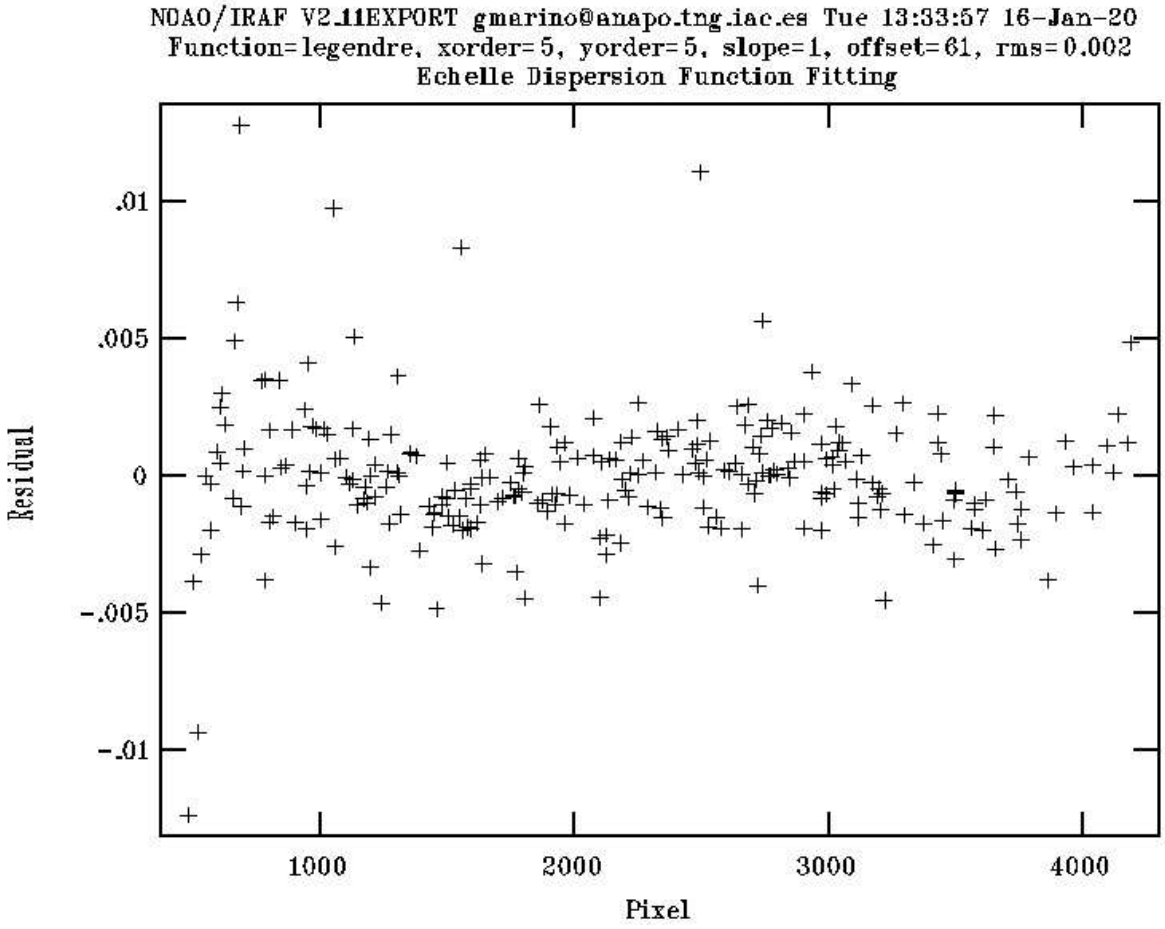
A set of information about the spectral formats is also given:

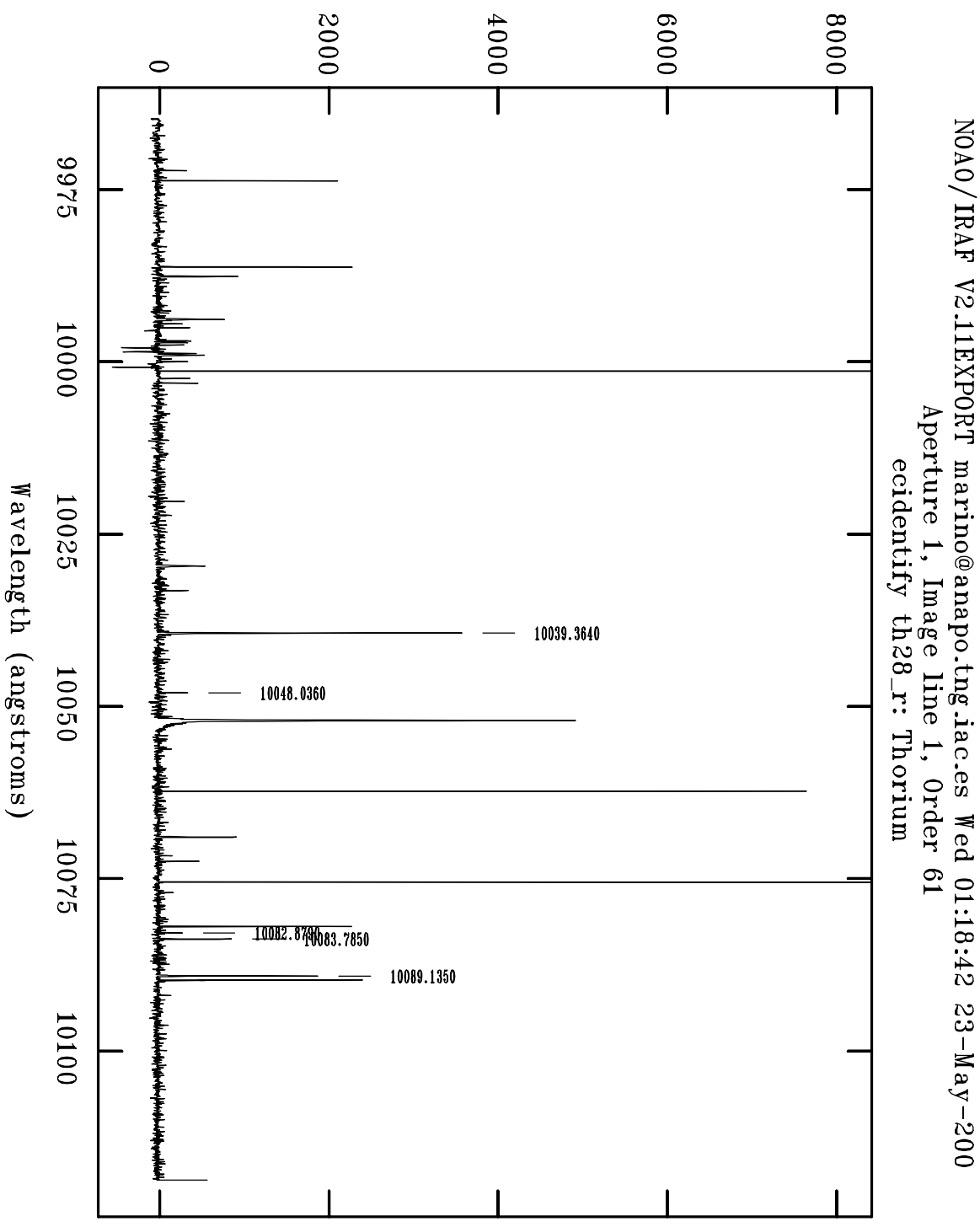
- a 2-D image of the blue CCD in 1×1 binning format (2100×4200 pixels) with the order position on to the CCD clearly indicated.
- a plot showing the change with the spectral order number of the separation between the order (together with the central wavelengths)
- a table listing: the aperture number (first column), the spectral order (second column), the central wavelength, corresponding to pixel 2048, the initial and ending wavelength, all in Å (third, fourth and fifth columns), the free spectral range (in Å), the average Δλ/pix, the spectral order separation at the centre of the order in pixels (the scale on detector is 0.16 arcsec/pixel). In the last column the number of the page where one can find the corresponding 1-D spectrum plot with the identification of some line.
- A plot showing the residuals of the wavelength solution

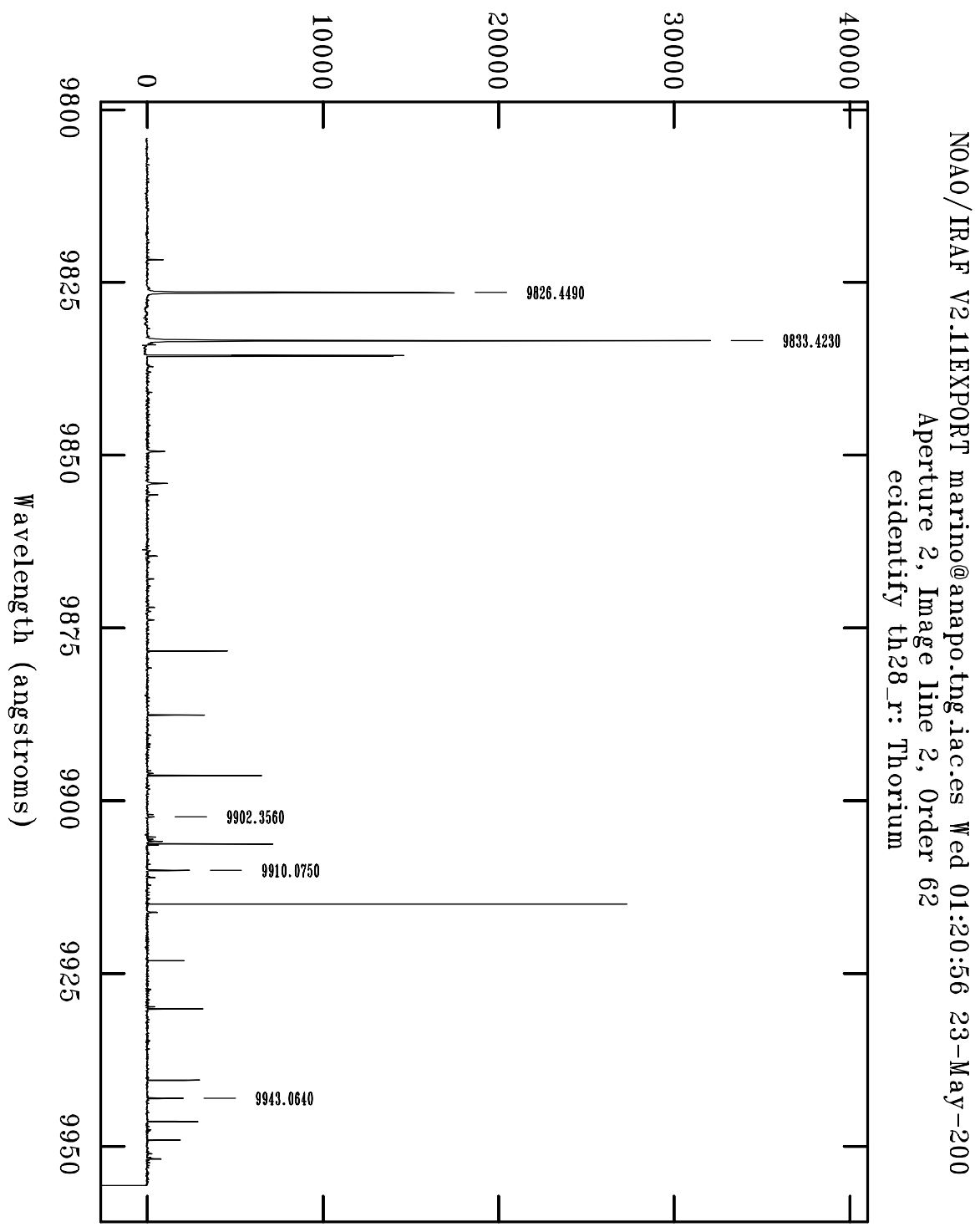

61
62
63
64
65
66
67
68
69
70
71
72
73
74
75
76
77
78
79
80
81
82

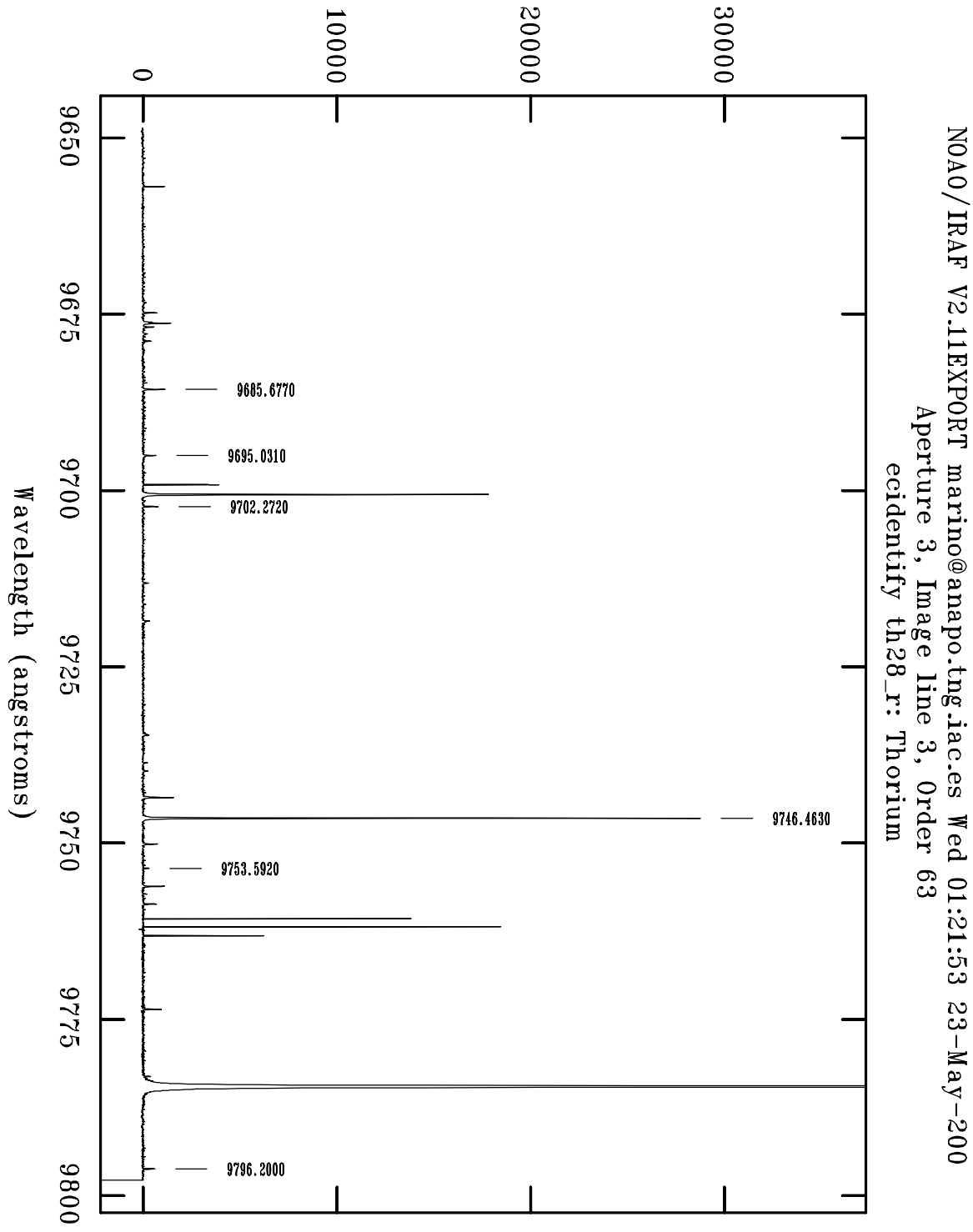
Ap.	**Order**	**λ_C**	**λ_1**	**λ_2**	**FSR**	**$\Delta\lambda$**	**Sep**	**Page**
	#		*(Å)*	*(Å)*	*(Å)*	*(Å/px)*	*(pix)*	
1	61	10065.6	9964.669	10118.77	165.0	0.036708	/	**8**
2	62	9903.3	9804.100	9955.717	159.7	0.036116	122.00	**9**
3	63	9746.1	9648.603	9797.826	154.7	0.035546	119.10	**10**
4	64	9593.8	9497.946	9644.858	149.9	0.034996	115.15	**11**
5	65	9446.2	9351.910	9496.588	145.3	0.034464	112.02	**12**
6	66	9303.1	9210.287	9352.803	141.0	0.033949	108.30	**13**
7	67	9164.2	9072.885	9213.305	136.8	0.033449	105.04	**14**
8	68	9029.5	8939.520	9077.904	132.8	0.032964	102.78	**15**
9	69	8898.6	8810.018	8946.424	129.0	0.032493	99.04	**16**
10	70	8771.5	8684.216	8818.698	125.3	0.032035	97.03	**17**
11	71	8648.0	8561.959	8694.567	121.8	0.031588	93.49	**18**
12	72	8527.8	8443.100	8573.882	118.4	0.031153	91.72	**19**
13	73	8411.0	8327.500	8456.501	115.2	0.030729	89.34	**20**
14	74	8297.4	8251.029	8342.292	112.1	0.030315	86.47	**21**
15	75	8186.7	8105.559	8231.127	109.2	0.029911	84.94	**22**
16	76	8079.0	7998.974	8122.886	106.3	0.029517	82.42	**23**
17	77	7974.1	7895.159	8017.454	103.6	0.029132	80.53	**24**
18	78	7871.9	7794.007	7914.724	100.9	0.028756	78.62	**25**
19	79	7772.2	7695.416	7814.593	98.4	0.028389	76.65	**26**
20	80	7675.1	7599.288	7716.962	95.9	0.028031	75.08	**27**
21	81	7580.3	7505.531	7621.739	93.6	0.027682	73.17	**28**
22	82	7487.9	7414.055	7528.835	91.3	0.027342	71.88	**29**

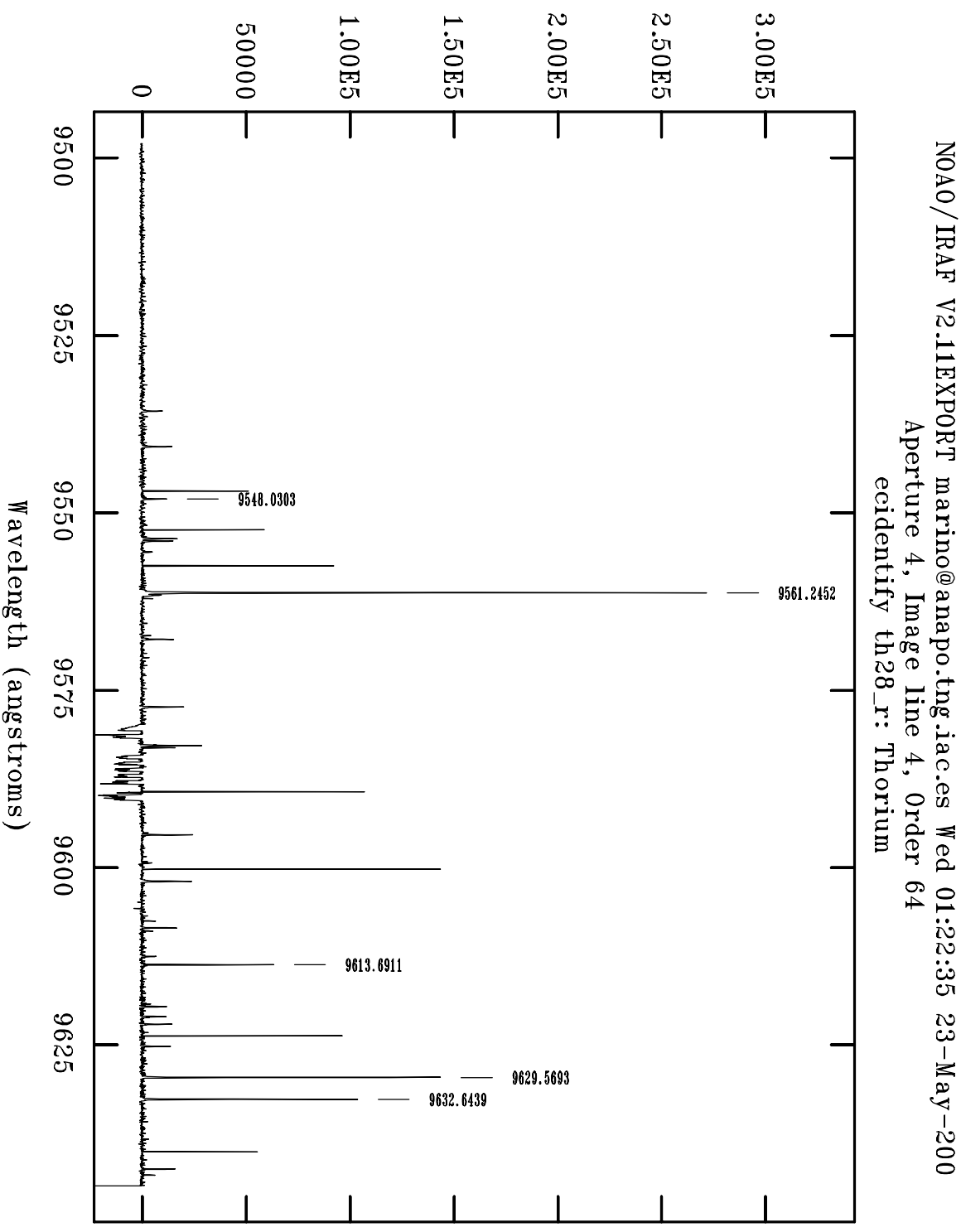

Blaze Wavelength (nm)
1023.3
767.5
614.0
511.7
438.6
RED Cross Disperser
Red CCD
Blue CCD
Order Separation (pix)
Order Separation (arcsec)
Spectral Order
140
120
100
80
60
40
20
60
80
100
120
140
20
15
10
5

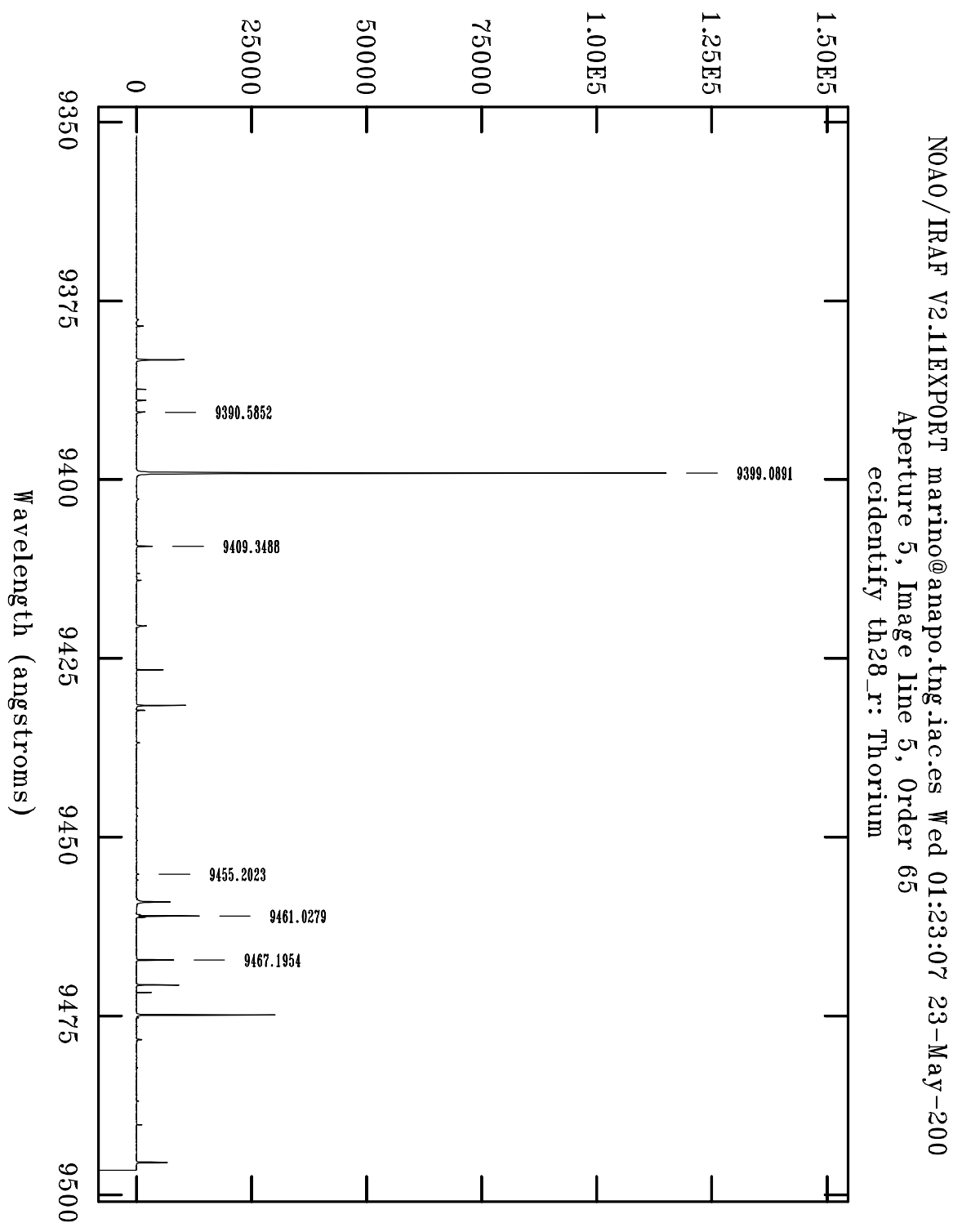

NOAO/IRAF V2.11EXPORT gmarino@anapo.tng.iac.es Tue 13:33:57 16-Jan-20
Function=legendre, xorder=5, yorder=5, slope=1, offset=61, rms=0.002
Echelle Dispersion Function Fitting
Residual
.01
.005
0
-.005
-.01
1000
2000
3000
4000
Pixel

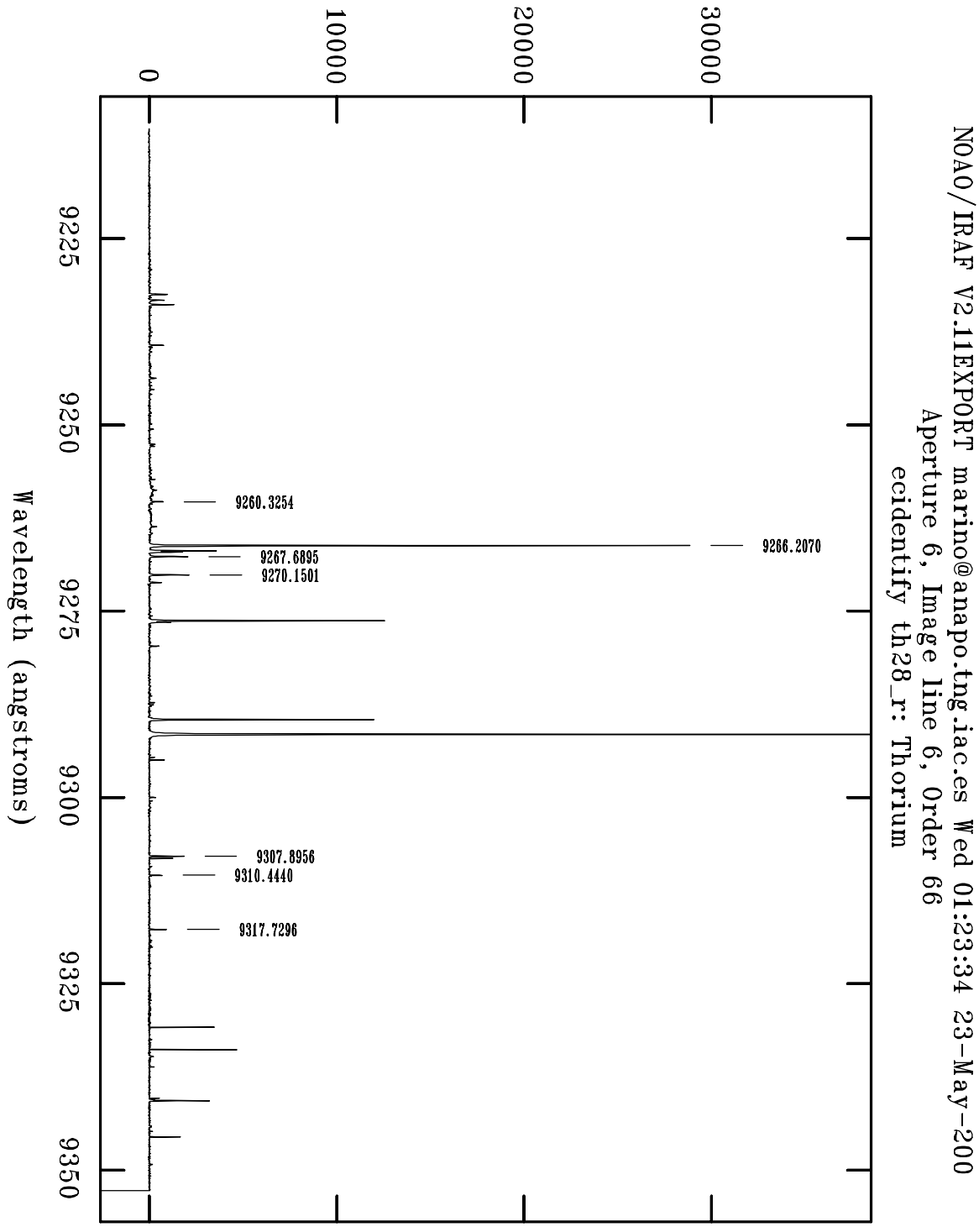

NOAO/IRAF V2.11EXPORT marino@anapo.tng.iac.es Wed 01:18:42 23-May-200
Aperture 1, Image line 1, Order 61
ecidentify th28_r: Thorium
0
2000
4000
6000
8000
9975
10000
10025
10050
10075
10100
Wavelength (angstroms)
10039.3640
10048.0360
10083.7850
10089.1350

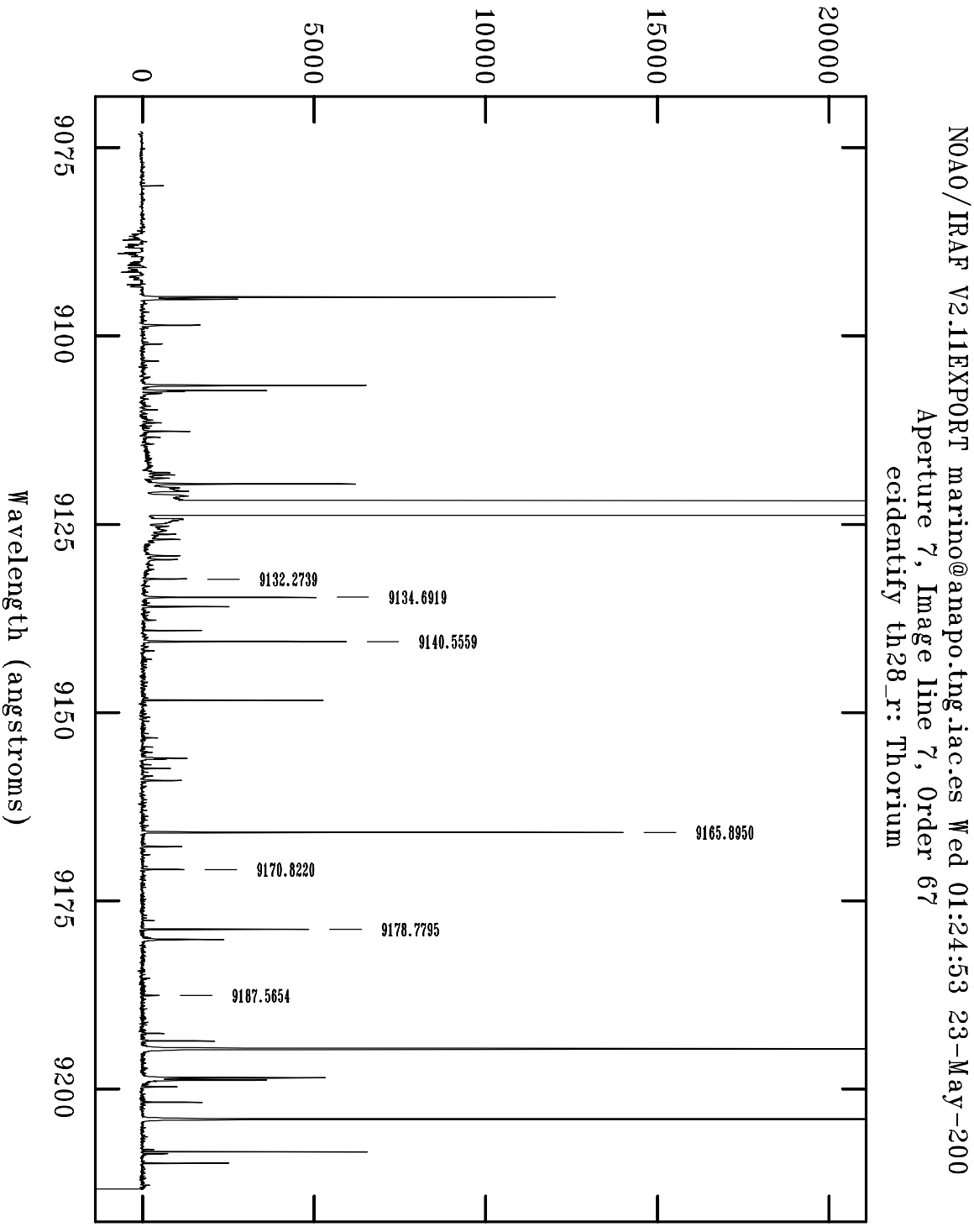

NOAO/IRAF V2.11EXPORT marino@anapo.tng.iac.es Wed 01:20:56 23-May-200
Aperture 2, Image line 2, Order 62
ecidentify th28_r: Thorium
0
10000
20000
30000
40000
9800
9825
9850
9875
9900
9925
9950
Wavelength (angstroms)
9826.4490
9833.4230
9902.3560
9910.0750
9943.0640

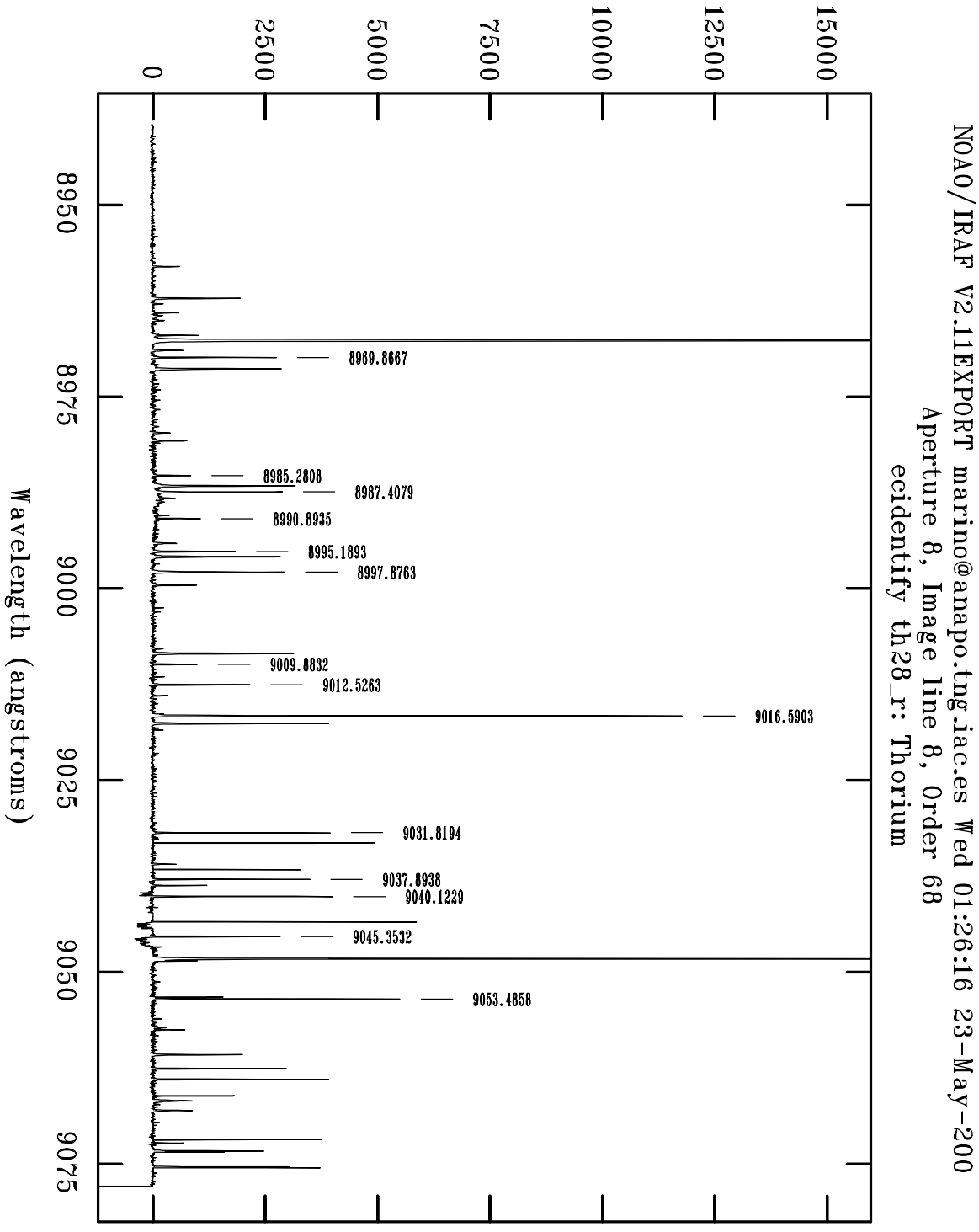

NOAO/IRAF V2.11EXPORT marino@anapo.tng.iac.es Wed 01:21:53 23-May-200
Aperture 3, Image line 3, Order 63
ecidentify th28_r: Thorium
0
10000
20000
30000
9650
9675
9700
9725
9750
9775
9800
Wavelength (angstroms)
9685.6770
9695.0310
9702.2720
9746.4630
9753.5920
9796.2000

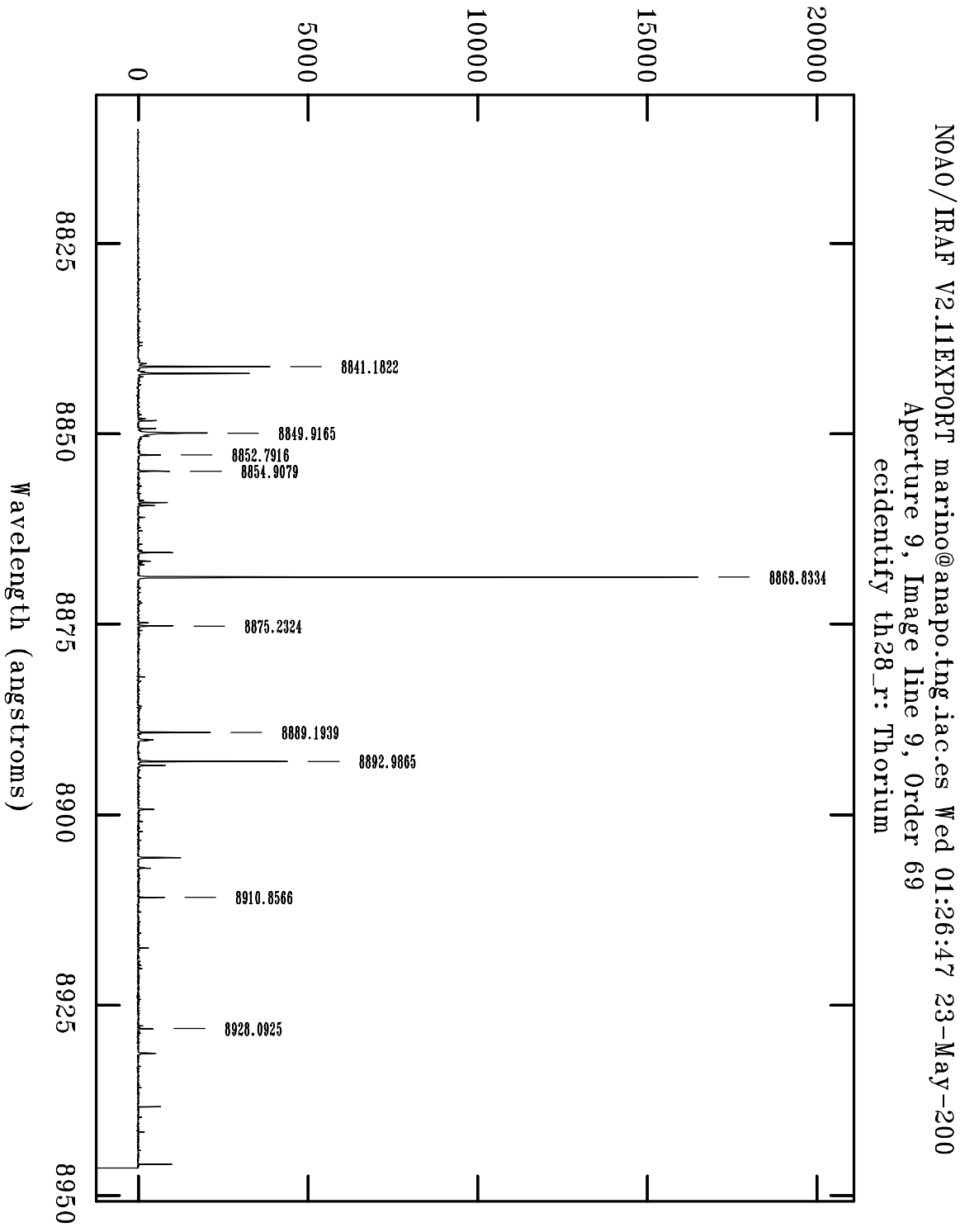

NOAO/IRAF V2.11EXPORT marino@anapo.tng.iac.es Wed 01:22:35 23-May-200
Aperture 4, Image line 4, Order 64
ecidentify th28_r: Thorium
0
50000
1.00E5
1.50E5
2.00E5
2.50E5
3.00E5
9500
9525
9550
9575
9600
9625
Wavelength (angstroms)
9548.0303
9561.2452
9613.6911
9629.5693
9632.6439

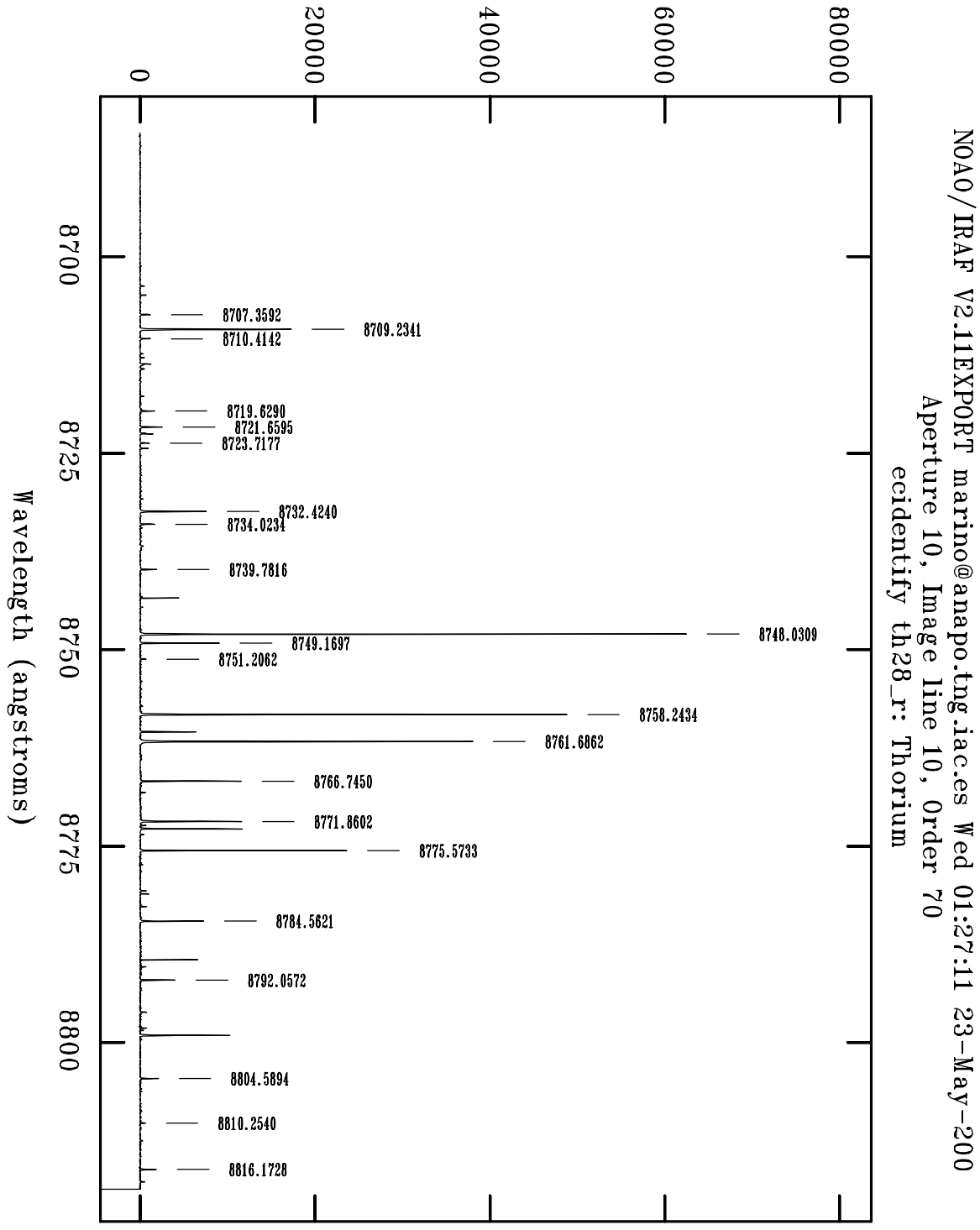

NOAO/IRAF V2.11EXPORT marino@anapo.tng.iac.es Wed 01:23:07 23-May-200
Aperture 5, Image line 5, Order 65
ecidentify th28_r: Thorium
1.50E5
1.25E5
1.00E5
75000
50000
25000
0
9350
9375
9400
9425
9450
9475
9500
Wavelength (angstroms)
9390.5852
9399.0891
9409.3488
9455.2023
9461.0279
9467.1954

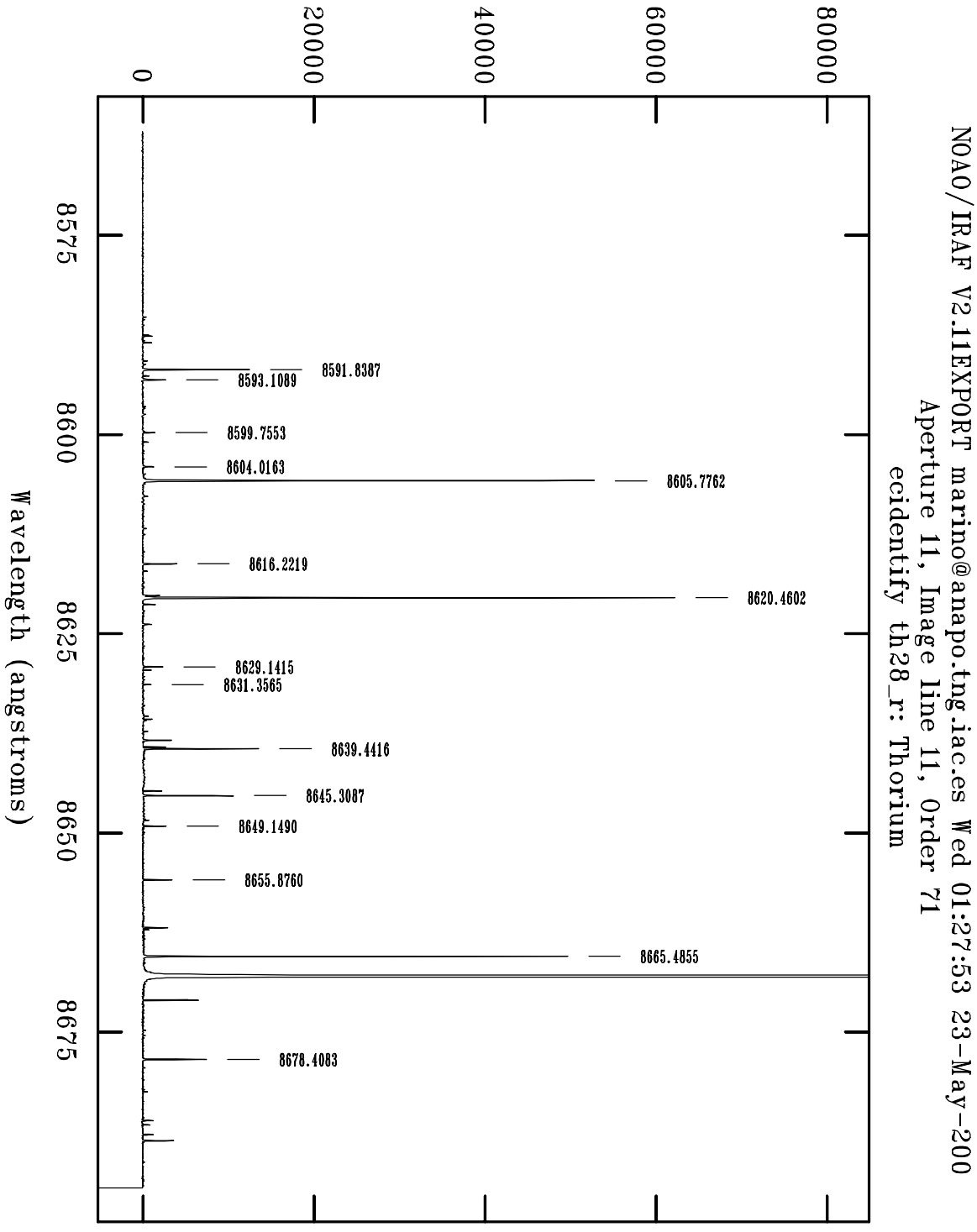

NOAO/IRAF V2.11EXPORT marino@anapo.tng.iac.es Wed 01:23:34 23-May-200
Aperture 6, Image line 6, Order 66
ecidentify th28_r: Thorium
0
10000
20000
30000
9225
9250
9275
9300
9325
9350
Wavelength (angstroms)
9260.3254
9266.2070
9267.6895
9270.1501
9307.8956
9310.4440
9317.7296

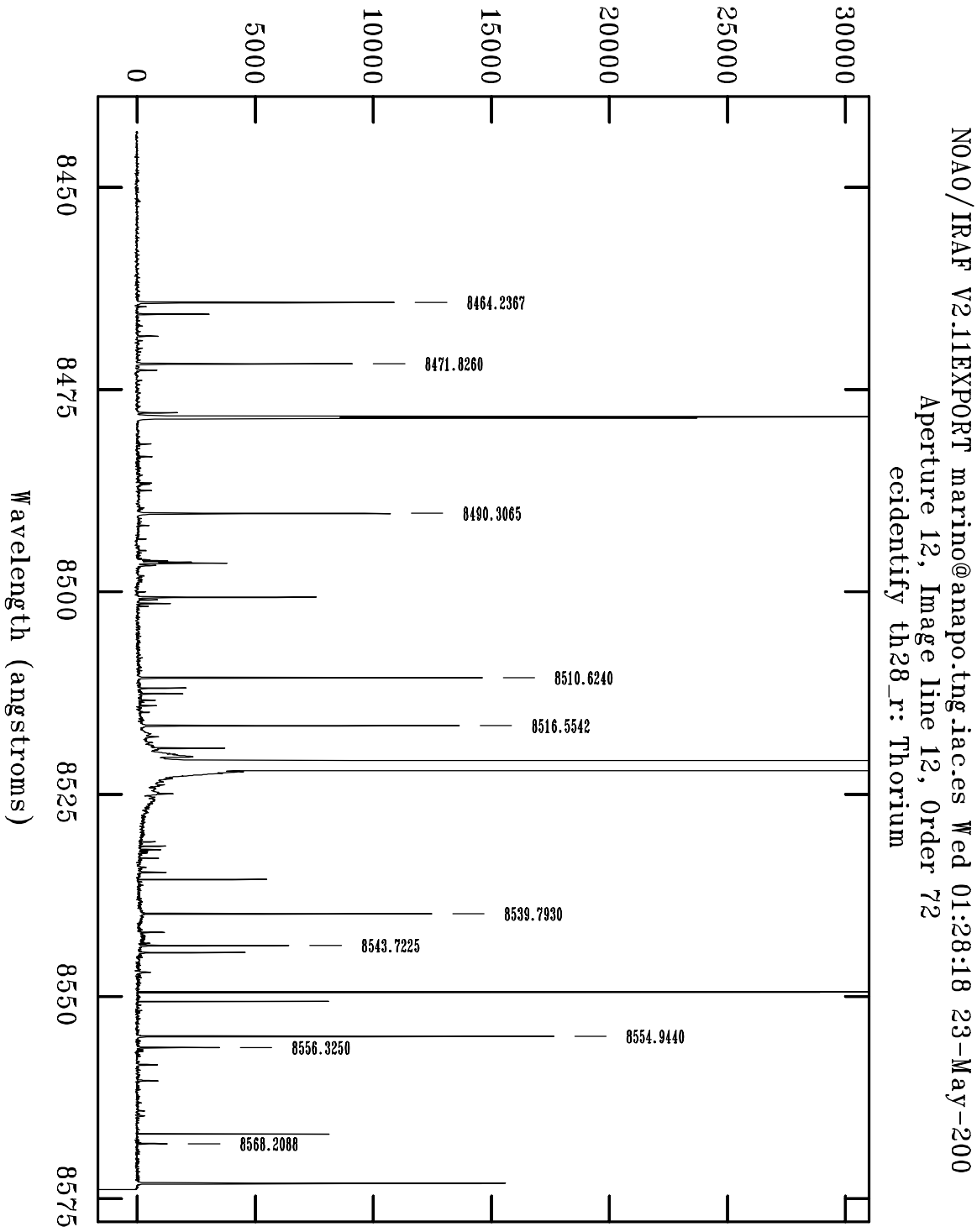

NOAO/IRAF V2.11EXPORT marino@anapo.tng.iac.es Wed 01:24:53 23-May-200
Aperture 7, Image line 7, Order 67
ecidentify th28_r: Thorium
0
5000
10000
15000
20000
9075
9100
9125
9150
9175
9200
Wavelength (angstroms)
9132.2739
9134.6919
9140.5559
9165.8950
9170.8220
9178.7795
9187.5654

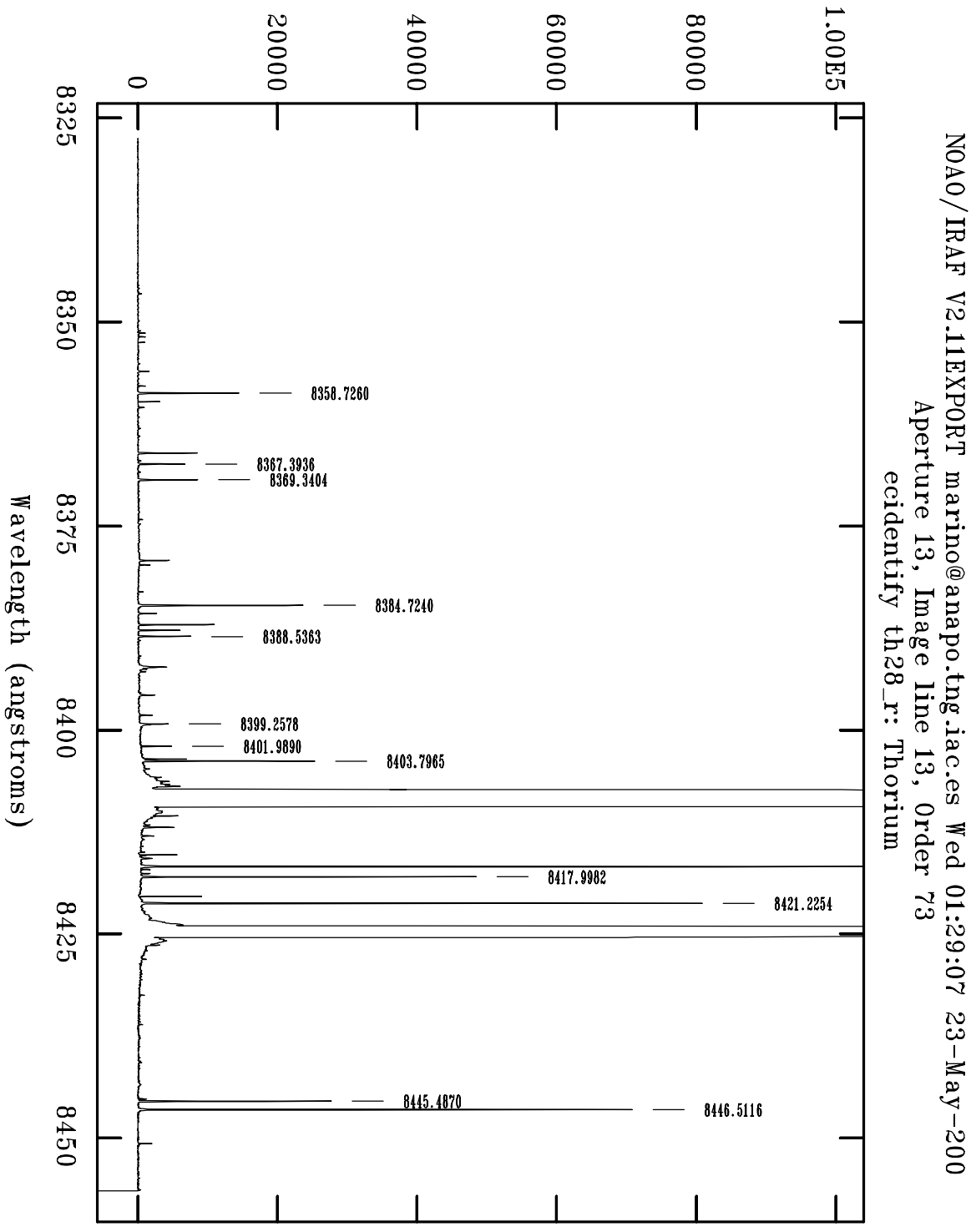

NOAO/IRAF V2.11EXPORT marino@anapo.tng.iac.es Wed 01:26:16 23-May-200
Aperture 8, Image line 8, Order 68
ecidentify th28_r: Thorium
0
2500
5000
7500
10000
12500
15000
8950
8975
9000
9025
9050
9075
Wavelength (angstroms)
8969.8667
8985.2808
8987.4079
8990.8935
8995.1893
8997.8763
9009.8832
9012.5263
9016.5903
9031.8194
9037.8938
9040.1229
9045.3532
9053.4858

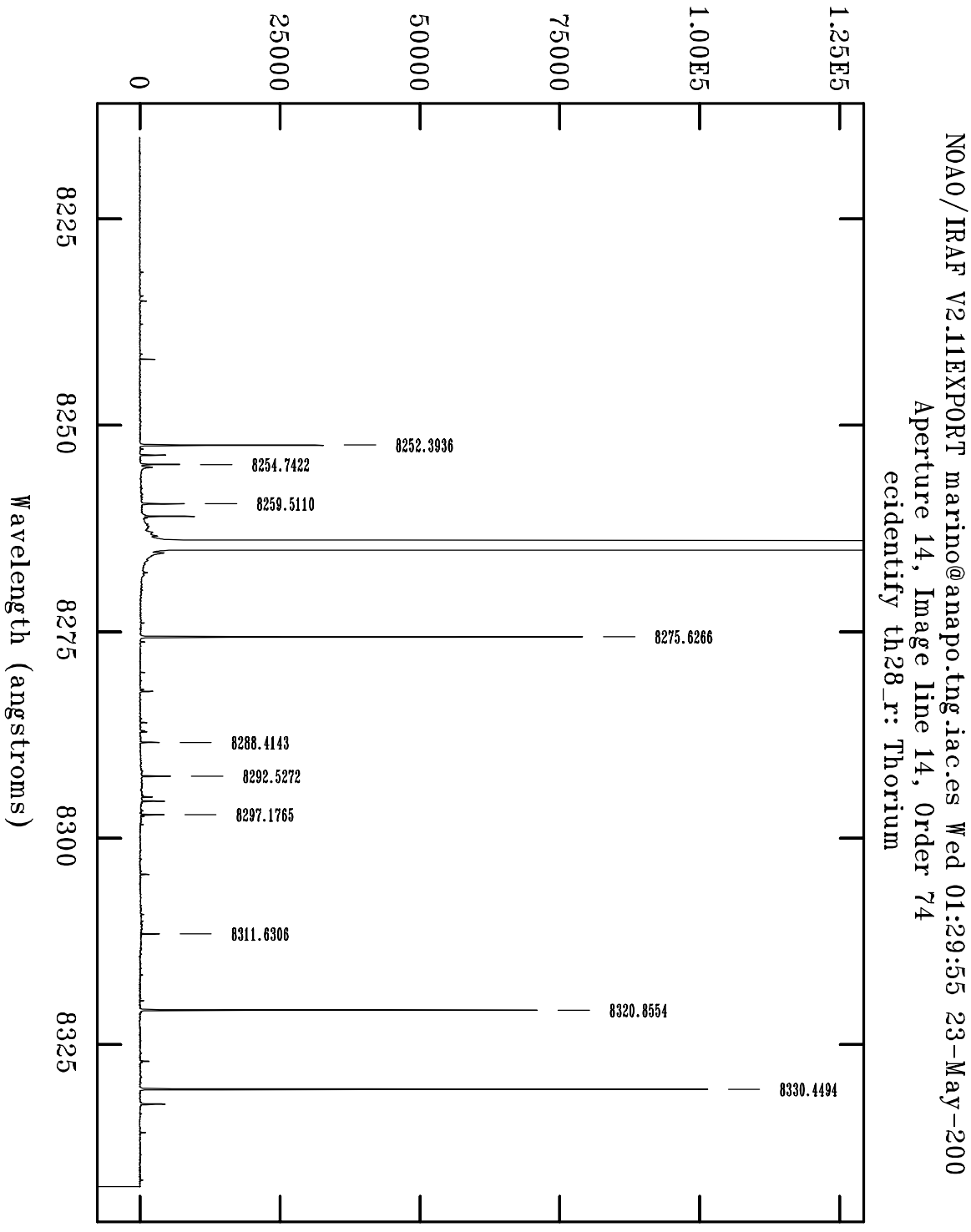

NOAO/IRAF V2.11EXPORT marino@anapo.tng.iac.es Wed 01:26:47 23-May-200
Aperture 9, Image line 9, Order 69
ecidentify th28_r: Thorium
0
5000
10000
15000
20000
8825
8850
8875
8900
8925
8950
Wavelength (angstroms)
8841.1822
8849.9165
8852.7916
8854.9079
8868.8334
8875.2324
8889.1939
8892.9865
8910.8566
8928.0925

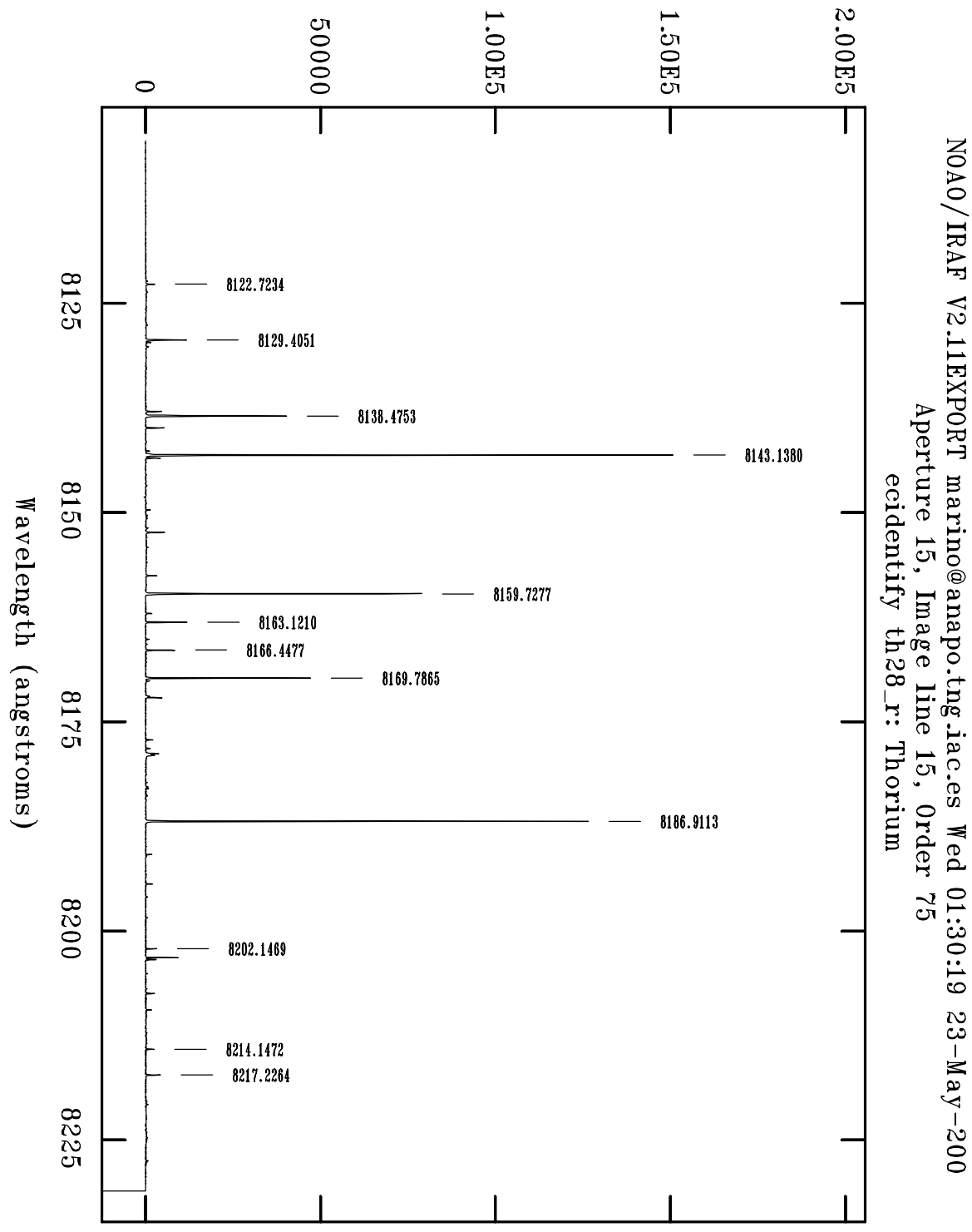

NOAO/IRAF V2.11EXPORT marino@anapo.tng.iac.es Wed 01:27:11 23-May-200
Aperture 10, Image line 10, Order 70
ecidentify th28_r: Thorium
0
20000
40000
60000
80000
8700
8725
8750
8775
8800
Wavelength (angstroms)
8707.3592
8709.2341
8710.4142
8719.6290
8721.6595
8723.7177
8732.4240
8734.0234
8739.7816
8748.0309
8749.1697
8751.2062
8758.2434
8761.6862
8766.7450
8771.8602
8775.5733
8784.5621
8792.0572
8804.5894
8810.2540
8816.1728

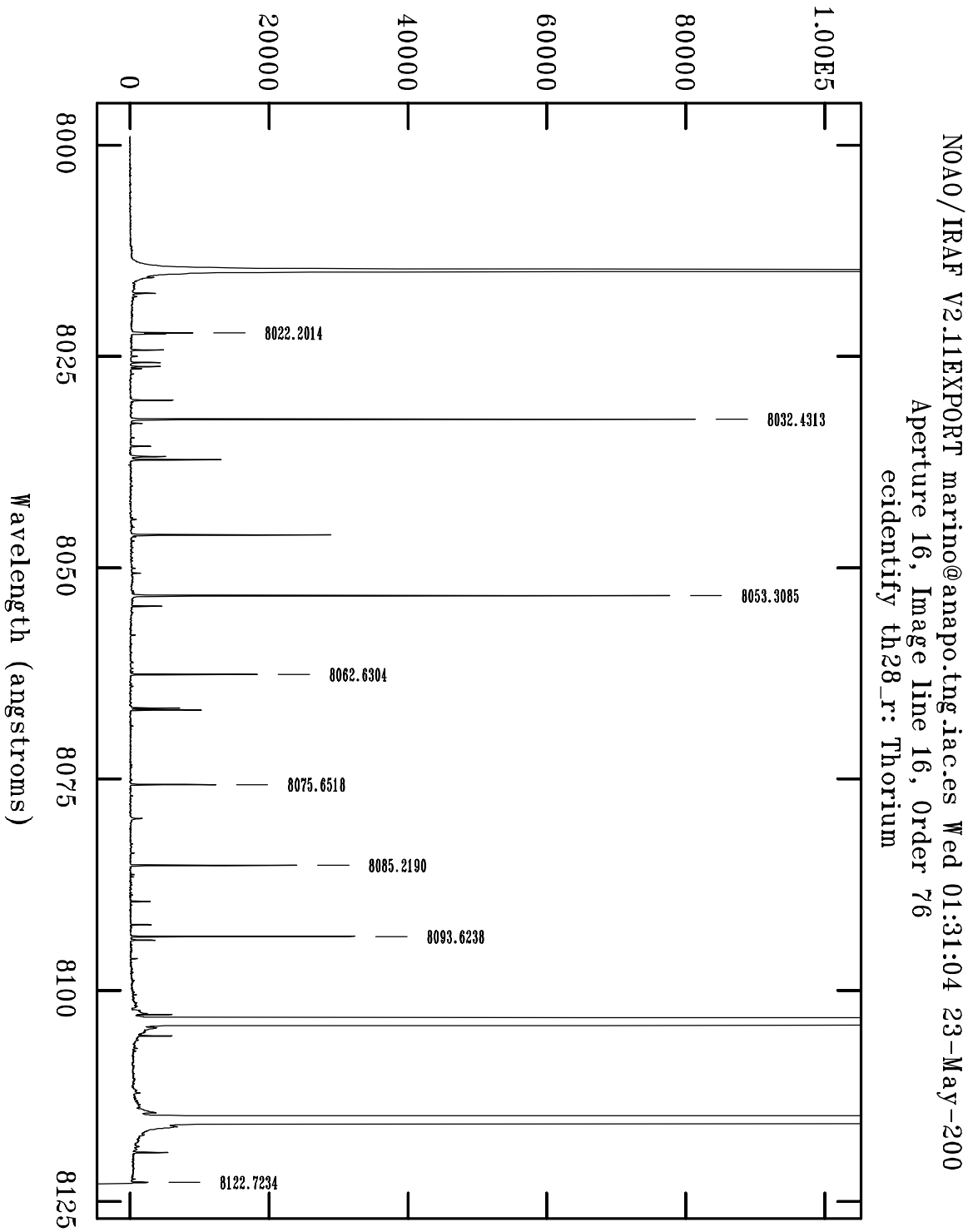

NOAO/IRAF V2.11EXPORT marino@anapo.tng.iac.es Wed 01:27:53 23-May-200
Aperture 11, Image line 11, Order 71
ecidentify th28_r: Thorium
0
20000
40000
60000
80000
8575
8600
8625
8650
8675
Wavelength (angstroms)
8591.8387
8593.1089
8599.7553
8604.0163
8605.7762
8616.2219
8620.4602
8629.1415
8631.3565
8639.4416
8645.3087
8649.1490
8655.8760
8665.4855
8678.4083

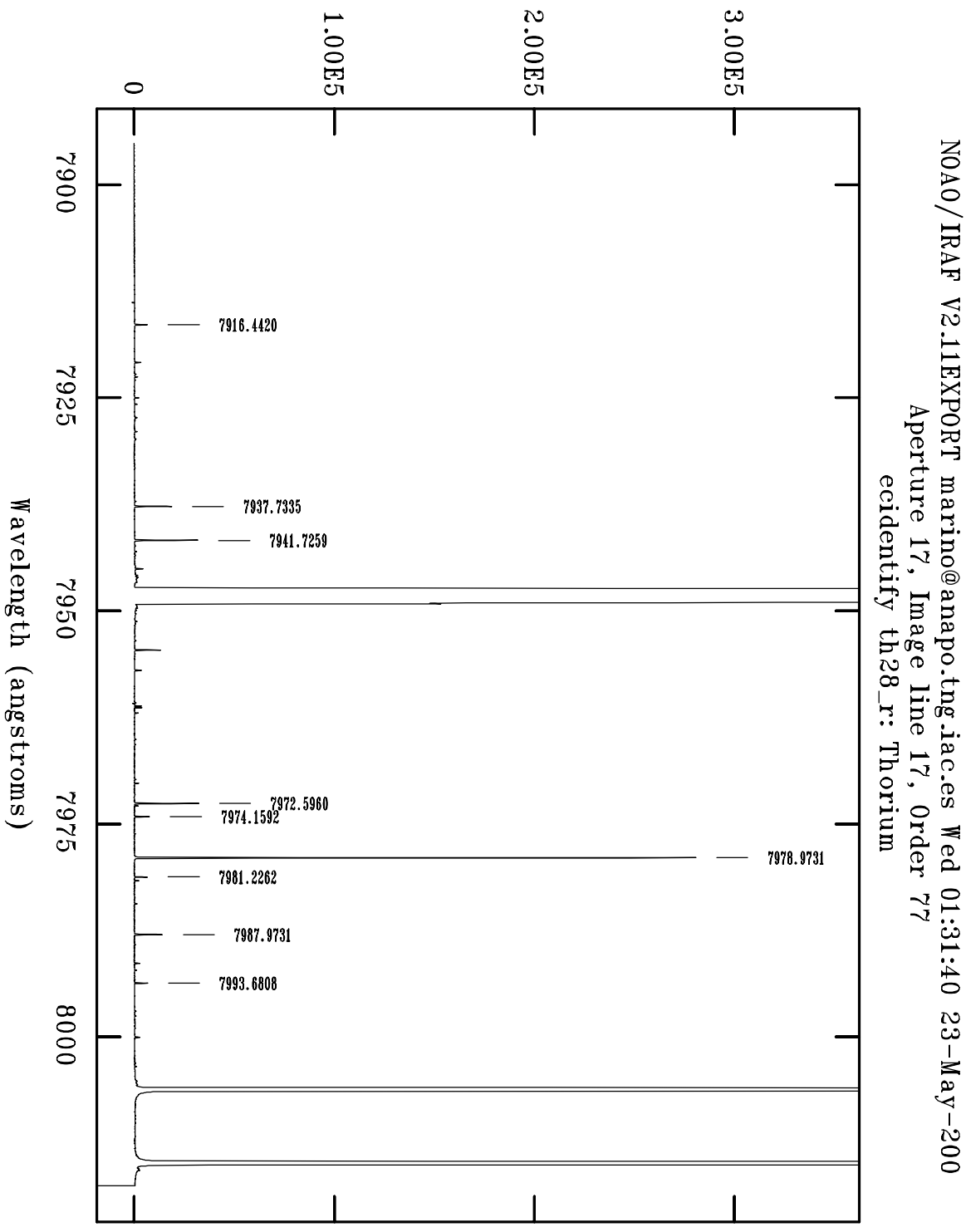

NOAO/IRAF V2.11EXPORT marino@anapo.tng.iac.es Wed 01:28:18 23-May-200
Aperture 12, Image line 12, Order 72
ecidentify th28_r: Thorium
0
5000
10000
15000
20000
25000
30000
8450
8475
8500
8525
8550
8575
Wavelength (angstroms)
8464.2367
8471.8260
8490.3065
8510.6240
8516.5542
8539.7930
8543.7225
8554.9440
8556.3250
8568.2088

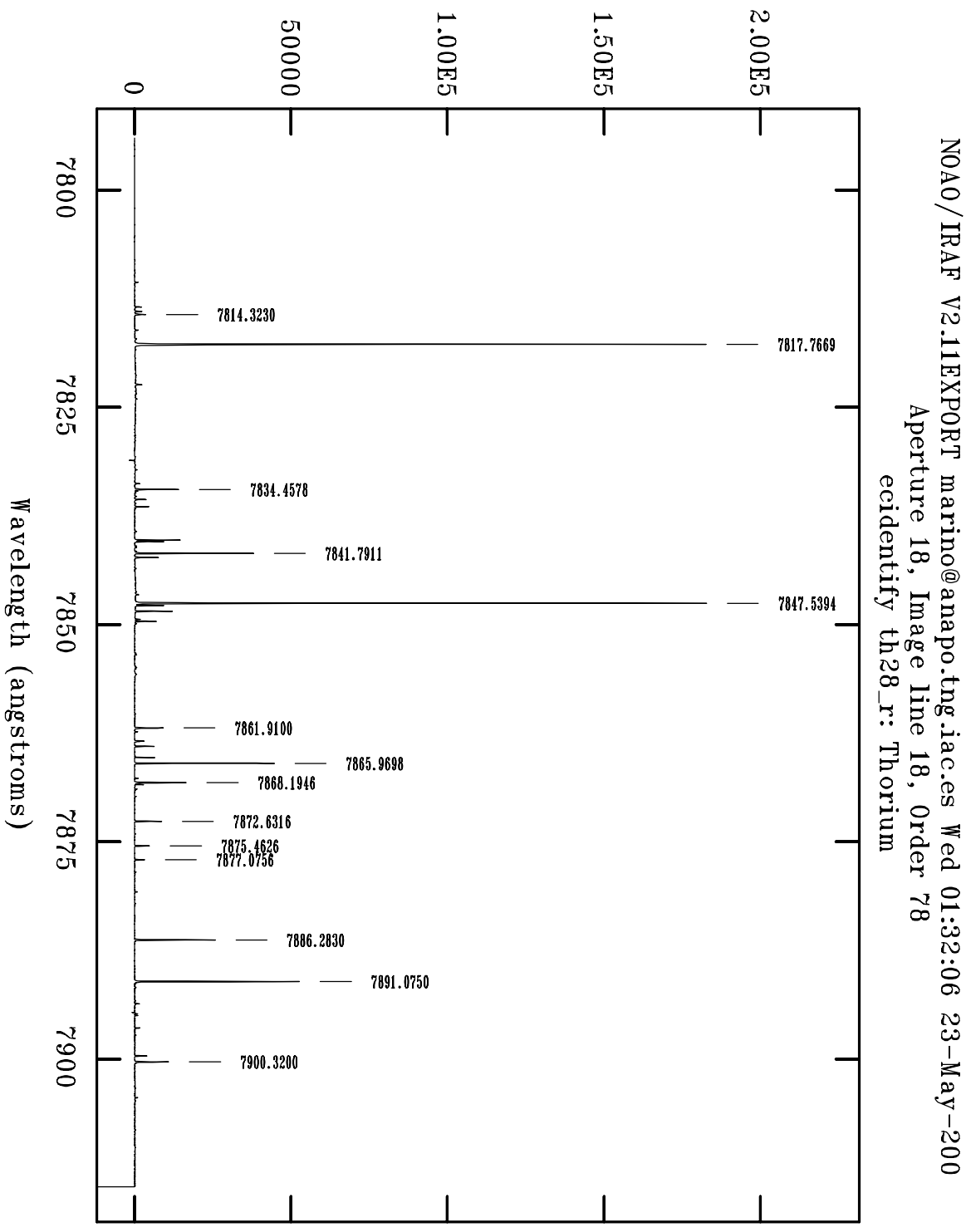

NOAO/IRAF V2.11EXPORT marino@anapo.tng.iac.es Wed 01:29:07 23-May-200
Aperture 13, Image line 13, Order 73
ecidentify th28_r: Thorium
0
20000
40000
60000
80000
1.00E5
8325
8350
8375
8400
8425
8450
Wavelength (angstroms)
8358.7260
8367.3936
8369.3404
8384.7240
8388.5363
8399.2578
8401.9890
8403.7965
8417.9982
8421.2254
8445.4870
8446.5116

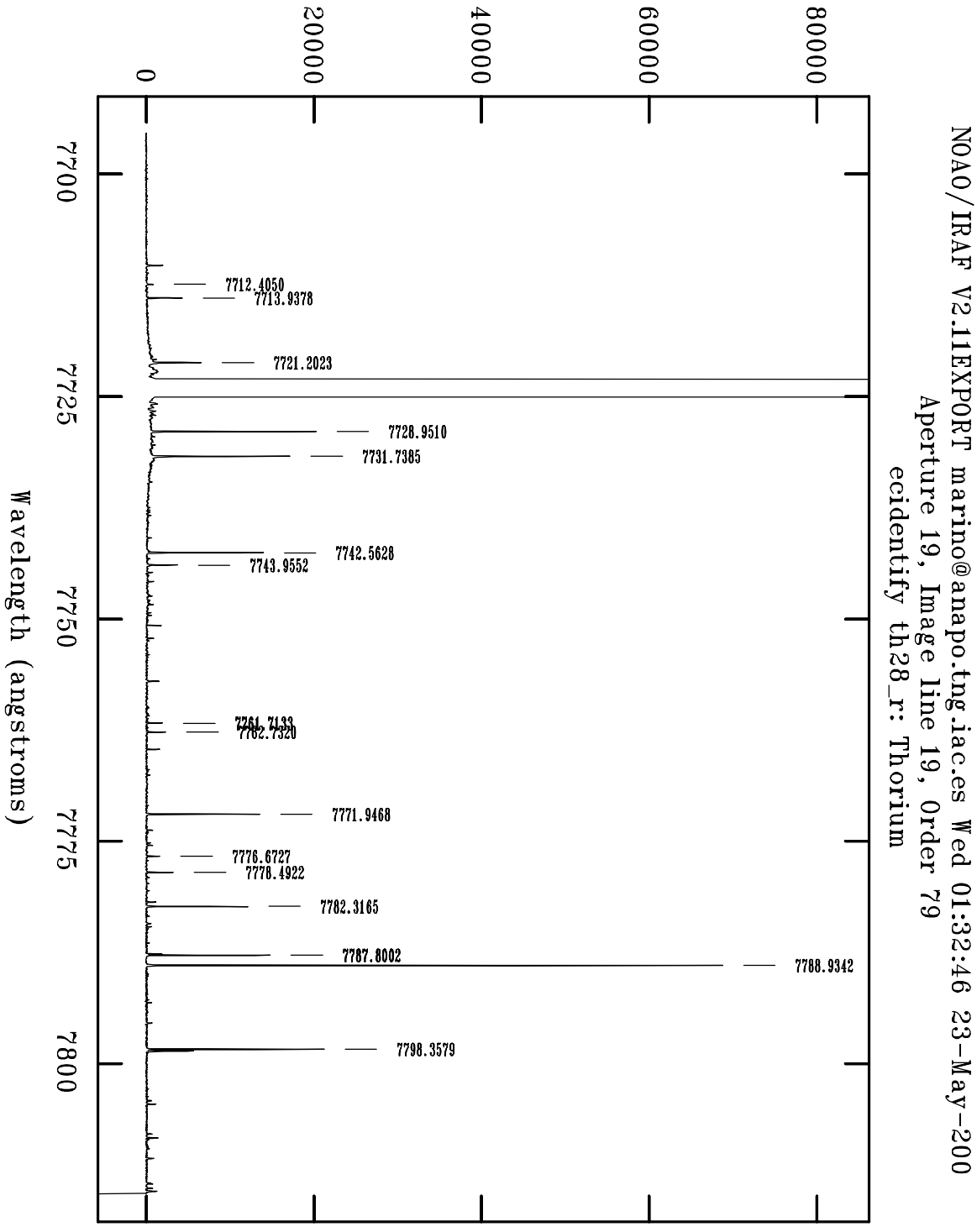

NOAO/IRAF V2.11EXPORT marino@anapo.tng.iac.es Wed 01:29:55 23-May-200
Aperture 14, Image line 14, Order 74
ecidentify th28_r: Thorium
0
25000
50000
75000
1.00E5
1.25E5
8225
8250
8275
8300
8325
Wavelength (angstroms)
8252.3936
8254.7422
8259.5110
8275.6266
8288.4143
8292.5272
8297.1765
8311.6306
8320.8554
8330.4494

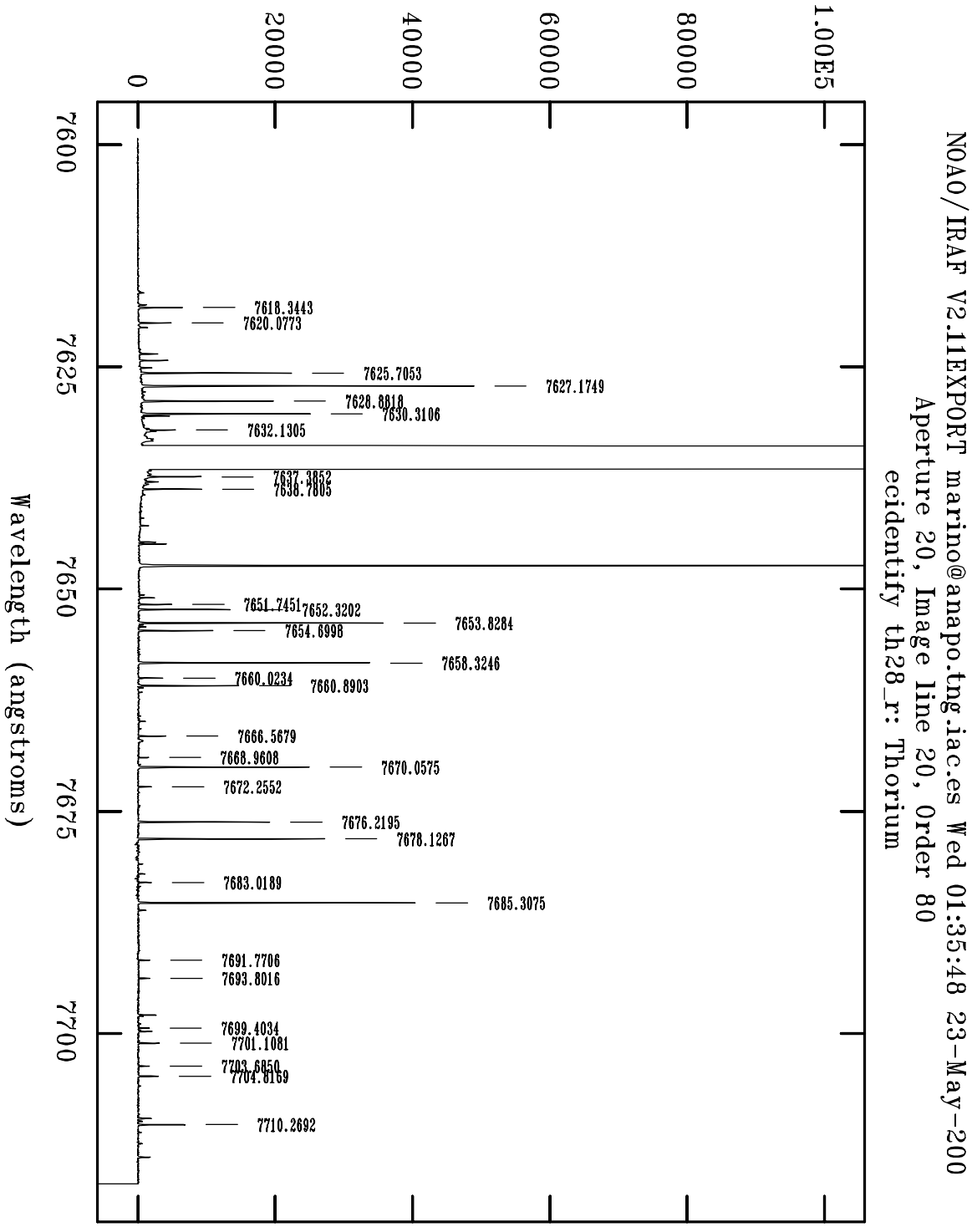

NOAO/IRAF V2.11EXPORT marino@anapo.tng.iac.es Wed 01:30:19 23-May-200
Aperture 15, Image line 15, Order 75
ecidentify th28_r: Thorium
0
50000
1.00E5
1.50E5
2.00E5
8122.7234
8129.4051
8138.4753
8143.1380
8159.7277
8163.1210
8166.4477
8169.7865
8186.9113
8202.1469
8214.1472
8217.2264
8125
8150
8175
8200
8225
Wavelength (angstroms)

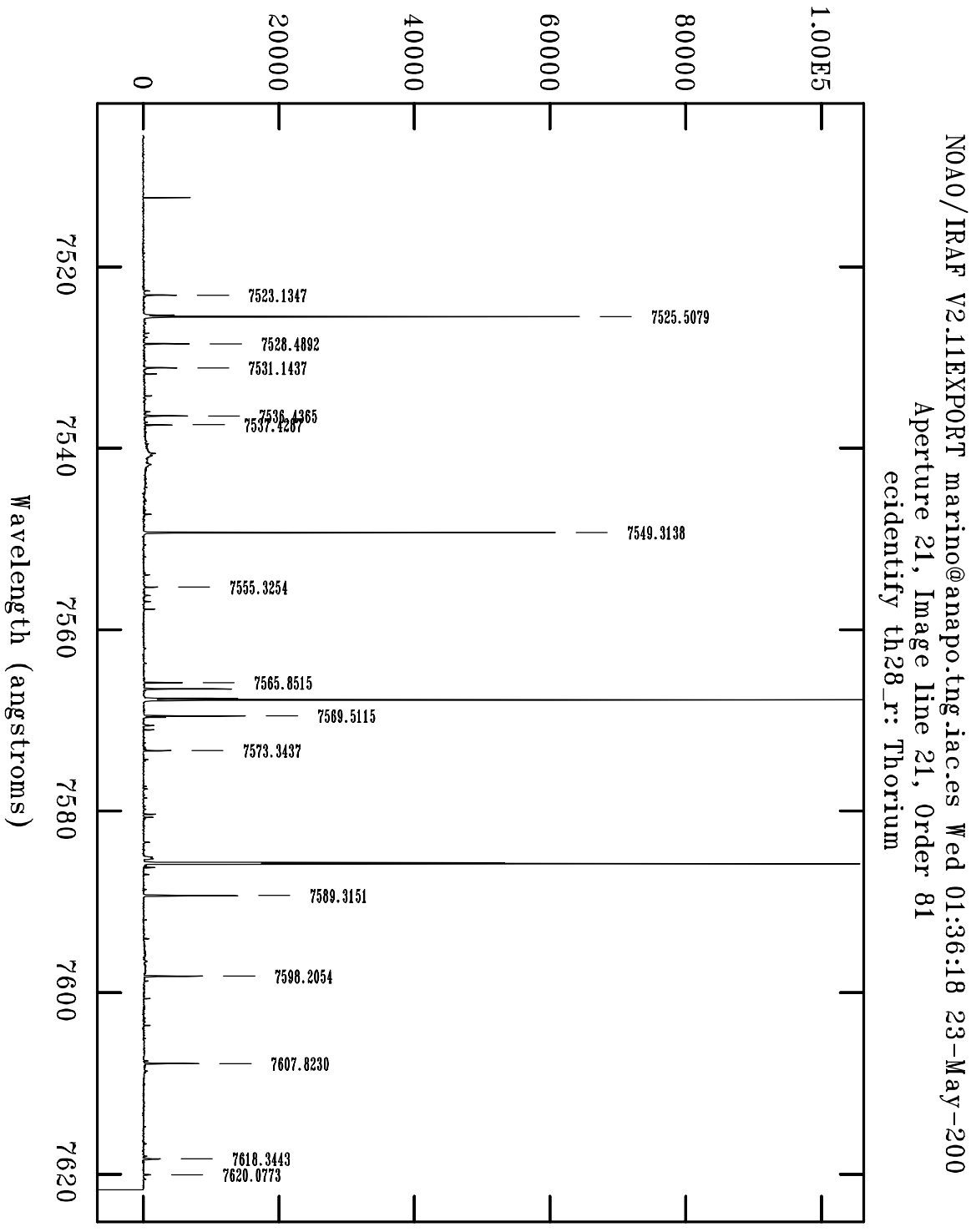

NOAO/IRAF V2.11EXPORT marino@anapo.tng.iac.es Wed 01:31:04 23-May-200
Aperture 16, Image line 16, Order 76
ecidentify th28_r: Thorium
0
20000
40000
60000
80000
1.00E5
8000
8025
8050
8075
8100
8125
Wavelength (angstroms)
8022.2014
8032.4313
8053.3085
8062.6304
8075.6518
8085.2190
8093.6238
8122.7234

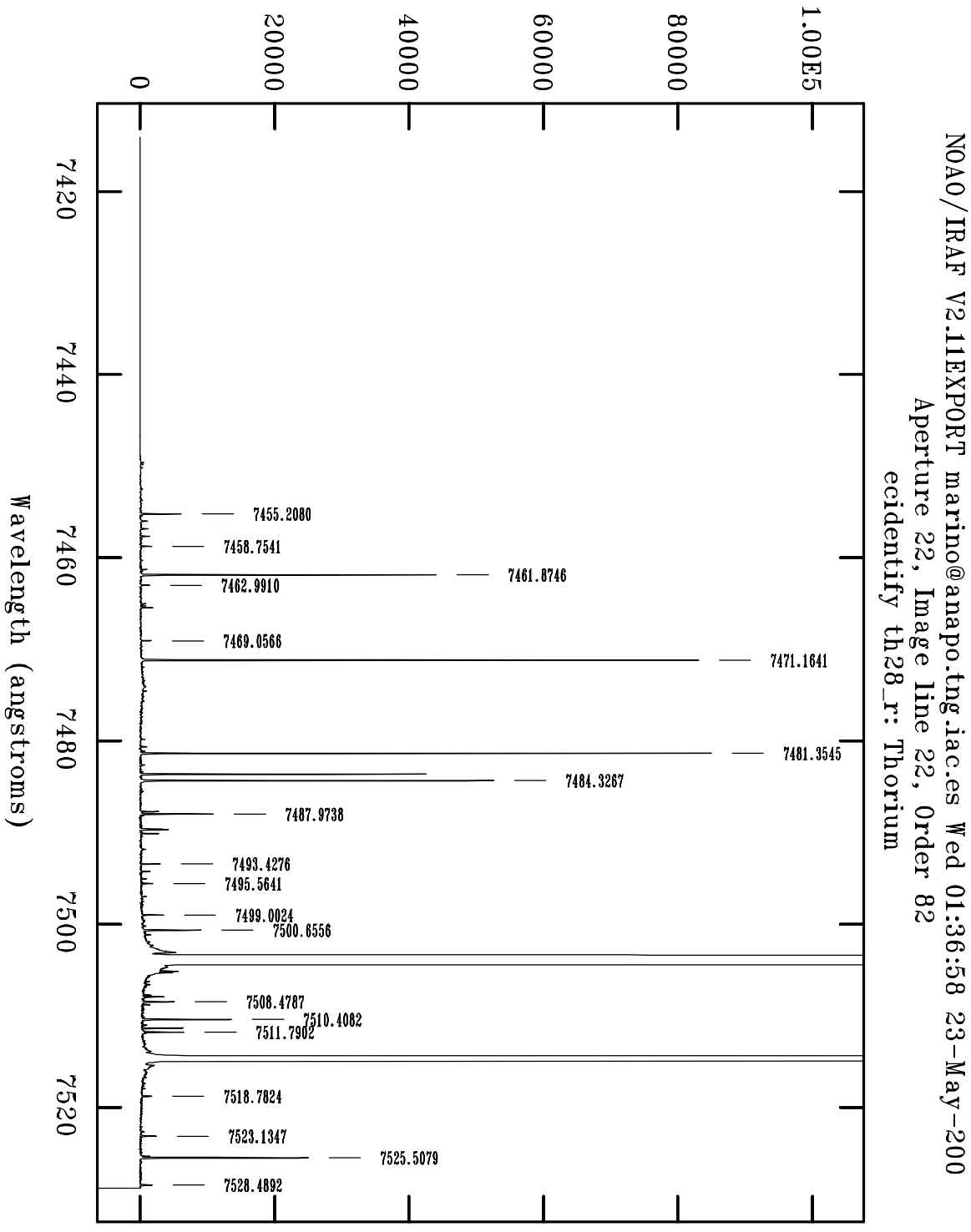

NOAO/IRAF V2.11EXPORT marino@anapo.tng.iac.es Wed 01:31:40 23-May-200
Aperture 17, Image line 17, Order 77
ecidentify th28_r: Thorium
0
1.00E5
2.00E5
3.00E5
7900
7925
7950
7975
8000
Wavelength (angstroms)
7916.4420
7937.7335
7941.7259
7972.5960
7974.1592
7978.9731
7981.2262
7987.9731
7993.6808


NOAO/IRAF V2.11EXPORT marino@anapo.tng.iac.es Wed 01:32:06 23-May-200
Aperture 18, Image line 18, Order 78
ecidentify th28_r: Thorium
0
50000
1.00E5
1.50E5
2.00E5
7800
7825
7850
7875
7900
Wavelength (angstroms)
7814.3230
7817.7669
7834.4578
7841.7911
7847.5394
7861.9100
7865.9698
7868.1946
7872.6316
7875.4626
7877.0756
7886.2830
7891.0750
7900.3200


NOAO/IRAF V2.11EXPORT marino@anapo.tng.iac.es Wed 01:32:46 23-May-200
Aperture 19, Image line 19, Order 79
ecidentify th28_r: Thorium
0
20000
40000
60000
80000
7700
7725
7750
7775
7800
Wavelength (angstroms)
7712.4050
7713.9378
7721.2023
7728.9510
7731.7385
7742.5628
7743.9552
7771.9468
7776.6727
7778.4922
7782.3165
7787.8002
7788.9342
7798.3579


NOAO/IRAF V2.11EXPORT marino@anapo.tng.iac.es Wed 01:35:48 23-May-200
Aperture 20, Image line 20, Order 80
ecidentify th28_r: Thorium
0
20000
40000
60000
80000
1.00E5
7600
7625
7650
7675
7700
Wavelength (angstroms)
7618.3443
7620.0773
7625.7053
7627.1749
7628.8818
7630.3106
7632.1305
7637.3852
7638.7805
7651.7451
7652.3202
7653.8284
7654.6998
7658.3246
7660.0234
7660.8903
7666.5679
7668.9608
7670.0575
7672.2552
7676.2195
7678.1267
7683.0189
7685.3075
7691.7706
7693.8016
7699.4034
7701.1081
7703.6850
7704.8169
7710.2692


NOAO/IRAF V2.11EXPORT marino@anapo.tng.iac.es Wed 01:36:18 23-May-200
Aperture 21, Image line 21, Order 81
ecidentify th28_r: Thorium
0
20000
40000
60000
80000
1.00E5
7520
7540
7560
7580
7600
7620
Wavelength (angstroms)
7523.1347
7525.5079
7528.4892
7531.1437
7536.4365
7537.4267
7549.3138
7555.3254
7565.8515
7569.5115
7573.3437
7589.3151
7598.2054
7607.8230
7618.3443
7620.0773


NOAO/IRAF V2.11EXPORT marino@anapo.tng.iac.es Wed 01:36:58 23-May-200
Aperture 22, Image line 22, Order 82
ecidentify th28_r: Thorium
0
20000
40000
60000
80000
1.00E5
7420
7440
7460
7480
7500
7520
Wavelength (angstroms)
7455.2080
7458.7541
7461.8746
7462.9910
7469.0566
7471.1641
7481.3545
7484.3267
7487.9738
7493.4276
7495.5641
7499.0024
7500.6556
7508.4787
7510.4082
7511.7902
7518.7824
7523.1347
7525.5079
7528.4892