Thorium-Argon Atlas for High Resolution Spectrograph on Xinglong 2.16m Telescope

Version 1.0

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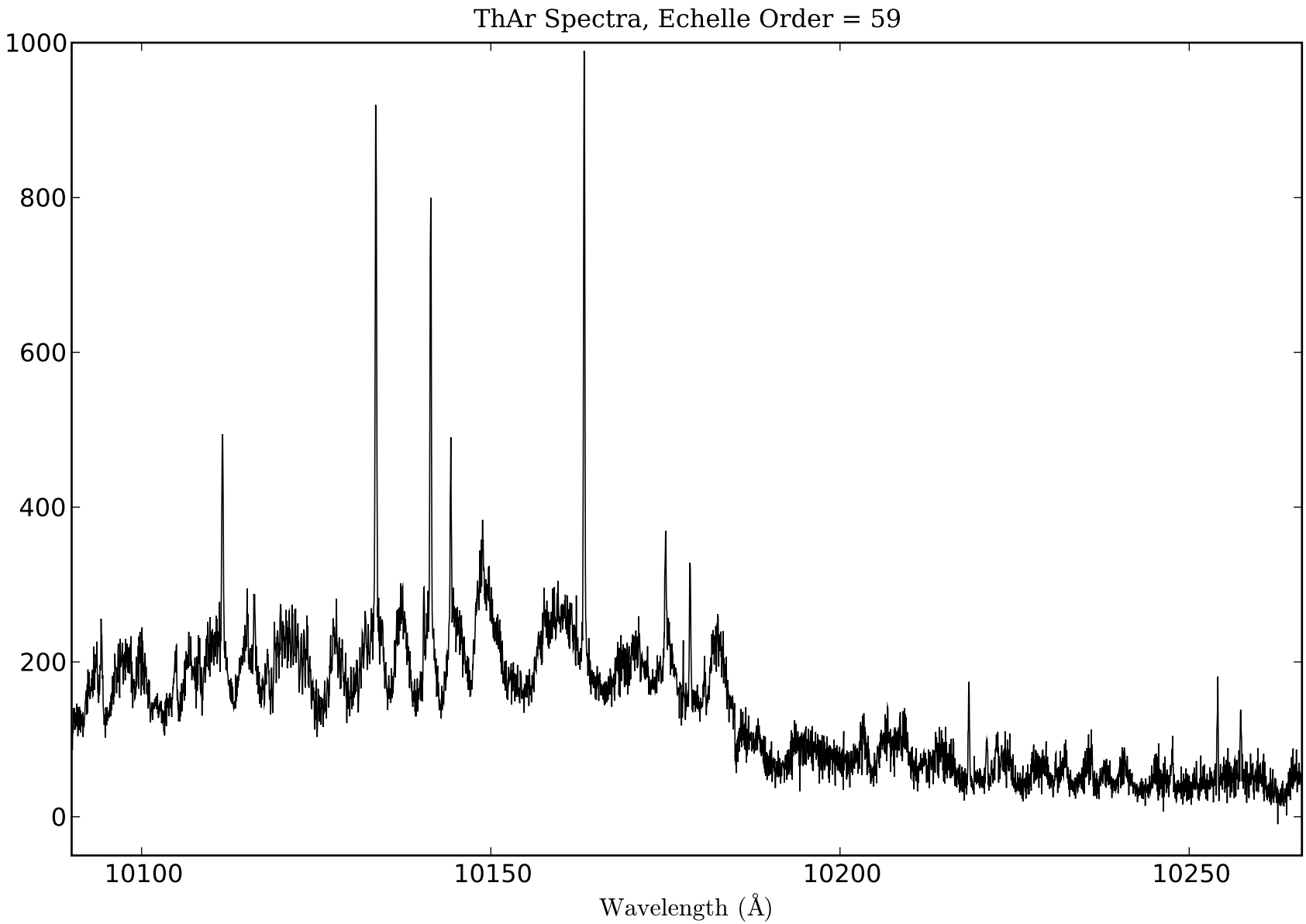
Introduction

This thorium argon spectra was taken on June 13, 2011 (Frame No. 26), with the EEV 203-82 CCD (4k x 4k) installed on the High Resolution Spectrograph (HRS) of Xinglong 2.16m telescope. The Th-Ar lamp was attached on the interface of Cassegrain focus. The slit width was set to 0.19 mm, corresponding to a resolving power ($R = \lambda/\Delta\lambda$) of $\sim 45,000$ around 5500 Å. The exposure time was 80 seconds. After bias subtraction and flat fielding, 90 orders were extracted with the `echelle` package in IRAF[1] v2.12.2, covering the wavelength region of 4030 Å − 10250 Å (echell order 148 − 59). The echelle orders and the respective wavelength ranges are listed in Table 1. More than 500 emission lines were identified with IRAF `ecidentify` task. A complete list of Th-Ar lines can be found in the IRAF `noaolib$linelists` directory as the `thar.dat` file.

[1]IRAF is distributed by the National Optical Astronomy Observatory, which is operated by the Association of Universities for Research in Astronomy, Inc., under cooperative agreement with the National Science Foundation.

Table 1: List of echelle orders of HRS and the respective wavelength ranges.

Order	Wavelength (Å)	Order	Wavelength (Å)
148	4023 - 4094	103	5780 - 5881
147	4050 - 4122	102	5837 - 5939
146	4078 - 4150	101	5894 - 5998
145	4106 - 4178	100	5953 - 6058
144	4135 - 4207	99	6014 - 6119
143	4164 - 4237	98	6075 - 6181
142	4193 - 4267	97	6137 - 6245
141	4223 - 4297	96	6201 - 6310
140	4253 - 4328	95	6267 - 6376
139	4283 - 4359	94	6333 - 6444
138	4315 - 4390	93	6401 - 6514
137	4346 - 4422	92	6471 - 6584
136	4378 - 4455	91	6542 - 6657
135	4410 - 4488	90	6615 - 6731
134	4443 - 4521	89	6689 - 6806
133	4477 - 4555	88	6765 - 6883
132	4511 - 4590	87	6843 - 6963
131	4545 - 4625	86	6922 - 7044
130	4580 - 4660	85	7004 - 7126
129	4615 - 4696	84	7087 - 7211
128	4651 - 4733	83	7173 - 7298
127	4688 - 4770	82	7260 - 7387
126	4725 - 4808	81	7350 - 7478
125	4763 - 4847	80	7441 - 7572
124	4801 - 4886	79	7536 - 7668
123	4840 - 4925	78	7632 - 7766
122	4880 - 4966	77	7731 - 7867
121	4920 - 5007	76	7833 - 7970
120	4961 - 5048	75	7938 - 8076
119	5003 - 5091	74	8045 - 8185
118	5045 - 5134	73	8155 - 8298
117	5089 - 5178	72	8268 - 8413
116	5132 - 5222	71	8385 - 8531
115	5177 - 5268	70	8504 - 8653
114	5222 - 5314	69	8628 - 8779
113	5269 - 5361	68	8755 - 8908
112	5316 - 5409	67	8885 - 9041
111	5364 - 5458	66	9020 - 9177
110	5412 - 5507	65	9159 - 9319
109	5462 - 5558	64	9302 - 9464
108	5512 - 5609	63	9449 - 9614
107	5564 - 5662	62	9602 - 9769
106	5616 - 5715	61	9759 - 9930
105	5670 - 5769	60	9922 - 10095
104	5724 - 5825	59	10090 - 10266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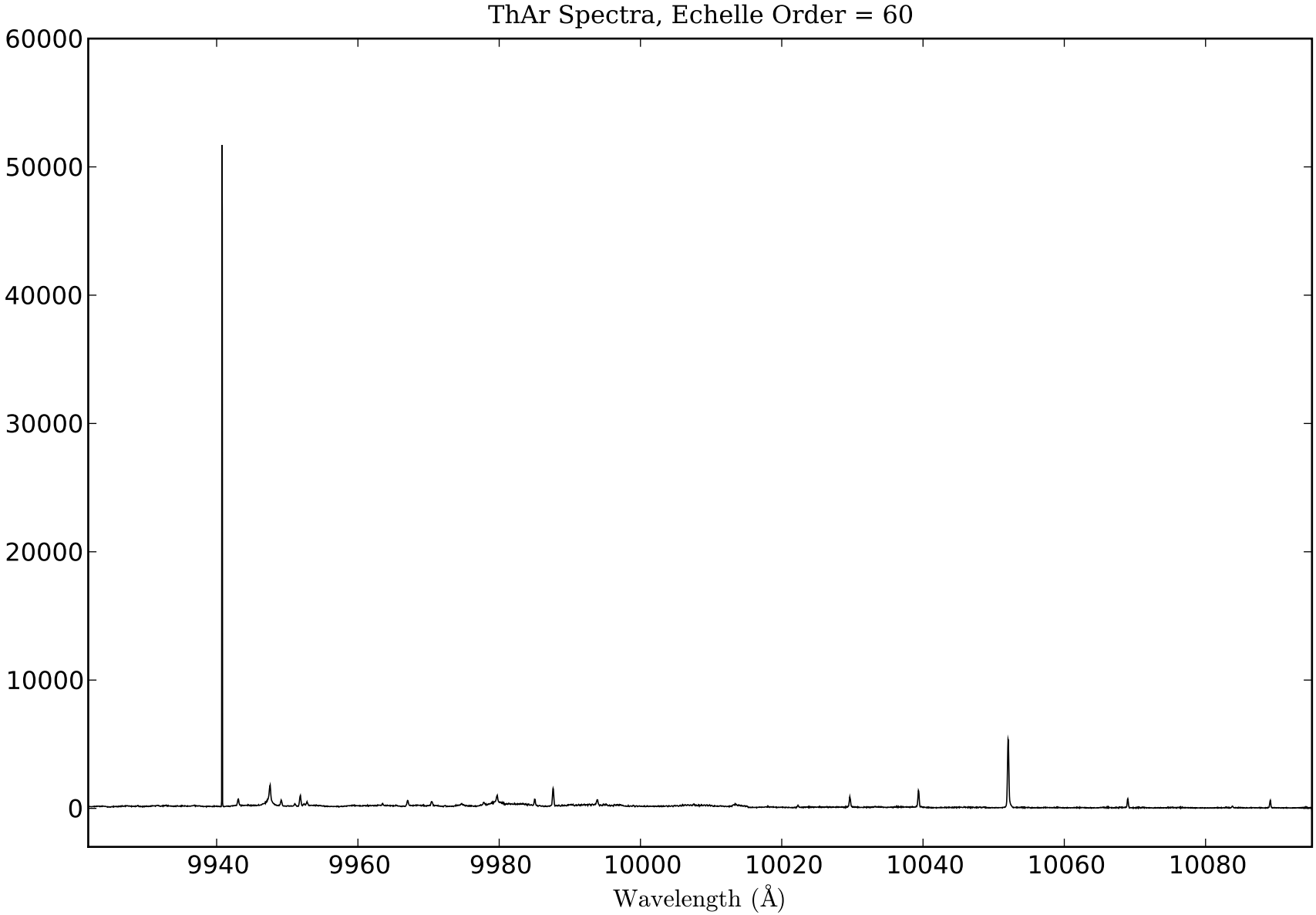
800
600
400
200
0
10100
10150
10200
10250
Wavelength (Å)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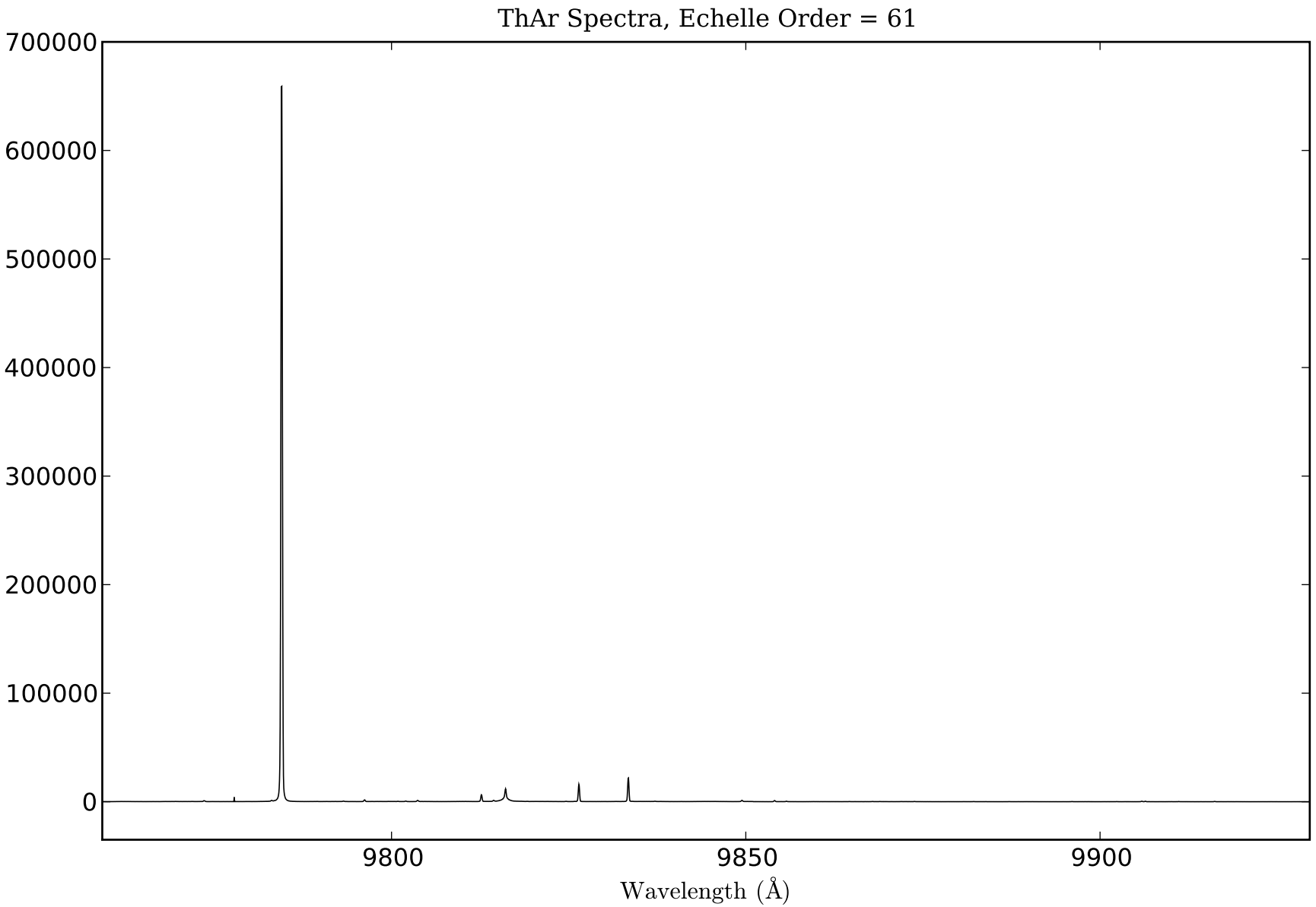
40000
30000
20000
10000
0
9940
9960
9980
10000
10020
10040
10060
10080
Wavelength (Å)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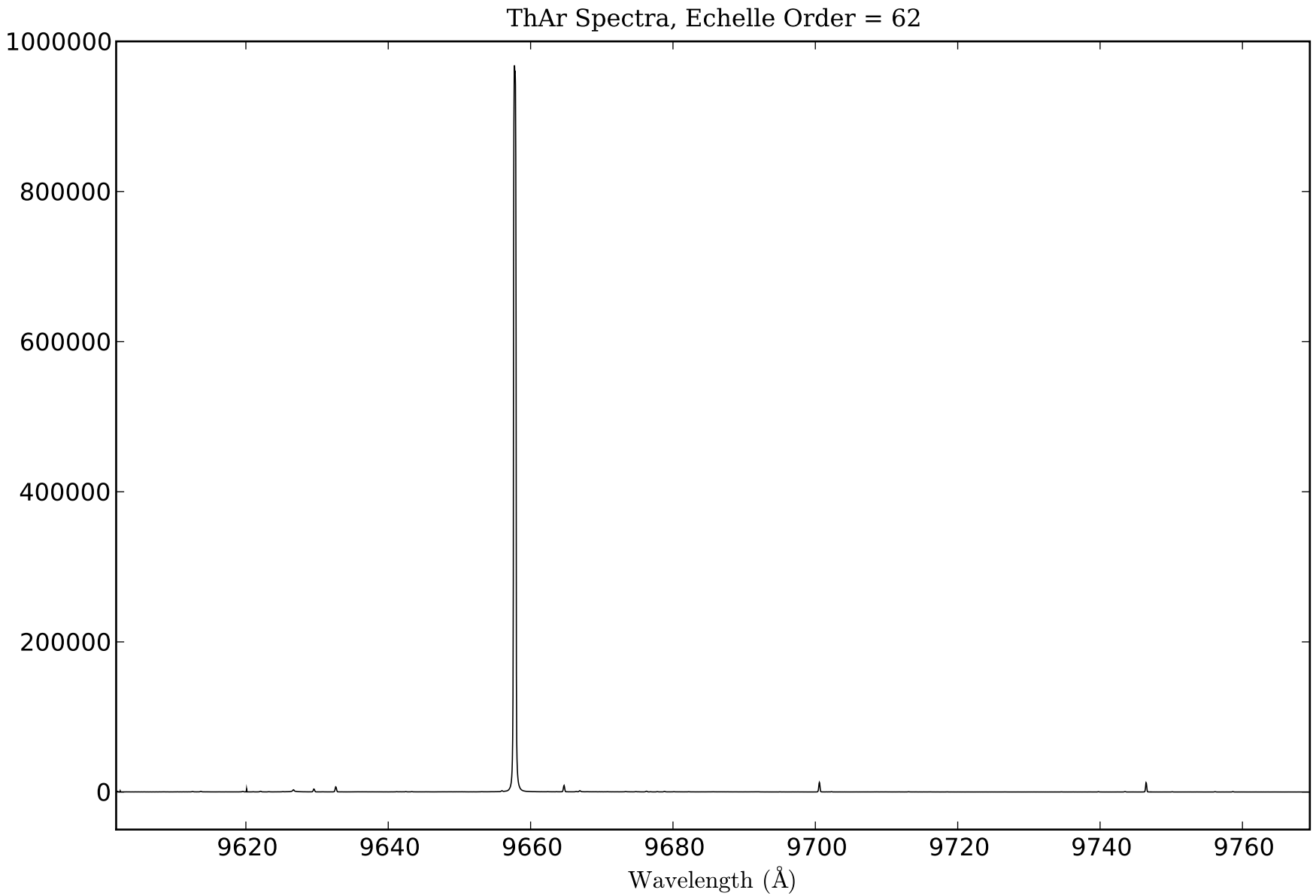
600000
500000
400000
300000
200000
100000
0
9800
9850
9900
Wavelength (Å)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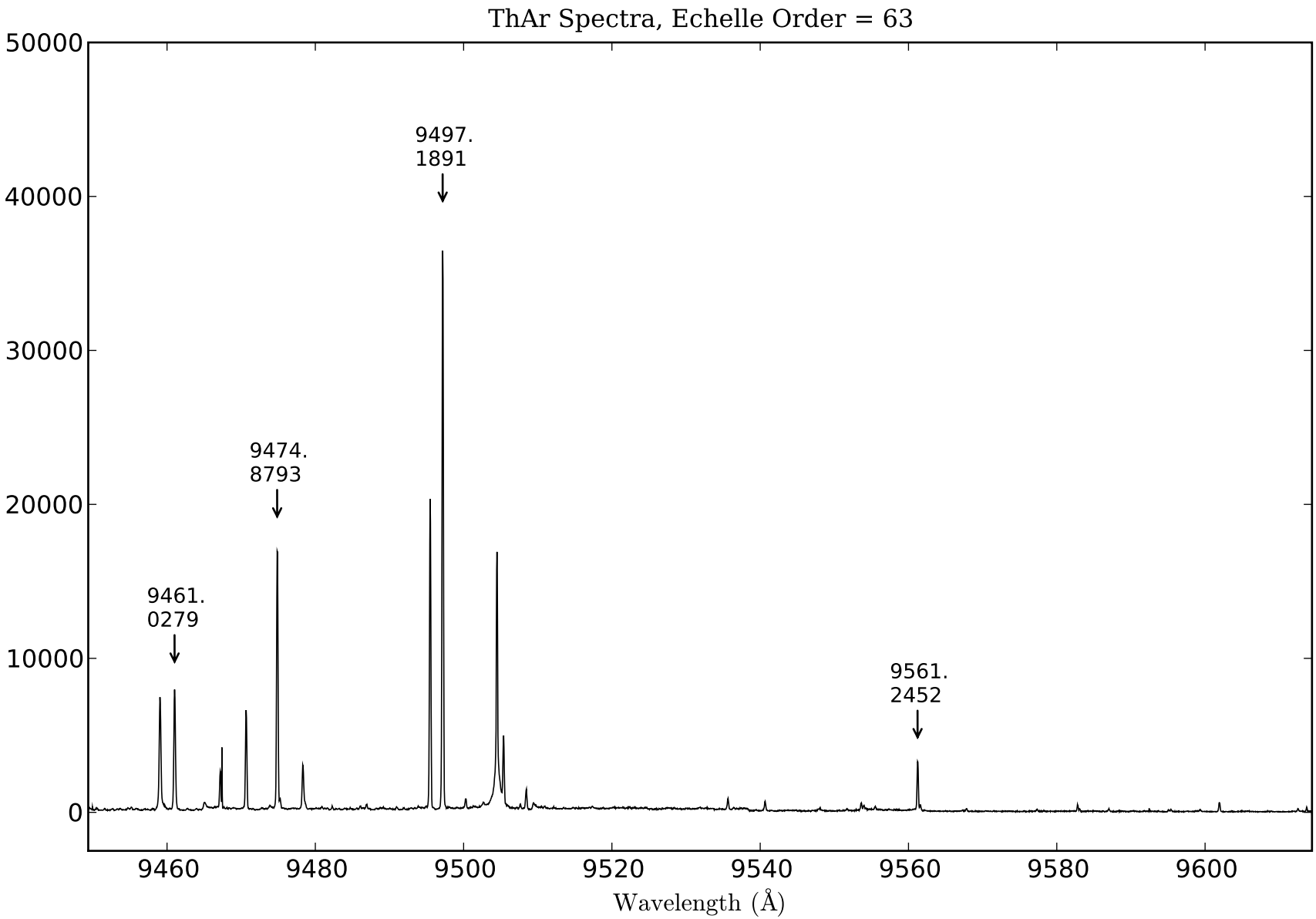
800000
600000
400000
200000
0
9620
9640
9660
9680
9700
9720
9740
9760
Wavelength (Å)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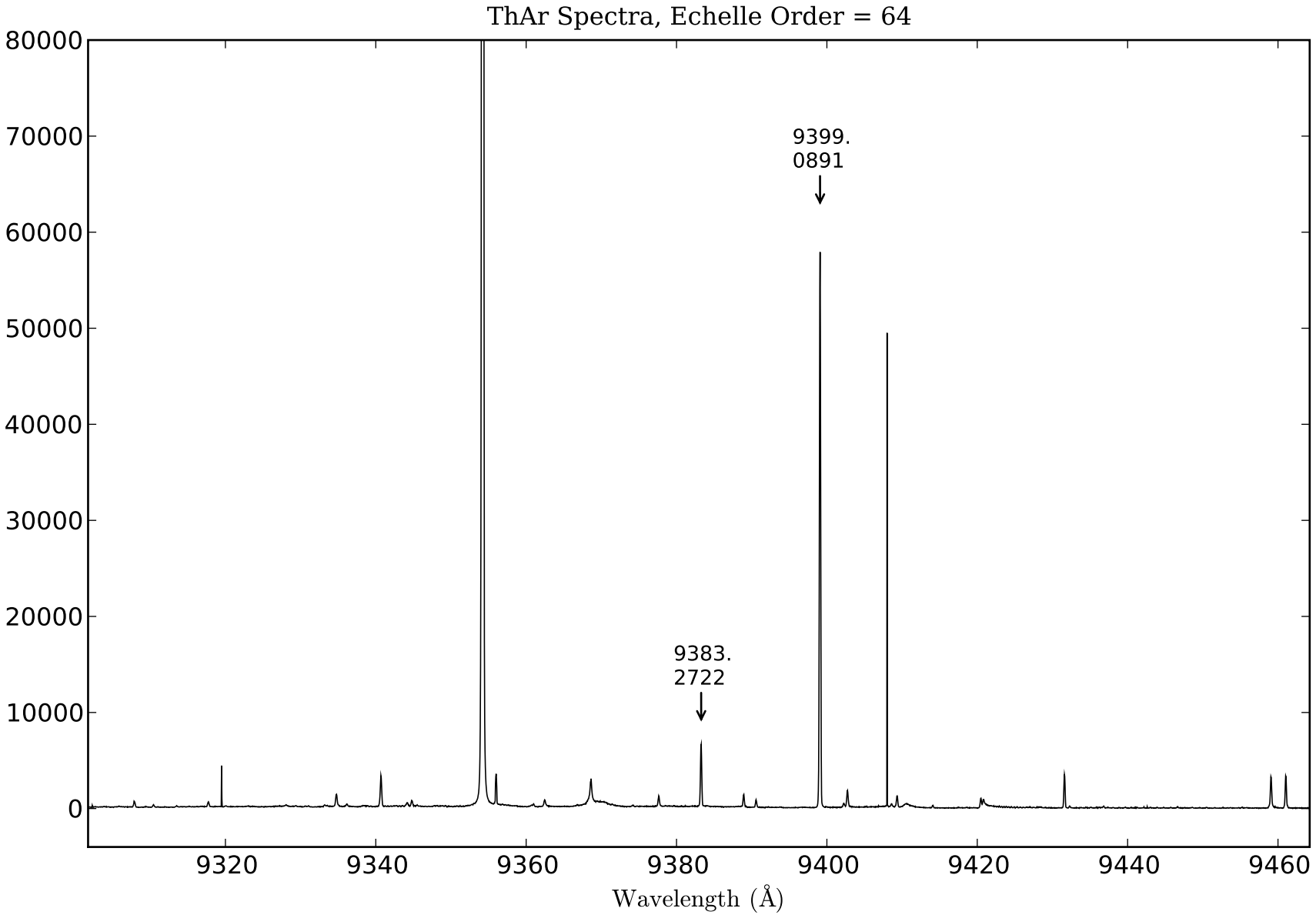
40000
30000
20000
10000
0
9497.
1891
9474.
8793
9461.
0279
9561.
2452
9460
9480
9500
9520
9540
9560
9580
9600
Wavelength (Å)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80000
70000
60000
50000
40000
30000
20000
10000
0
9399.
0891
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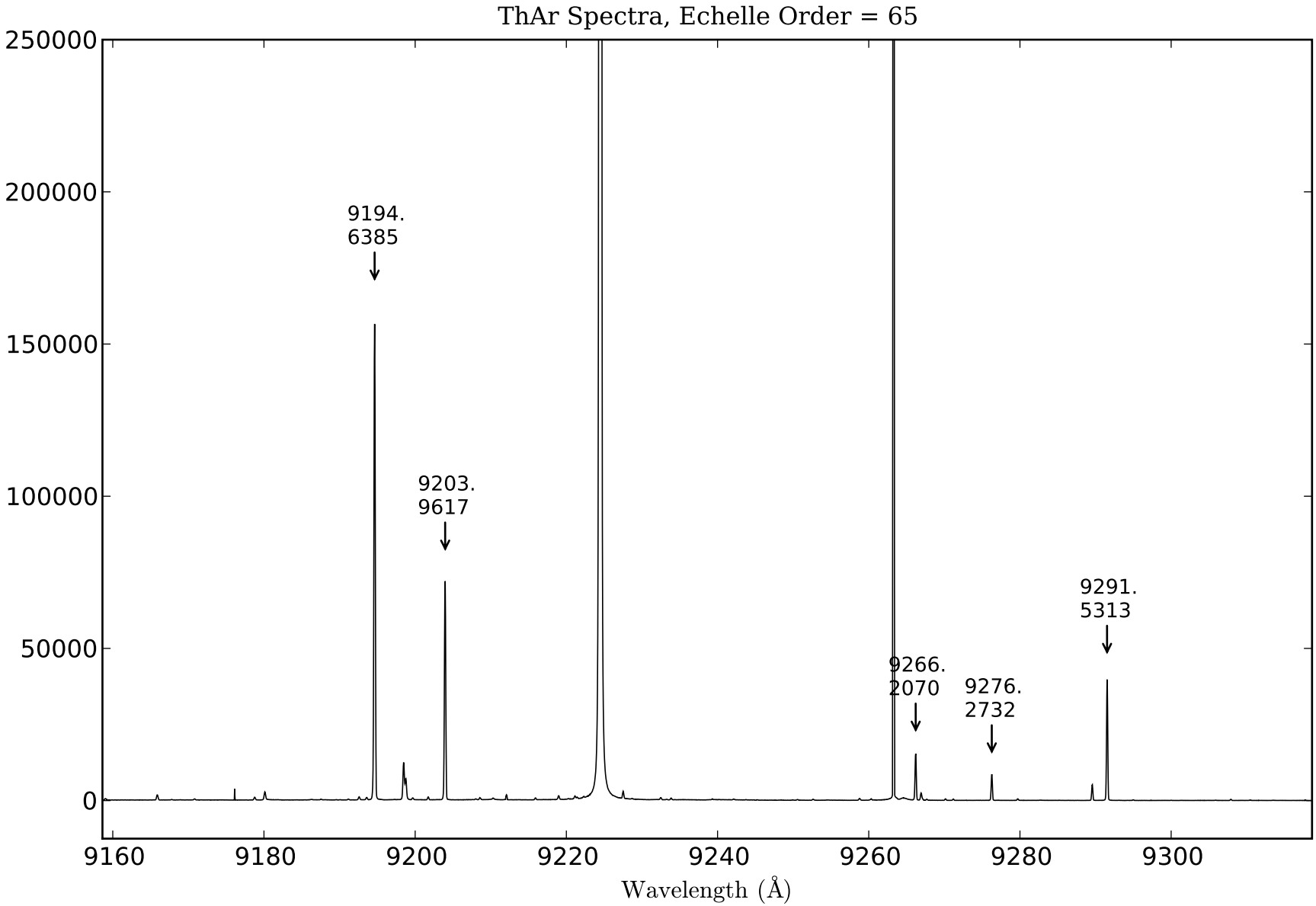
9340
9360
9380
9400
9420
9440
9460
Wavelength (Å)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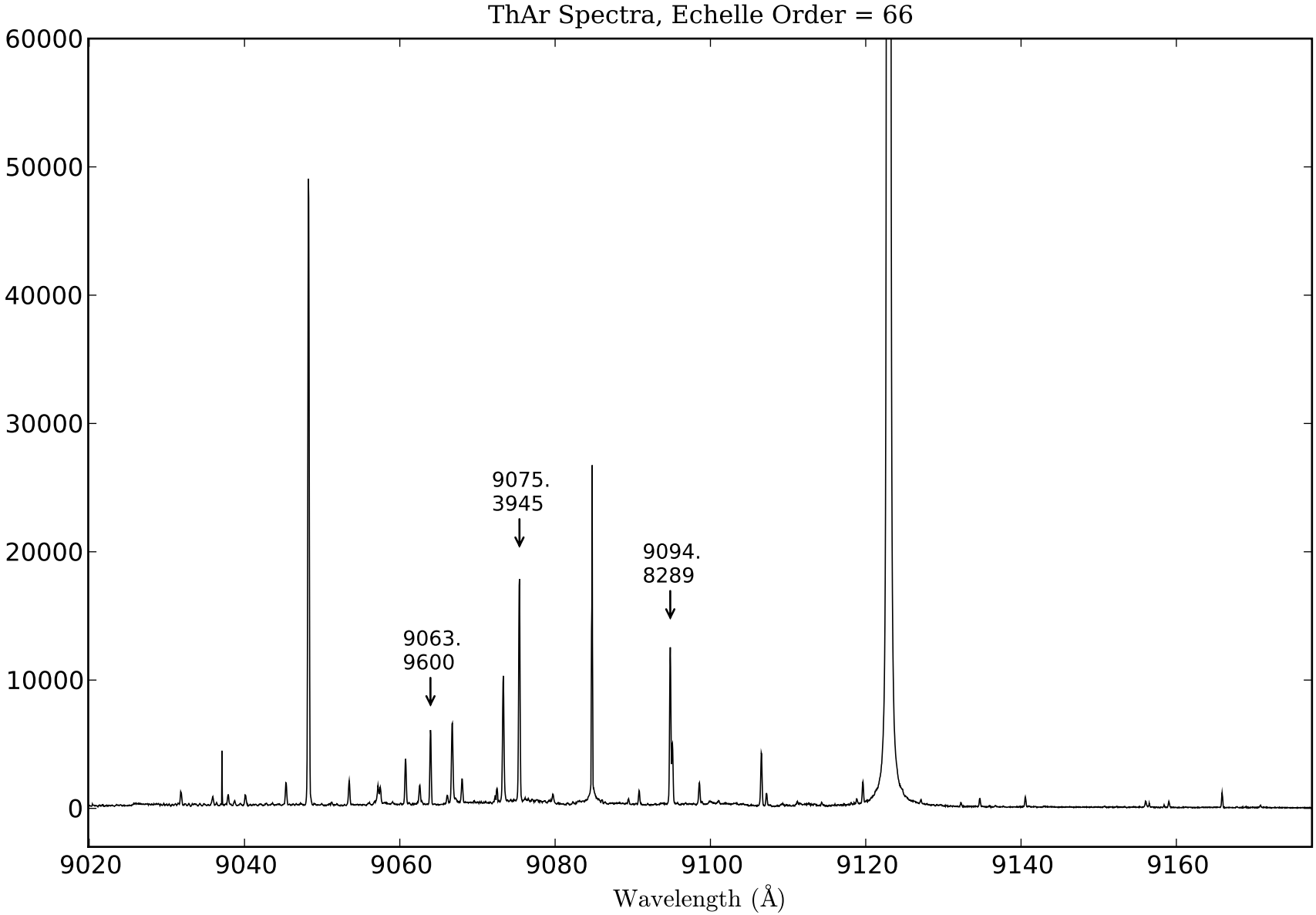
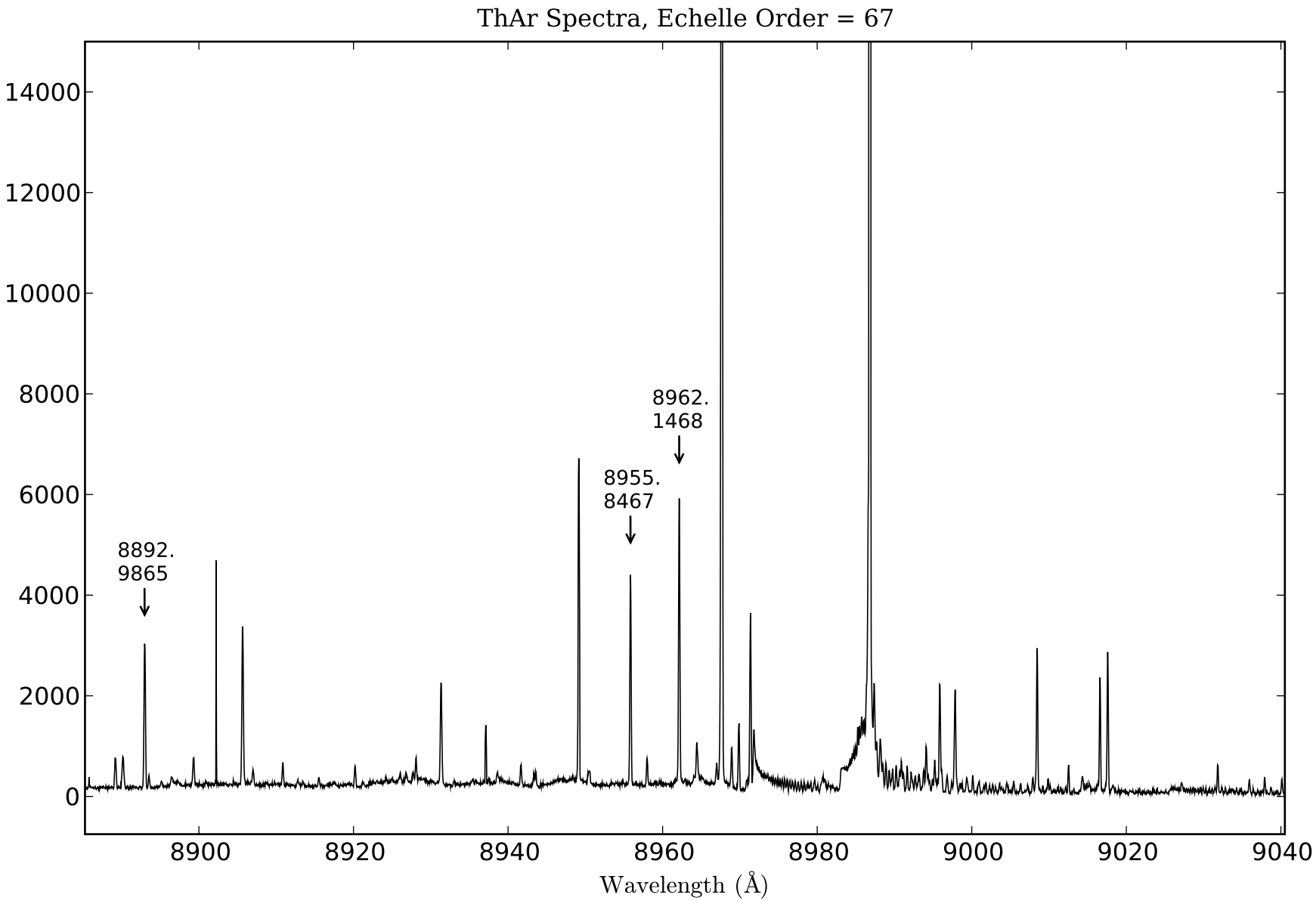
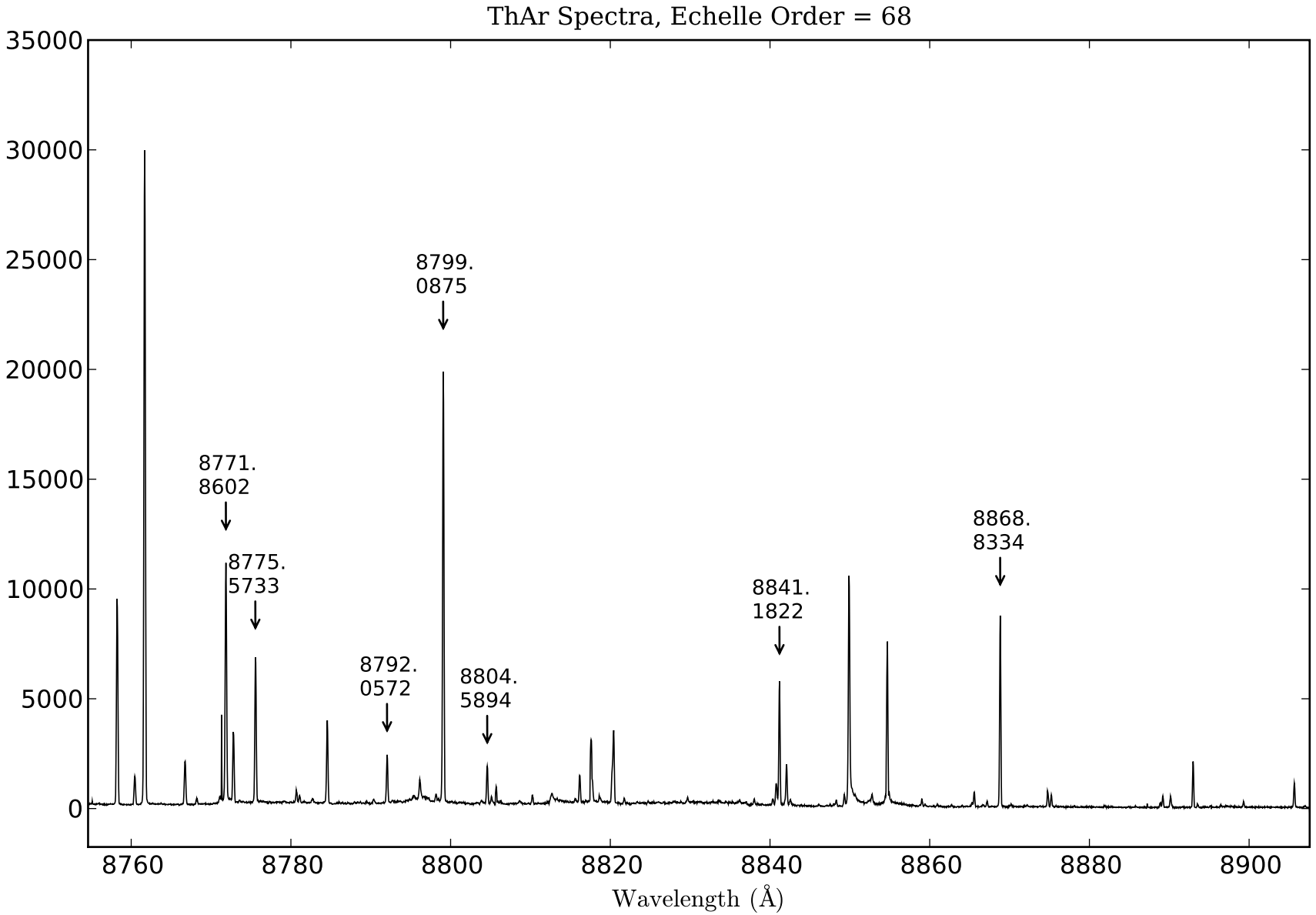
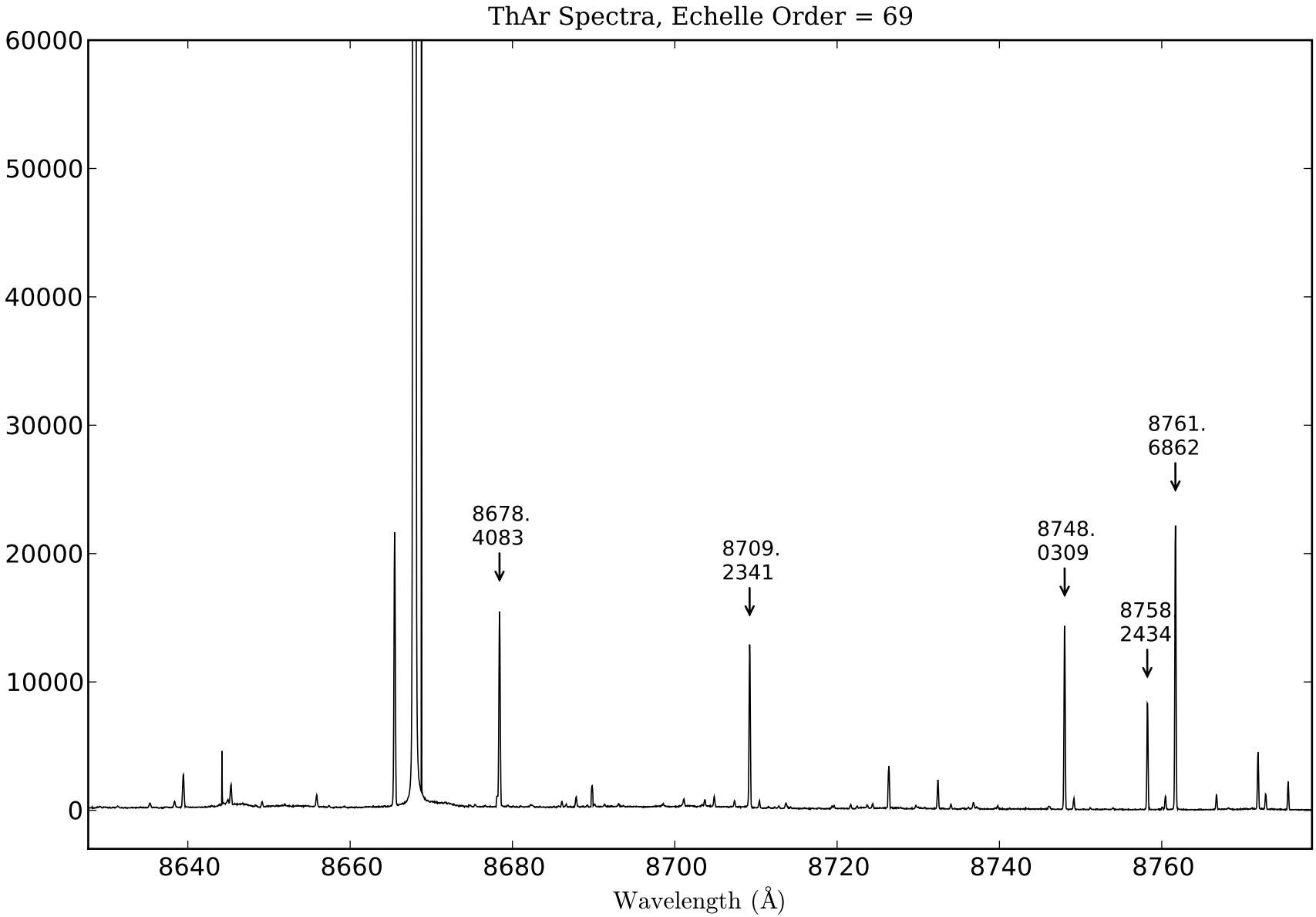
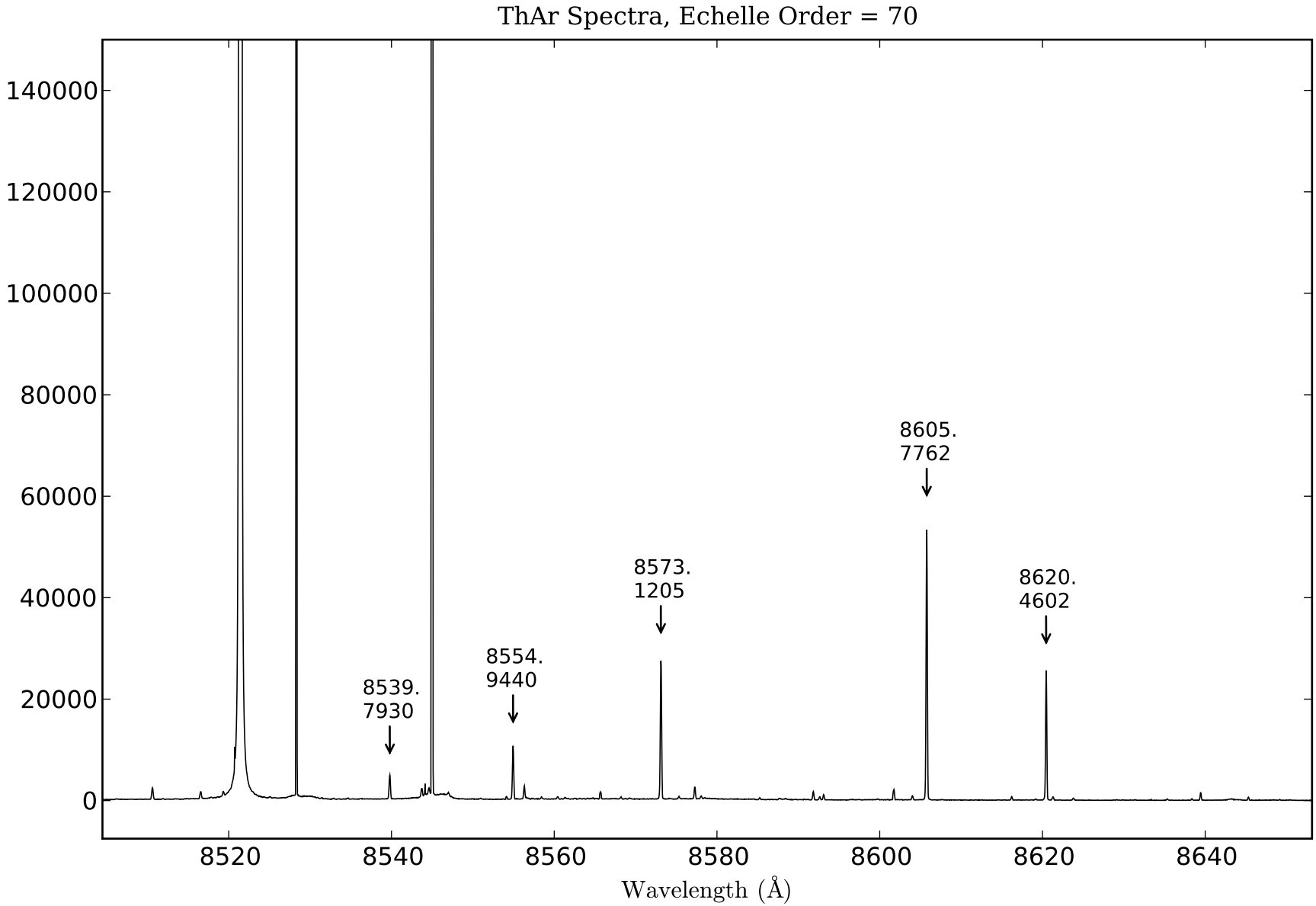
250000
200000
150000
100000
50000
0
9160
9180
9200
9220
9240
9260
9280
9300
Wavelength (Å)
9194.
6385
9203.
9617
9266.
2070
9276.
2732
9291.
5313

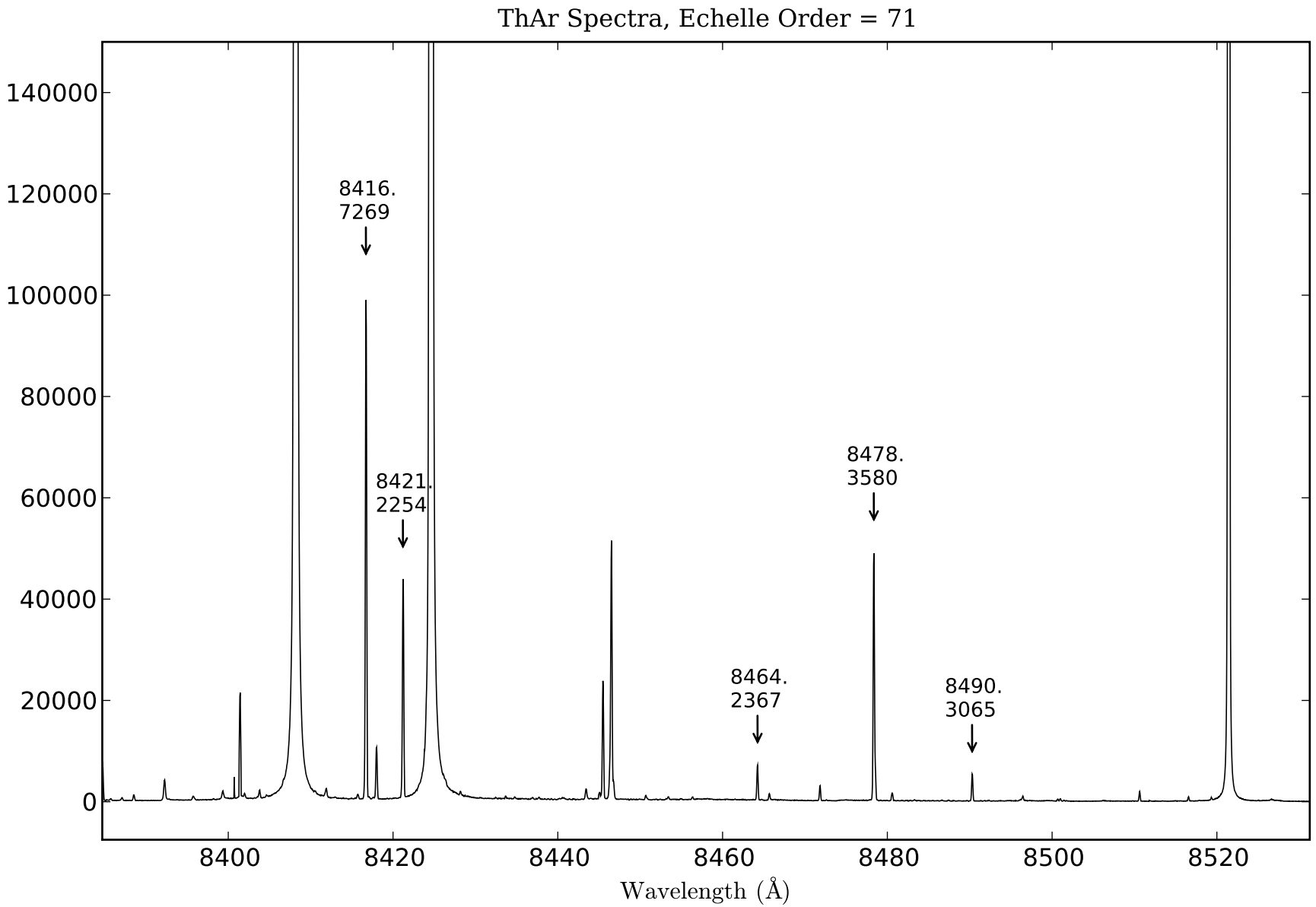

ThAr Spectra, Echelle Order = 66
60000
50000
40000
30000
20000
10000
0
9020
9040
9060
9080
9100
9120
9140
9160
Wavelength (Å)
9075.
3945
9094.
8289
9063.
9600

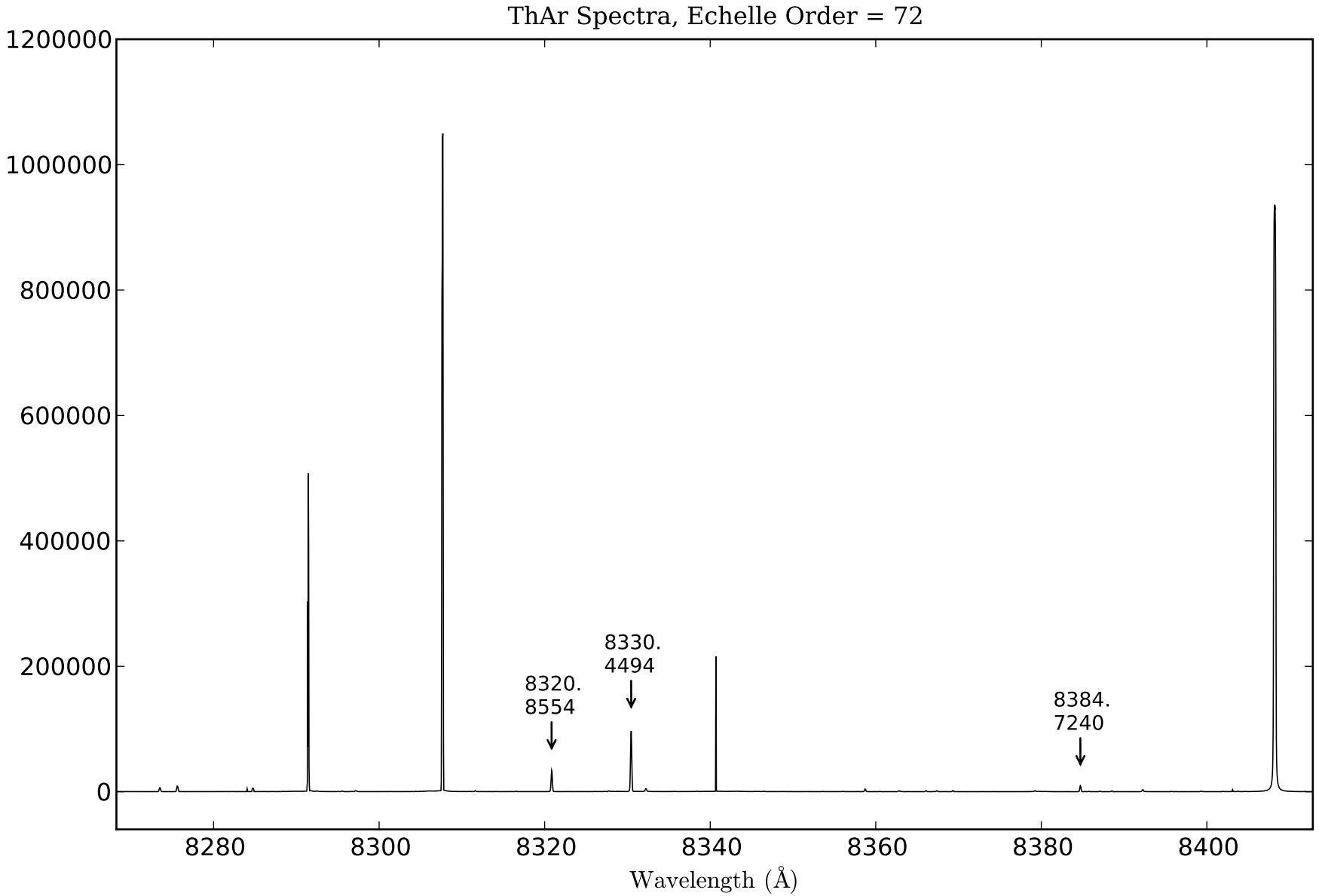

ThAr Spectra, Echelle Order = 67
14000
12000
10000
8000
6000
4000
2000
0
8892.
9865
8955.
8467
8962.
1468
8900
8920
8940
8960
8980
9000
9020
9040
Wavelength (Å)

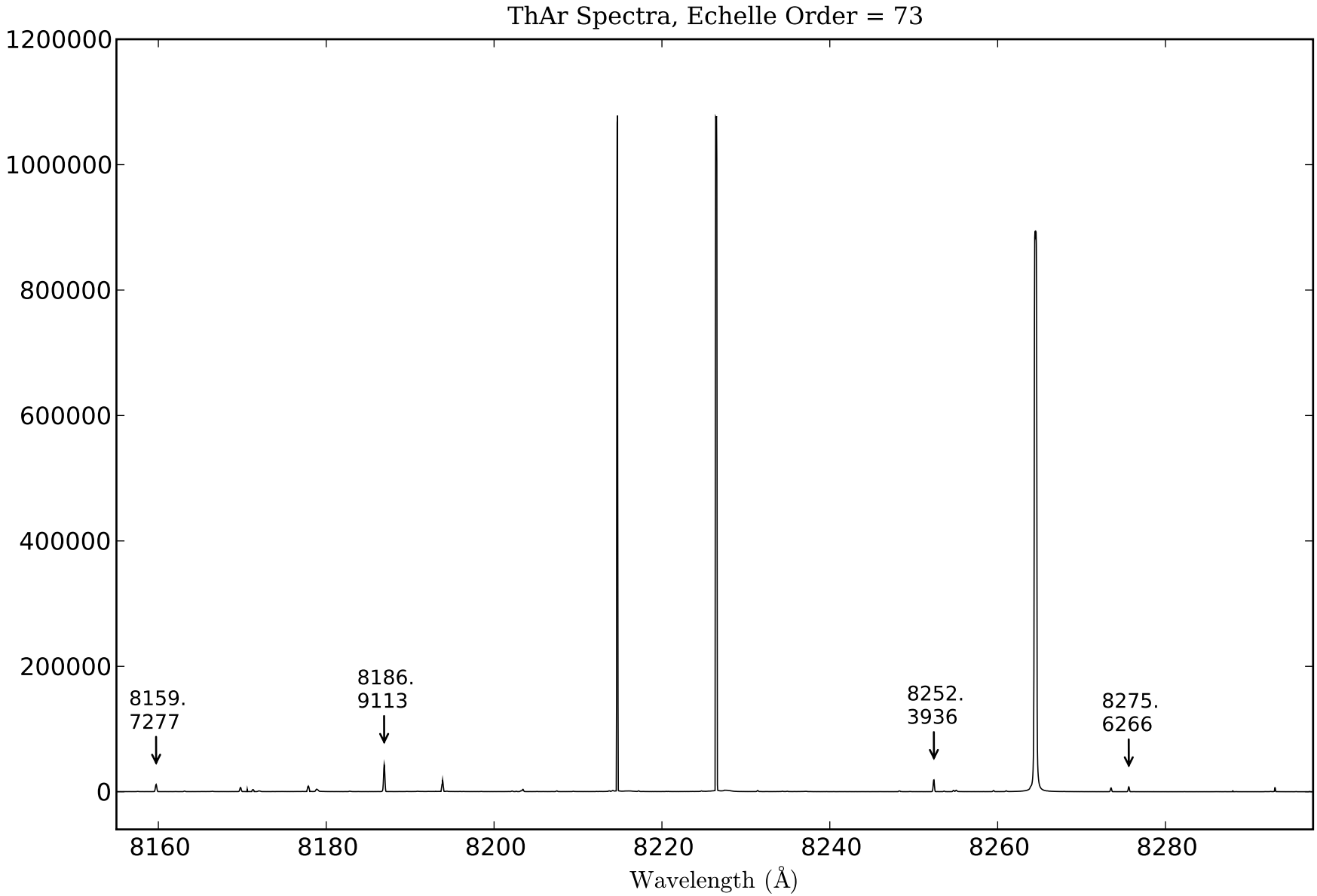

ThAr Spectra, Echelle Order = 68
35000
30000
25000
20000
15000
10000
5000
0
8760
8780
8800
8820
8840
8860
8880
8900
Wavelength (Å)
8771.
8602
8775.
5733
8792.
0572
8799.
0875
8804.
5894
8841.
1822
8868.
8334

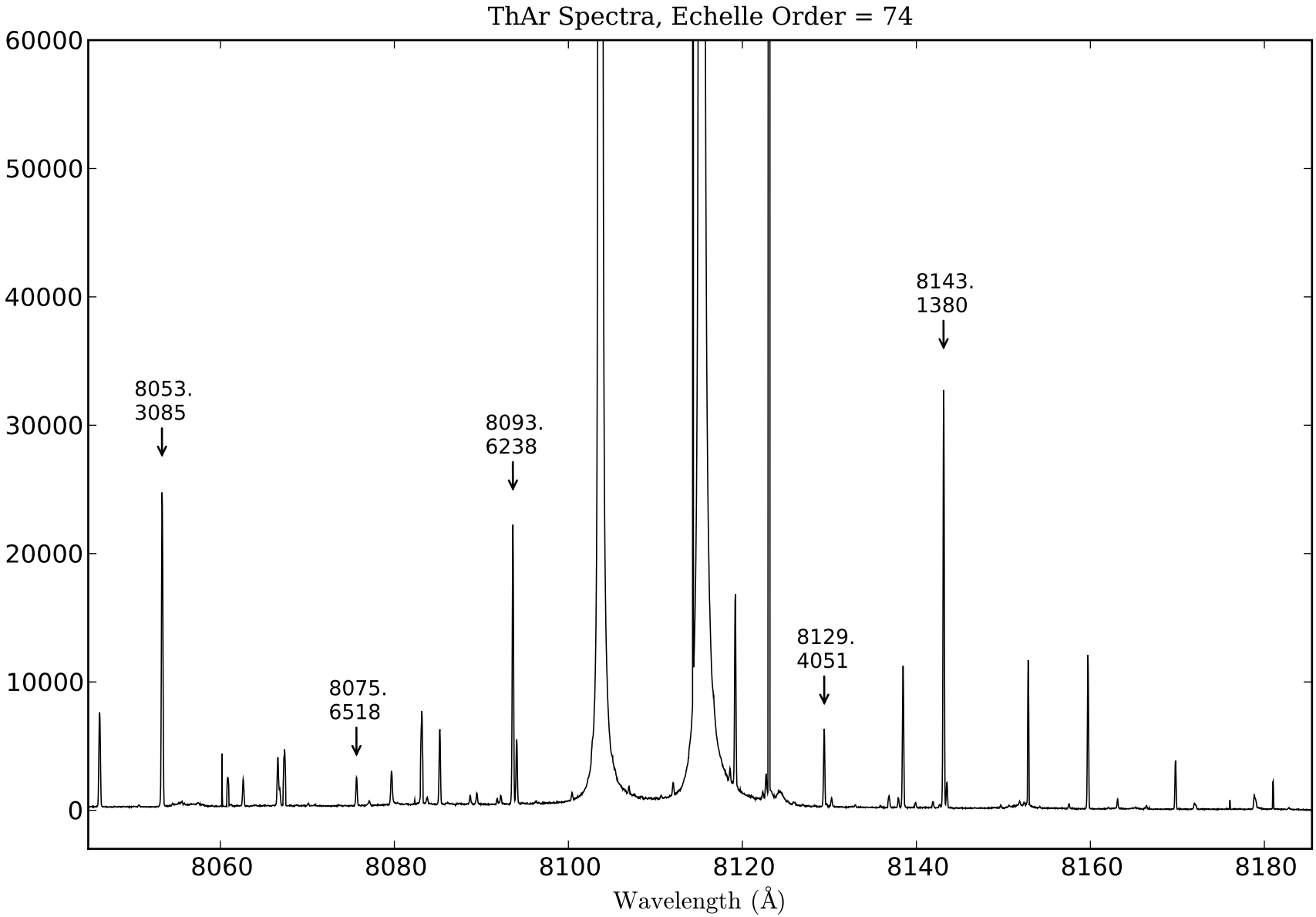

ThAr Spectra, Echelle Order = 69
60000
50000
40000
30000
20000
10000
0
8640
8660
8680
8700
8720
8740
8760
Wavelength (Å)
8678.
4083
8709.
2341
8748.
0309
8758.
2434
8761.
6862

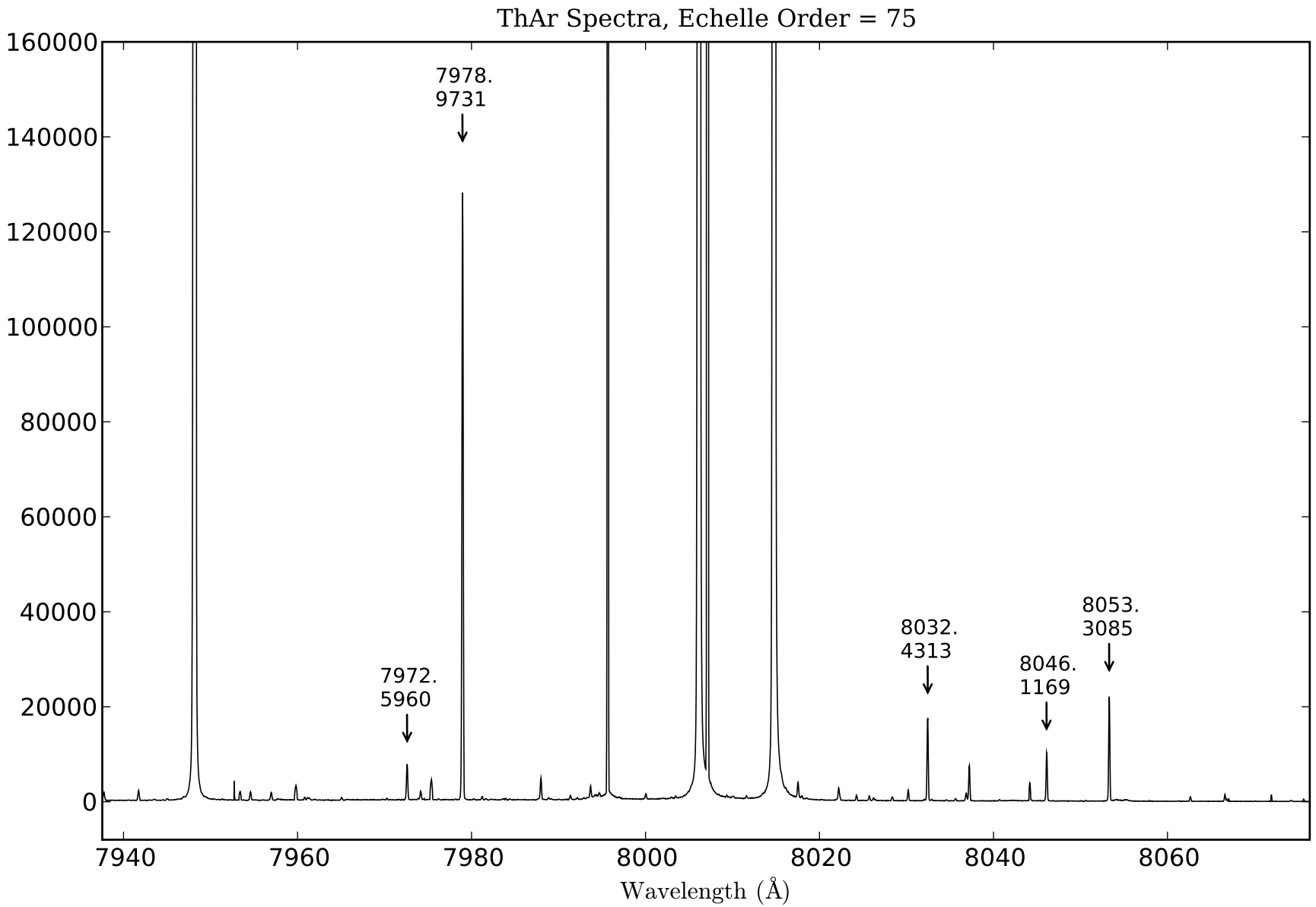

ThAr Spectra, Echelle Order = 70
140000
120000
100000
80000
60000
40000
20000
0
8520
8540
8560
8580
8600
8620
8640
Wavelength (Å)
8539.
7930
8554.
9440
8573.
1205
8605.
7762
8620.
4602

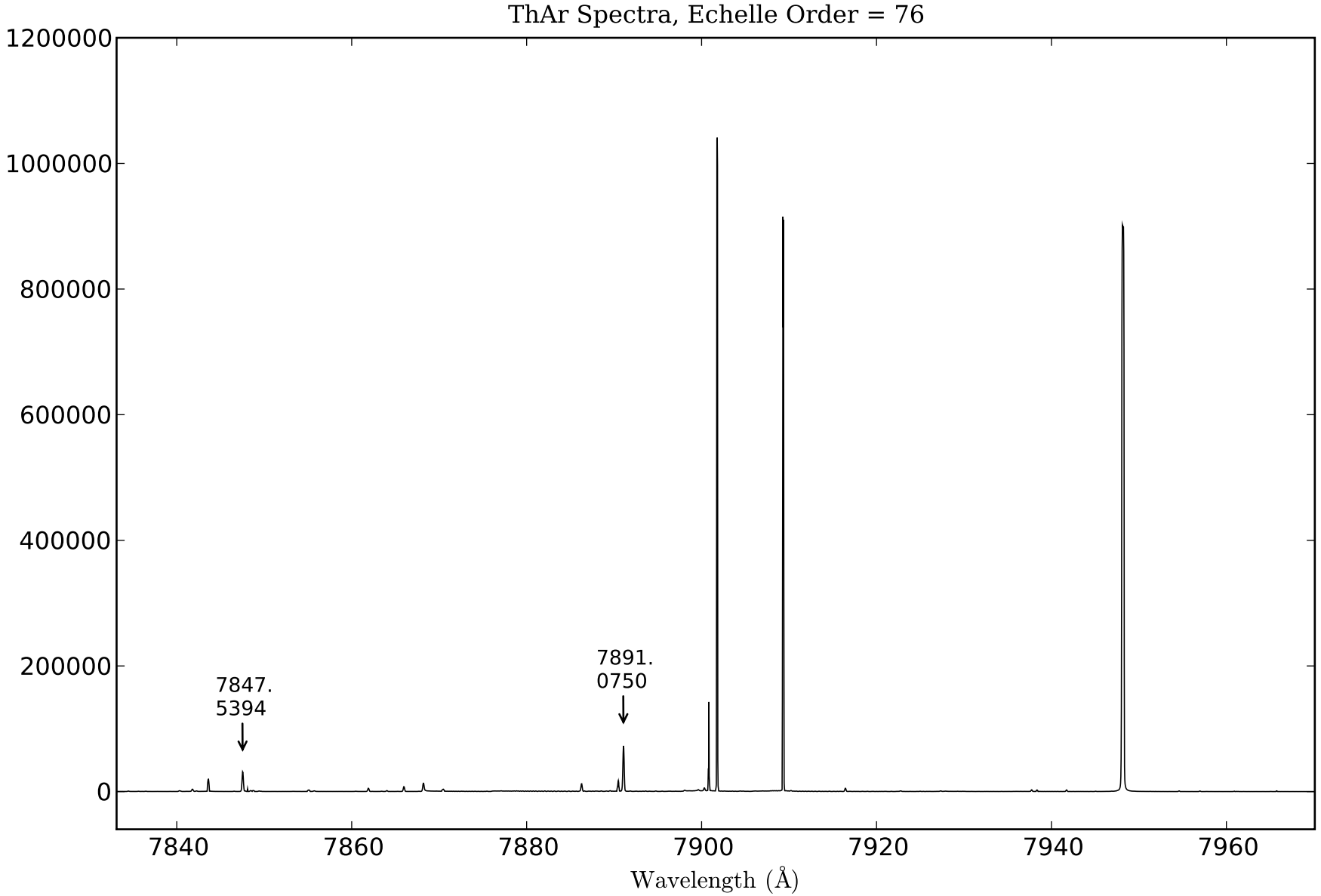

ThAr Spectra, Echelle Order = 71
140000
120000
100000
80000
60000
40000
20000
0
8400
8420
8440
8460
8480
8500
8520
Wavelength (Å)
8416.
7269
8421.
2254
8464.
2367
8478.
3580
8490.
3065


ThAr Spectra, Echelle Order = 72
1200000
1000000
800000
600000
400000
200000
0
8320.
8554
8330.
4494
8384.
7240
8280
8300
8320
8340
8360
8380
8400
Wavelength (Å)


ThAr Spectra, Echelle Order = 73
1200000
1000000
800000
600000
400000
200000
0
8159.
7277
8186.
9113
8252.
3936
8275.
6266
8160
8180
8200
8220
8240
8260
8280
Wavelength (Å)


ThAr Spectra, Echelle Order = 74
60000
50000
40000
30000
20000
10000
0
8053.
3085
8075.
6518
8093.
6238
8129.
4051
8143.
1380
8060
8080
8100
8120
8140
8160
8180
Wavelength (Å)


ThAr Spectra, Echelle Order = 75
160000
140000
120000
100000
80000
60000
40000
20000
0
7940
7960
7980
8000
8020
8040
8060
Wavelength (Å)
7978.
9731
7972.
5960
8032.
4313
8046.
1169
8053.
3085


ThAr Spectra, Echelle Order = 76
1200000
1000000
800000
600000
400000
200000
0
7847.
5394
7891.
0750
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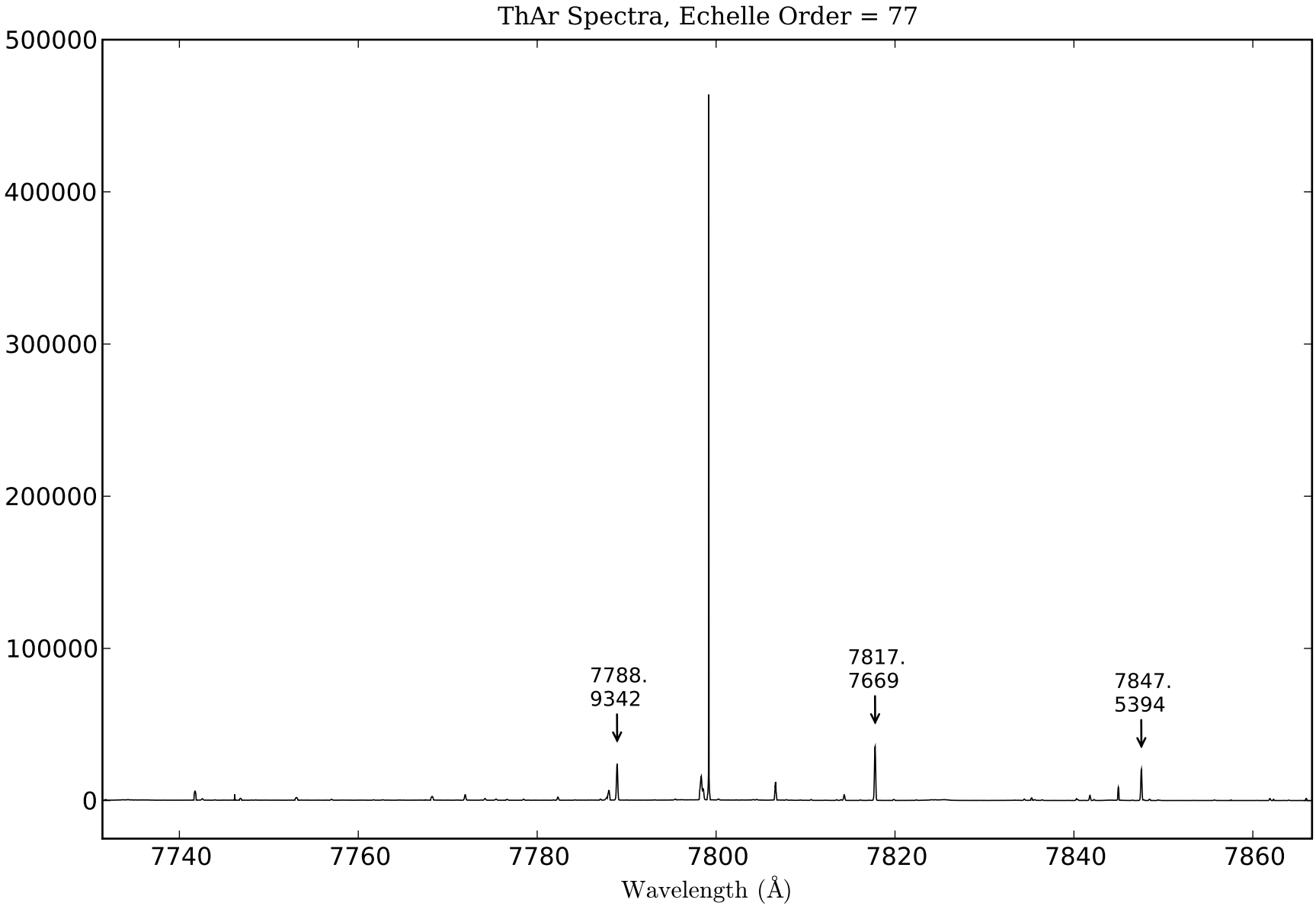
7860
7880
7900
7920
7940
7960
Wavelength (Å)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500000
400000
300000
200000
100000
0
7788.
9342
7817.
7669
7847.
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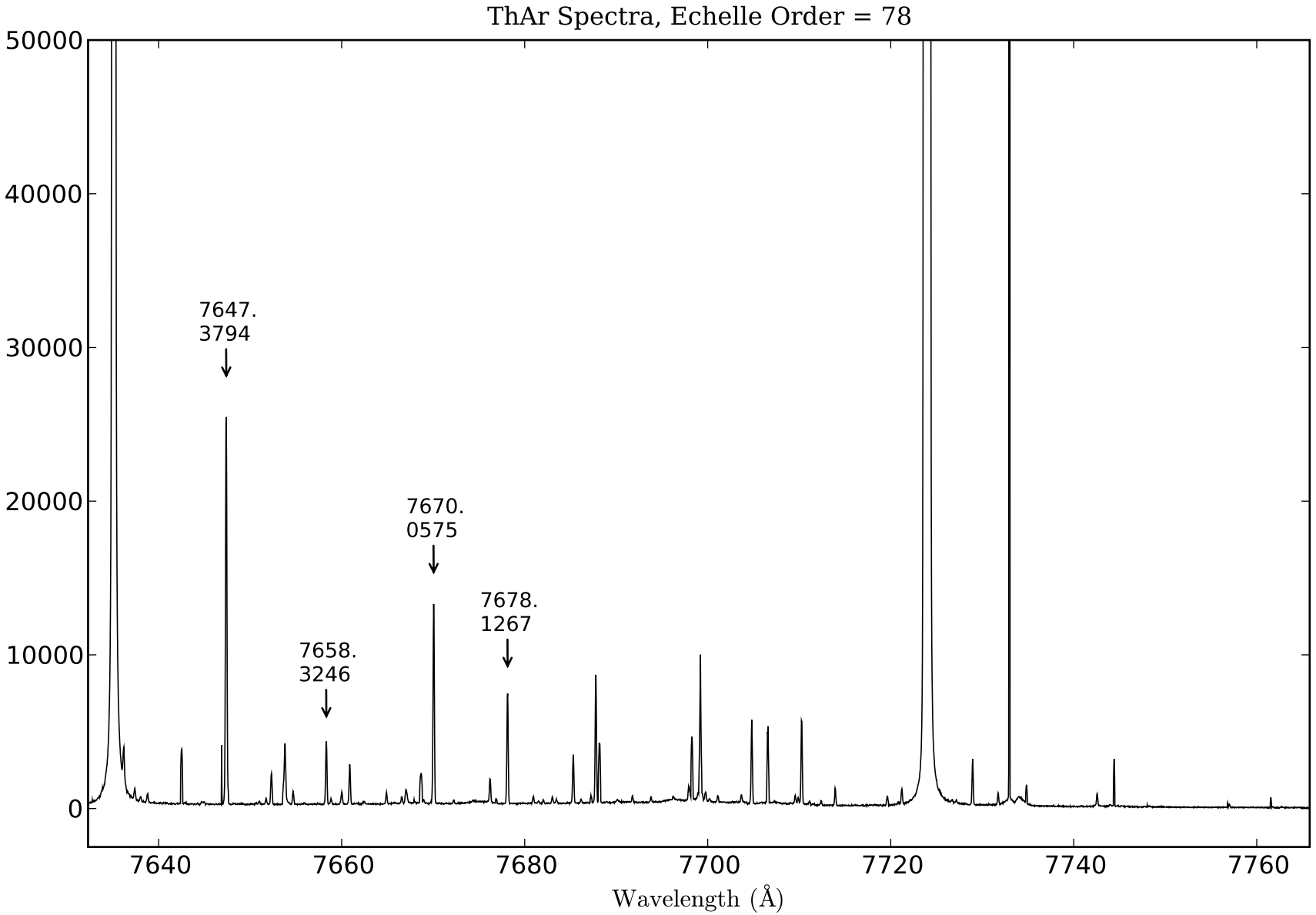
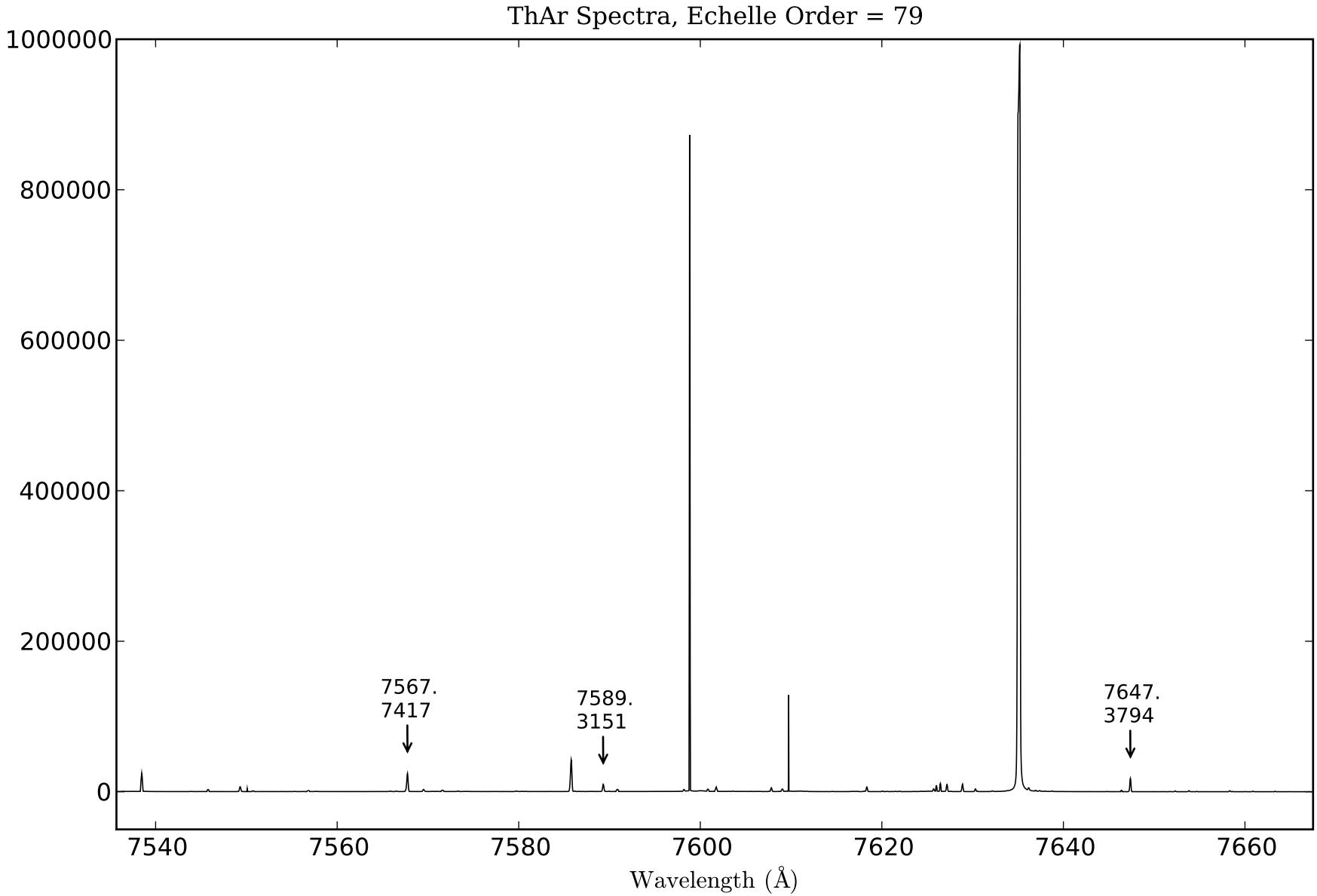
7760
7780
7800
7820
7840
7860
Wavelength (Å)


ThAr Spectra, Echelle Order = 78
50000
40000
30000
20000
10000
0
7647.
3794
7658.
3246
7670.
0575
7678.
1267
7640
7660
7680
7700
7720
7740
7760
Wavelength (Å)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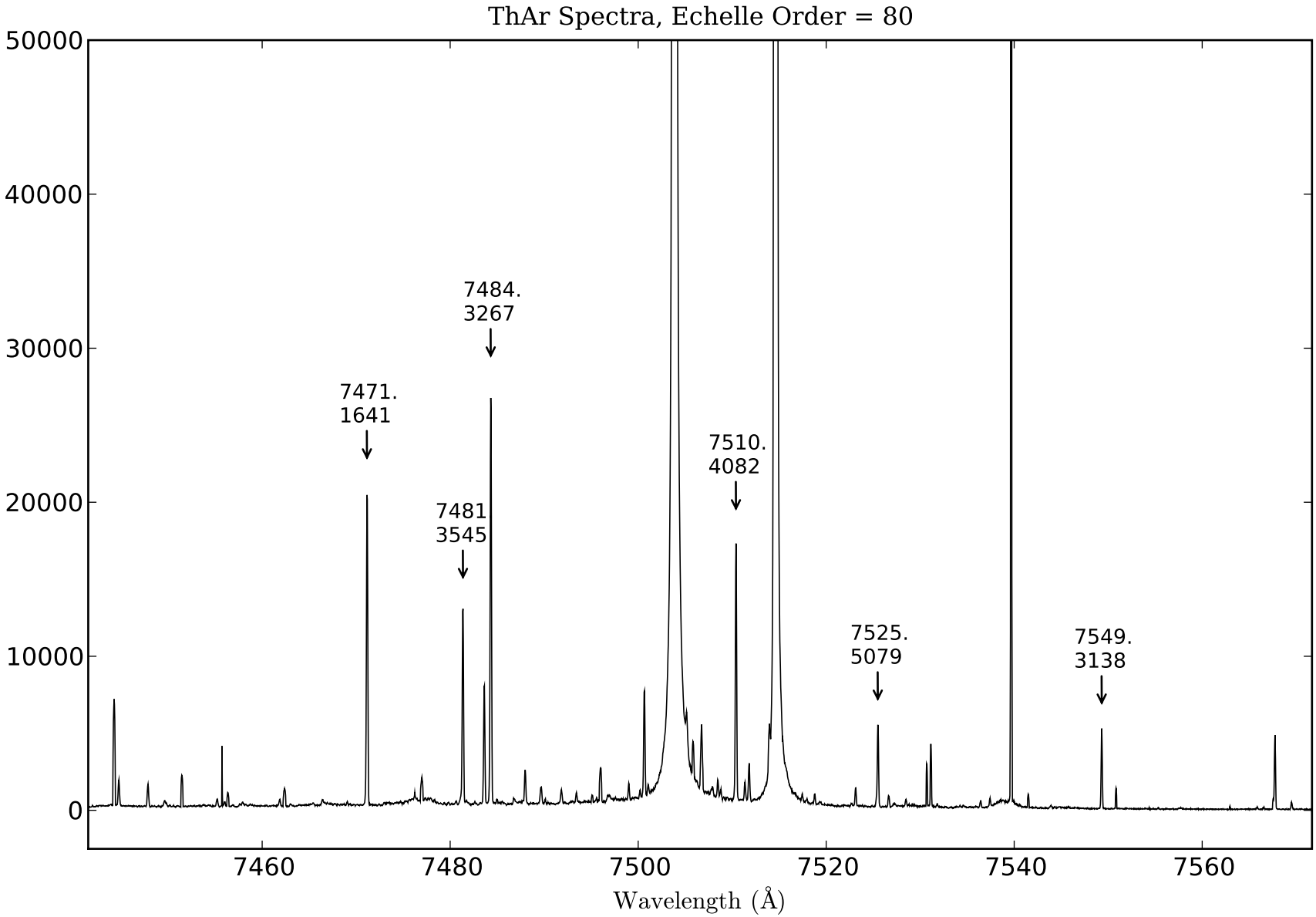
1000000
800000
600000
400000
200000
0
7567.
7417
7589.
3151
7647.
3794
7540
7560
7580
7600
7620
7640
7660
Wavelength (Å)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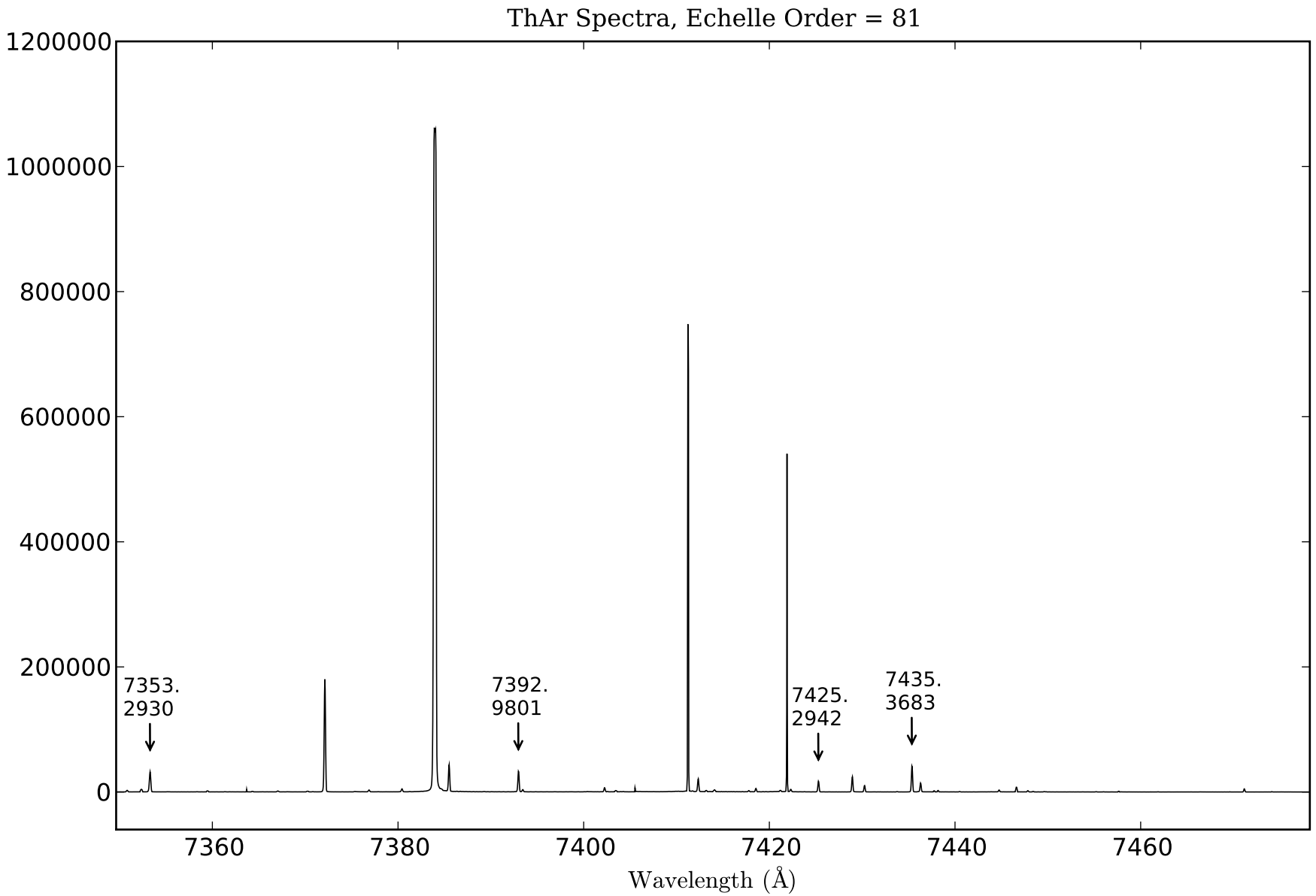
50000
40000
30000
20000
10000
0
7460
7480
7500
7520
7540
7560
Wavelength (Å)
7471.
1641
7484.
3267
7481
3545
7510.
4082
7525.
5079
7549.
3138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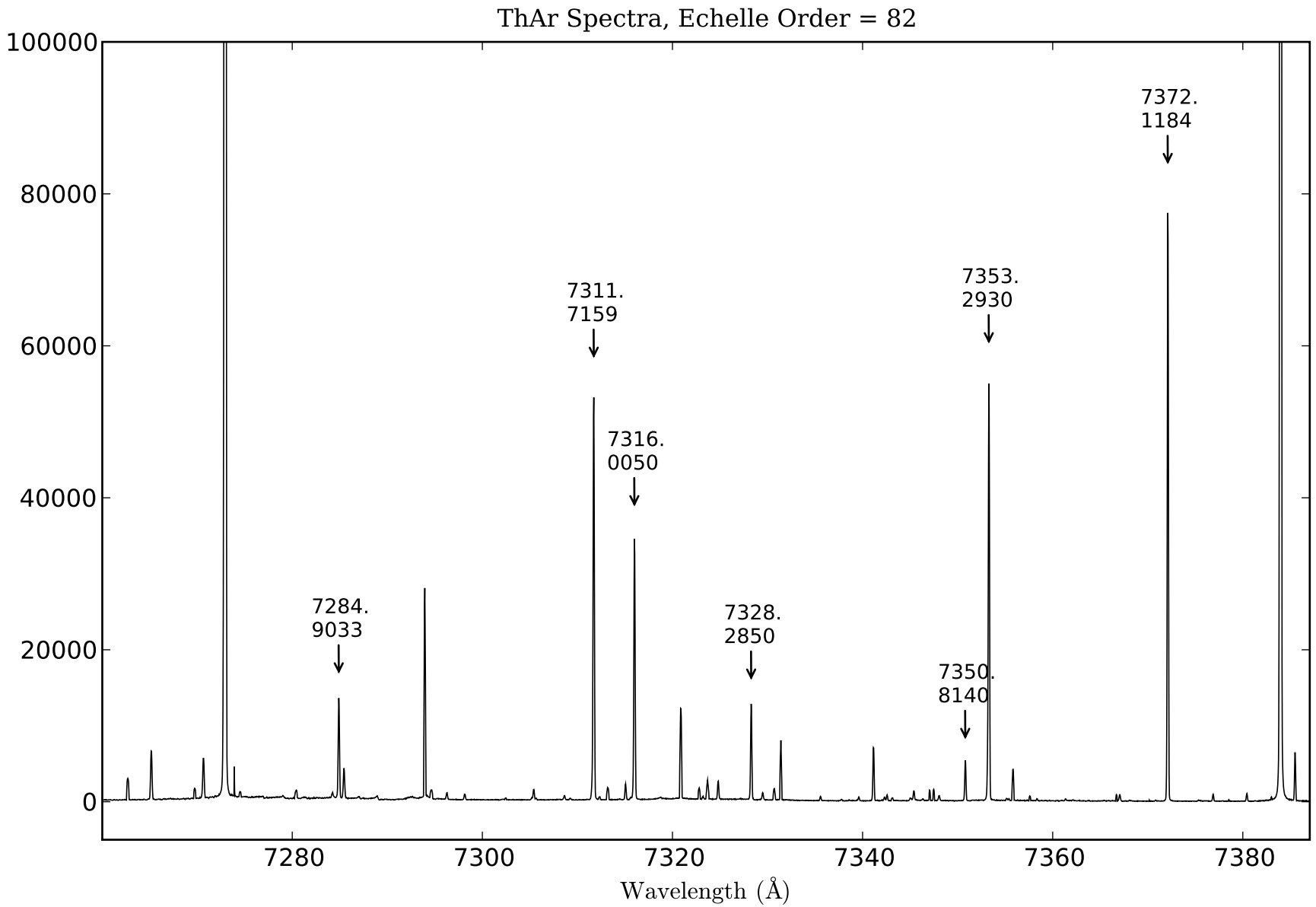
1000000
800000
600000
400000
200000
0
7353.
2930
7392.
9801
7425.
2942
7435.
3683
7360
7380
7400
7420
7440
7460
Wavelength (Å)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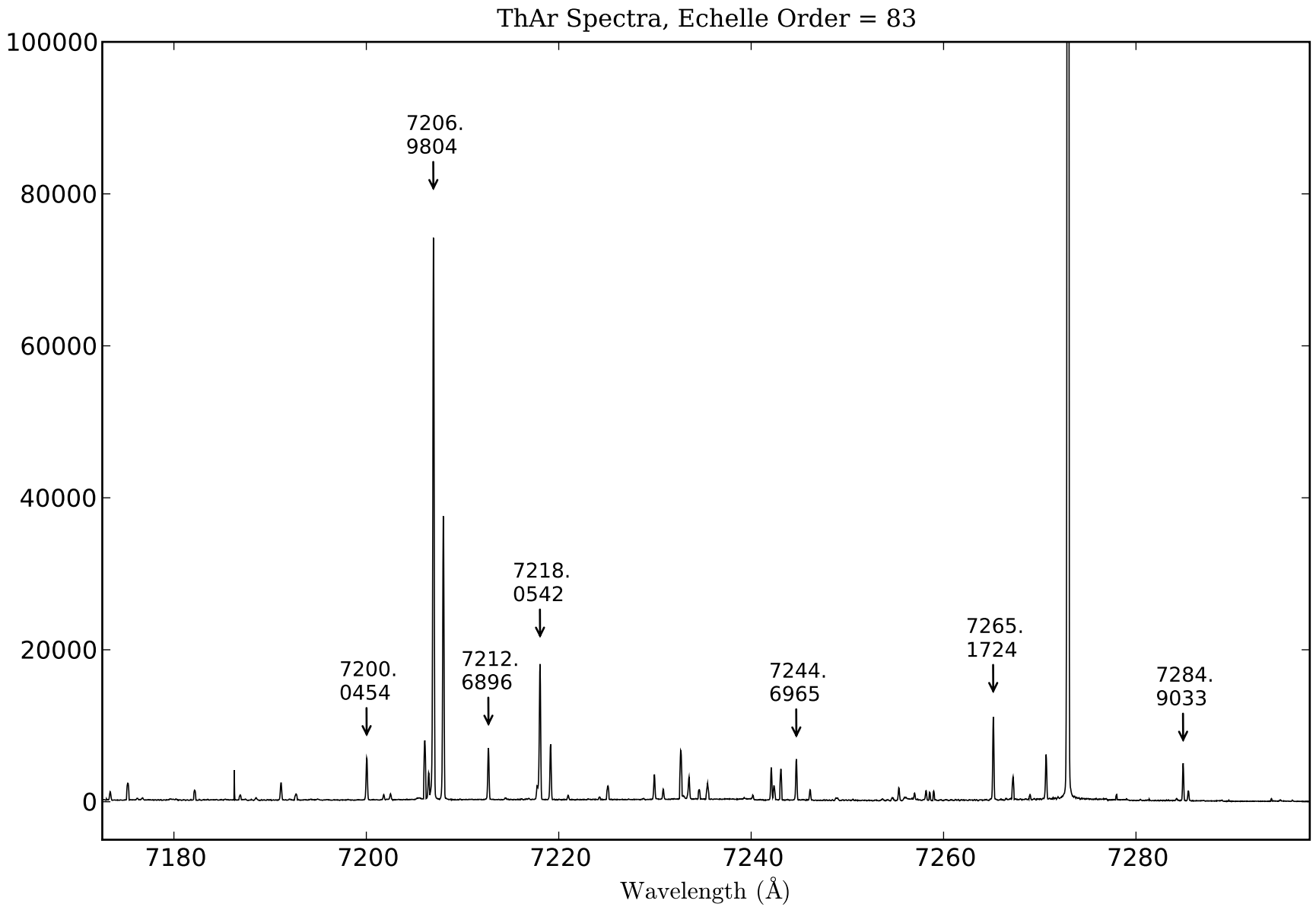
100000
80000
60000
40000
20000
0
7280
7300
7320
7340
7360
7380
Wavelength (Å)
7284.
9033
7311.
7159
7316.
0050
7328.
2850
7350.
8140
7353.
2930
7372.
1184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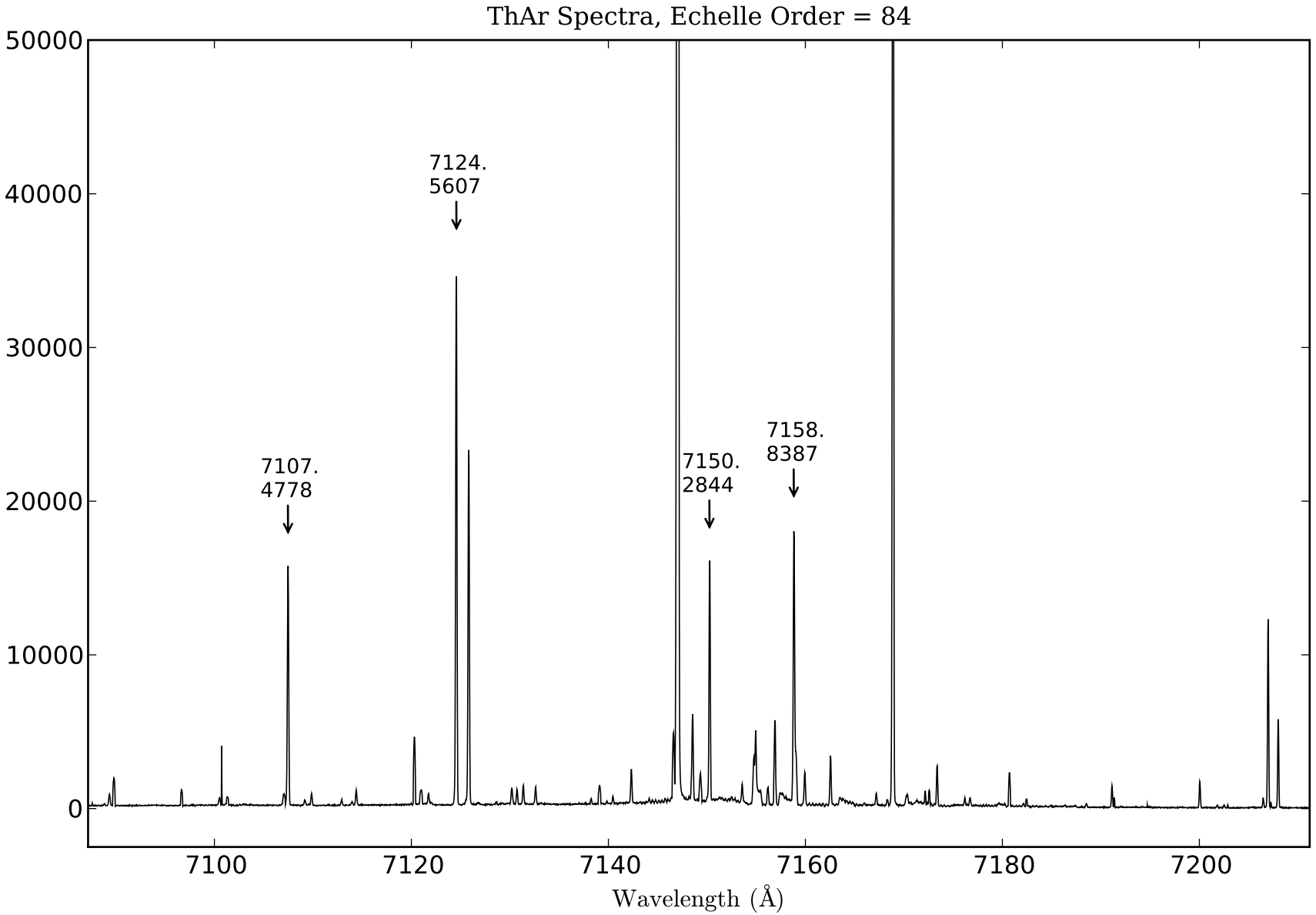
100000
80000
60000
40000
20000
0
7206.
9804
7218.
0542
7212.
6896
7200.
0454
7244.
6965
7265.
1724
7284.
9033
7180
7200
7220
7240
7260
7280
Wavelength (Å)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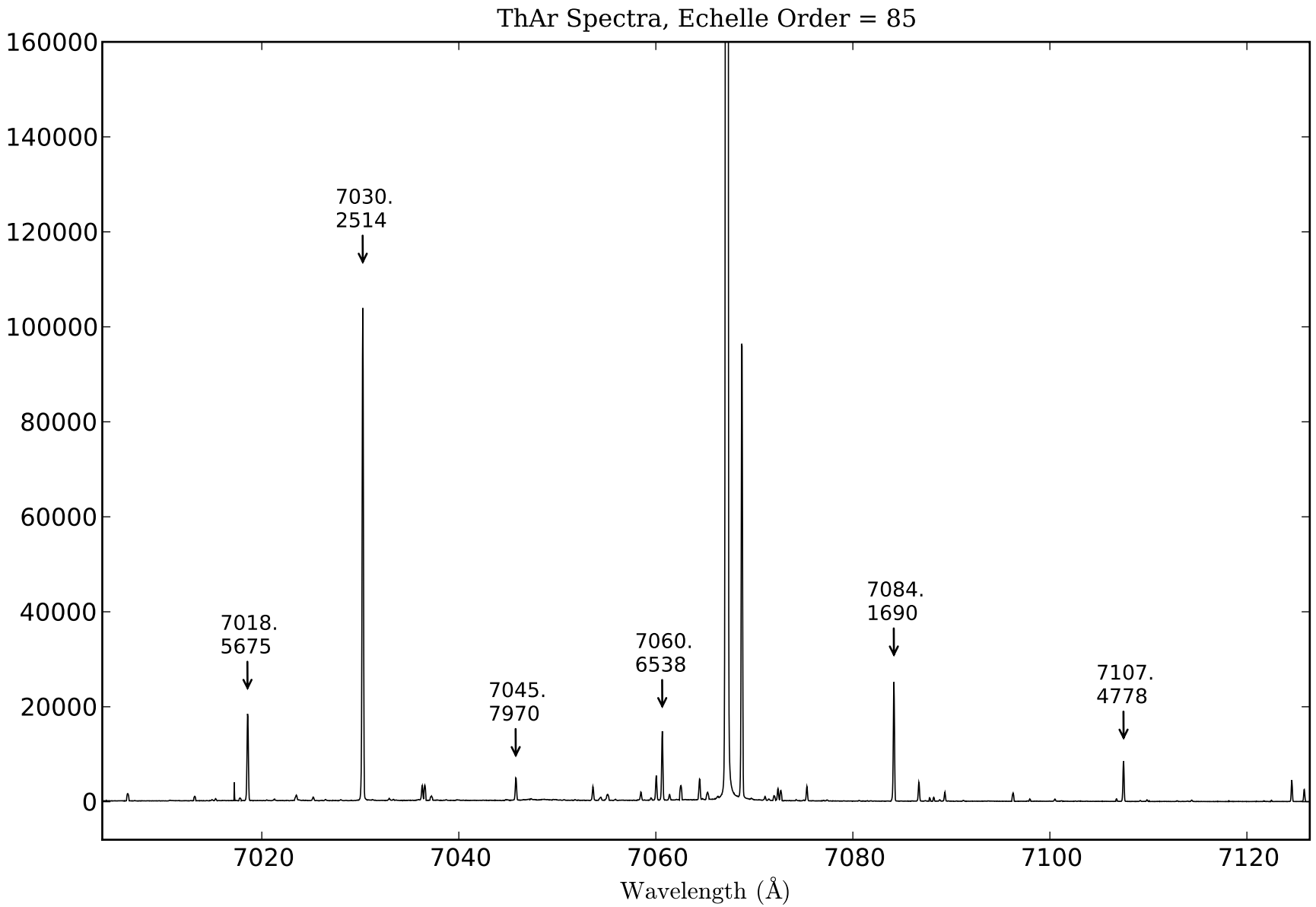
50000
40000
30000
20000
10000
0
7107.
4778
7124.
5607
7150.
2844
7158.
8387
7100
7120
7140
7160
7180
7200
Wavelength (Å)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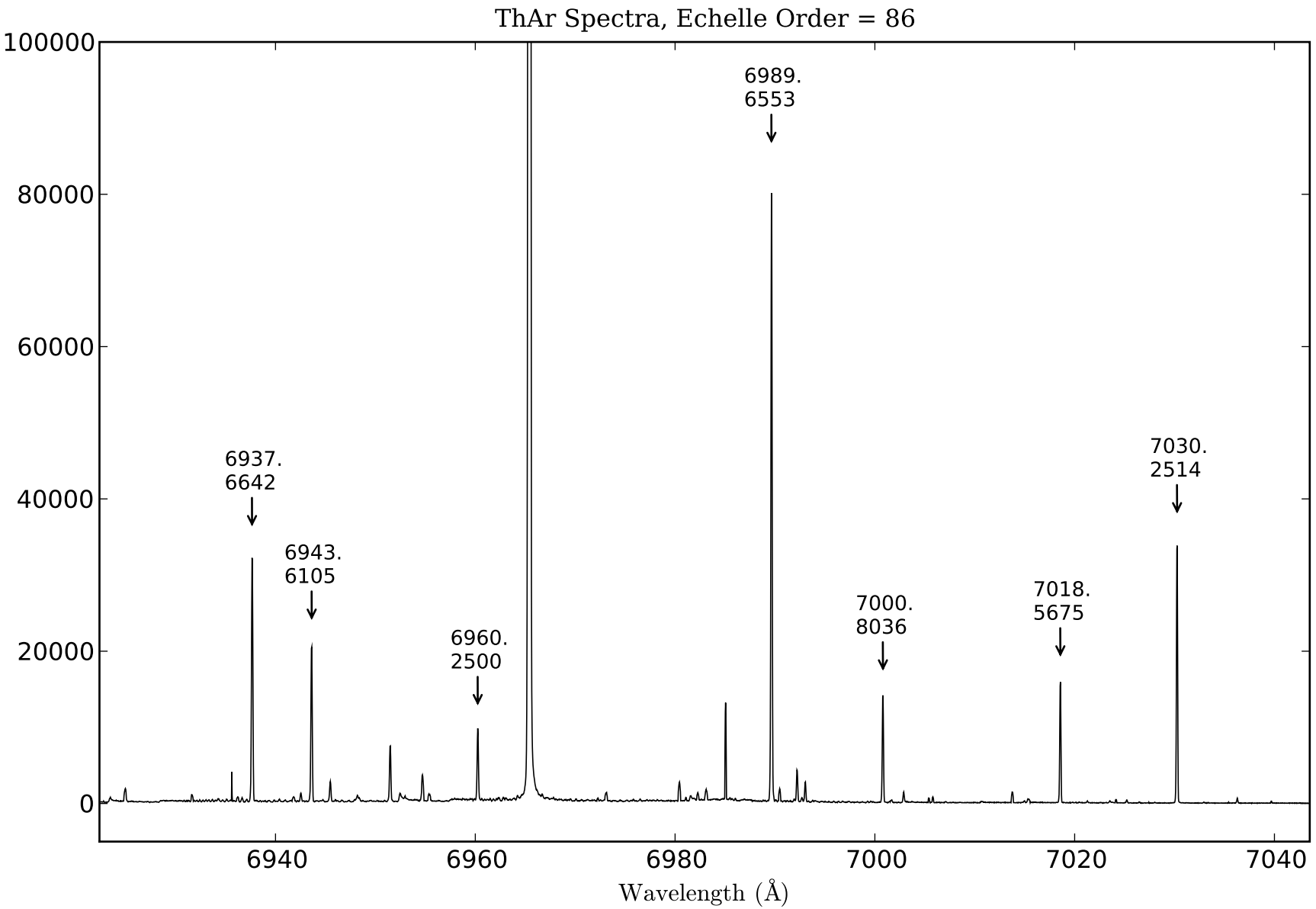
160000
140000
120000
100000
80000
60000
40000
20000
0
7020
7040
7060
7080
7100
7120
Wavelength (Å)
7018.
5675
7030.
2514
7045.
7970
7060.
6538
7084.
1690
7107.
4778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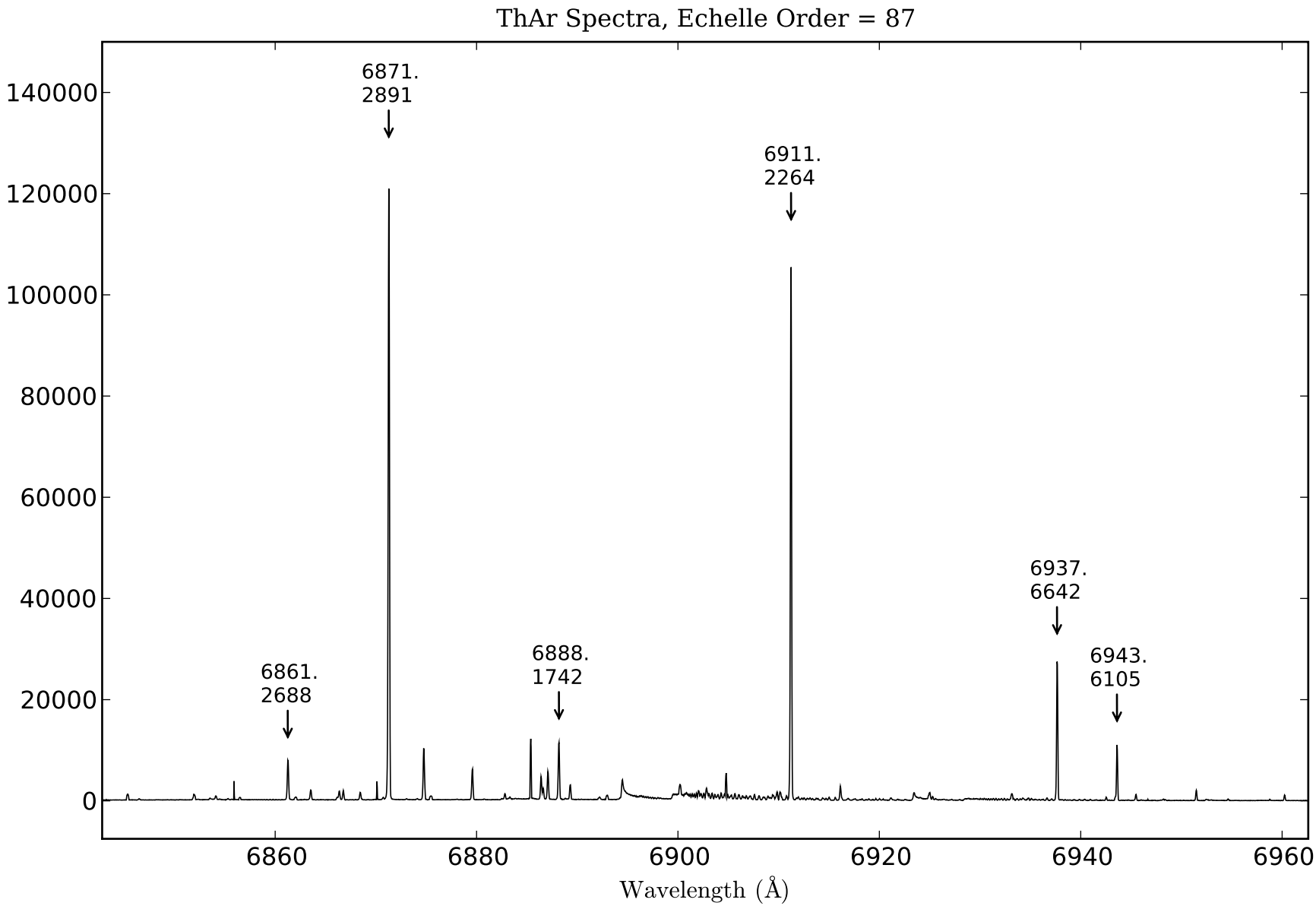
100000
80000
60000
40000
20000
0
6940
6960
6980
7000
7020
7040
Wavelength (Å)
6937.
6642
6943.
6105
6960.
2500
6989.
6553
7000.
8036
7018.
5675
7030.
2514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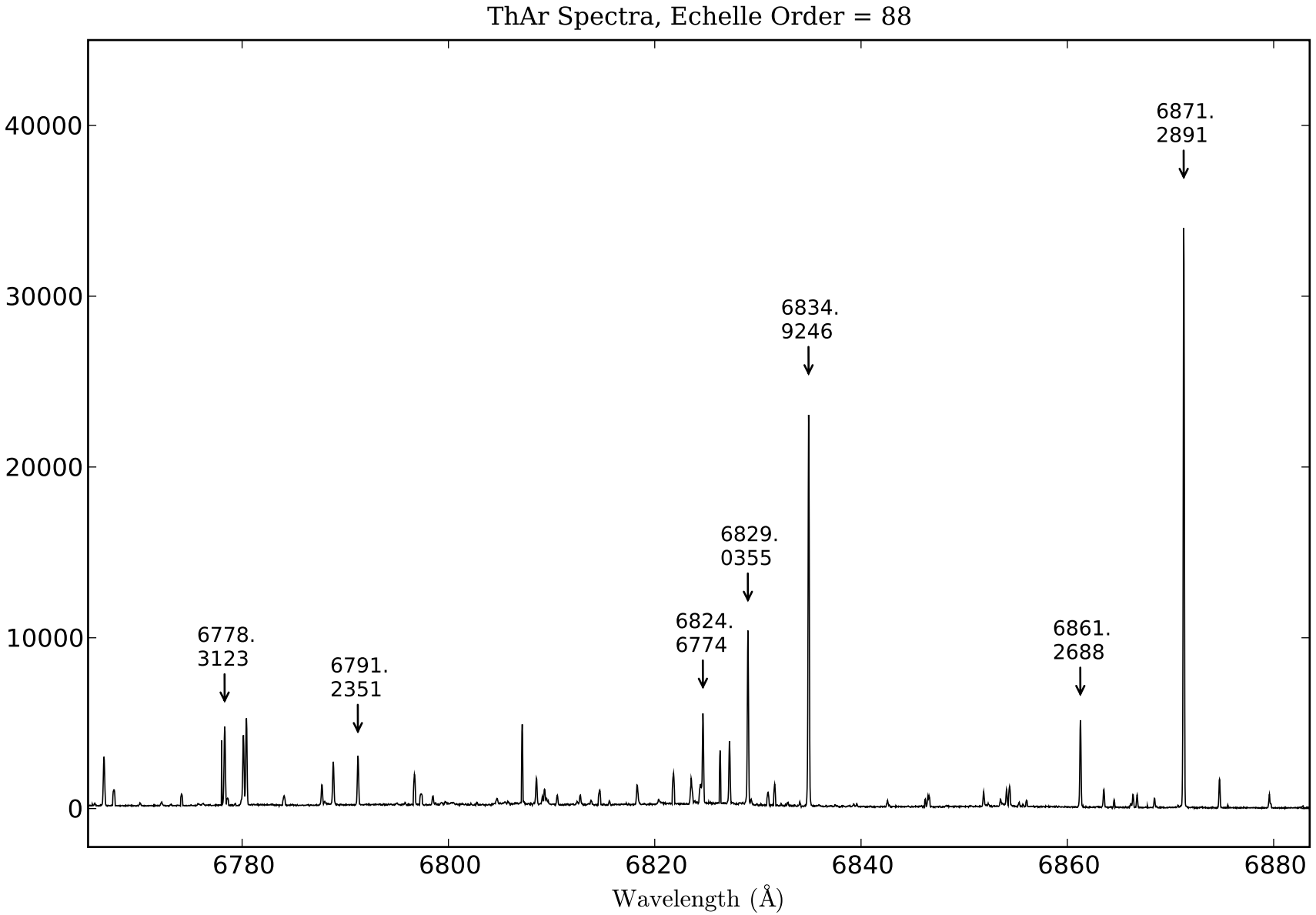
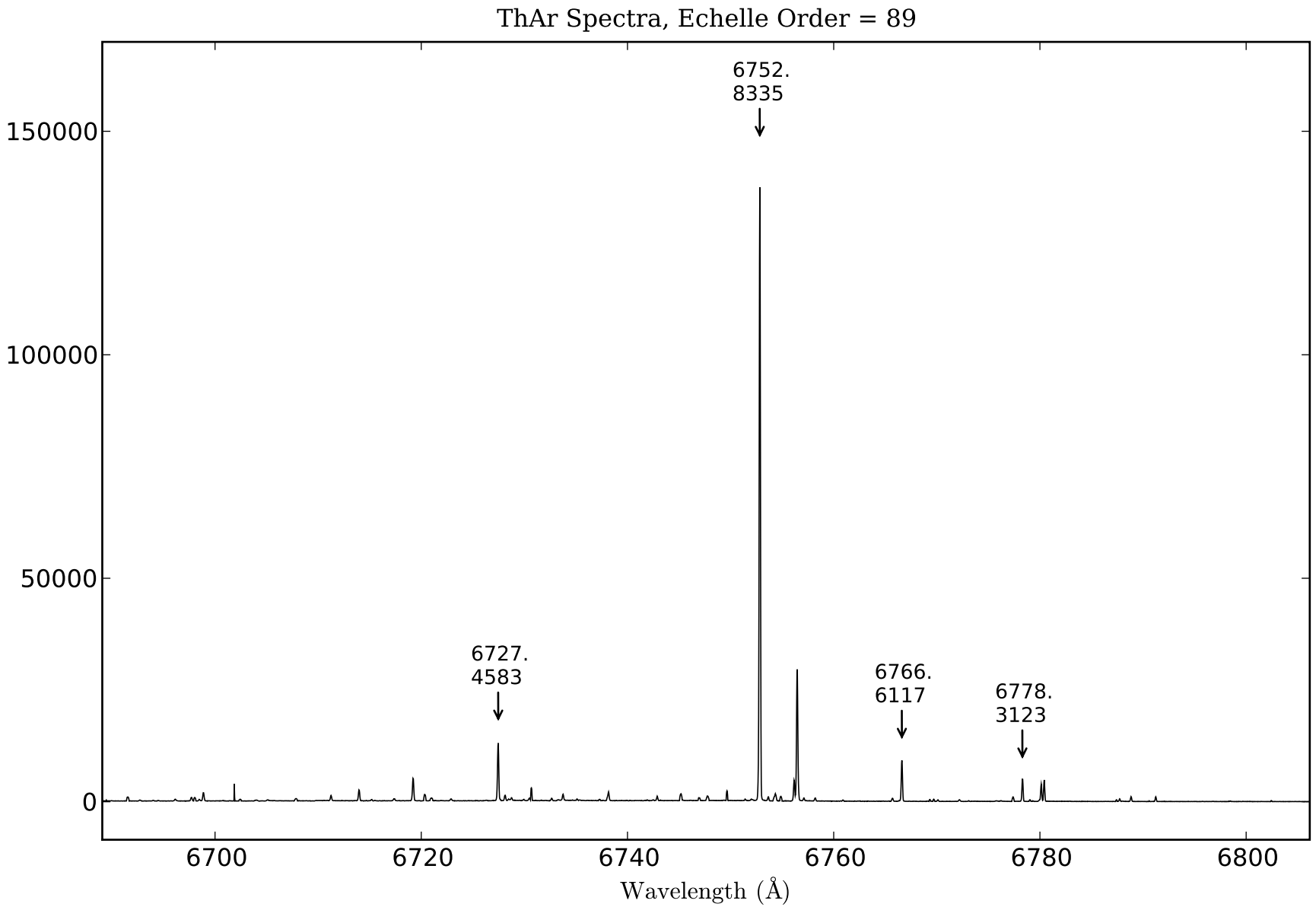
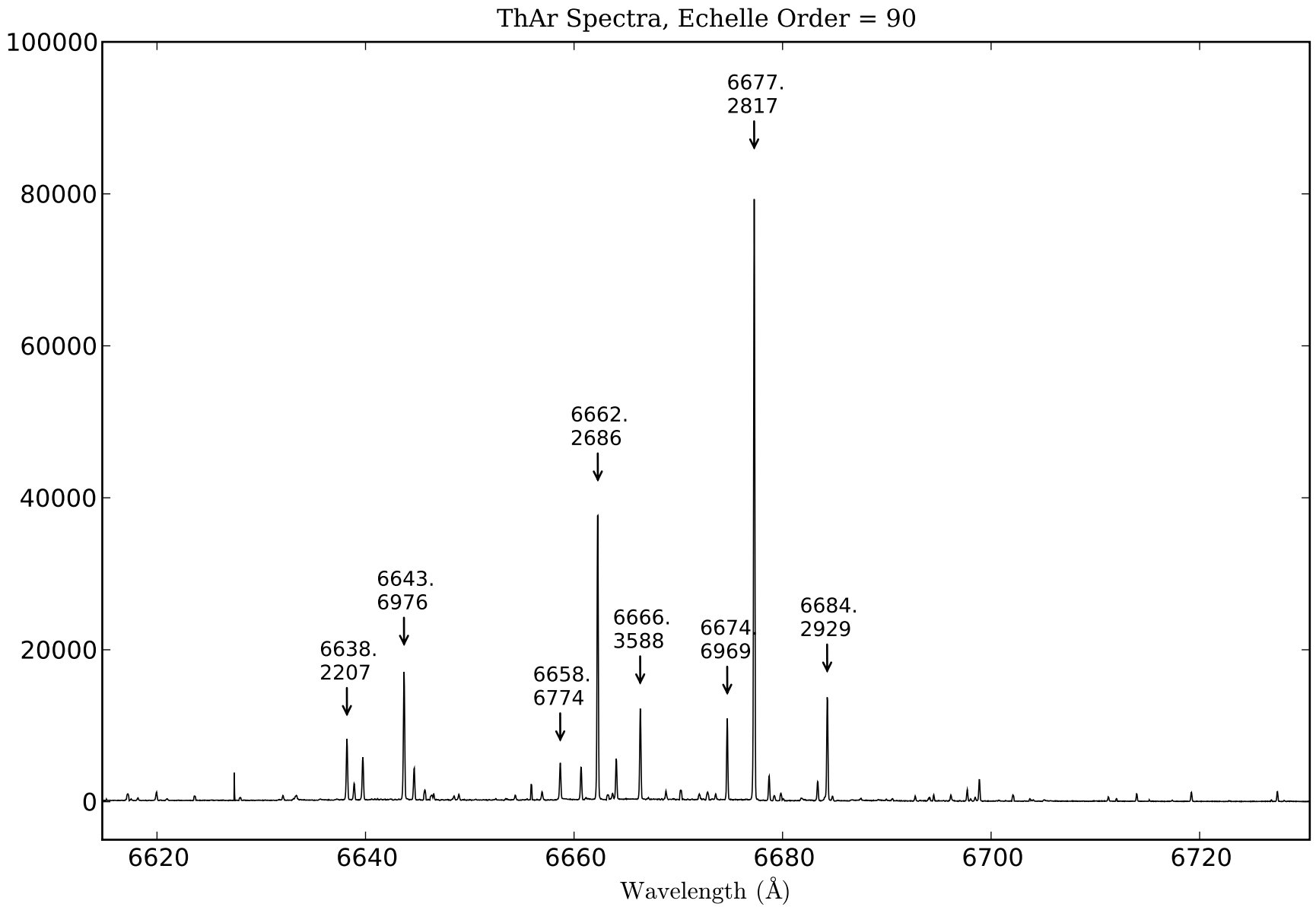
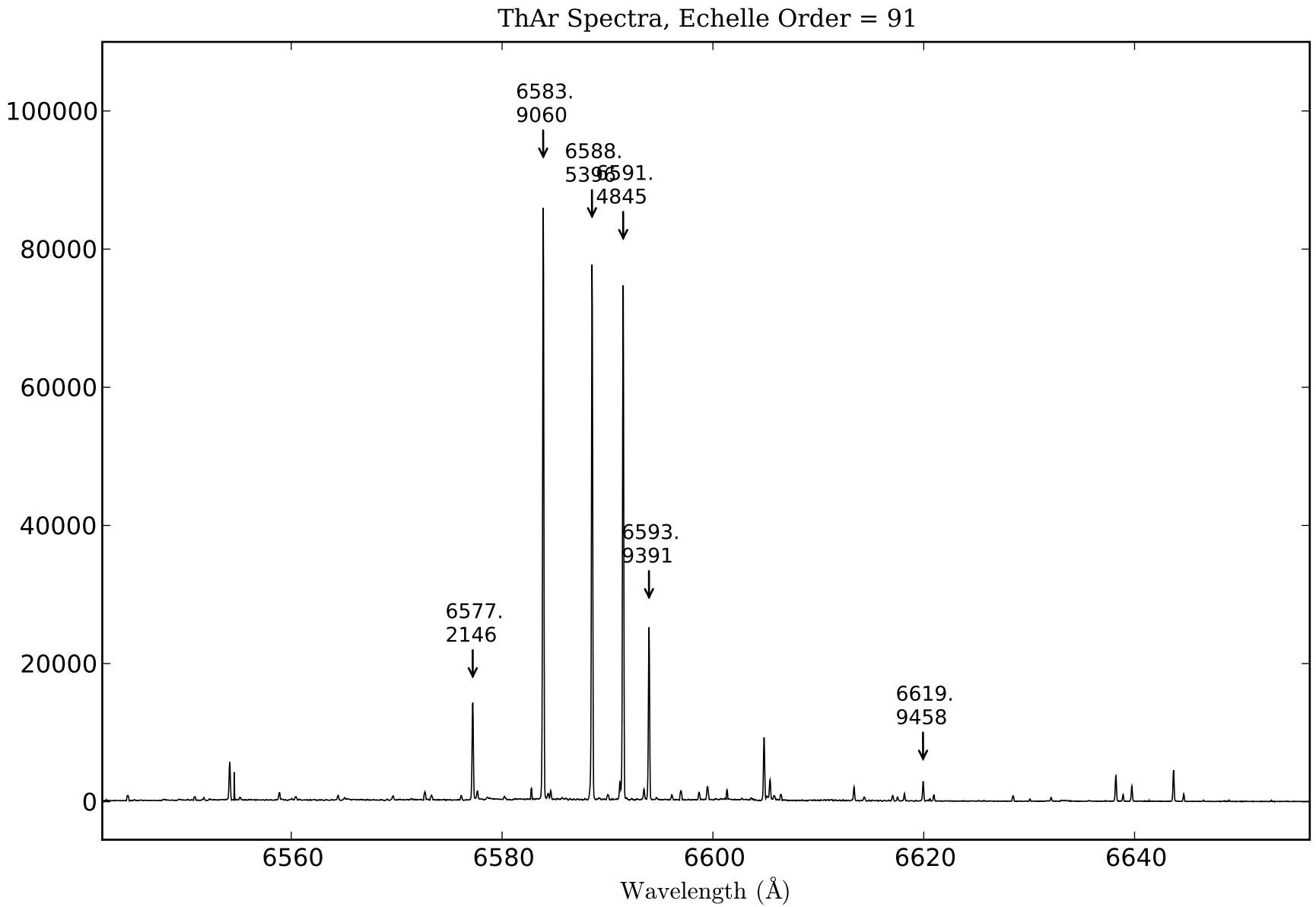
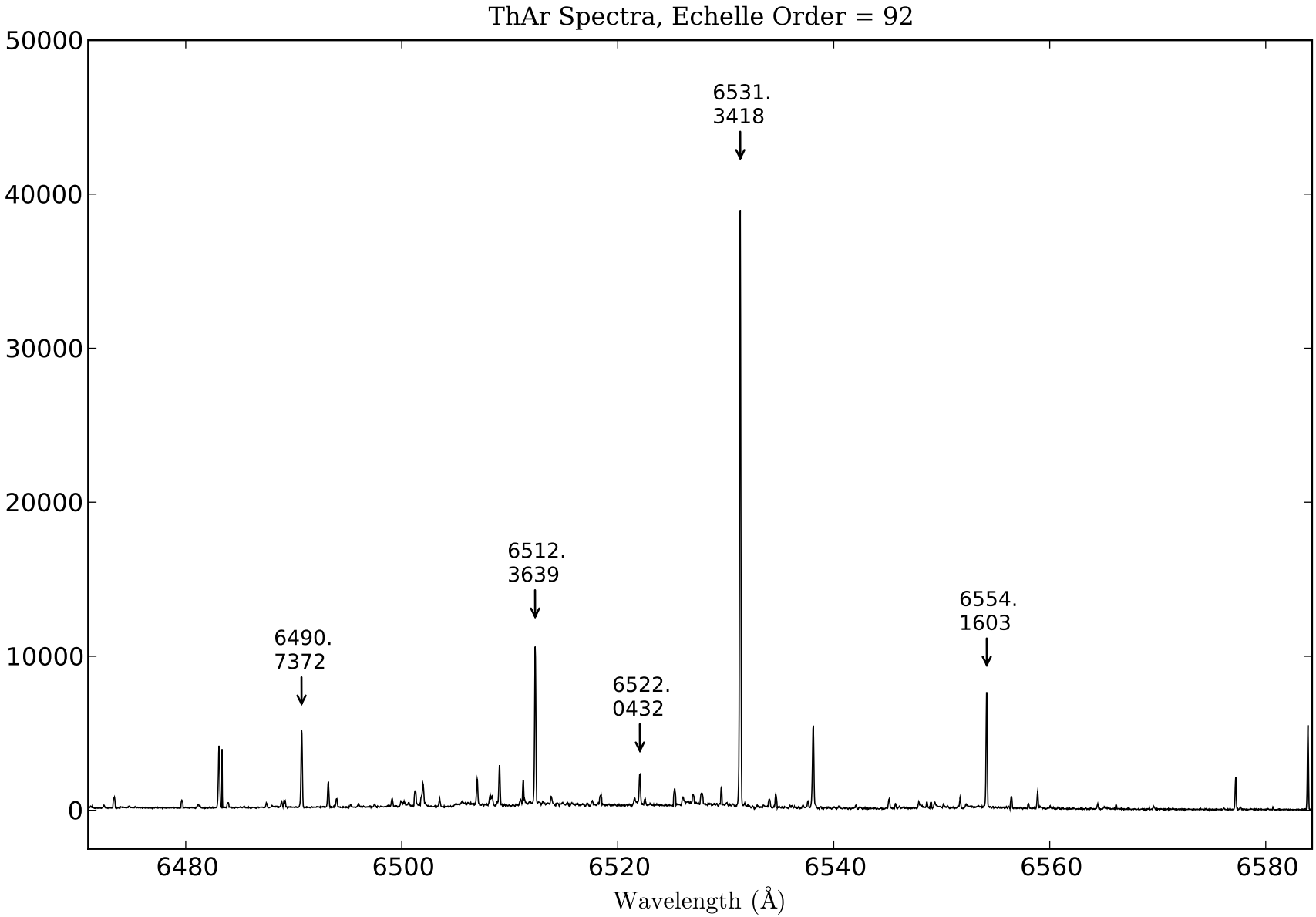
6871.
2891
6911.
2264
6937.
6642
6888.
1742
6943.
6105
6861.
2688
140000
120000
100000
80000
60000
40000
20000
0
6860
6880
6900
6920
6940
6960
Wavelength (Å)

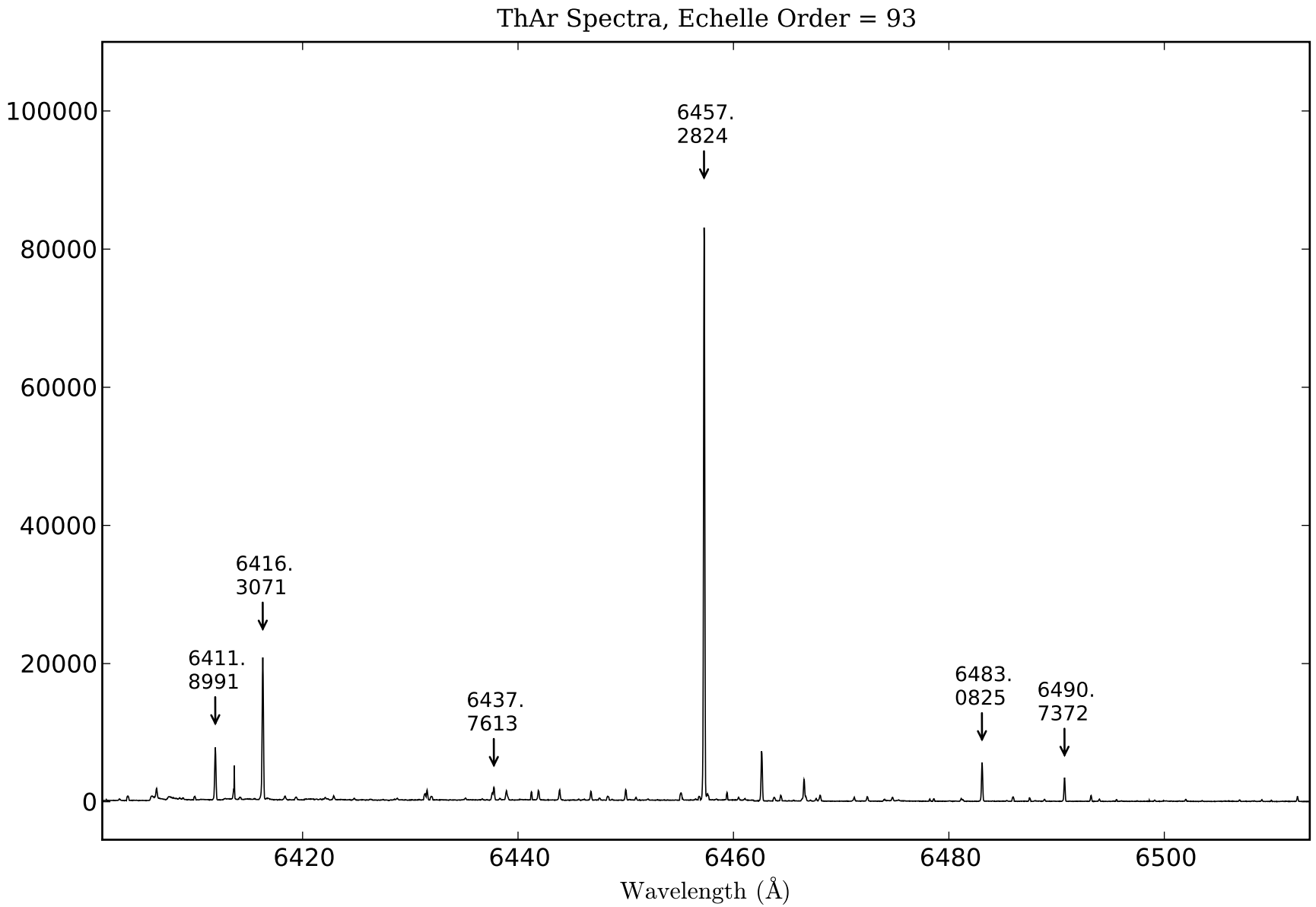

ThAr Spectra, Echelle Order = 88
40000
30000
20000
10000
0
6780
6800
6820
6840
6860
6880
Wavelength (Å)
6778.
3123
6791.
2351
6824.
6774
6829.
0355
6834.
9246
6861.
2688
6871.
2891

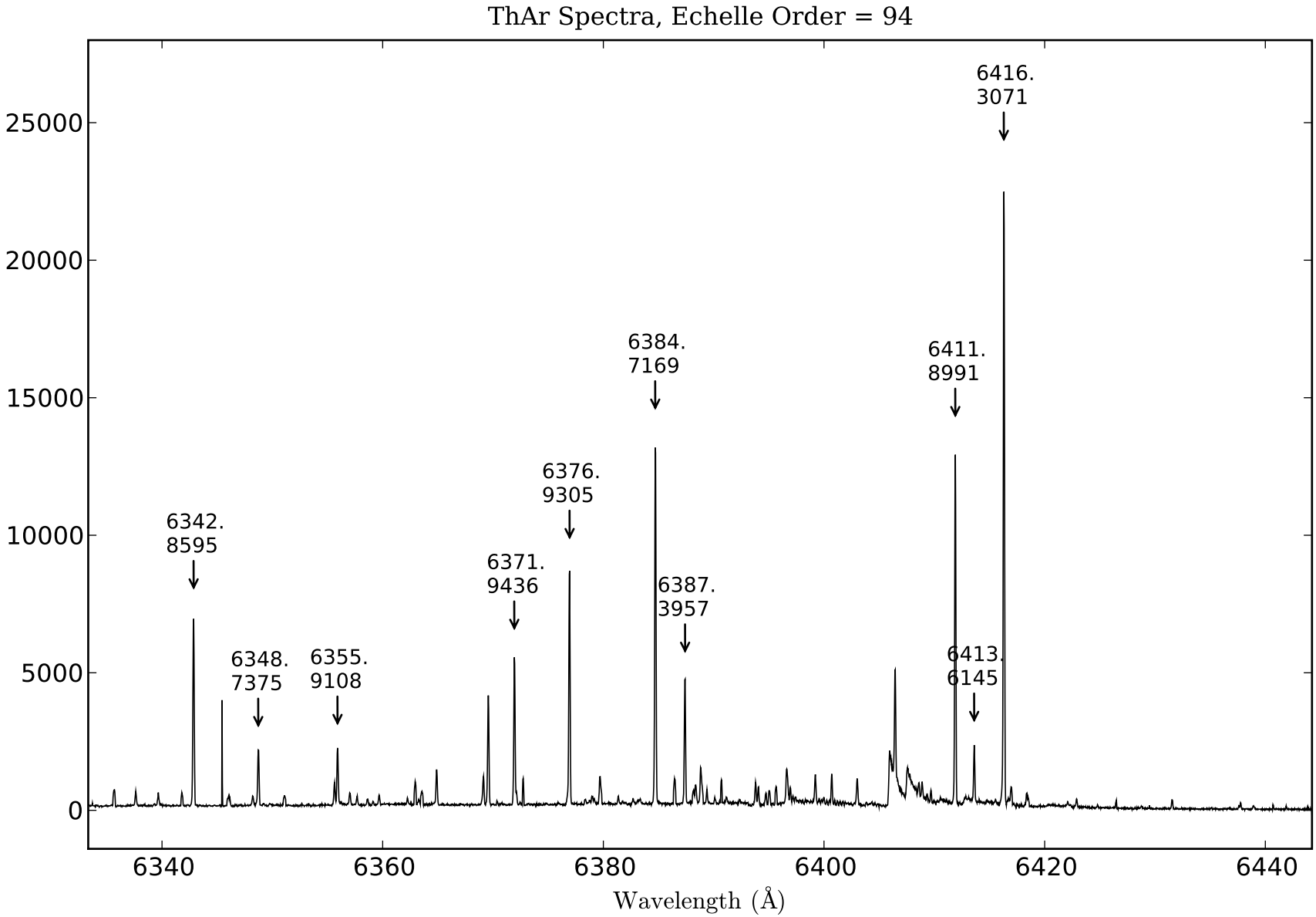

ThAr Spectra, Echelle Order = 89
6752.
8335
6727.
4583
6766.
6117
6778.
3123
150000
100000
50000
0
6700
6720
6740
6760
6780
6800
Wavelength (Å)

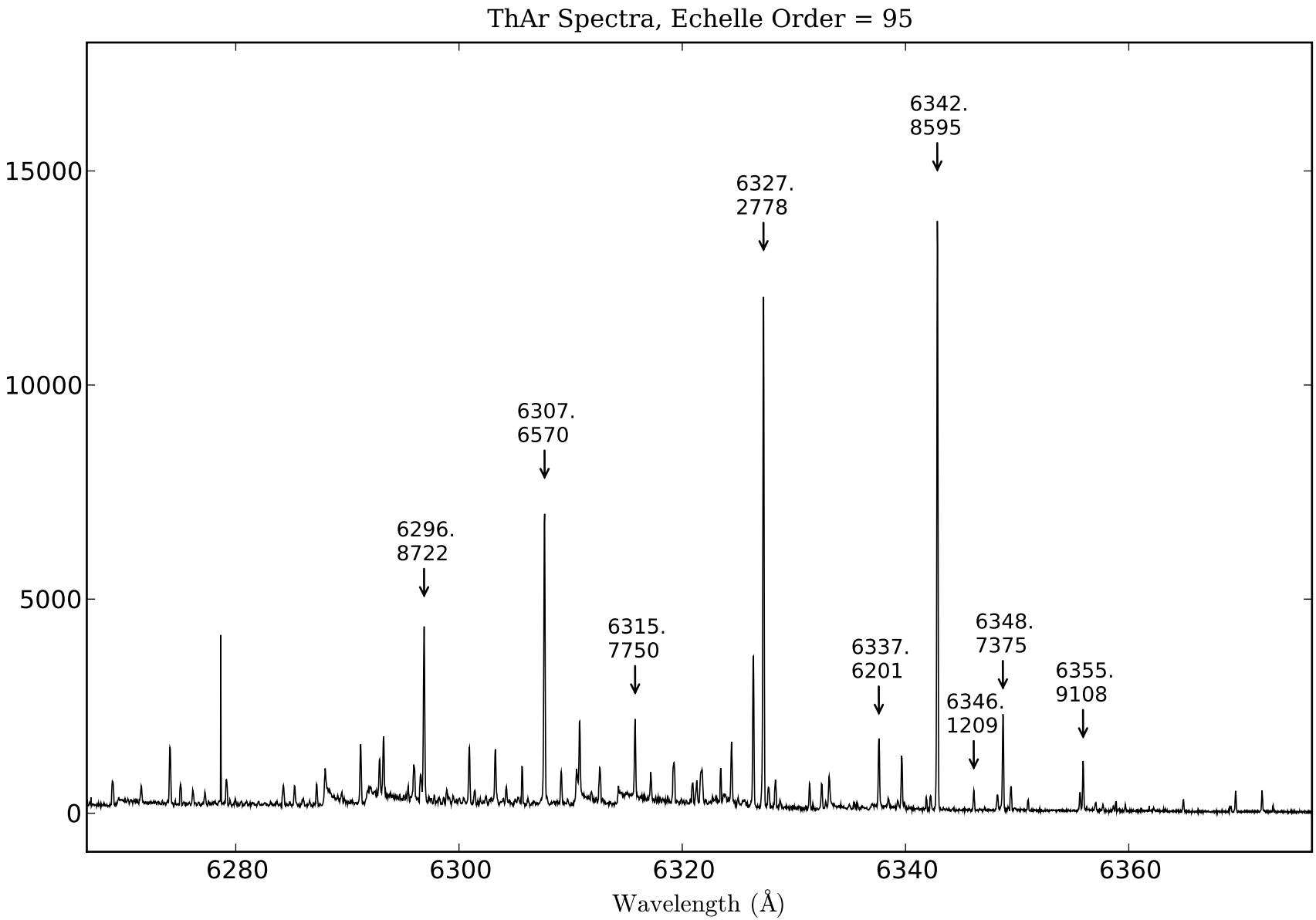

ThAr Spectra, Echelle Order = 90
100000
80000
60000
40000
20000
0
6620
6640
6660
6680
6700
6720
Wavelength (Å)
6677.
2817
6662.
2686
6643.
6976
6638.
2207
6658.
6774
6666.
3588
6674.
6969
6684.
2929

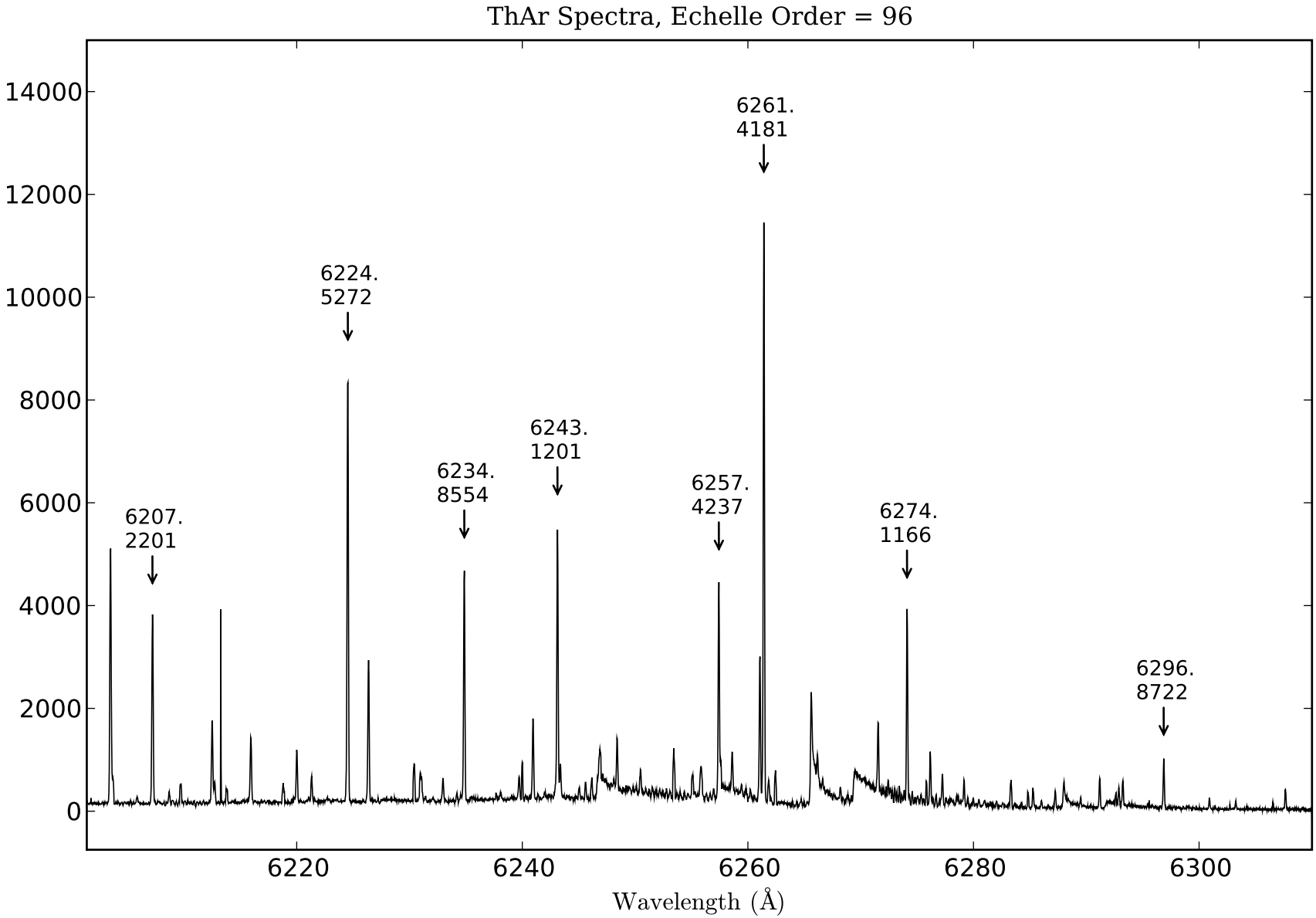

ThAr Spectra, Echelle Order = 91
6583.
9060
6588.
5396
6591.
4845
6593.
9391
6577.
2146
6619.
9458
100000
80000
60000
40000
20000
0
6560
6580
6600
6620
6640
Wavelength (Å)

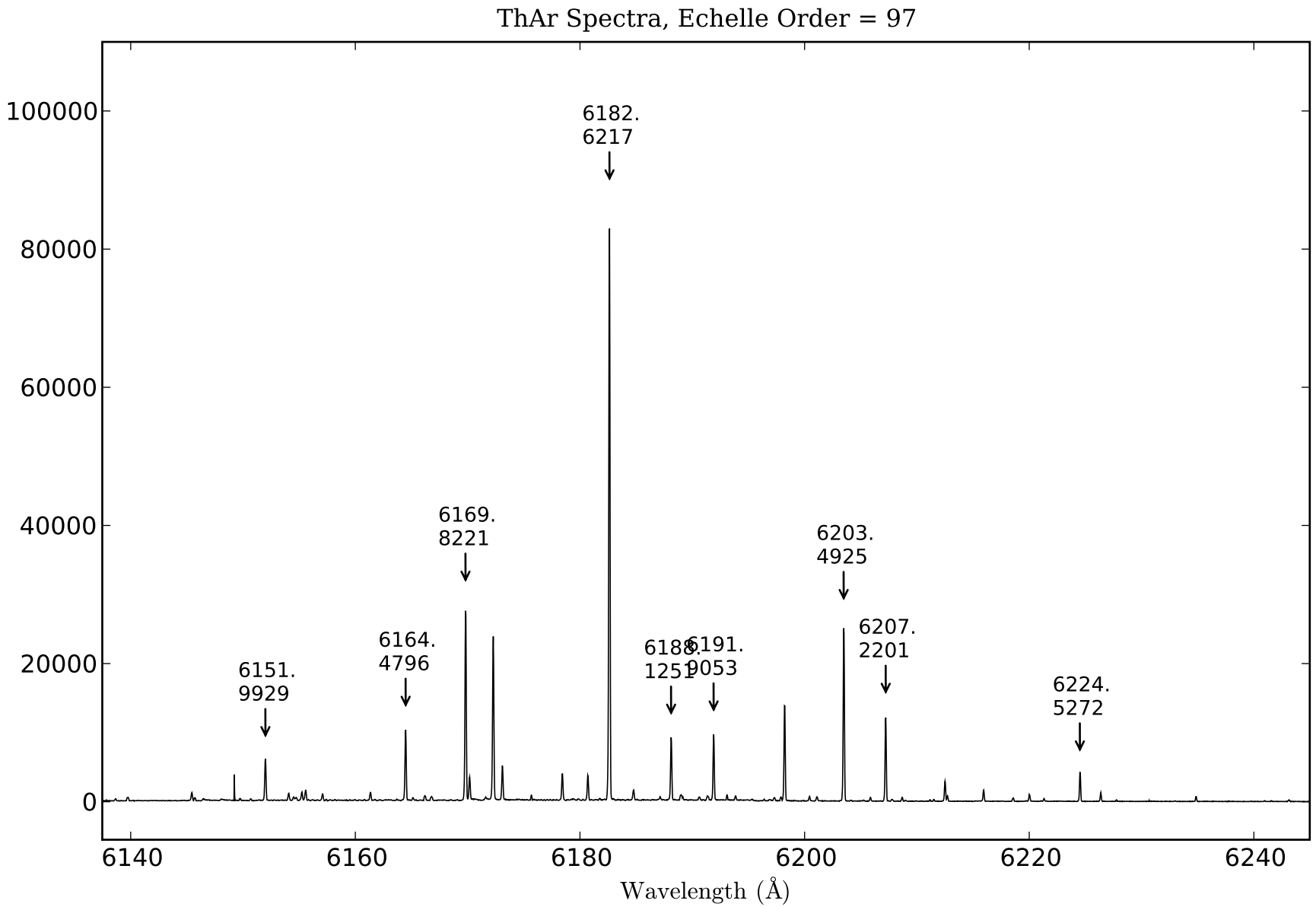

ThAr Spectra, Echelle Order = 92
50000
40000
30000
20000
10000
0
6480
6500
6520
6540
6560
6580
Wavelength (Å)
6531.
3418
6512.
3639
6490.
7372
6522.
0432
6554.
1603

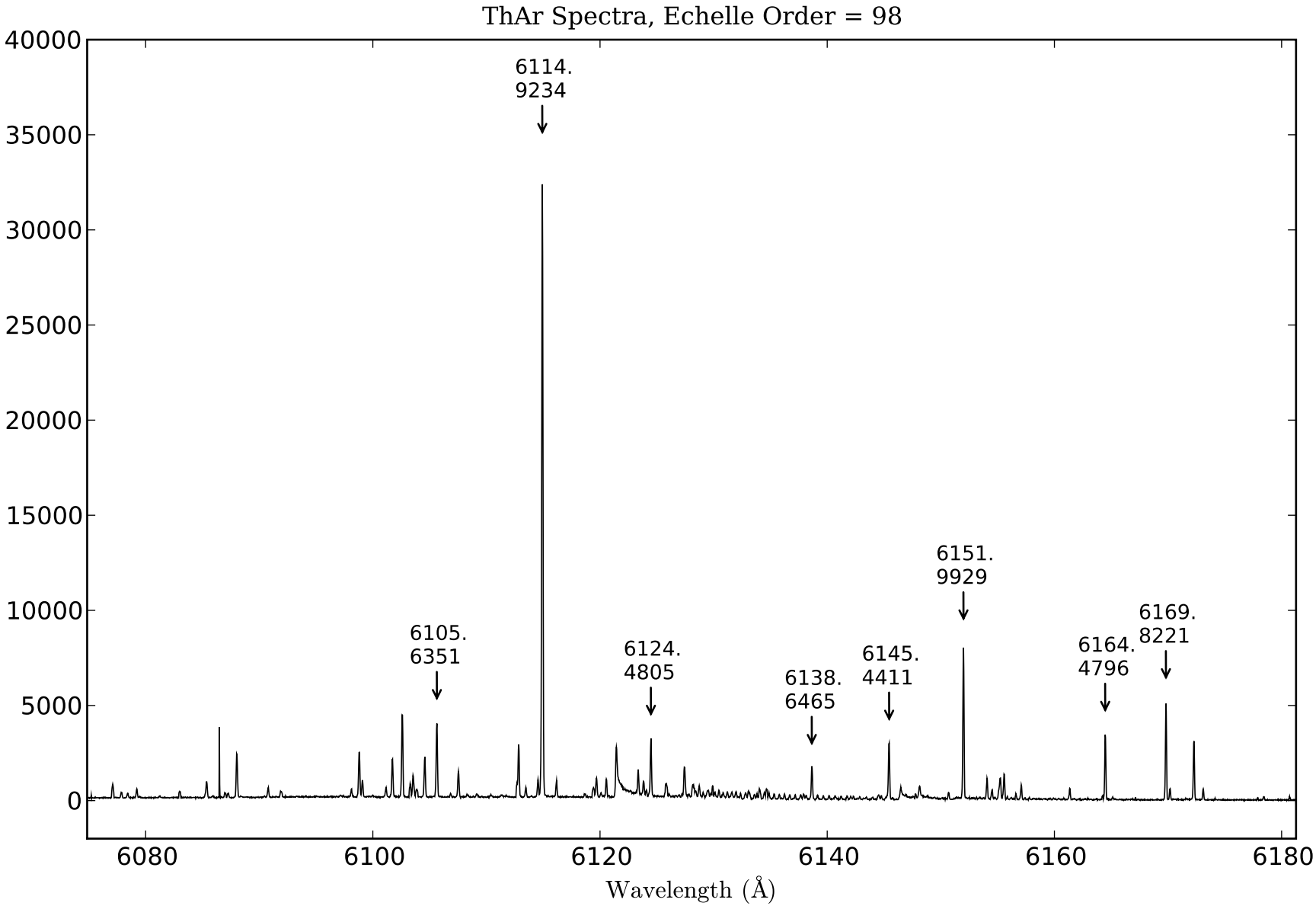

ThAr Spectra, Echelle Order = 93
100000
80000
60000
40000
20000
0
6457.
2824
6416.
3071
6411.
8991
6437.
7613
6483.
0825
6490.
7372
6420
6440
6460
6480
6500
Wavelength (Å)

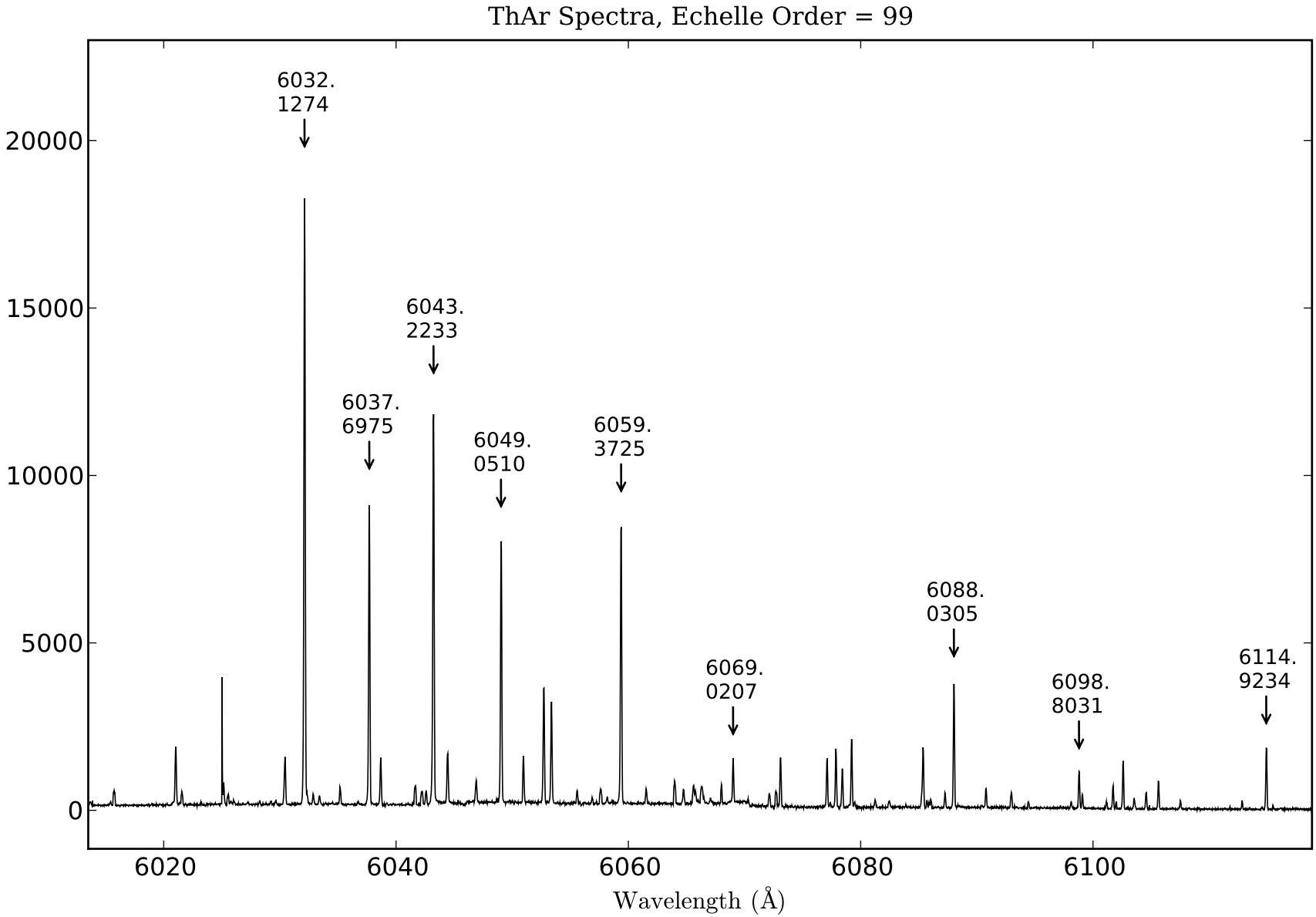

ThAr Spectra, Echelle Order = 94
25000
20000
15000
10000
5000
0
6340
6360
6380
6400
6420
6440
Wavelength (Å)
6342.
8595
6348.
7375
6355.
9108
6371.
9436
6376.
9305
6384.
7169
6387.
3957
6411.
8991
6413.
6145
6416.
3071

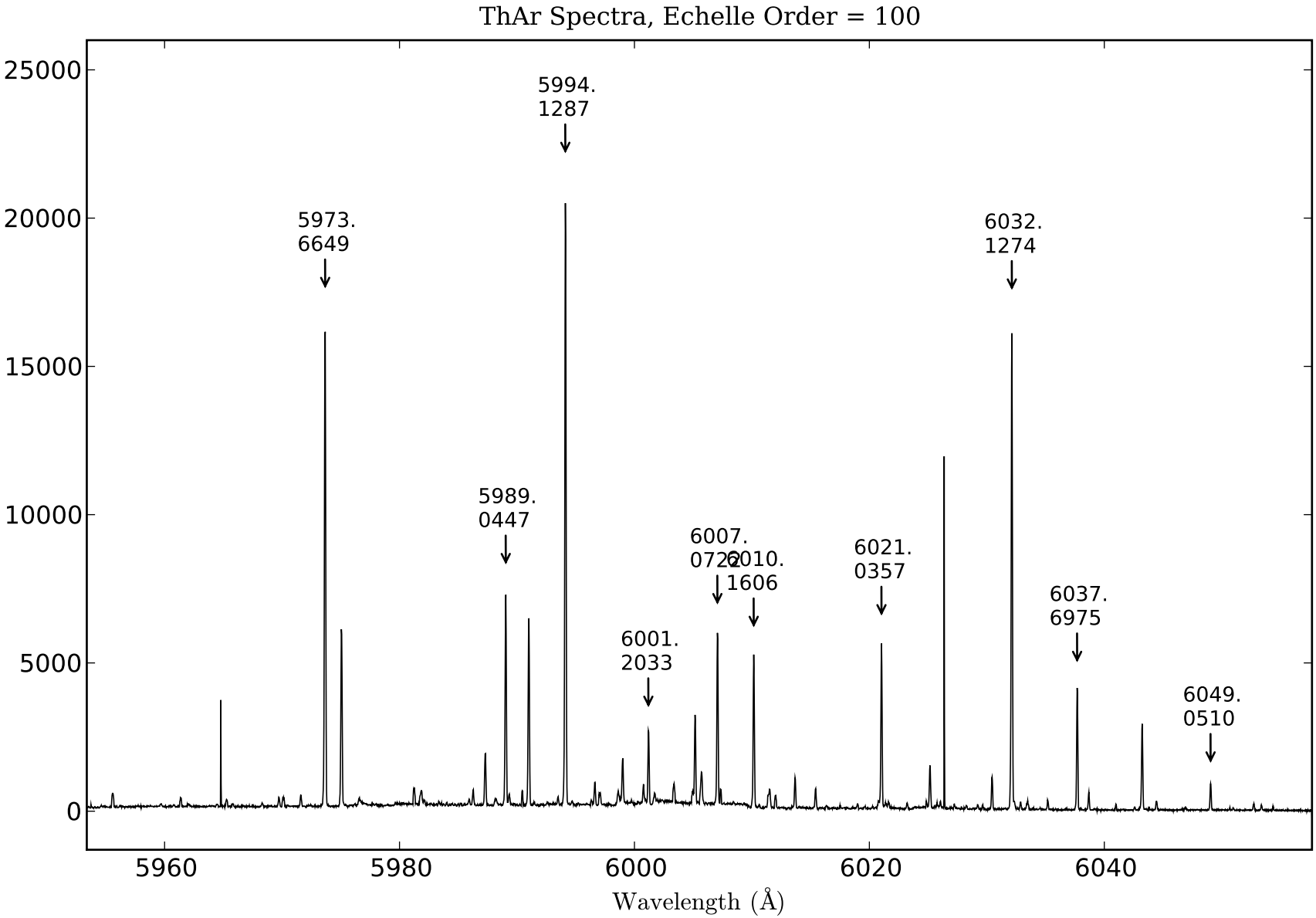

ThAr Spectra, Echelle Order = 95
15000
10000
5000
0
6280
6300
6320
6340
6360
Wavelength (Å)
6342.
8595
6327.
2778
6307.
6570
6296.
8722
6315.
7750
6337.
6201
6348.
7375
6355.
9108
6346.
1209

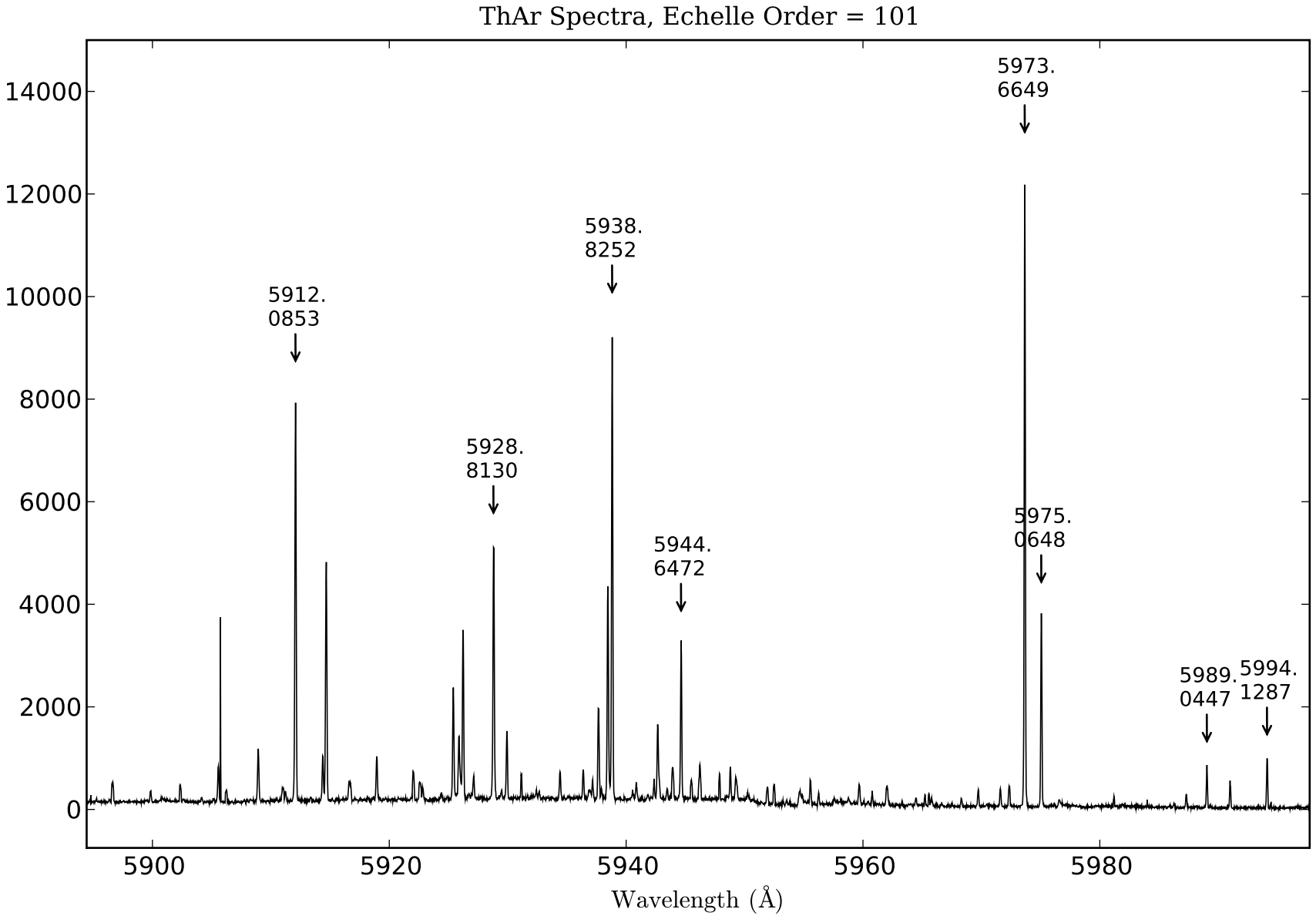

ThAr Spectra, Echelle Order = 96
14000
12000
10000
8000
6000
4000
2000
0
6220
6240
6260
6280
6300
Wavelength (Å)
6207.
2201
6224.
5272
6234.
8554
6243.
1201
6257.
4237
6261.
4181
6274.
1166
6296.
8722

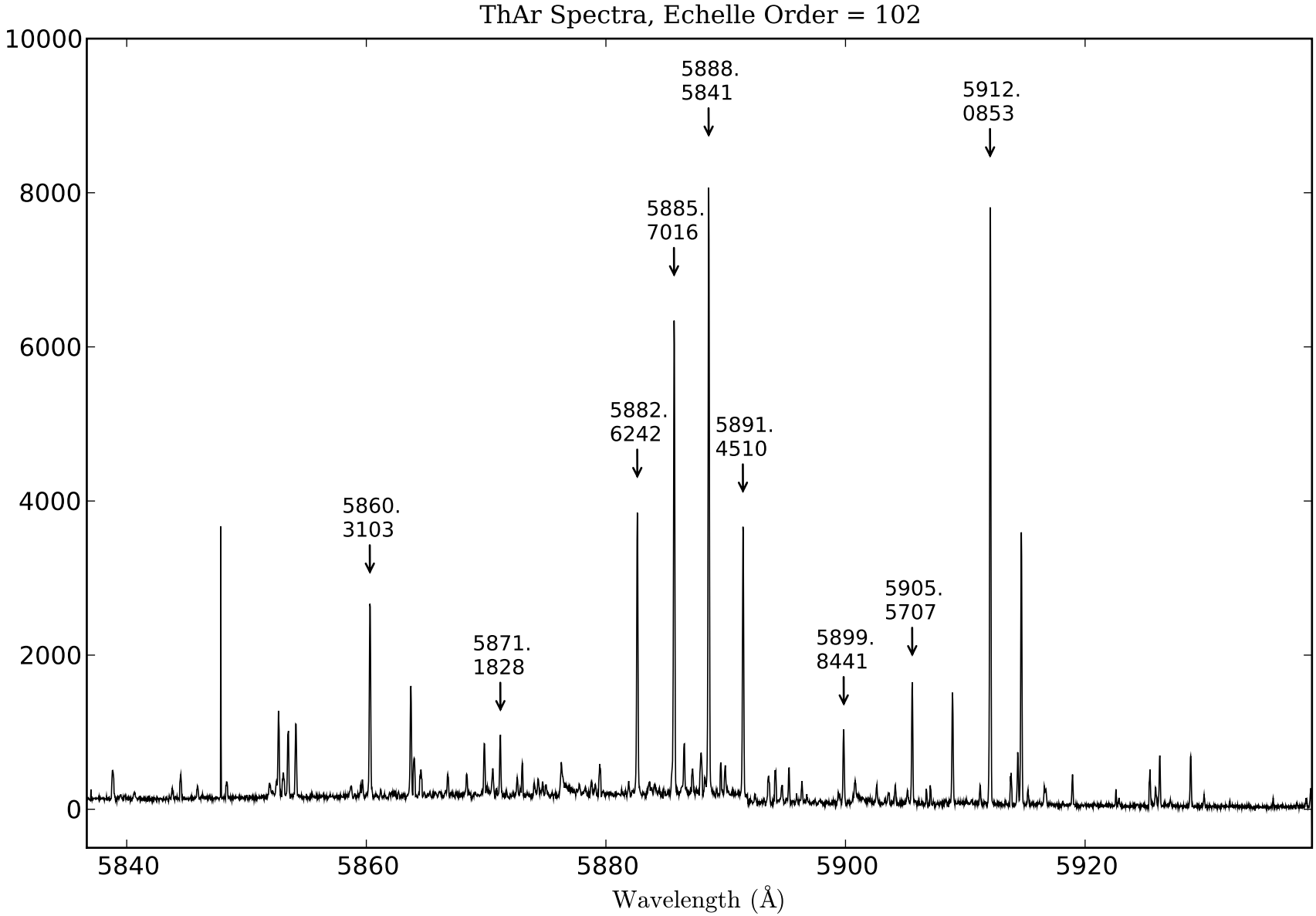

ThAr Spectra, Echelle Order = 97
100000
80000
60000
40000
20000
0
6140
6160
6180
6200
6220
6240
Wavelength (Å)
6151.
9929
6164.
4796
6169.
8221
6182.
6217
6188.
1251
6191.
9053
6203.
4925
6207.
2201
6224.
5272

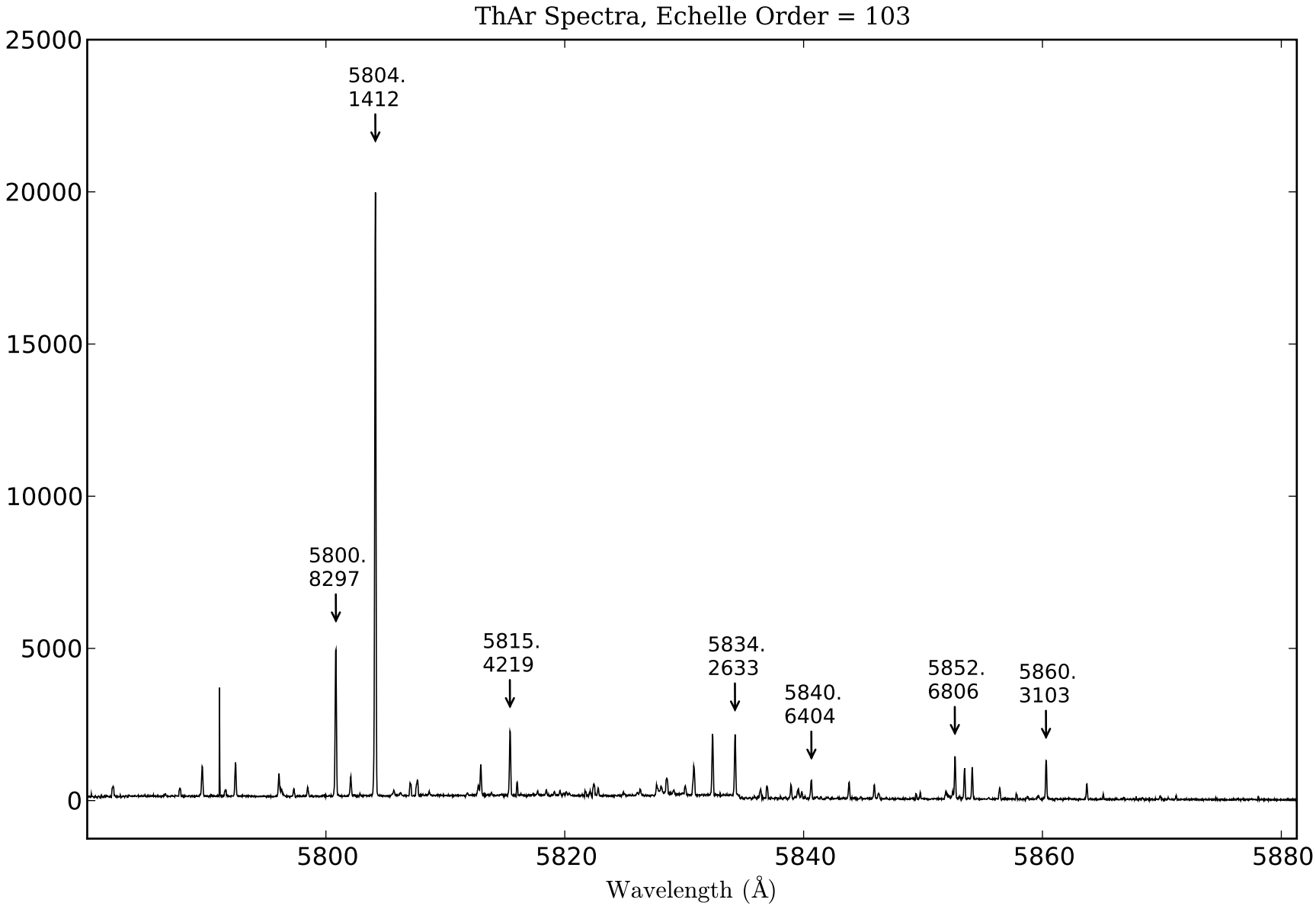

ThAr Spectra, Echelle Order = 98
40000
35000
30000
25000
20000
15000
10000
5000
0
6114.
9234
6105.
6351
6124.
4805
6138.
6465
6145.
4411
6151.
9929
6164.
4796
6169.
8221
6080
6100
6120
6140
6160
6180
Wavelength (Å)

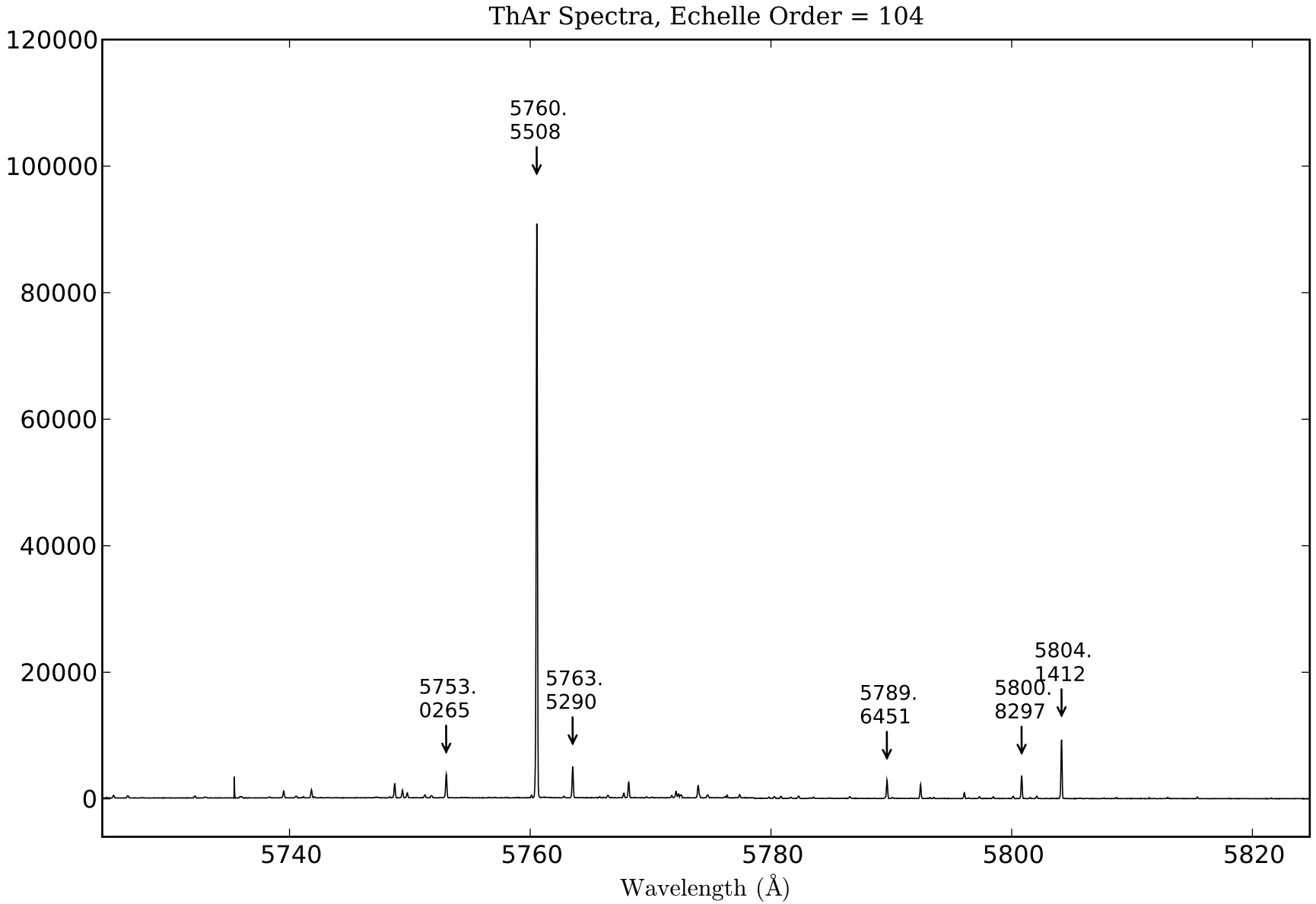

ThAr Spectra, Echelle Order = 99
6032.
1274
6043.
2233
6037.
6975
6049.
0510
6059.
3725
6088.
0305
6069.
0207
6098.
8031
6114.
9234
20000
15000
10000
5000
0
6020
6040
6060
6080
6100
Wavelength (Å)

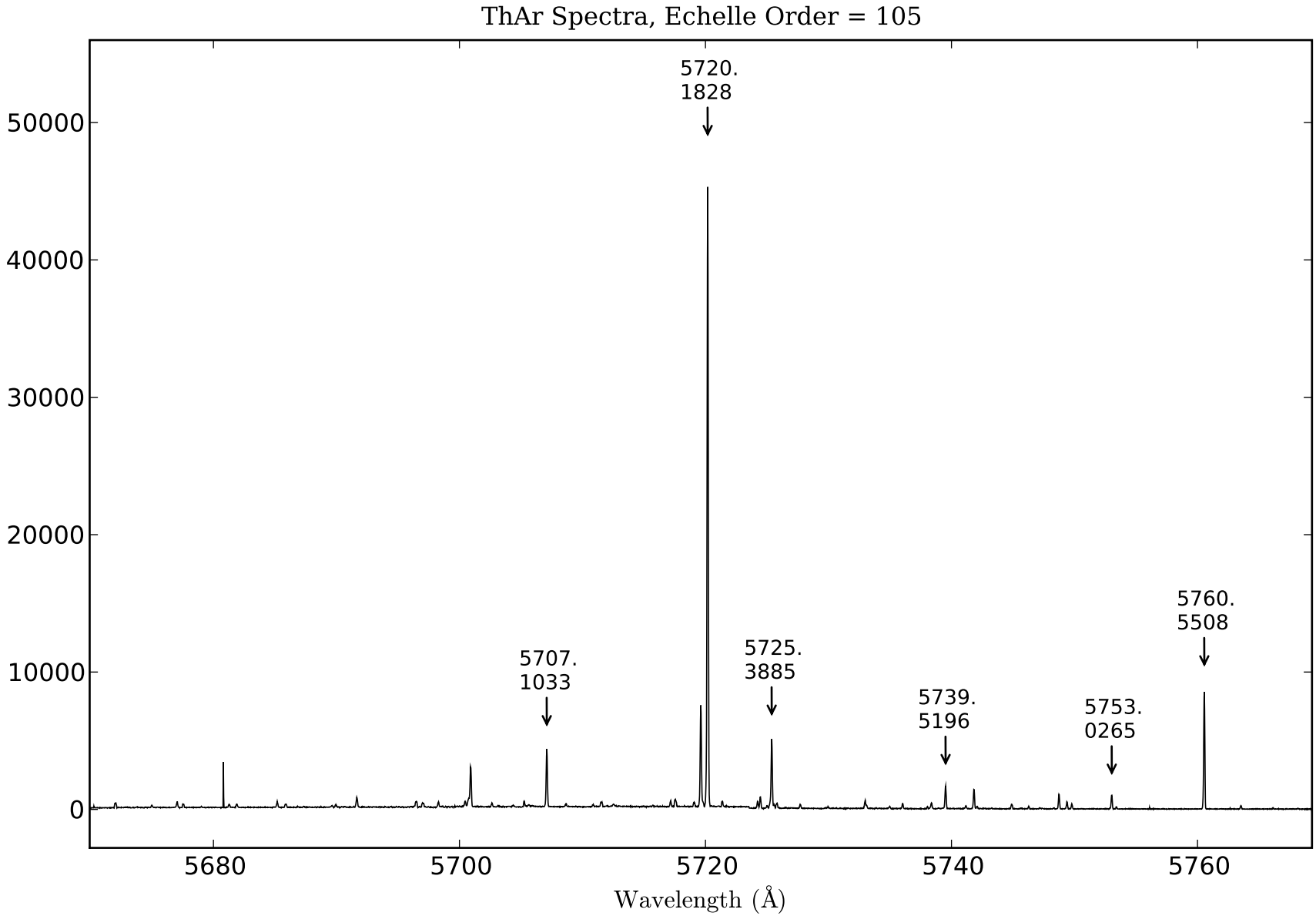

ThAr Spectra, Echelle Order = 100
25000
20000
15000
10000
5000
0
5960
5980
6000
6020
6040
Wavelength (Å)
5973.
6649
5989.
0447
5994.
1287
6001.
2033
6007.
0726
6010.
1606
6021.
0357
6032.
1274
6037.
6975
6049.
0510

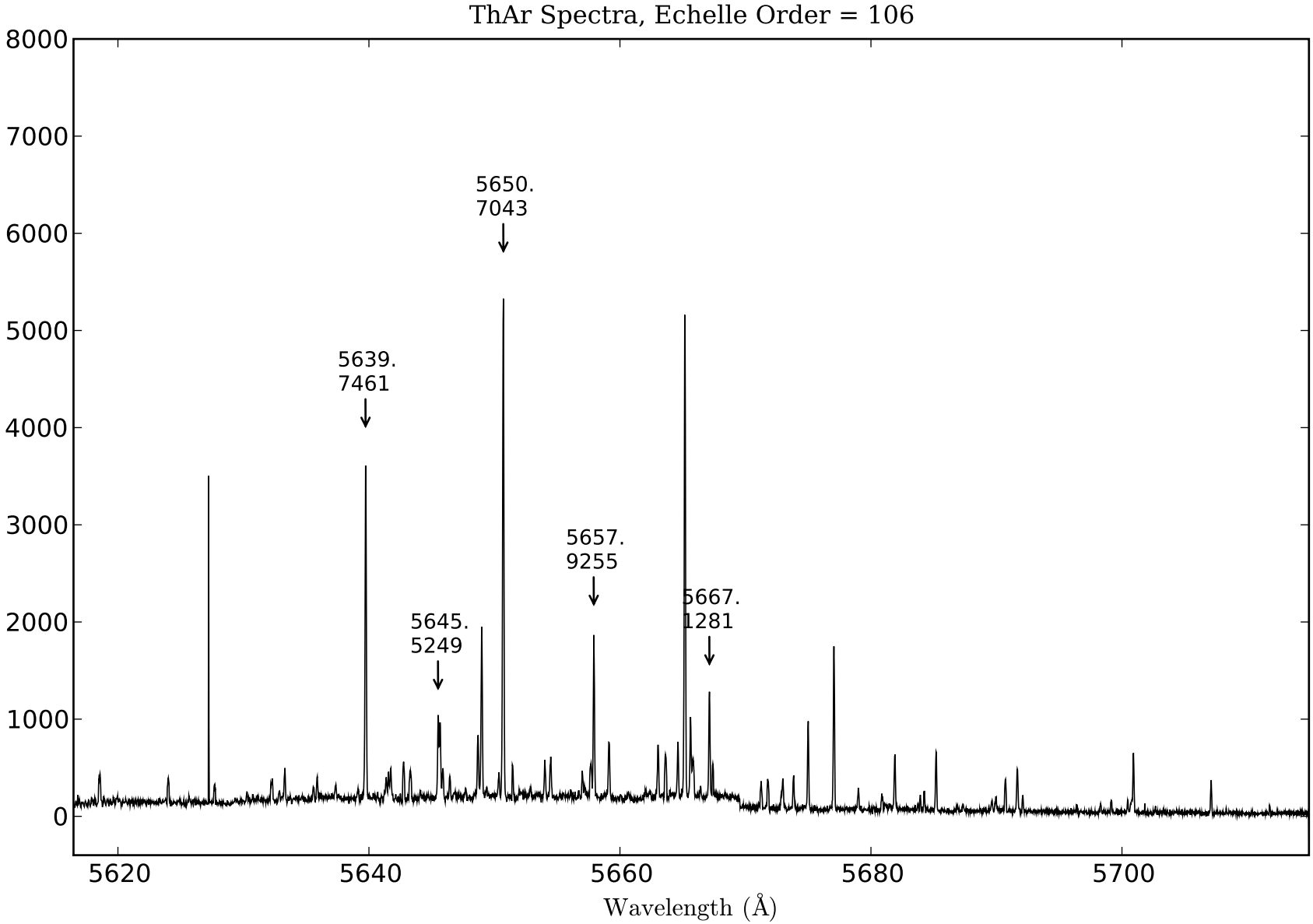

ThAr Spectra, Echelle Order = 101
14000
12000
10000
8000
6000
4000
2000
0
5900
5920
5940
5960
5980
Wavelength (Å)
5912.
0853
5928.
8130
5938.
8252
5944.
6472
5973.
6649
5975.
0648
5989.
0447
5994.
1287

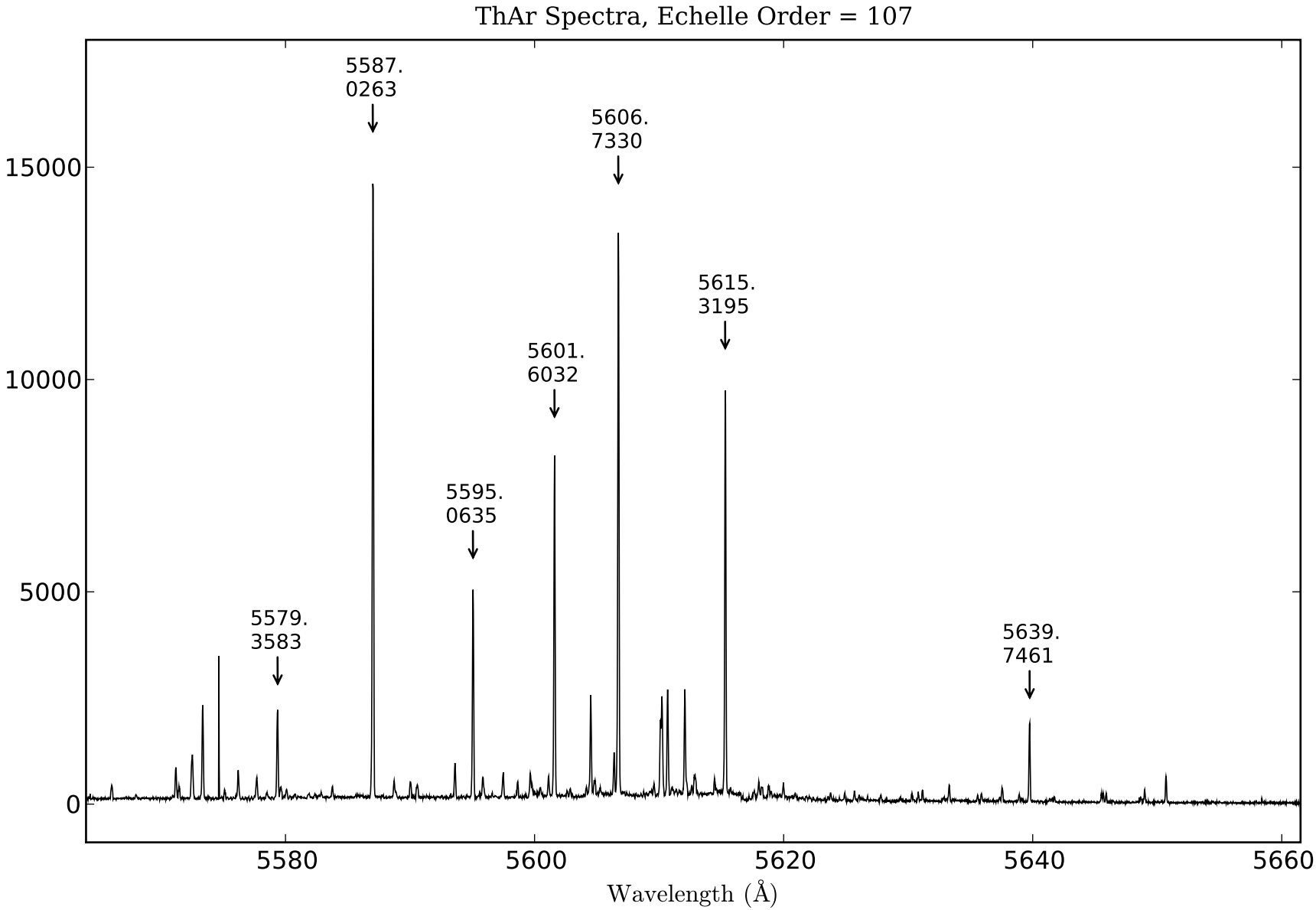

ThAr Spectra, Echelle Order = 102
10000
8000
6000
4000
2000
0
5840
5860
5880
5900
5920
Wavelength (Å)
5888.
5841
5912.
0853
5885.
7016
5882.
6242
5891.
4510
5860.
3103
5871.
1828
5905.
5707
5899.
8441

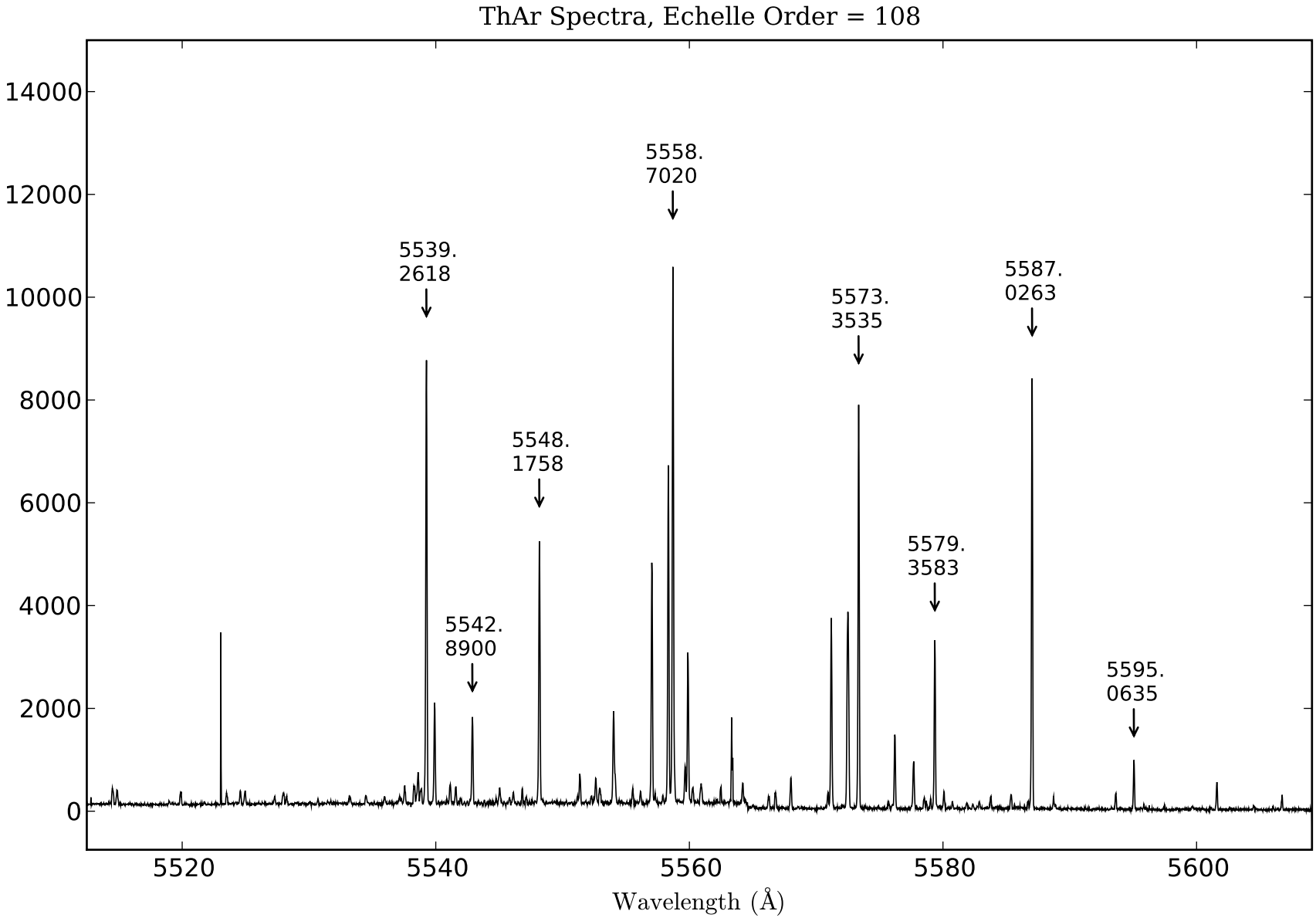

ThAr Spectra, Echelle Order = 103
25000
20000
15000
10000
5000
0
5804.
1412
5800.
8297
5815.
4219
5834.
2633
5840.
6404
5852.
6806
5860.
3103
5800
5820
5840
5860
5880
Wavelength (Å)

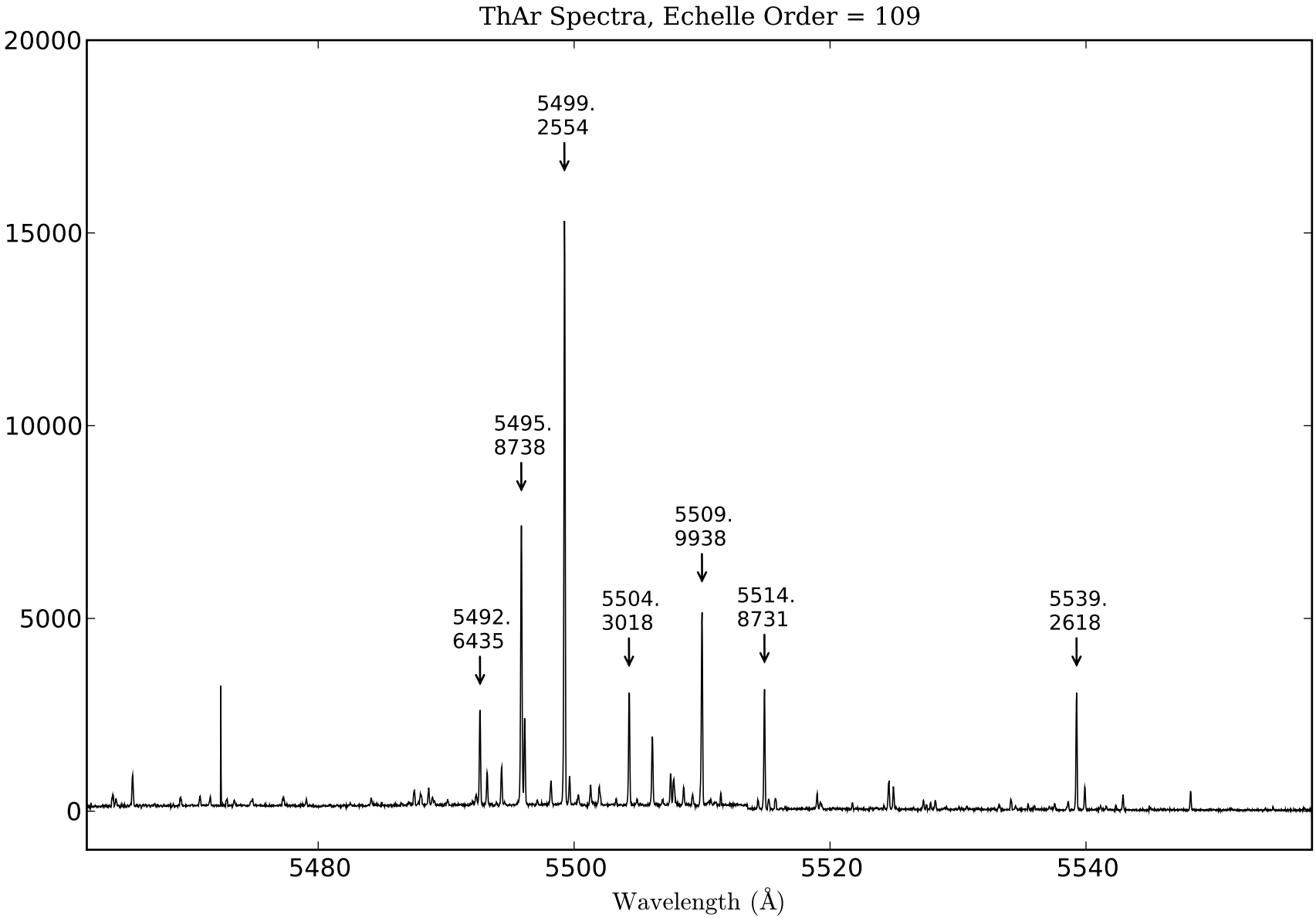

ThAr Spectra, Echelle Order = 104
120000
100000
80000
60000
40000
20000
0
5760.
5508
5753.
0265
5763.
5290
5789.
6451
5800.
8297
5804.
1412
5740
5760
5780
5800
5820
Wavelength (Å)

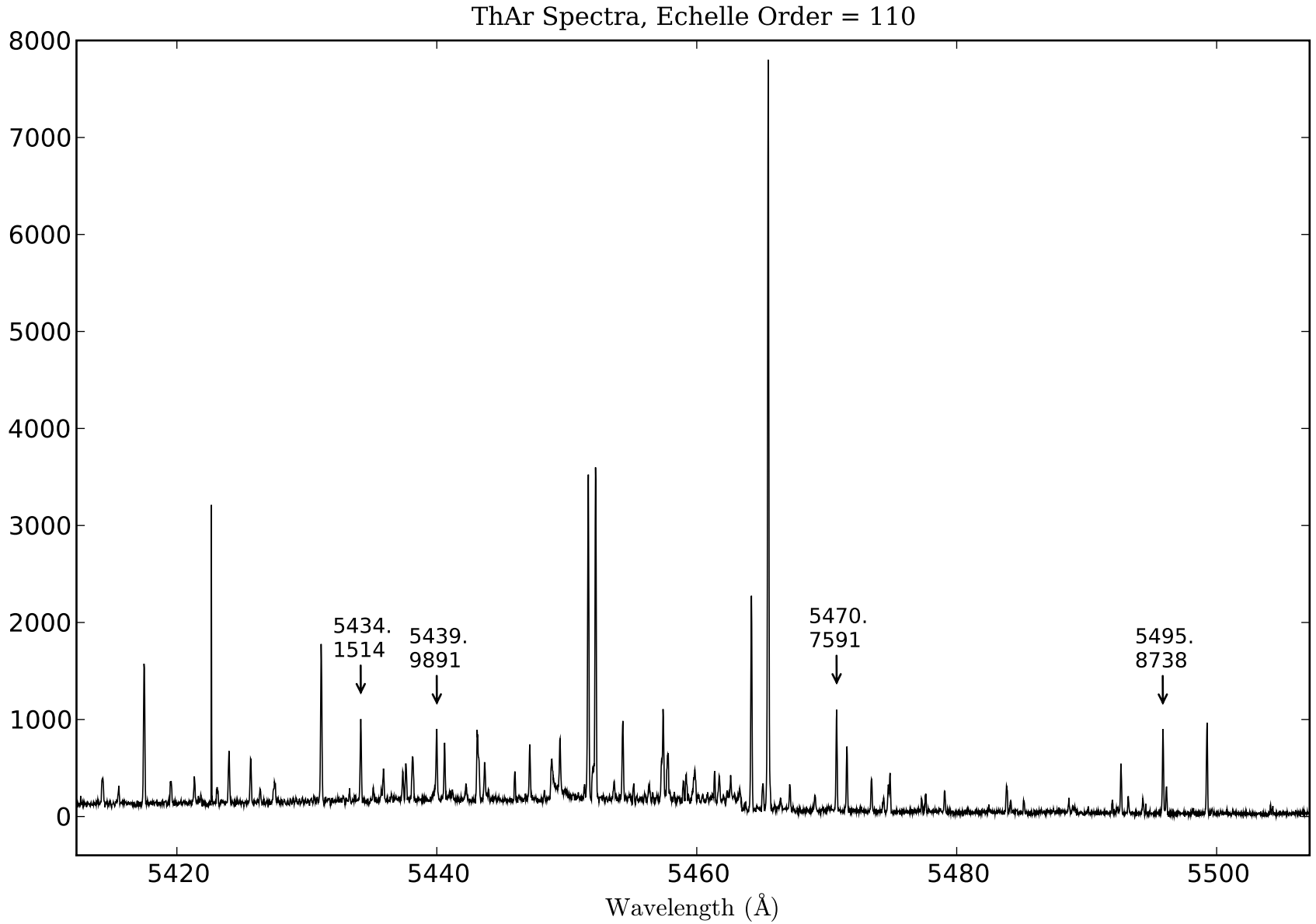

ThAr Spectra, Echelle Order = 105
5720.
1828
5707.
1033
5725.
3885
5739.
5196
5753.
0265
5760.
5508
50000
40000
30000
20000
10000
0
5680
5700
5720
5740
5760
Wavelength (Å)

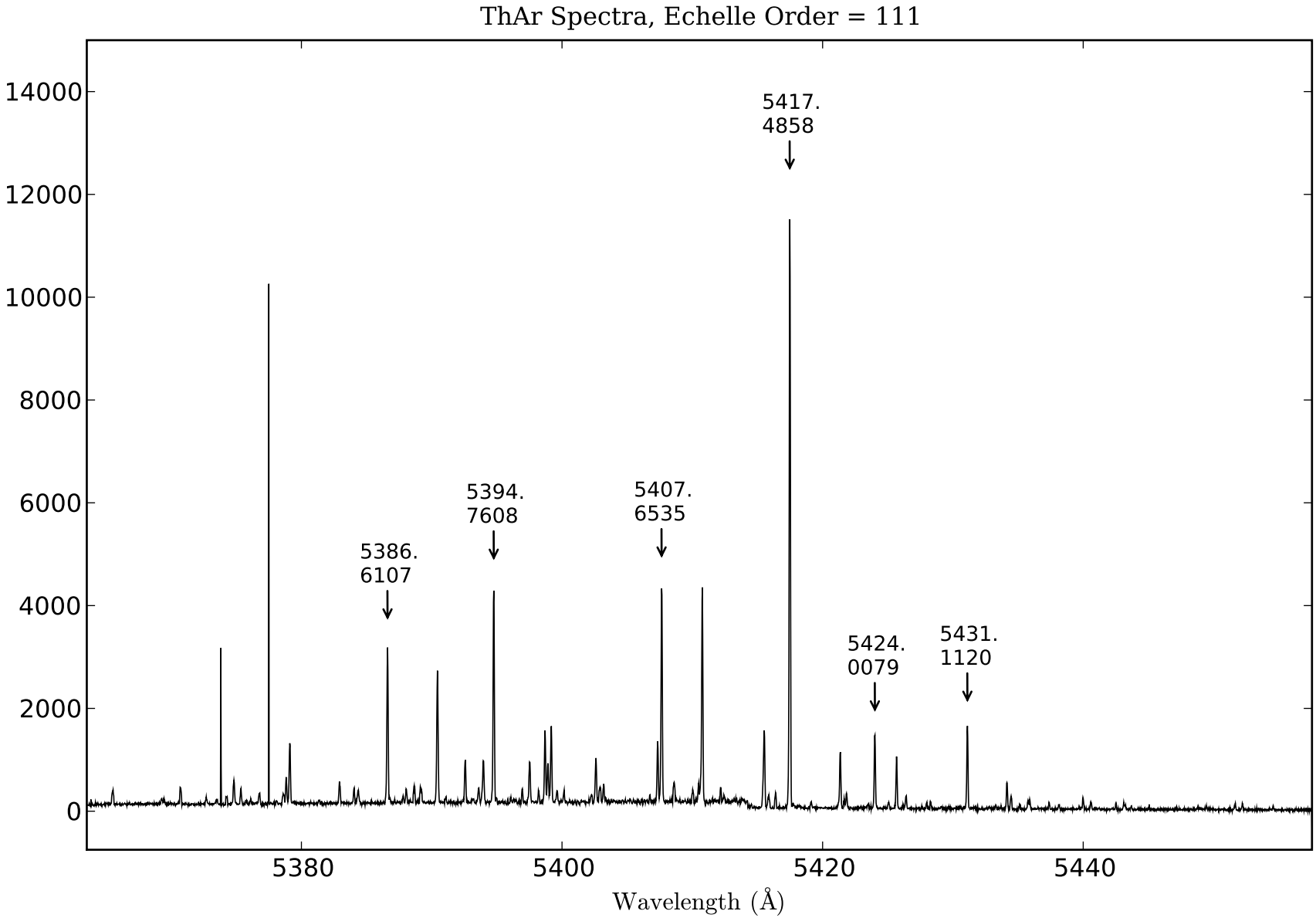

ThAr Spectra, Echelle Order = 106
8000
7000
6000
5000
4000
3000
2000
1000
0
5620
5640
5660
5680
5700
Wavelength (Å)
5650.
7043
5639.
7461
5645.
5249
5657.
9255
5667.
1281

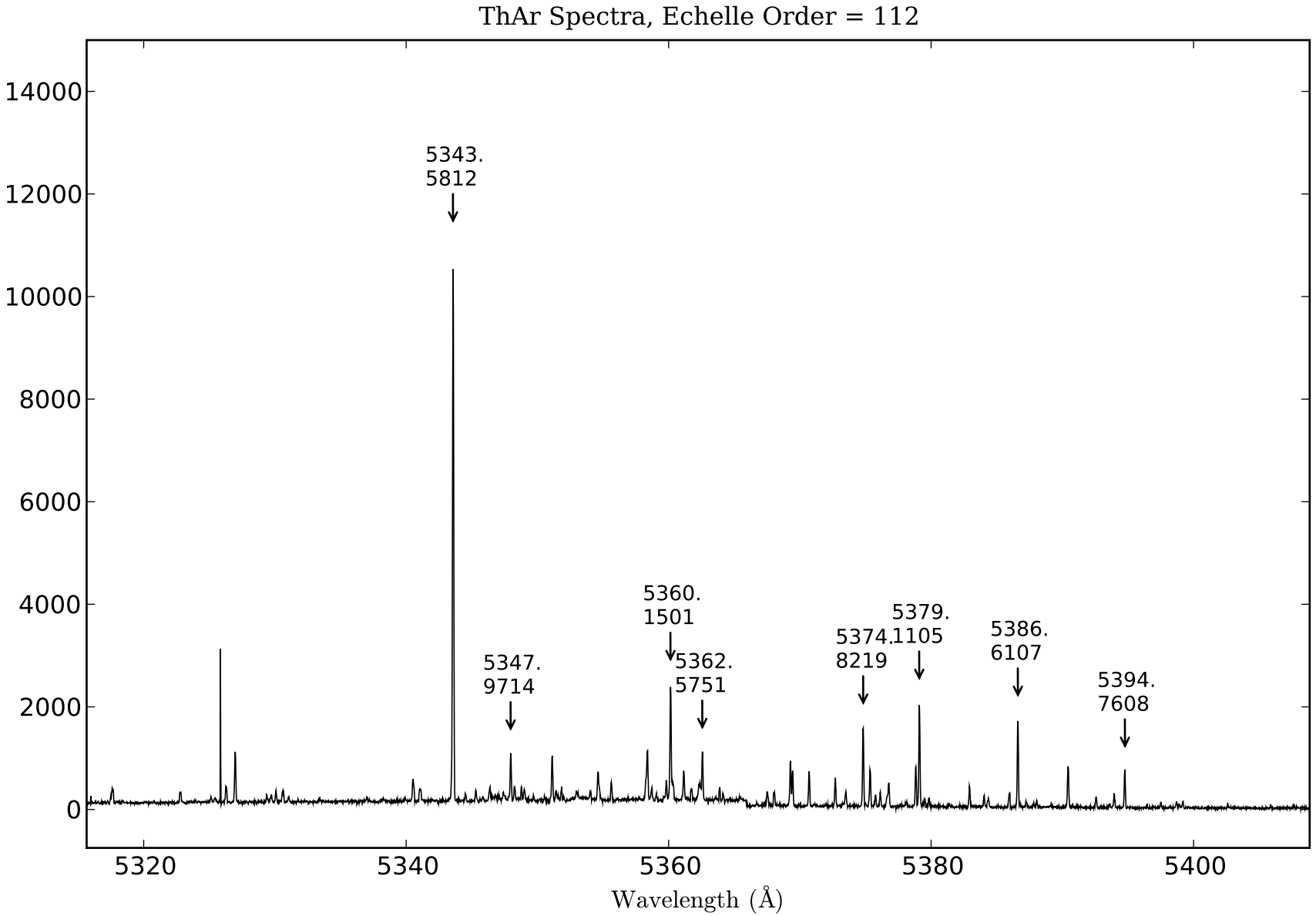

ThAr Spectra, Echelle Order = 107
5587.
0263
5606.
7330
5615.
3195
5601.
6032
5595.
0635
5579.
3583
5639.
7461
15000
10000
5000
0
5580
5600
5620
5640
5660
Wavelength (Å)

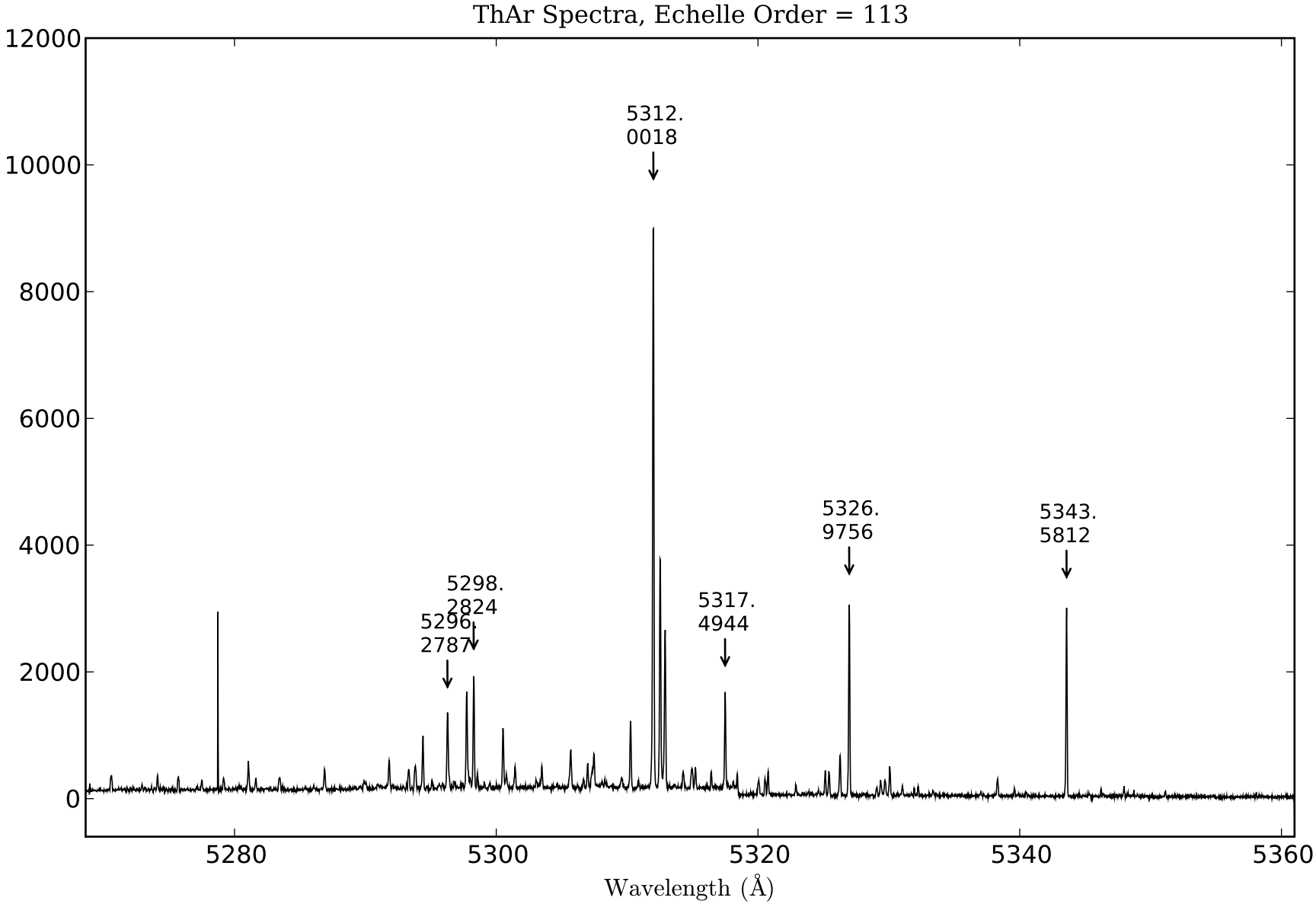

ThAr Spectra, Echelle Order = 108
14000
12000
10000
8000
6000
4000
2000
0
5520
5540
5560
5580
5600
Wavelength (Å)
5539.
2618
5558.
7020
5573.
3535
5587.
0263
5548.
1758
5579.
3583
5542.
8900
5595.
0635

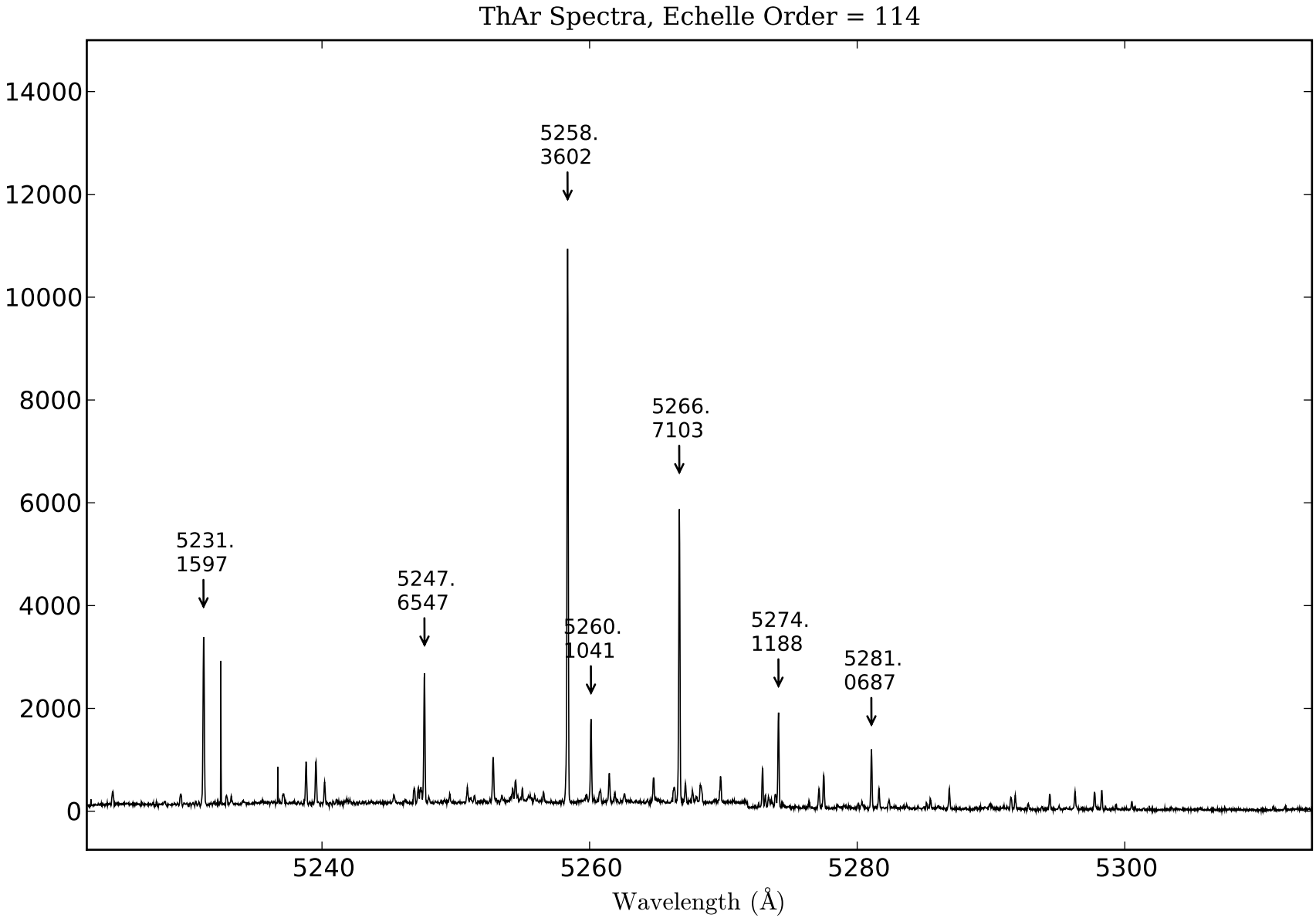

ThAr Spectra, Echelle Order = 109
20000
15000
10000
5000
0
5499.
2554
5495.
8738
5509.
9938
5504.
3018
5514.
8731
5492.
6435
5539.
2618
5480
5500
5520
5540
Wavelength (Å)

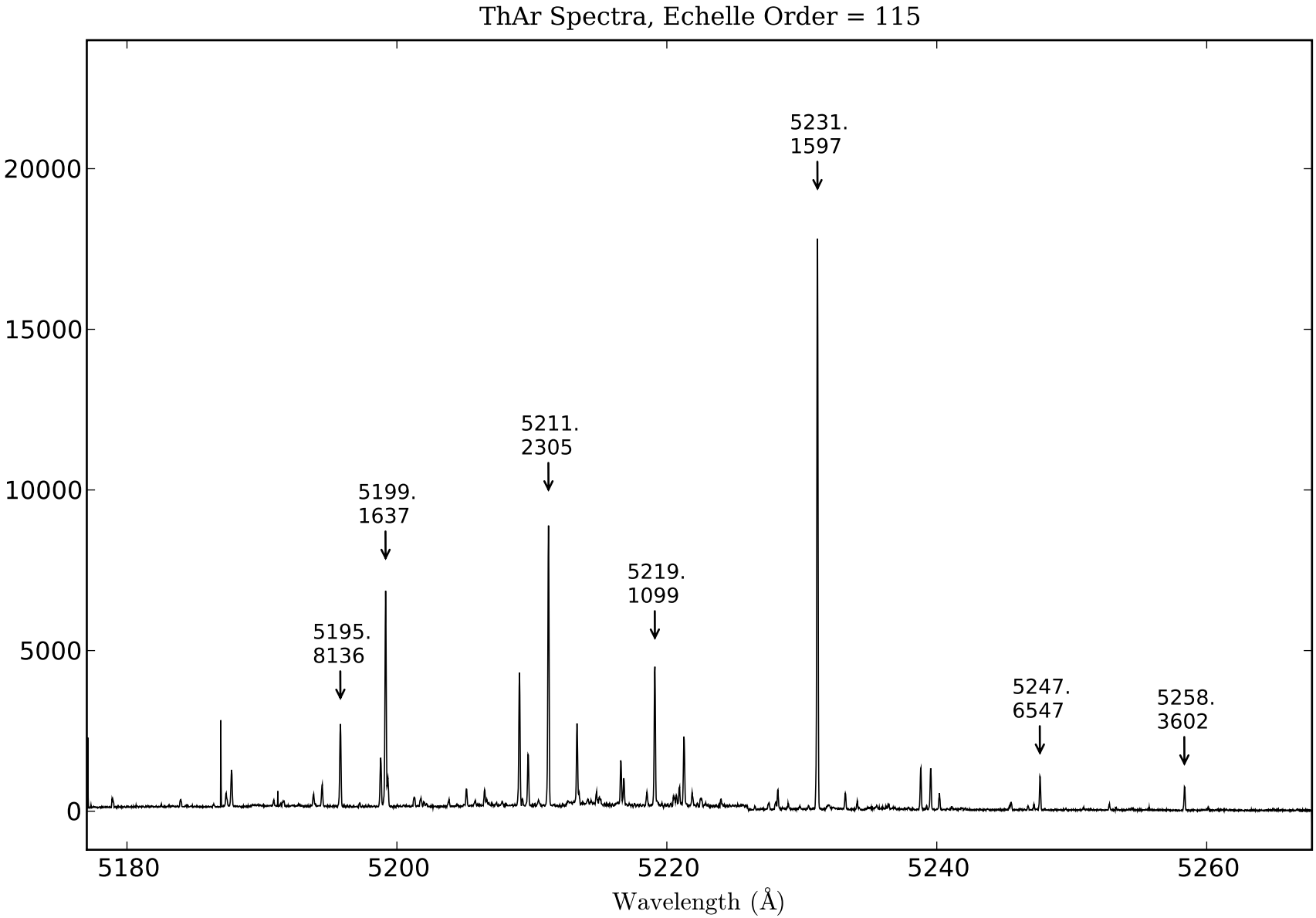

ThAr Spectra, Echelle Order = 110
8000
7000
6000
5000
4000
3000
2000
1000
0
5434.
1514
5439.
9891
5470.
7591
5495.
8738
5420
5440
5460
5480
5500
Wavelength (Å)

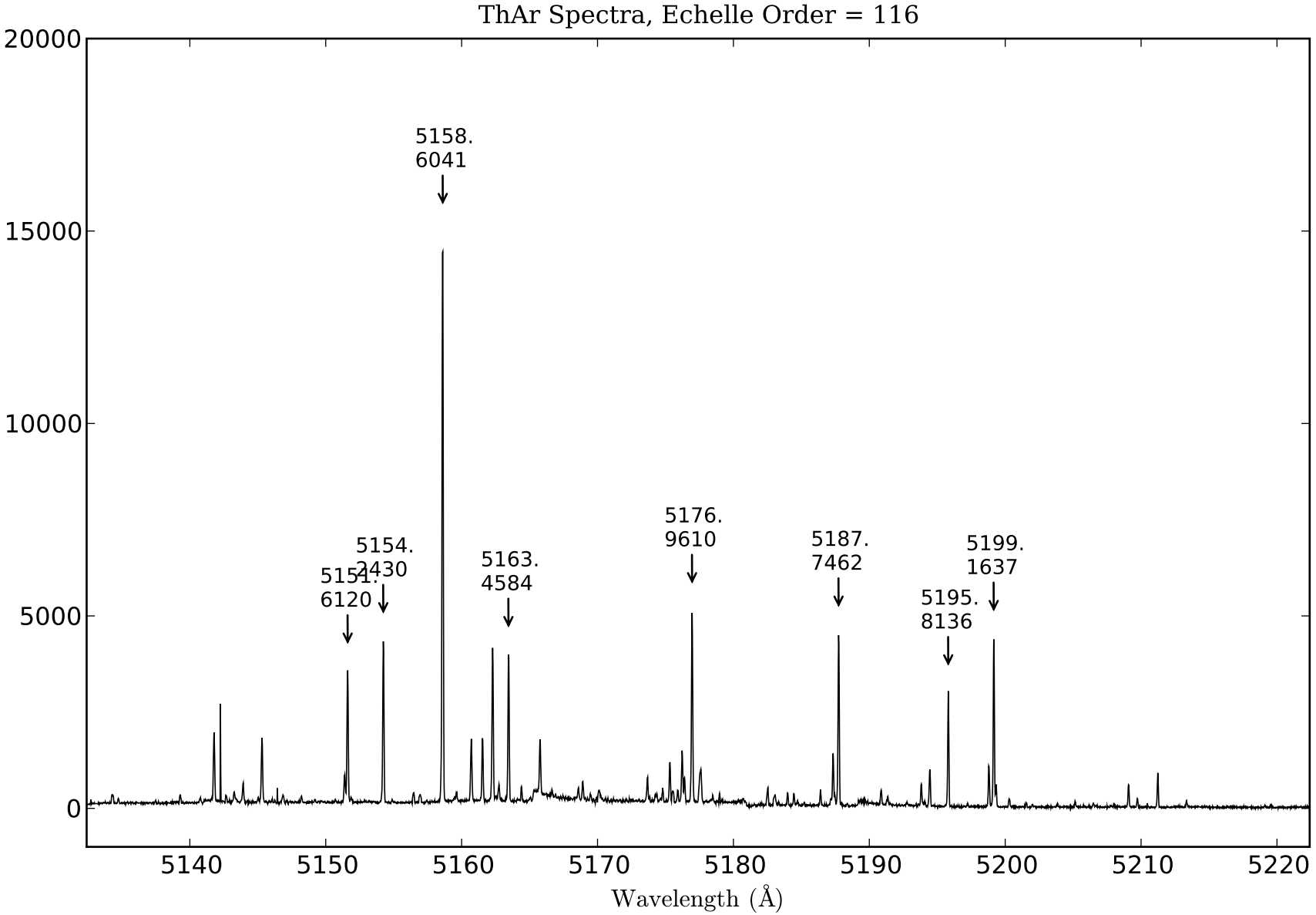

ThAr Spectra, Echelle Order = 111
14000
12000
10000
8000
6000
4000
2000
0
5380
5400
5420
5440
Wavelength (Å)
5417.
4858
5394.
7608
5407.
6535
5386.
6107
5424.
0079
5431.
1120

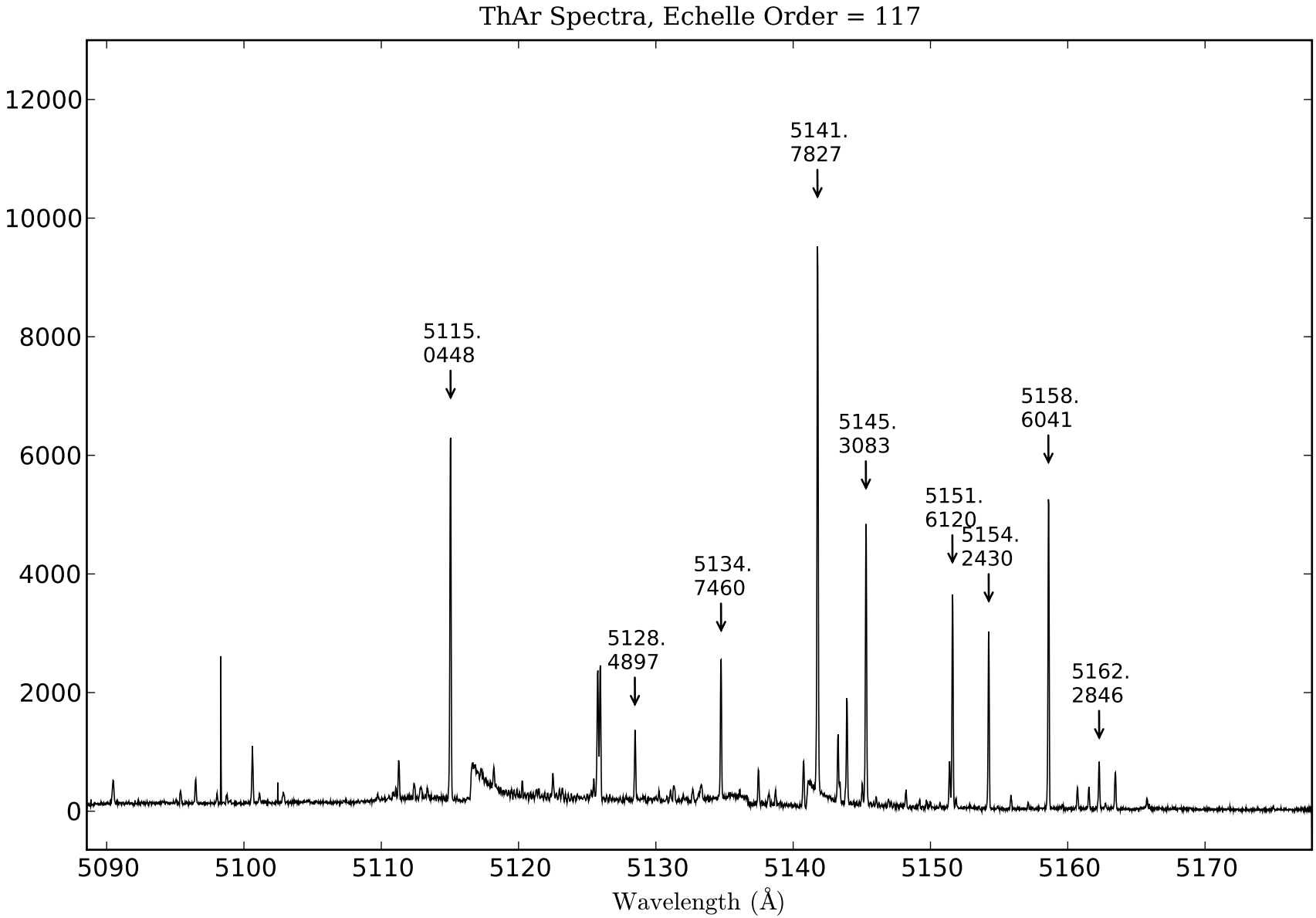

ThAr Spectra, Echelle Order = 112
14000
12000
10000
8000
6000
4000
2000
0
5320
5340
5360
5380
5400
Wavelength (Å)
5343.
5812
5347.
9714
5360.
1501
5362.
5751
5374.
8219
5379.
1105
5386.
6107
5394.
7608

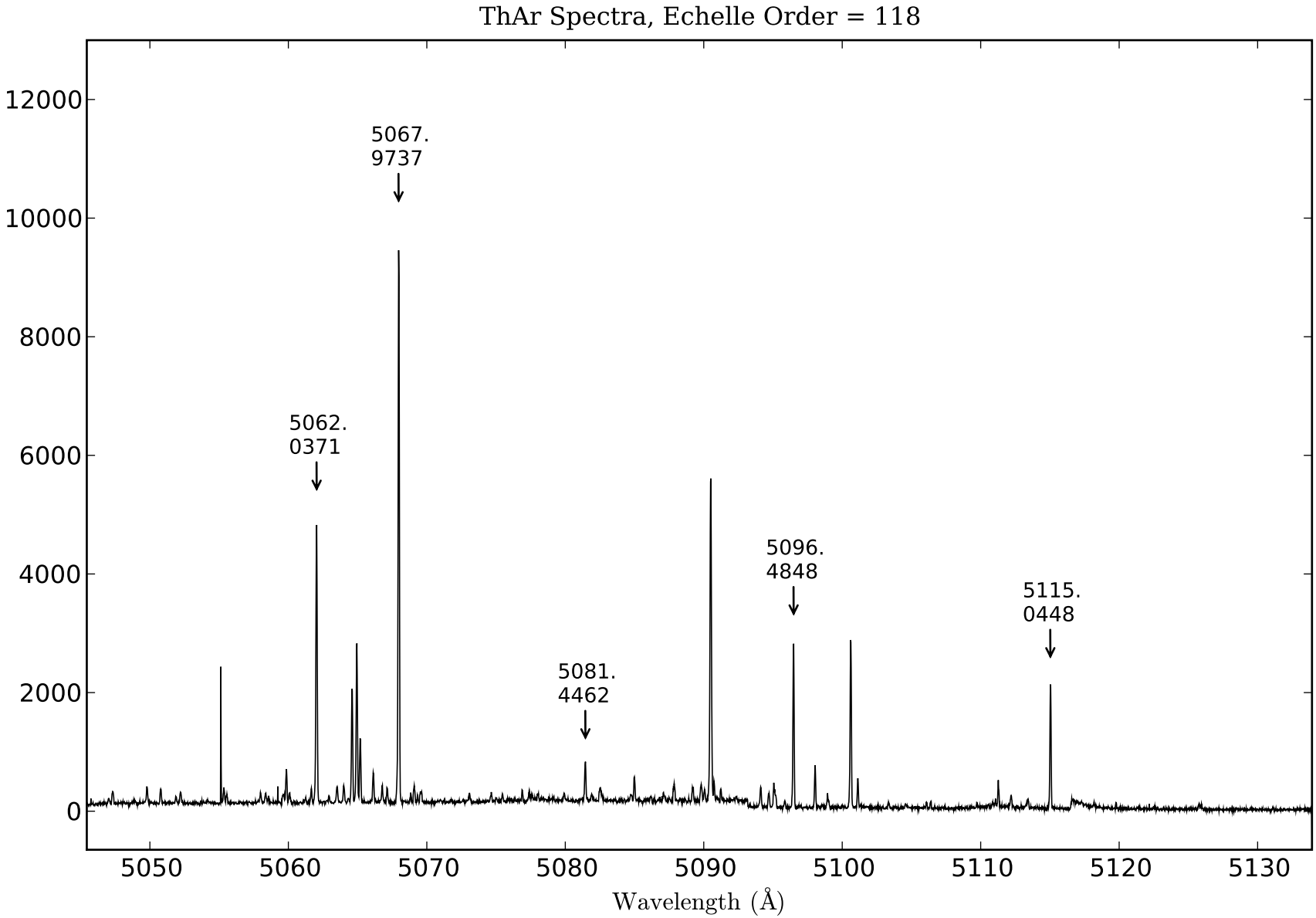

ThAr Spectra, Echelle Order = 113
12000
10000
8000
6000
4000
2000
0
5312.
0018
5326.
9756
5343.
5812
5298.
2824
5296.
2787
5317.
4944
5280
5300
5320
5340
5360
Wavelength (Å)

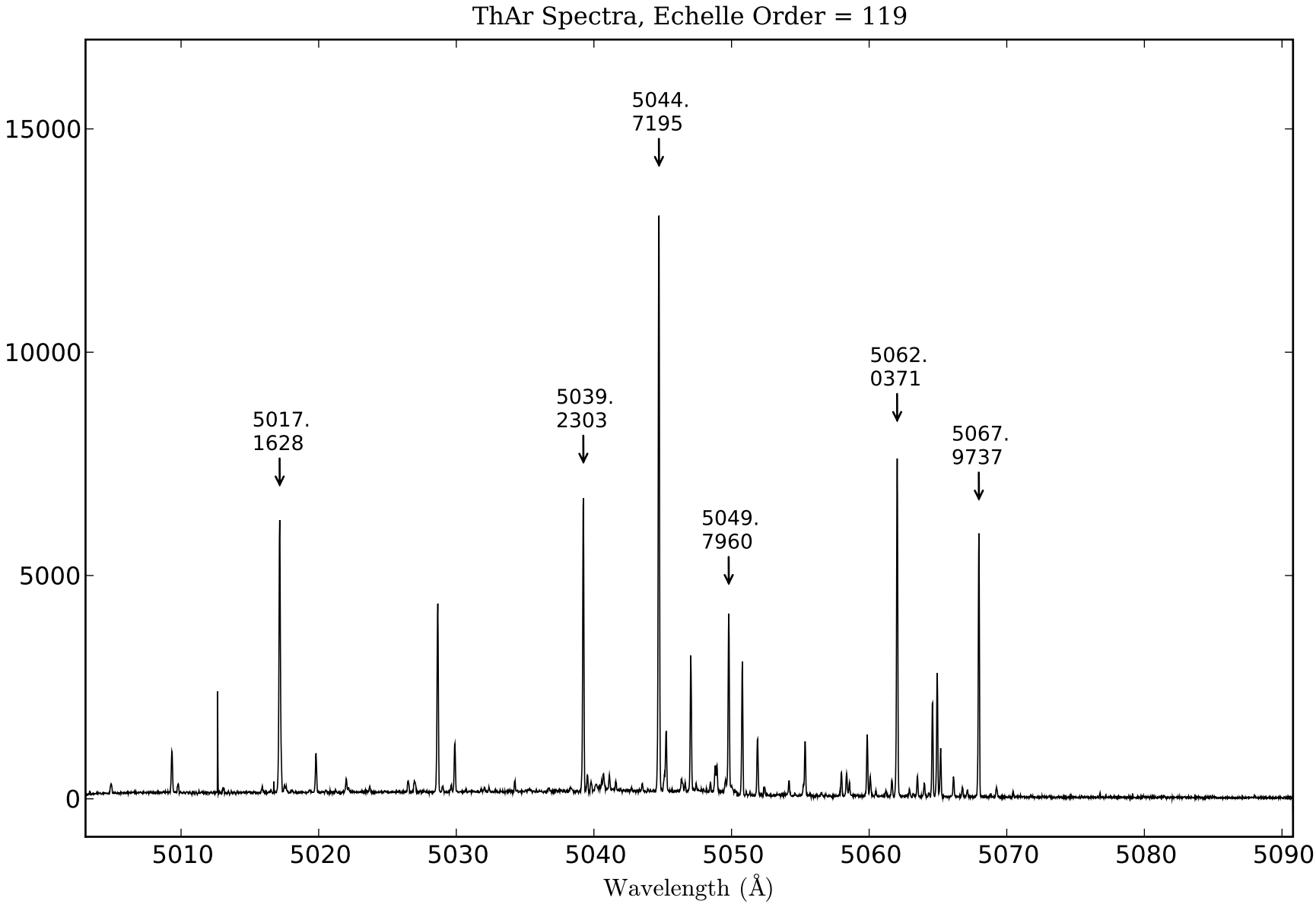

ThAr Spectra, Echelle Order = 114
14000
12000
10000
8000
6000
4000
2000
0
5240
5260
5280
5300
Wavelength (Å)
5231.
1597
5247.
6547
5258.
3602
5260.
1041
5266.
7103
5274.
1188
5281.
0687

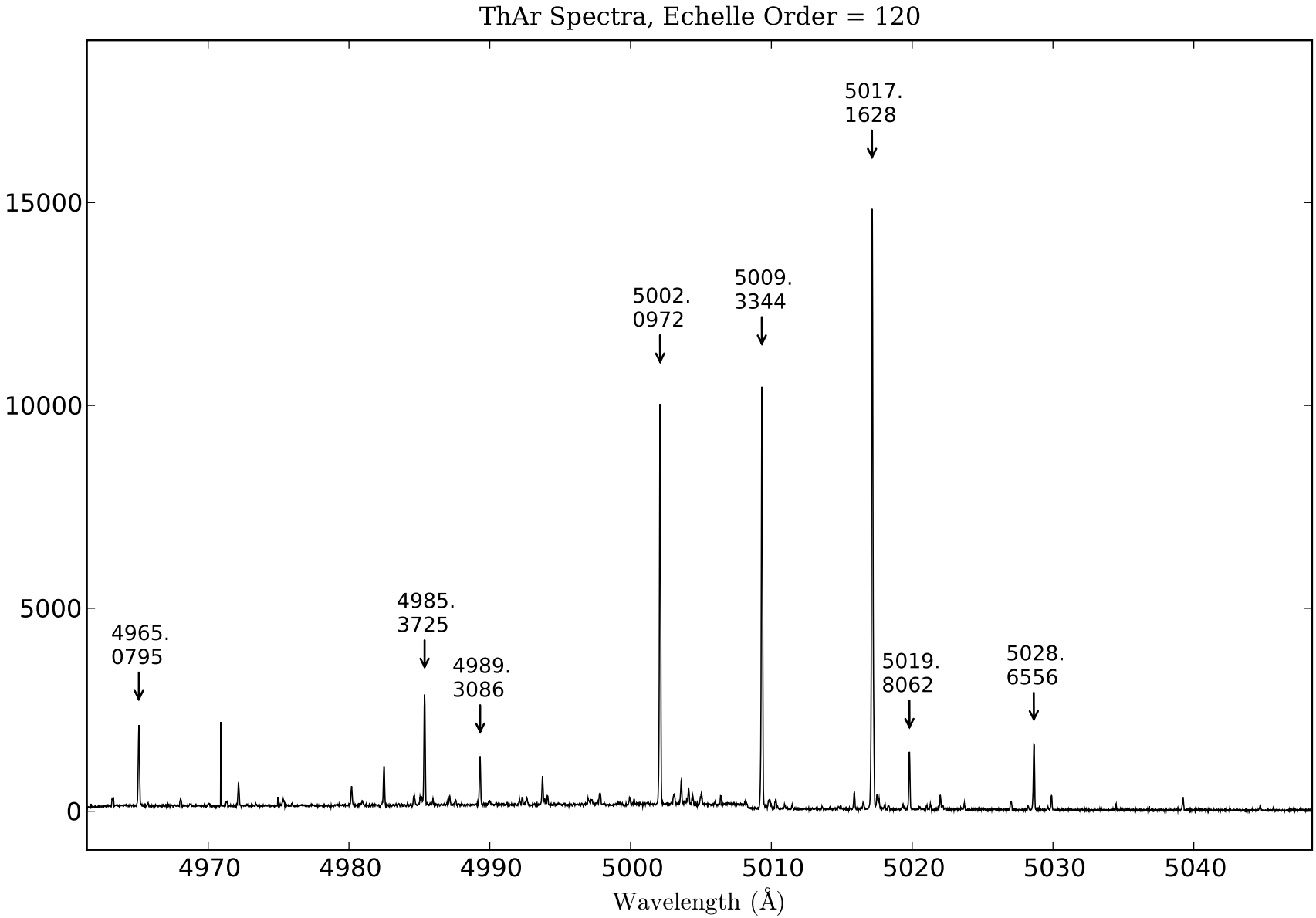

ThAr Spectra, Echelle Order = 115
20000
15000
10000
5000
0
5180
5200
5220
5240
5260
Wavelength (Å)
5231.
1597
5211.
2305
5199.
1637
5219.
1099
5195.
8136
5247.
6547
5258.
3602

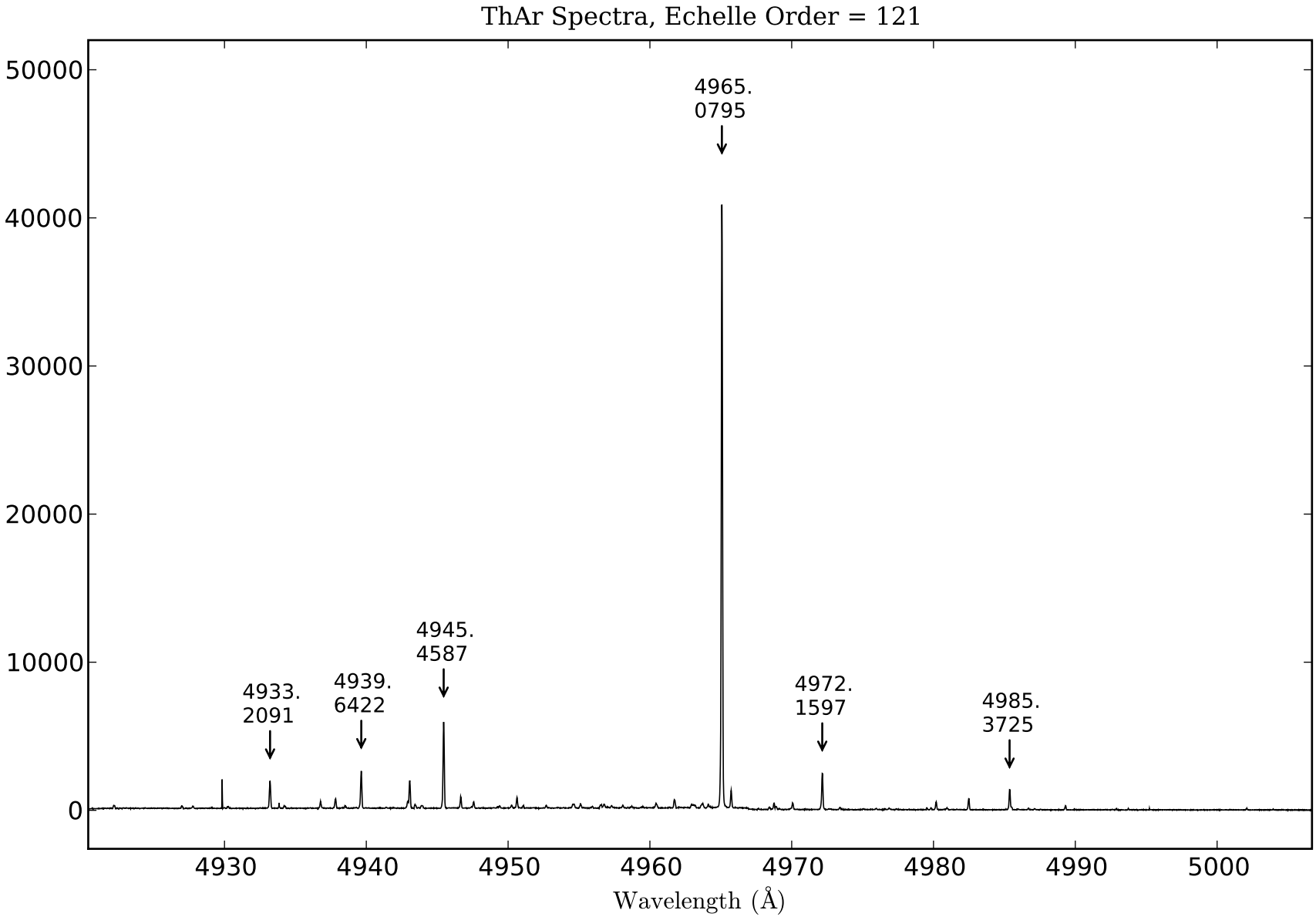

ThAr Spectra, Echelle Order = 116
20000
15000
10000
5000
0
5140
5150
5160
5170
5180
5190
5200
5210
5220
Wavelength (Å)
5158.
6041
5154.
2430
5151.
6120
5163.
4584
5176.
9610
5187.
7462
5195.
8136
5199.
1637

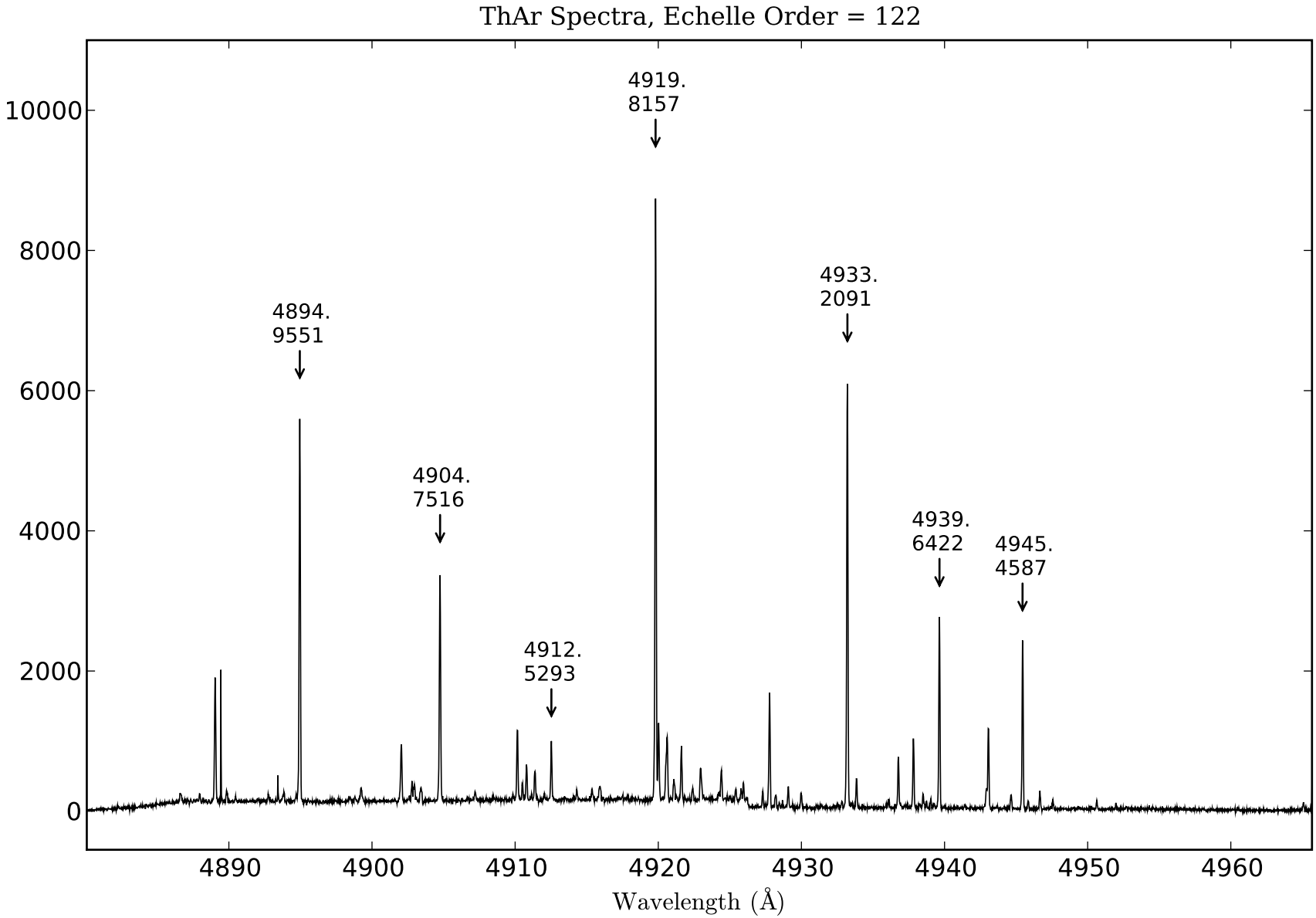

ThAr Spectra, Echelle Order = 117
12000
10000
8000
6000
4000
2000
0
5090
5100
5110
5120
5130
5140
5150
5160
5170
Wavelength (Å)
5115.
0448
5128.
4897
5134.
7460
5141.
7827
5145.
3083
5151.
6120
5154.
2430
5158.
6041
5162.
2846

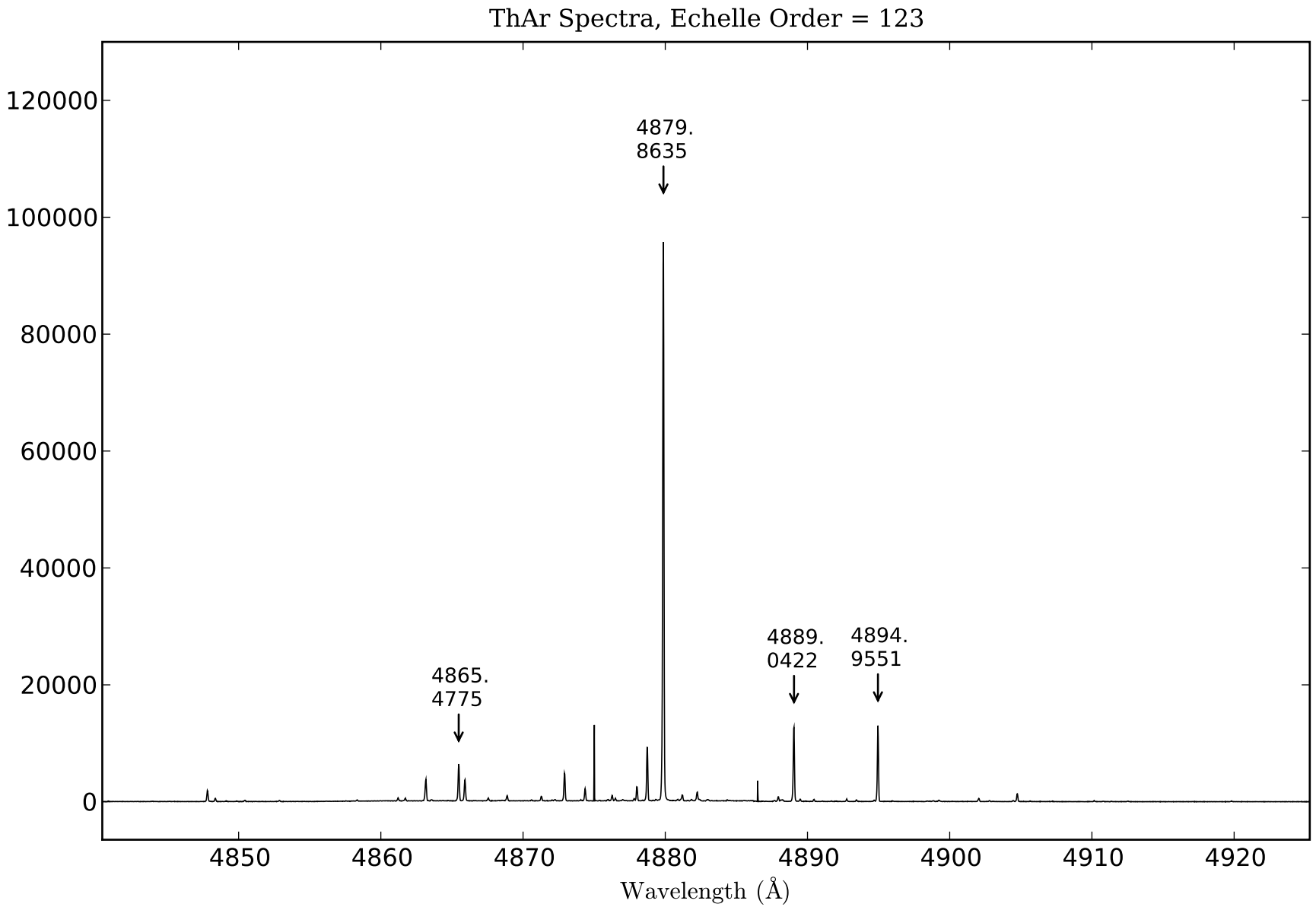

ThAr Spectra, Echelle Order = 118
12000
10000
8000
6000
4000
2000
0
5067.
9737
5062.
0371
5081.
4462
5096.
4848
5115.
0448
5050
5060
5070
5080
5090
5100
5110
5120
5130
Wavelength (Å)

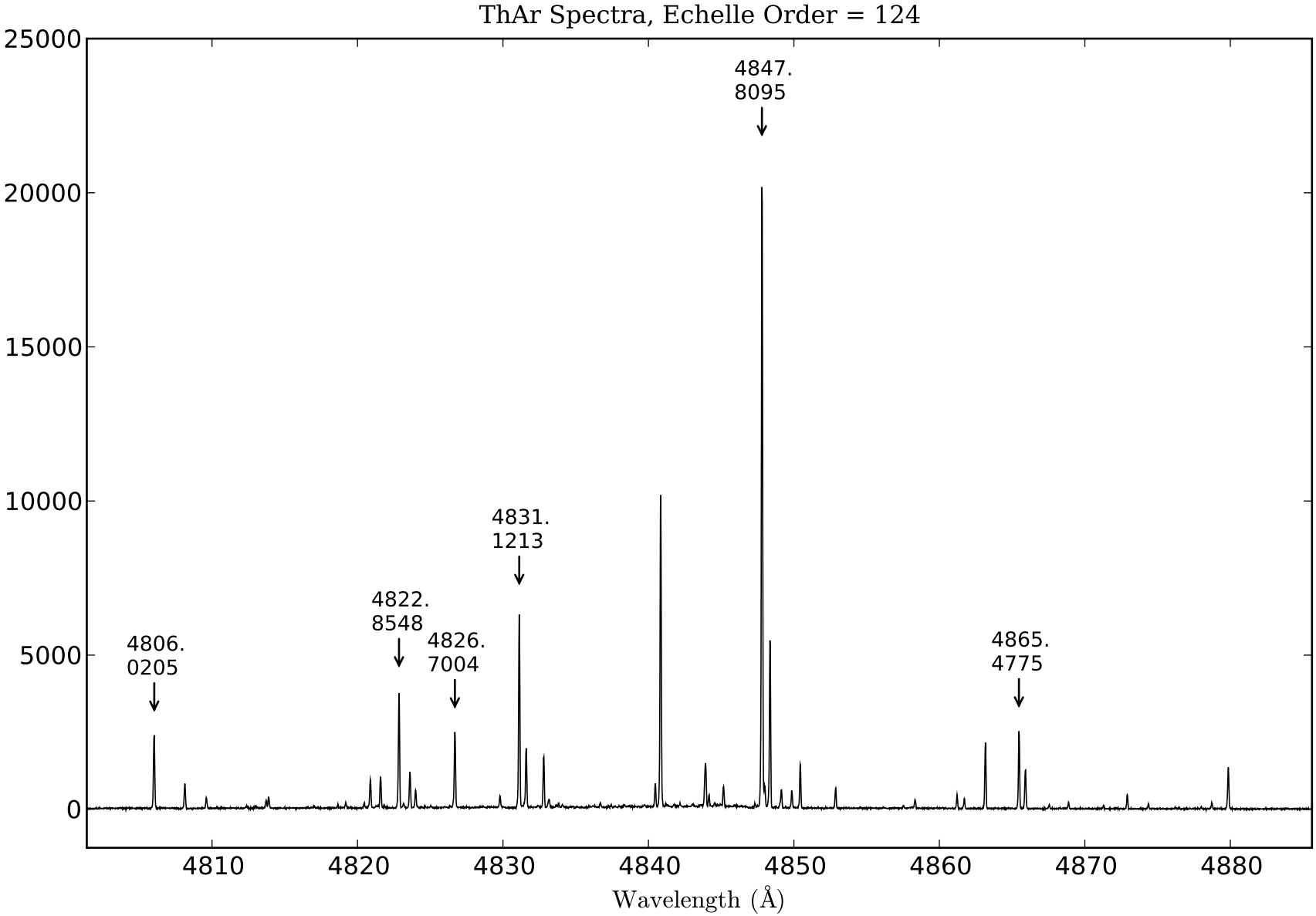

ThAr Spectra, Echelle Order = 119
15000
10000
5000
0
5017.
1628
5039.
2303
5044.
7195
5049.
7960
5062.
0371
5067.
9737
5010
5020
5030
5040
5050
5060
5070
5080
5090
Wavelength (Å)

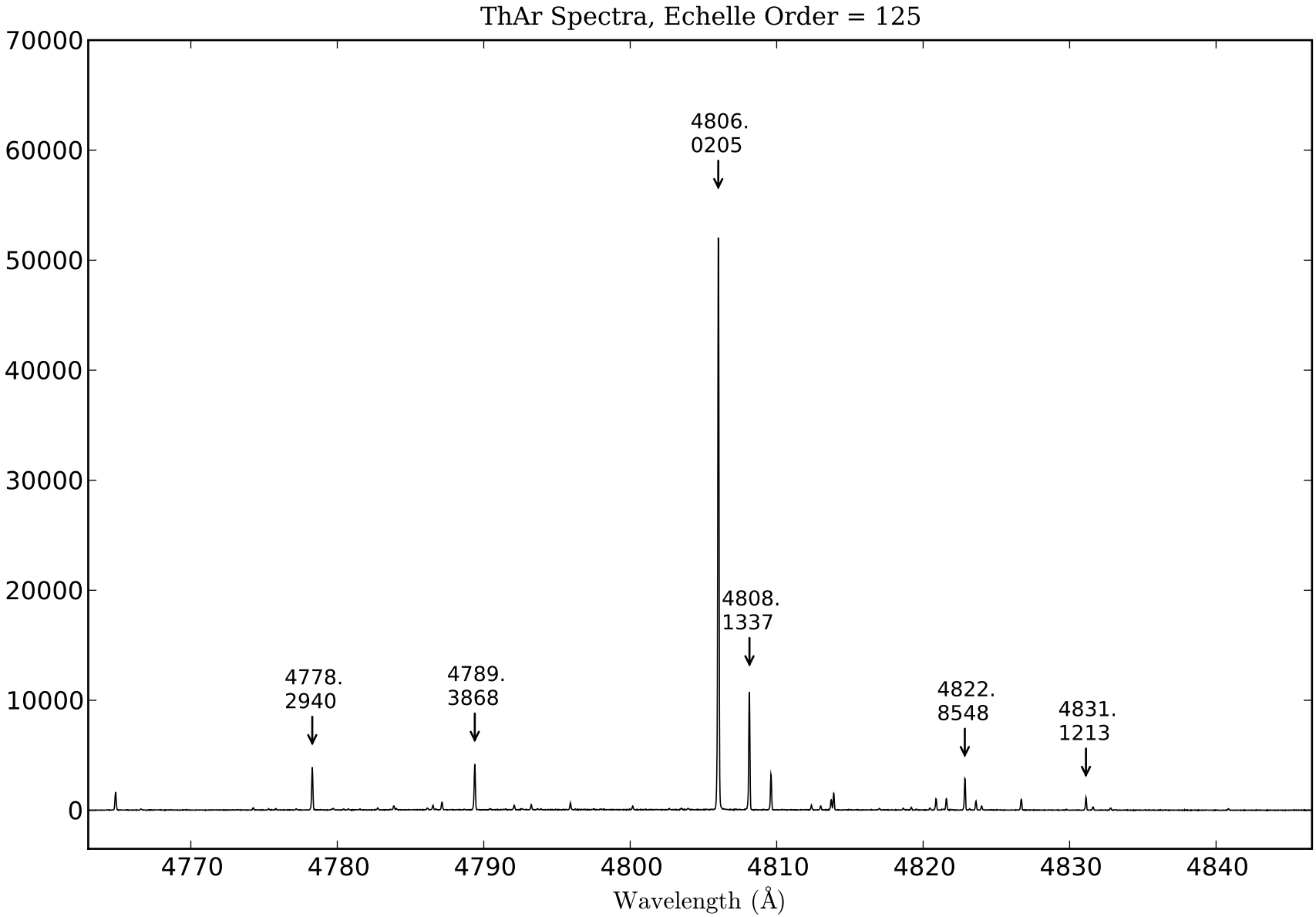

ThAr Spectra, Echelle Order = 120
15000
10000
5000
0
4965.
0795
4985.
3725
4989.
3086
5002.
0972
5009.
3344
5017.
1628
5019.
8062
5028.
6556
4970
4980
4990
5000
5010
5020
5030
5040
Wavelength (Å)

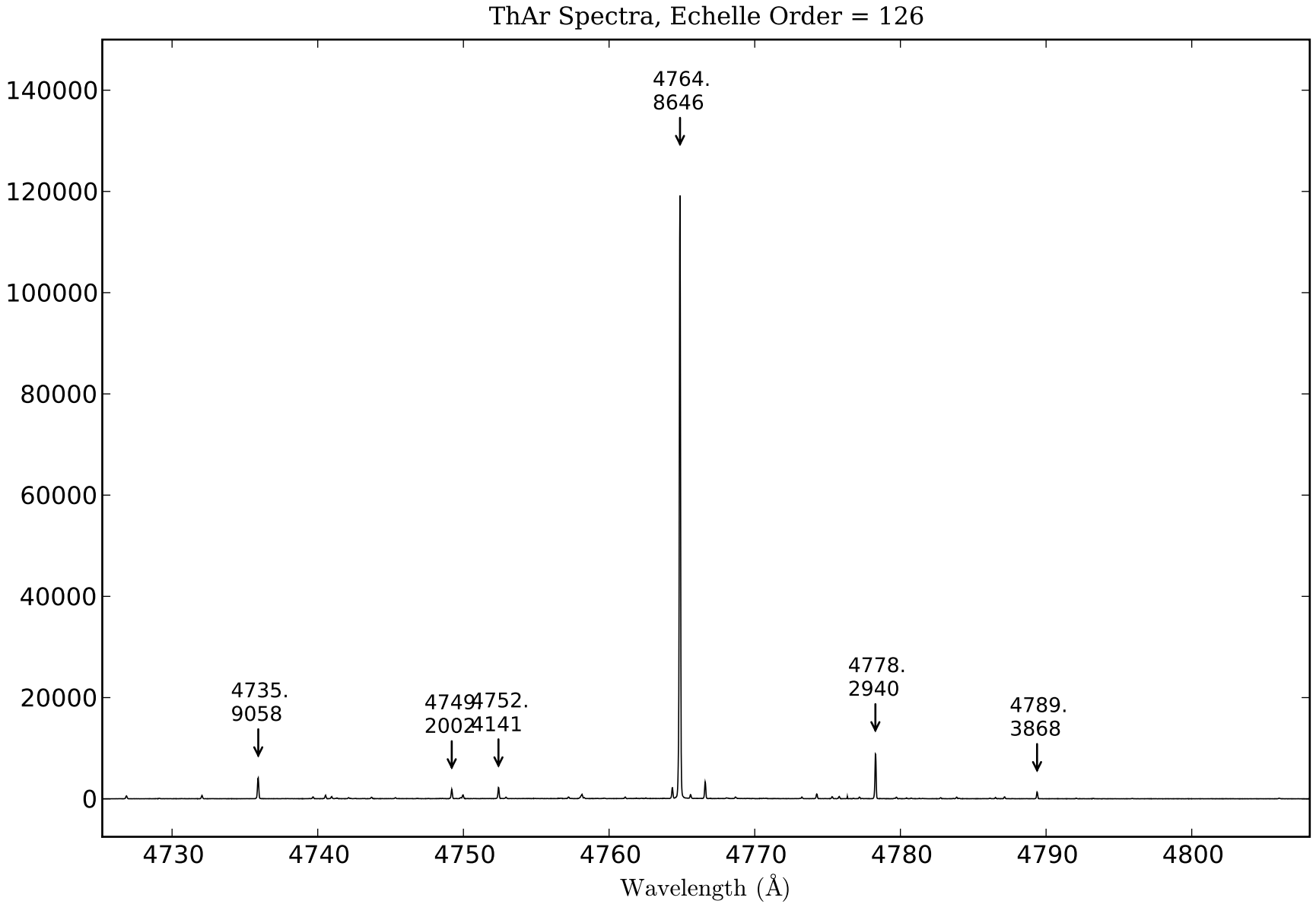

ThAr Spectra, Echelle Order = 121
50000
40000
30000
20000
10000
0
4965.
0795
4945.
4587
4939.
6422
4933.
2091
4972.
1597
4985.
3725
4930
4940
4950
4960
4970
4980
4990
5000
Wavelength (Å)

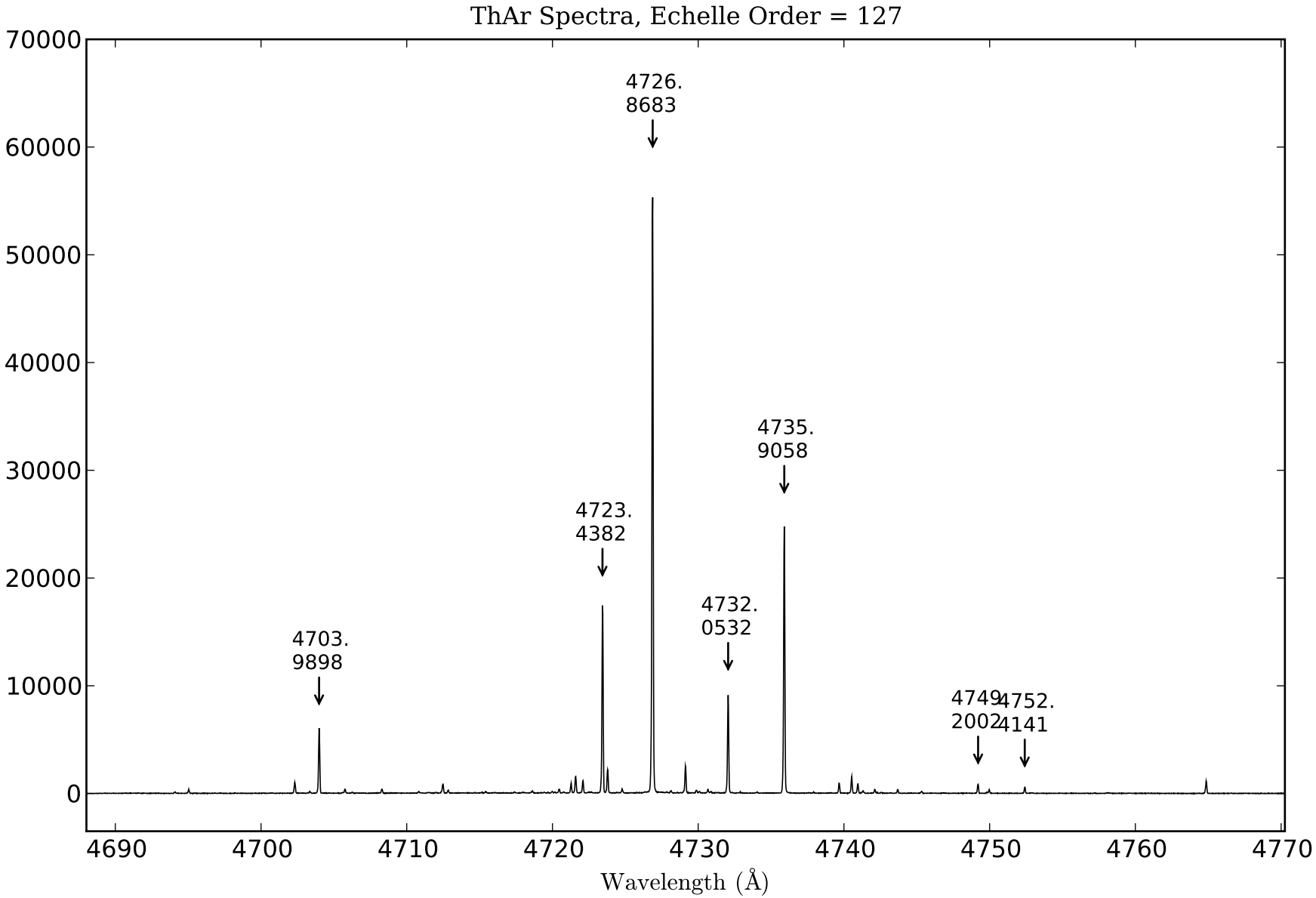

ThAr Spectra, Echelle Order = 122
4919.
8157
4894.
9551
4933.
2091
4904.
7516
4939.
6422
4945.
4587
4912.
5293
10000
8000
6000
4000
2000
0
4890
4900
4910
4920
4930
4940
4950
4960
Wavelength (Å)

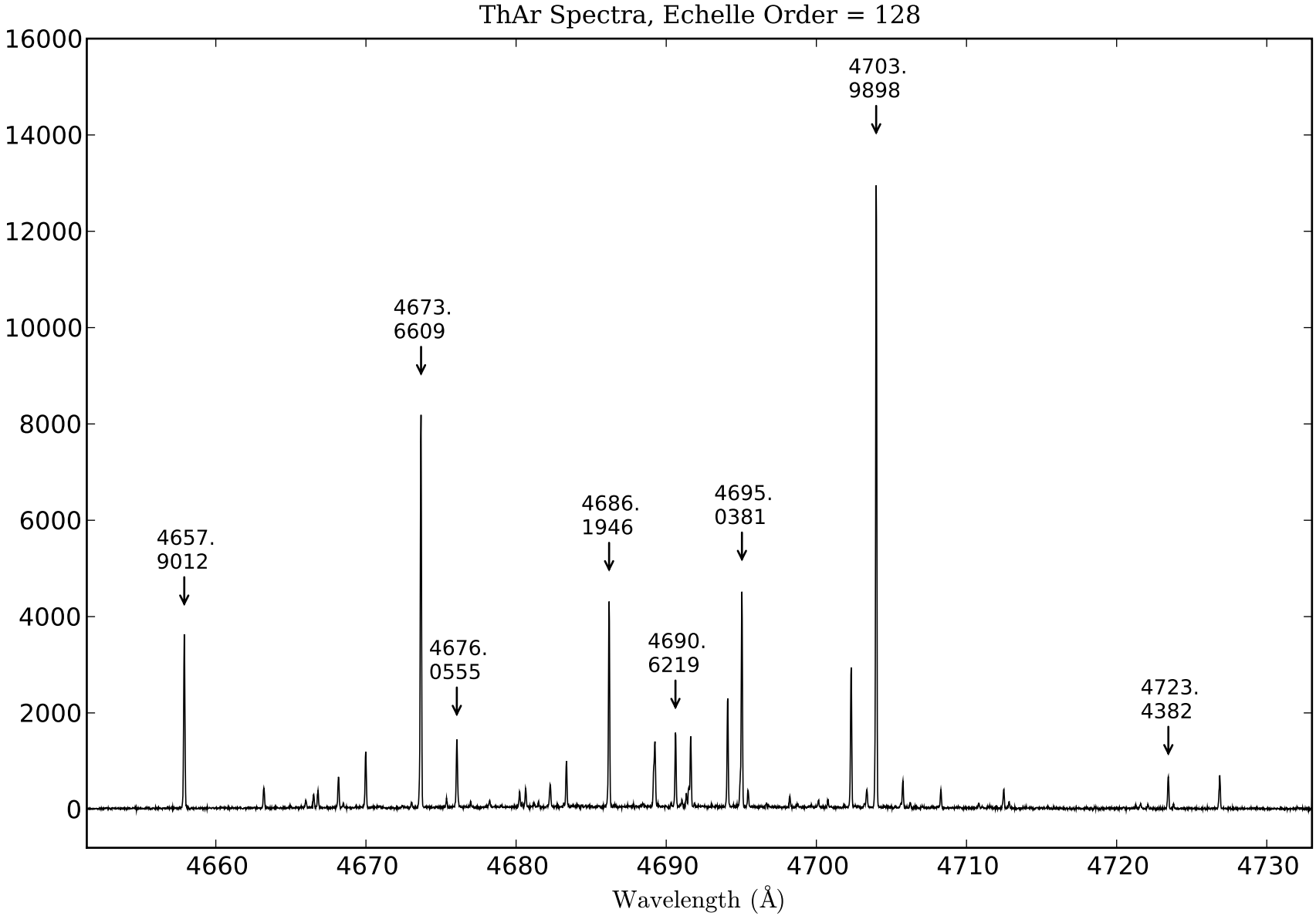

ThAr Spectra, Echelle Order = 123
120000
100000
80000
60000
40000
20000
0
4879.
8635
4889.
0422
4894.
9551
4865.
4775
4850
4860
4870
4880
4890
4900
4910
4920
Wavelength (Å)

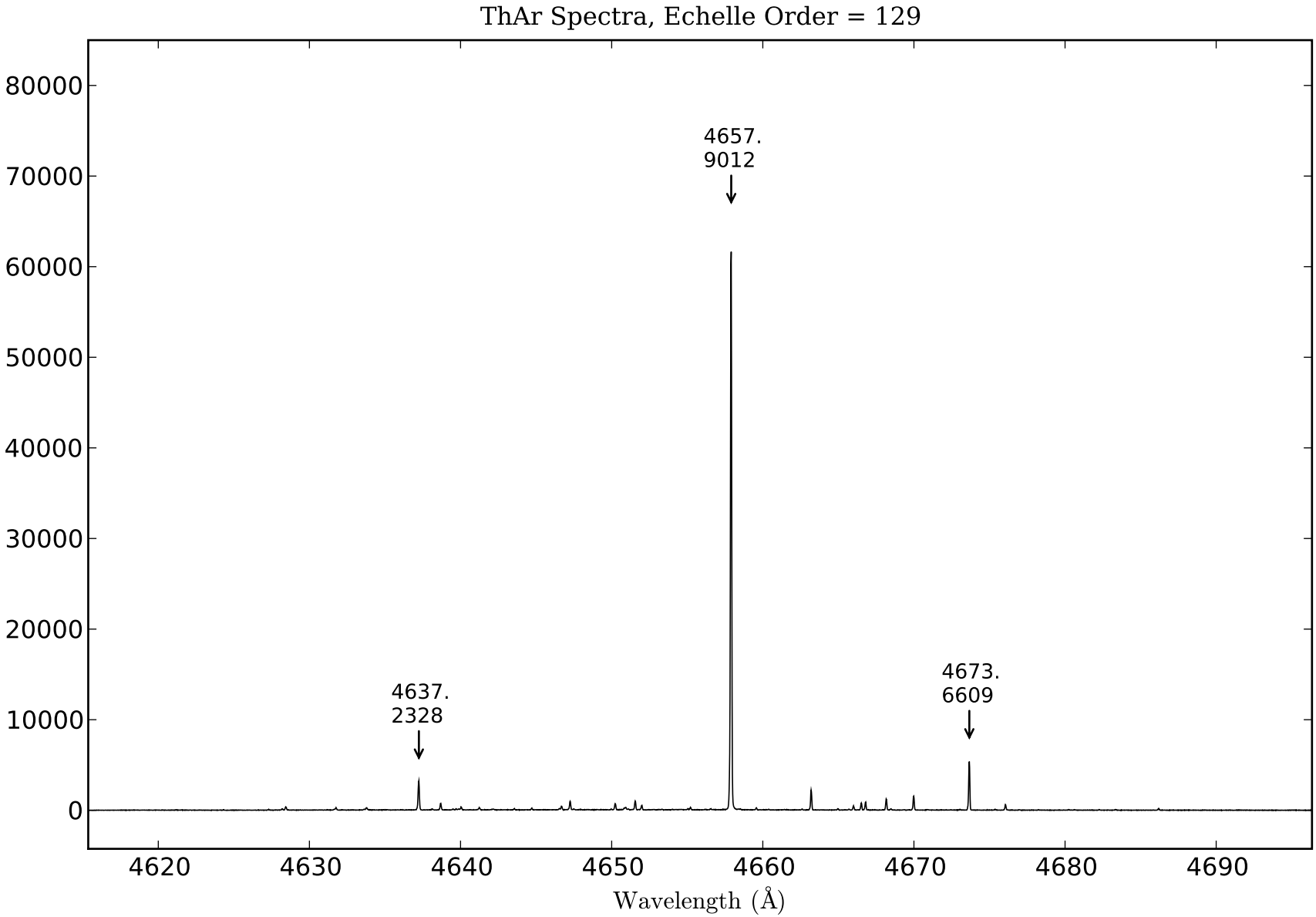

ThAr Spectra, Echelle Order = 124
25000
20000
15000
10000
5000
0
4847.
8095
4831.
1213
4822.
8548
4826.
7004
4806.
0205
4865.
4775
4810
4820
4830
4840
4850
4860
4870
4880
Wavelength (Å)

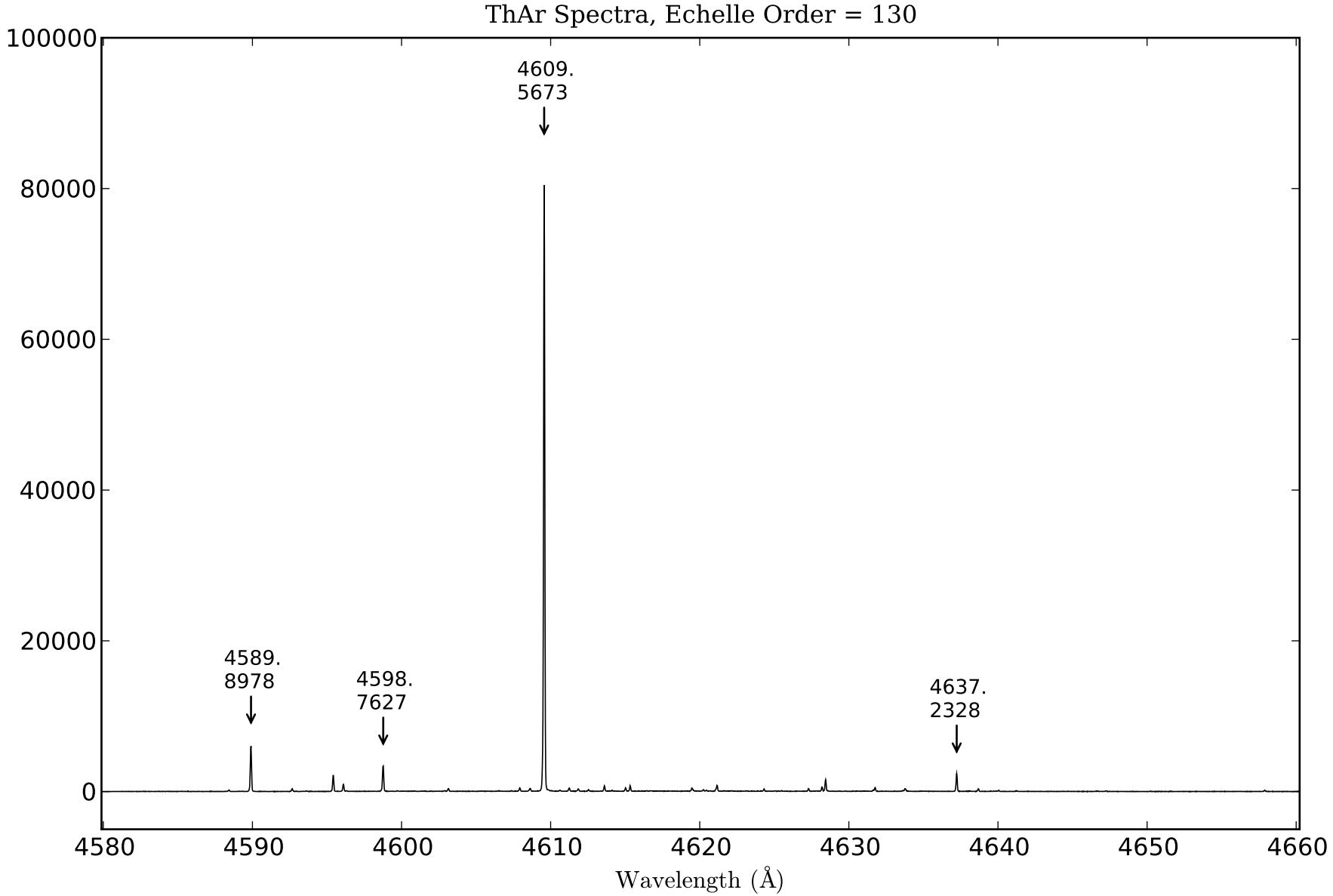

ThAr Spectra, Echelle Order = 125
70000
60000
50000
40000
30000
20000
10000
0
4806.
0205
4808.
1337
4778.
2940
4789.
3868
4822.
8548
4831.
1213
4770
4780
4790
4800
4810
4820
4830
4840
Wavelength (Å)

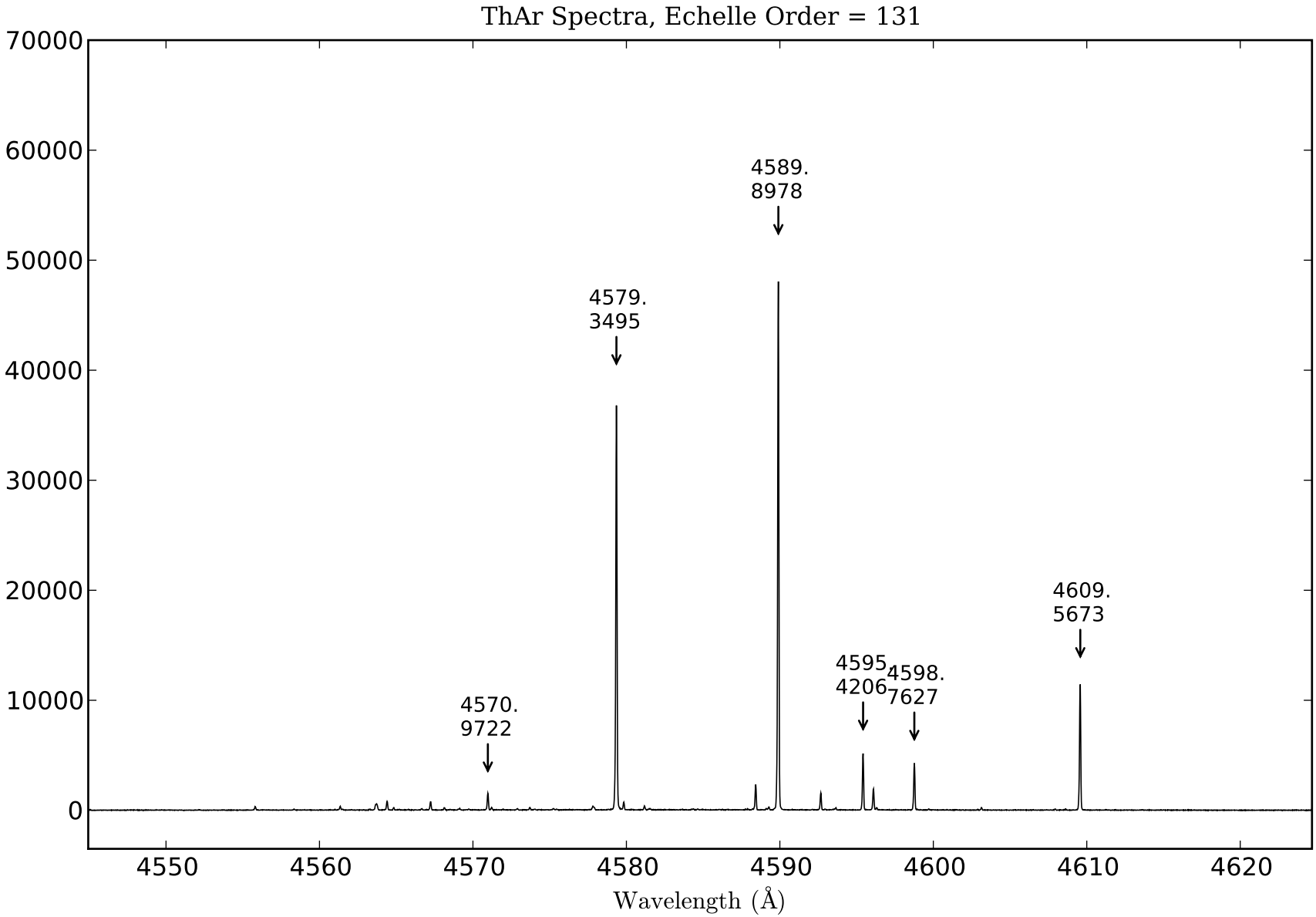

ThAr Spectra, Echelle Order = 126
140000
120000
100000
80000
60000
40000
20000
0
4730
4740
4750
4760
4770
4780
4790
4800
Wavelength (Å)
4764.
8646
4735.
9058
4749.
2002
4752.
4141
4778.
2940
4789.
3868

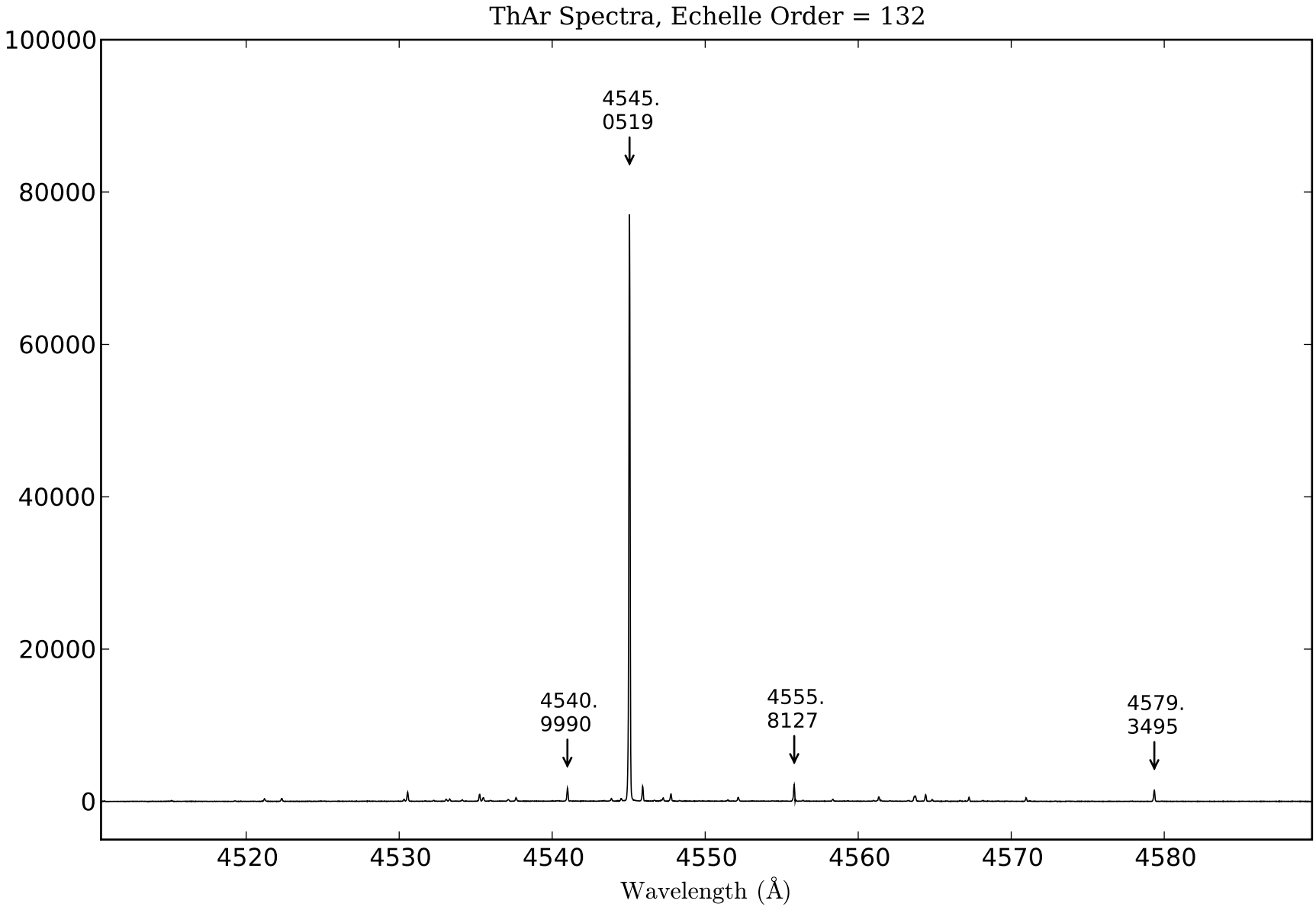

ThAr Spectra, Echelle Order = 127
70000
60000
50000
40000
30000
20000
10000
0
4690
4700
4710
4720
4730
4740
4750
4760
4770
Wavelength (Å)
4726.
8683
4735.
9058
4723.
4382
4732.
0532
4703.
9898
4749.
2002
4752.
4141

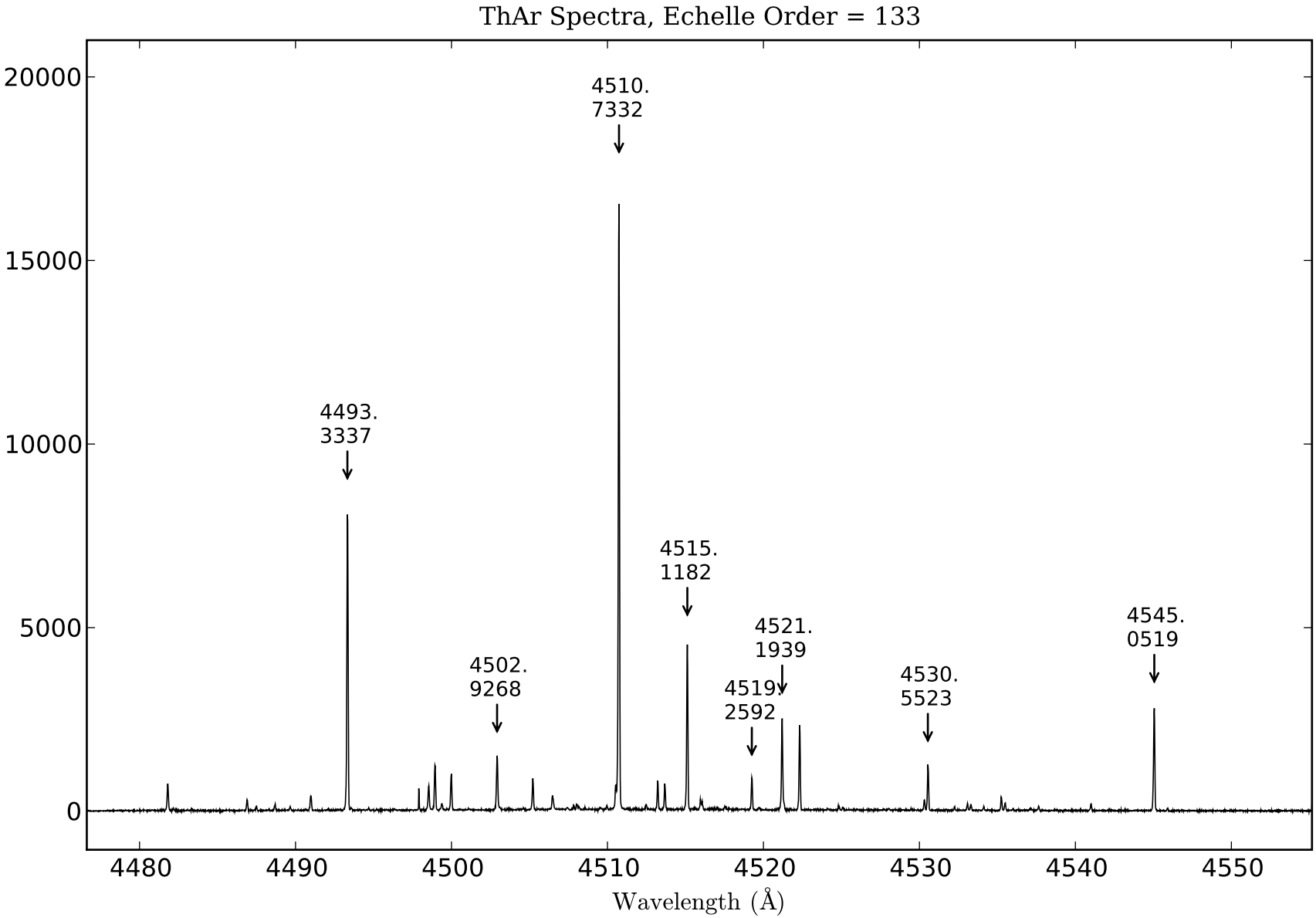

ThAr Spectra, Echelle Order = 128
16000
14000
12000
10000
8000
6000
4000
2000
0
4657.
9012
4673.
6609
4676.
0555
4686.
1946
4690.
6219
4695.
0381
4703.
9898
4723.
4382
4660
4670
4680
4690
4700
4710
4720
4730
Wavelength (Å)

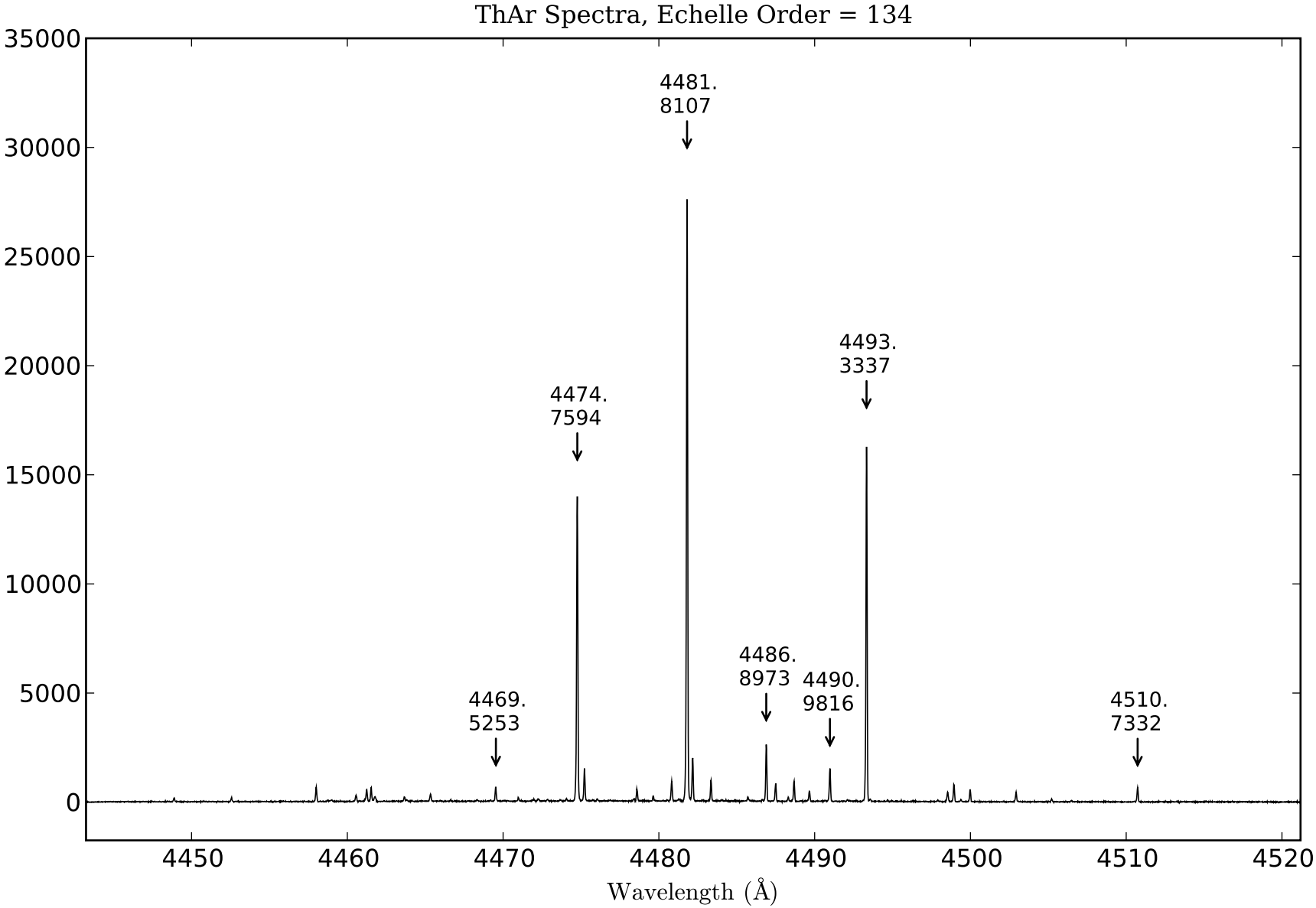

ThAr Spectra, Echelle Order = 129
80000
70000
60000
50000
40000
30000
20000
10000
0
4657.
9012
4637.
2328
4673.
6609
4620
4630
4640
4650
4660
4670
4680
4690
Wavelength (Å)

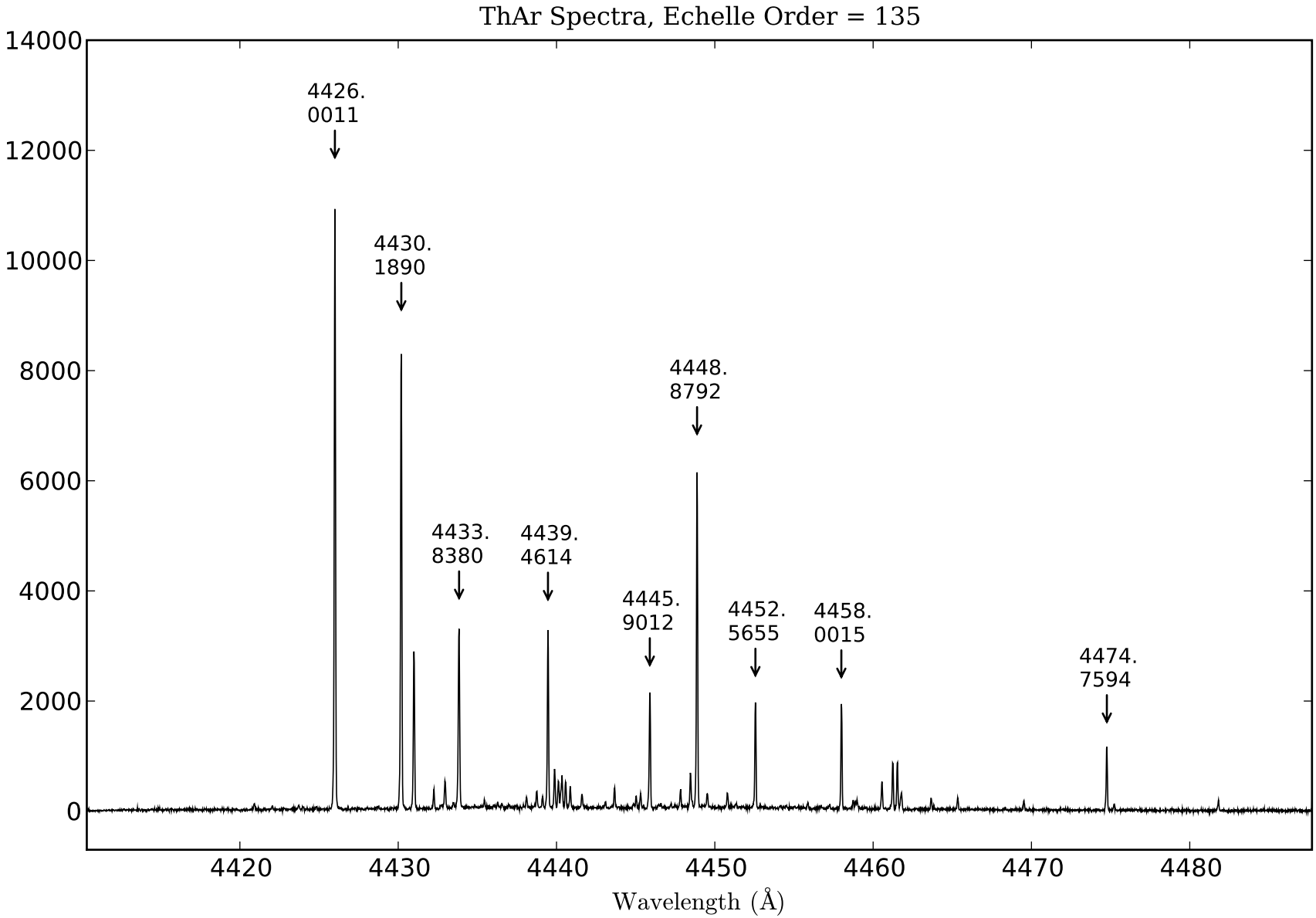

ThAr Spectra, Echelle Order = 130
100000
80000
60000
40000
20000
0
4609.
5673
4589.
8978
4598.
7627
4637.
2328
4580
4590
4600
4610
4620
4630
4640
4650
4660
Wavelength (Å)

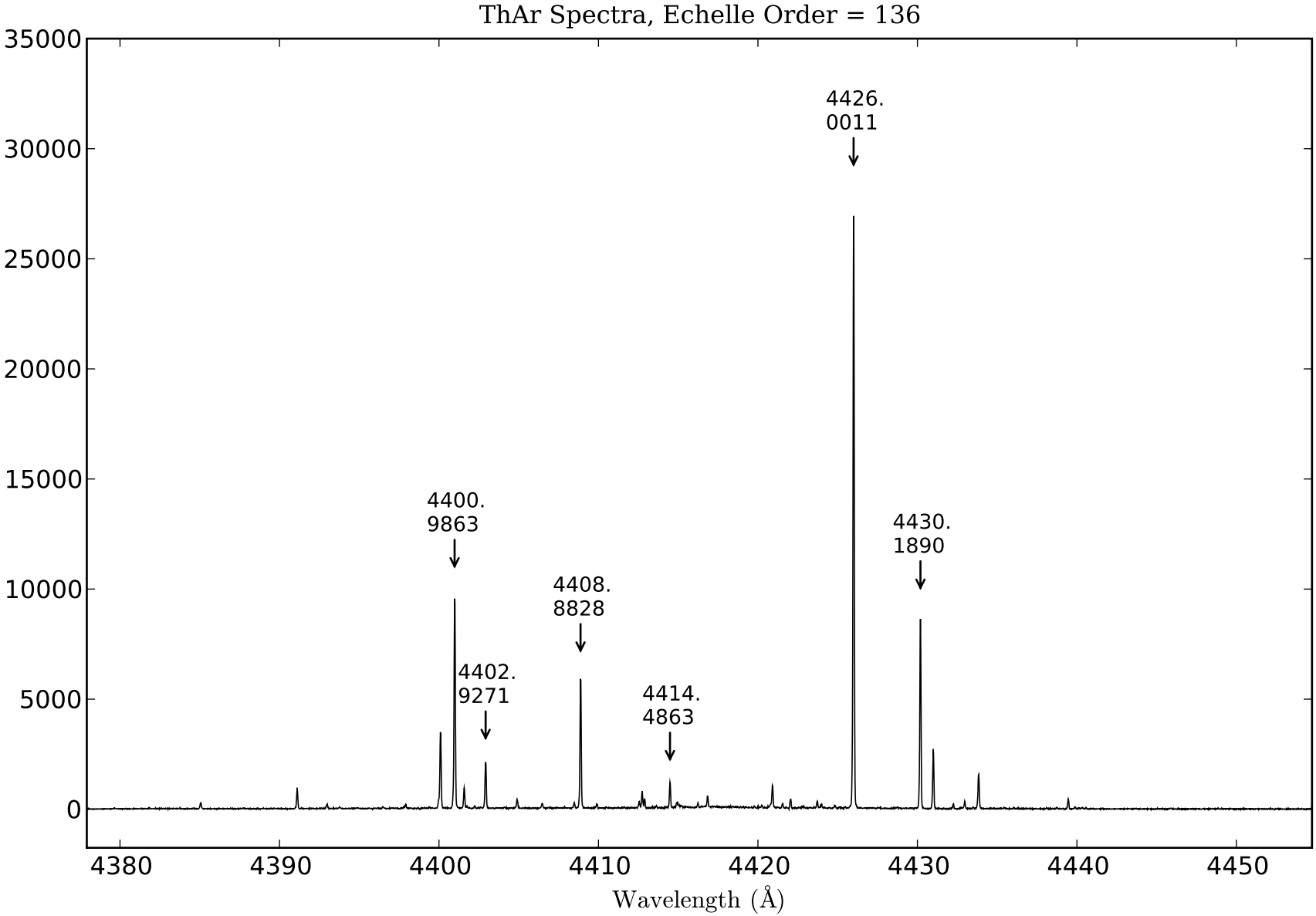

ThAr Spectra, Echelle Order = 131
70000
60000
50000
40000
30000
20000
10000
0
4550
4560
4570
4580
4590
4600
4610
4620
Wavelength (Å)
4589.
8978
4579.
3495
4609.
5673
4595.
4206
4598.
7627
4570.
9722

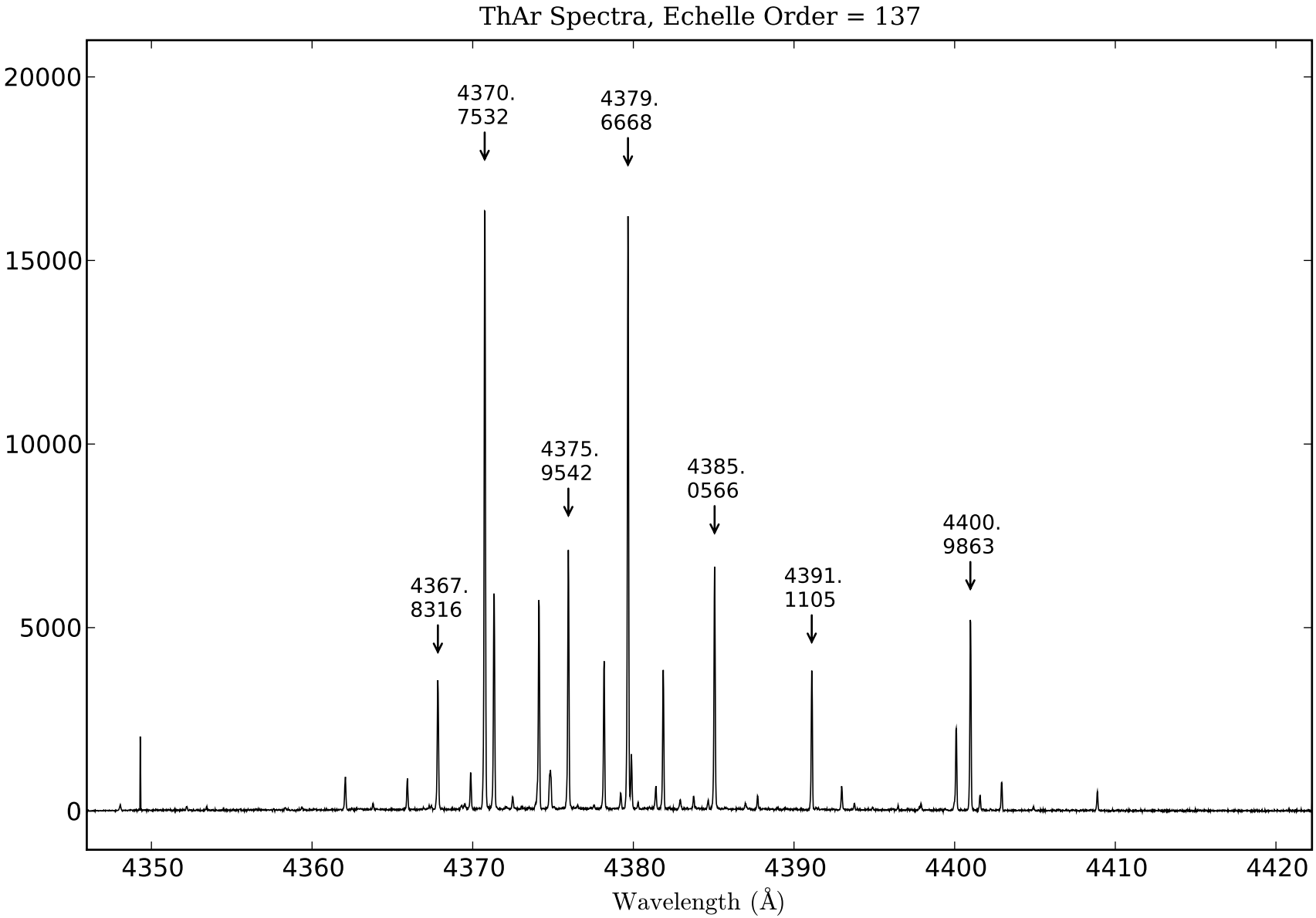

ThAr Spectra, Echelle Order = 132
100000
80000
60000
40000
20000
0
4545.
0519
4540.
9990
4555.
8127
4579.
3495
4520
4530
4540
4550
4560
4570
4580
Wavelength (Å)

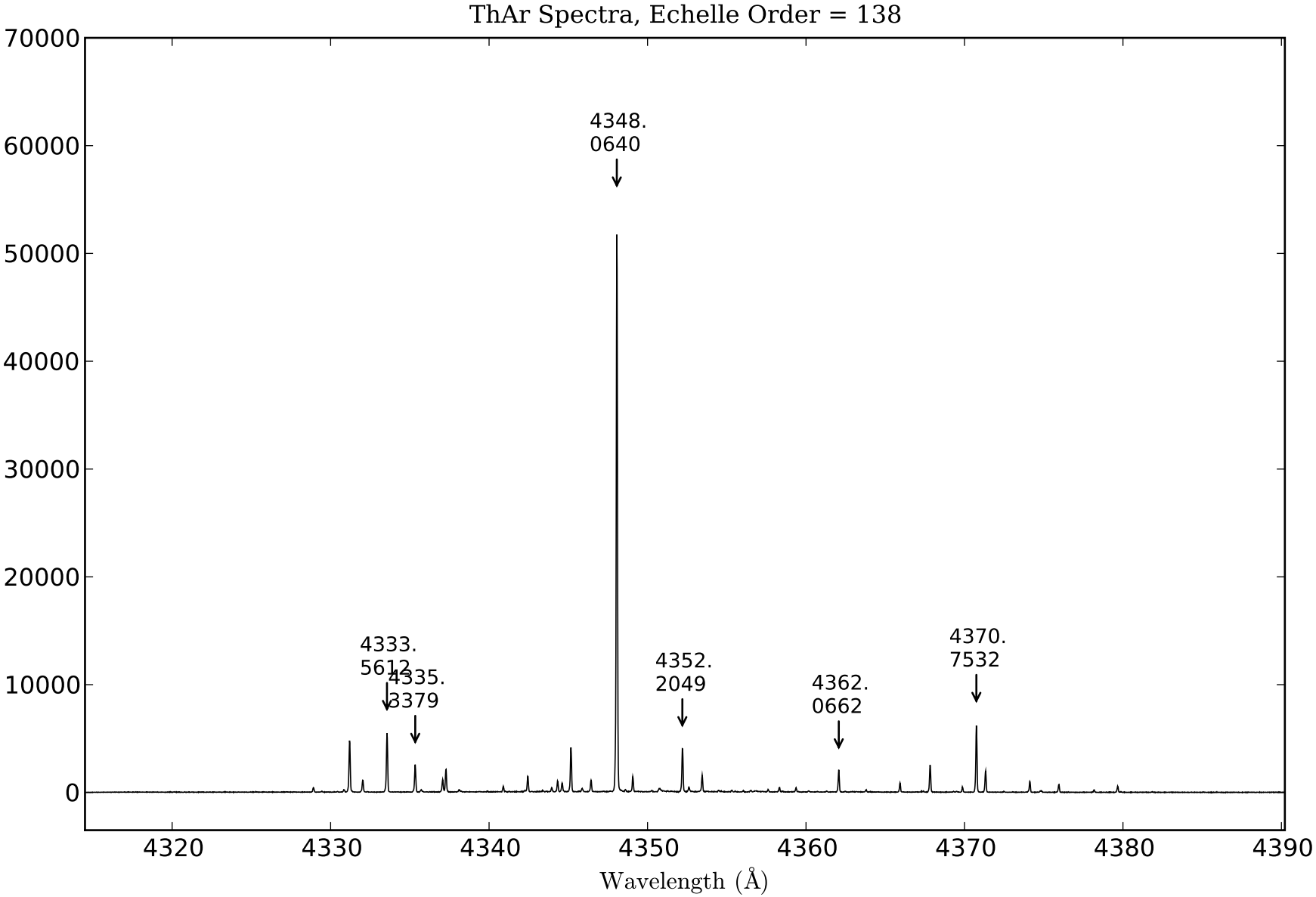

ThAr Spectra, Echelle Order = 133
20000
15000
10000
5000
0
4480
4490
4500
4510
4520
4530
4540
4550
Wavelength (Å)
4510.
7332
4493.
3337
4515.
1182
4502.
9268
4521.
1939
4519.
2592
4530.
5523
4545.
0519

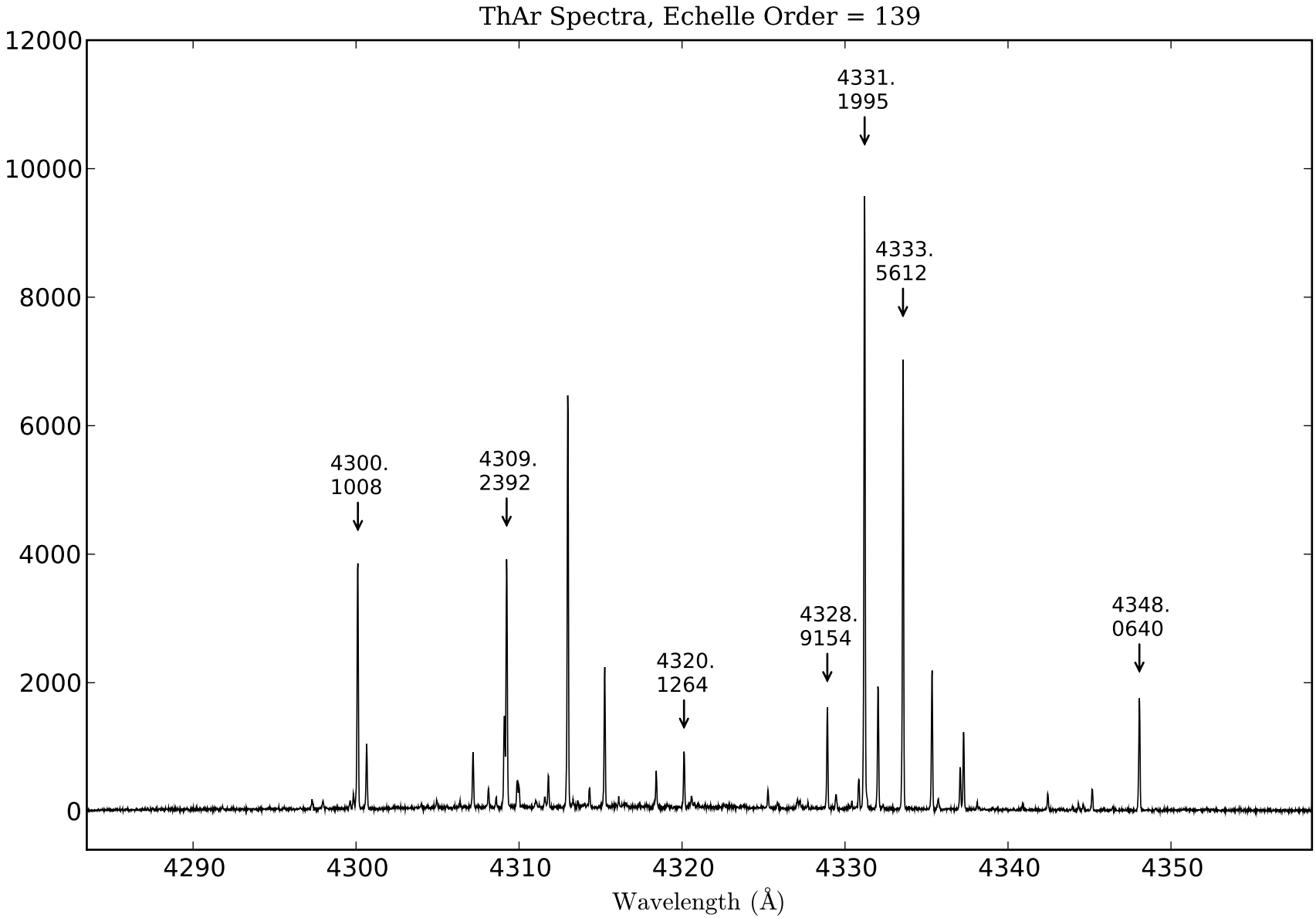

ThAr Spectra, Echelle Order = 134
35000
30000
25000
20000
15000
10000
5000
0
4450
4460
4470
4480
4490
4500
4510
4520
Wavelength (Å)
4481.
8107
4474.
7594
4493.
3337
4469.
5253
4486.
8973
4490.
9816
4510.
7332

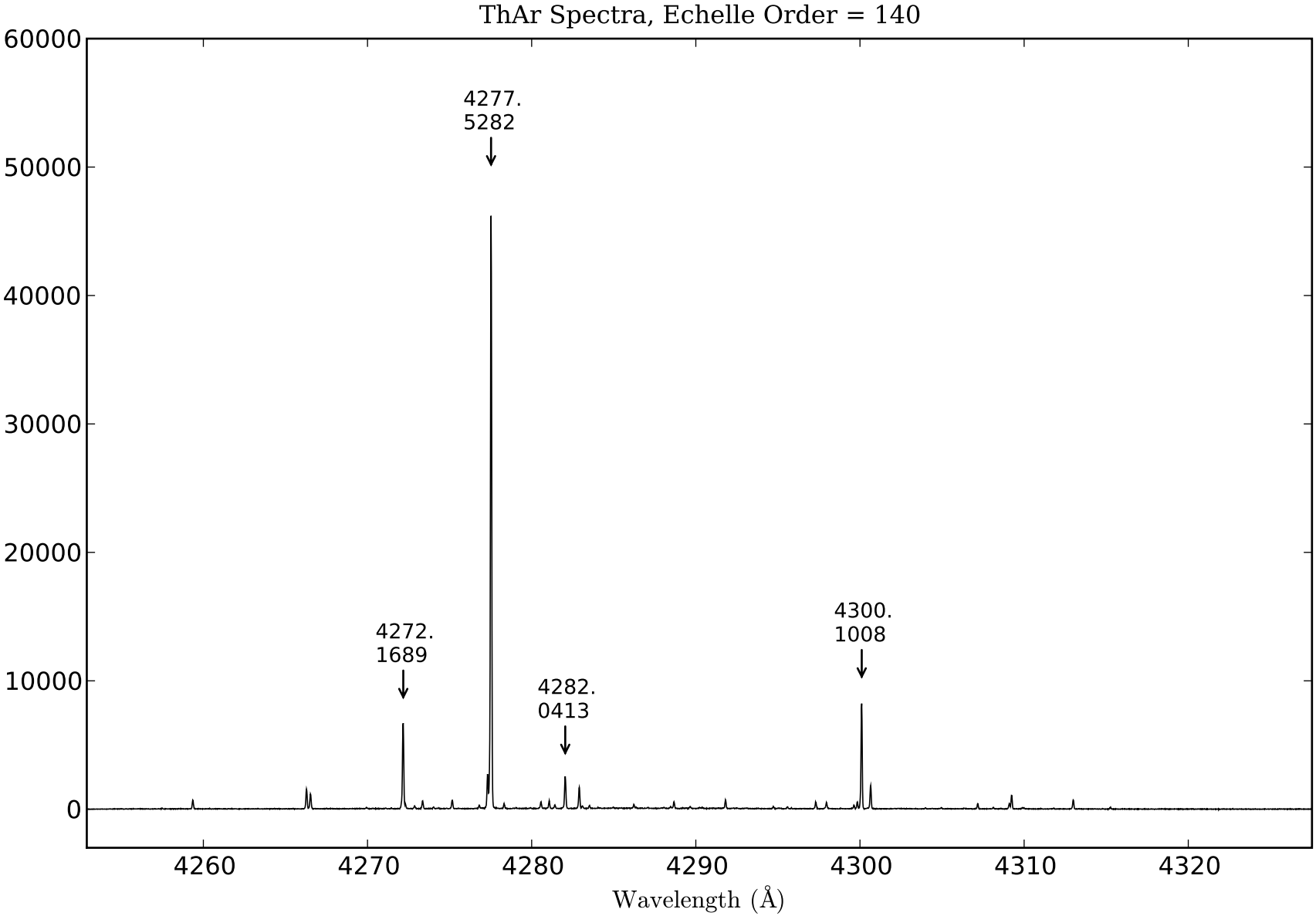

ThAr Spectra, Echelle Order = 135
14000
12000
10000
8000
6000
4000
2000
0
4426.
0011
4430.
1890
4433.
8380
4439.
4614
4445.
9012
4448.
8792
4452.
5655
4458.
0015
4474.
7594
4420
4430
4440
4450
4460
4470
4480
Wavelength (Å)

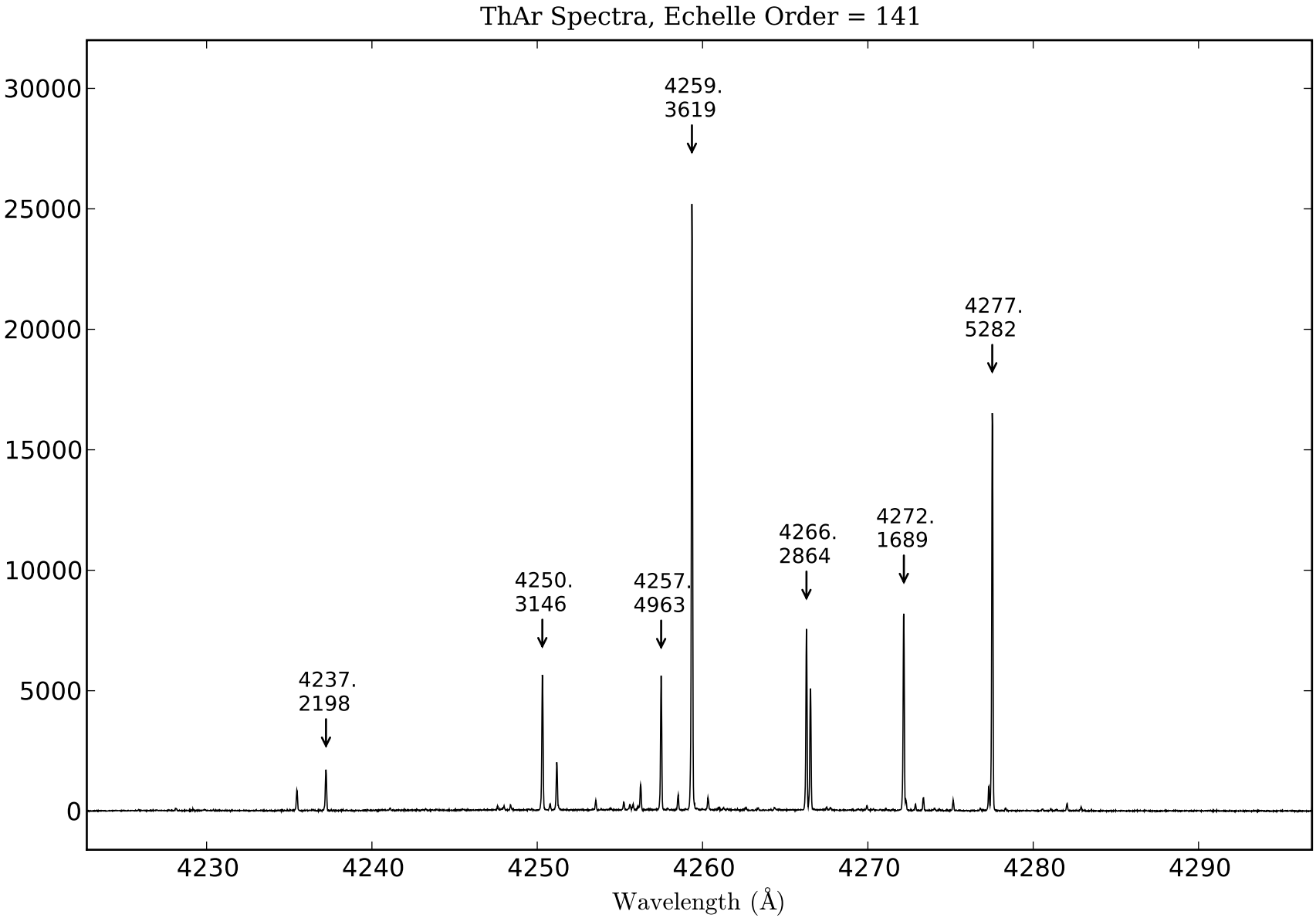

ThAr Spectra, Echelle Order = 136
35000
30000
25000
20000
15000
10000
5000
0
4380
4390
4400
4410
4420
4430
4440
4450
Wavelength (Å)
4426.
0011
4400.
9863
4408.
8828
4430.
1890
4402.
9271
4414.
4863

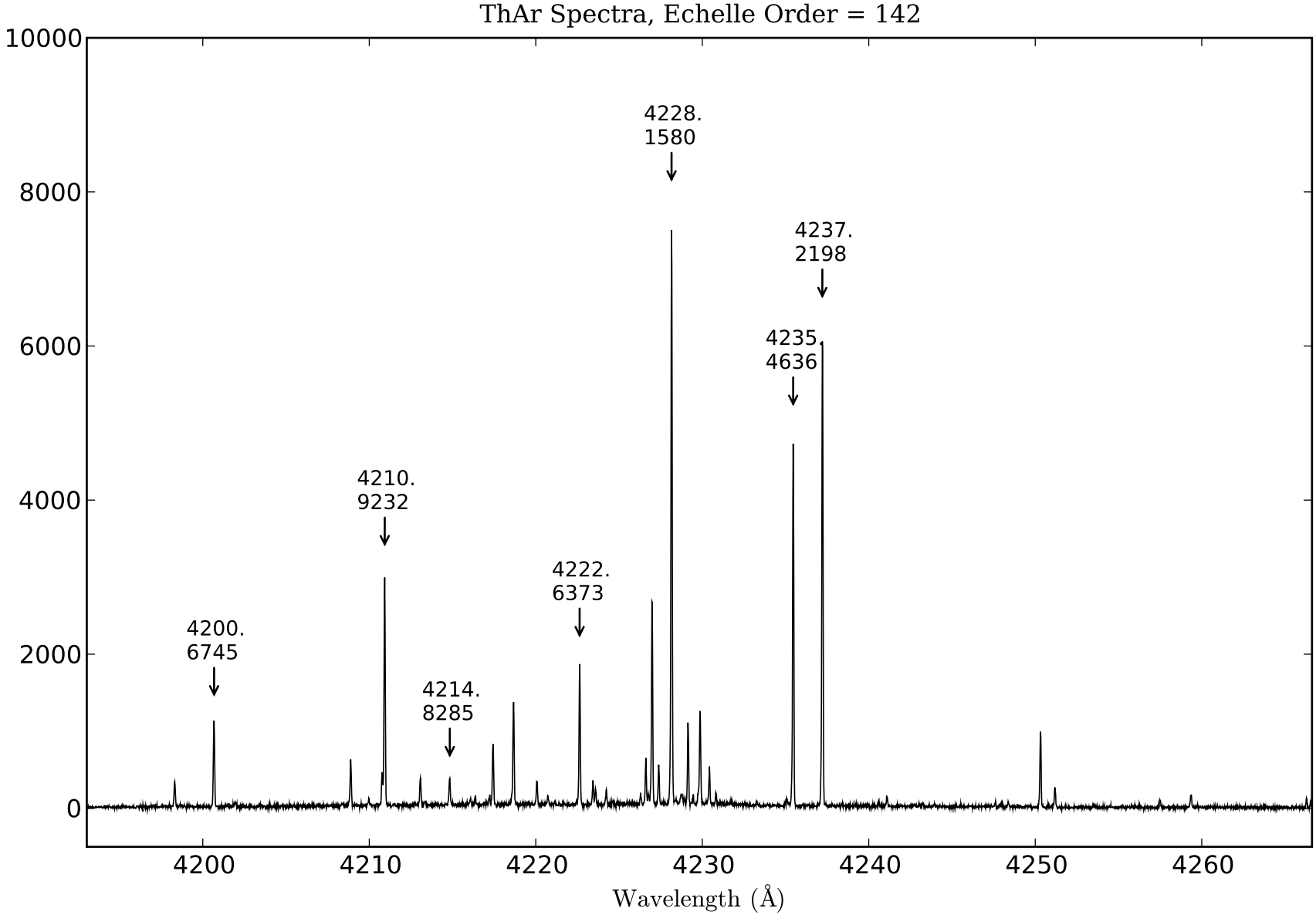

ThAr Spectra, Echelle Order = 137
20000
15000
10000
5000
0
4350
4360
4370
4380
4390
4400
4410
4420
Wavelength (Å)
4370.
7532
4379.
6668
4375.
9542
4385.
0566
4400.
9863
4391.
1105
4367.
8316

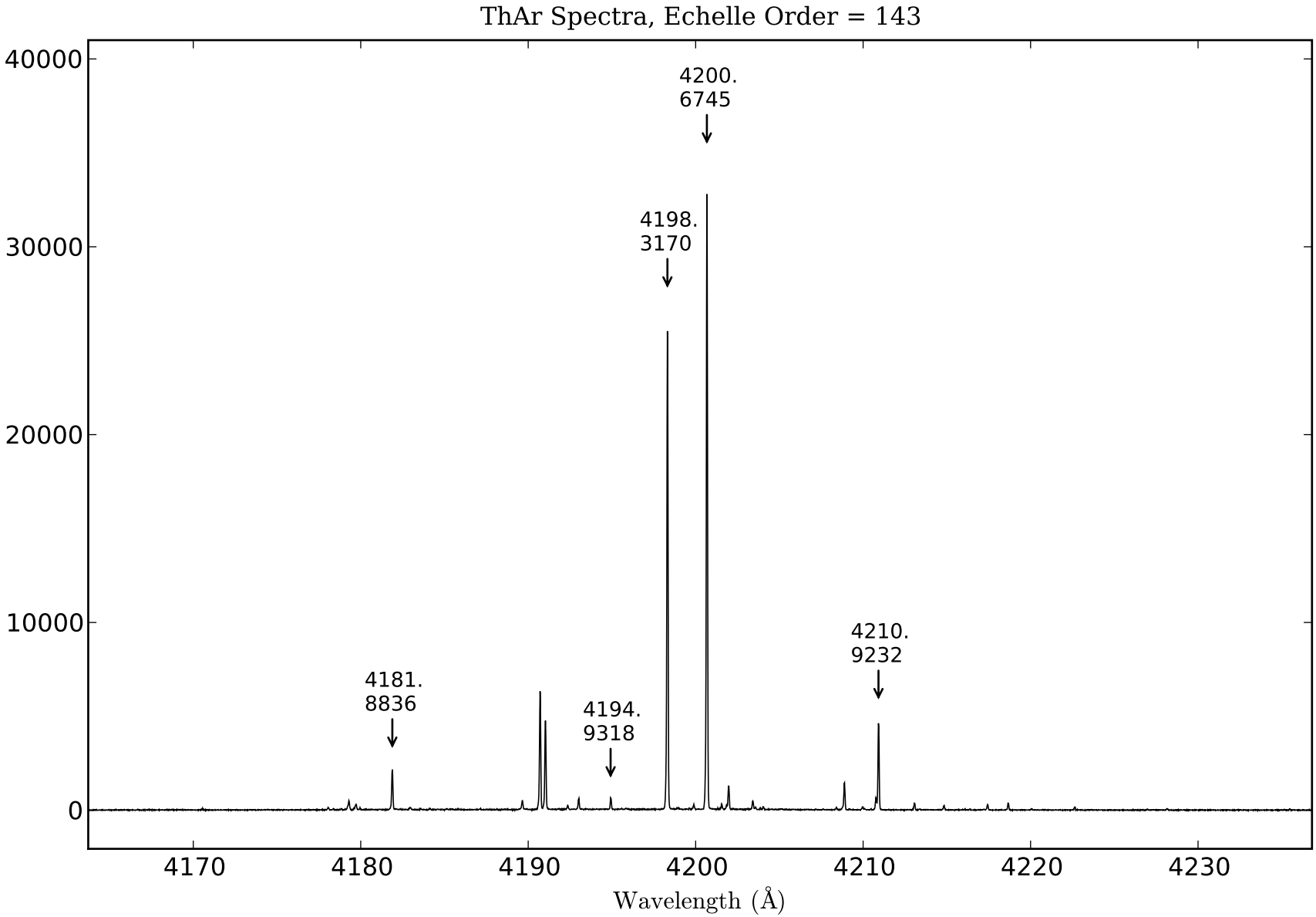

ThAr Spectra, Echelle Order = 138
70000
60000
50000
40000
30000
20000
10000
0
4320
4330
4340
4350
4360
4370
4380
4390
Wavelength (Å)
4348.
0640
4333.
5612
4335.
3379
4352.
2049
4362.
0662
4370.
7532

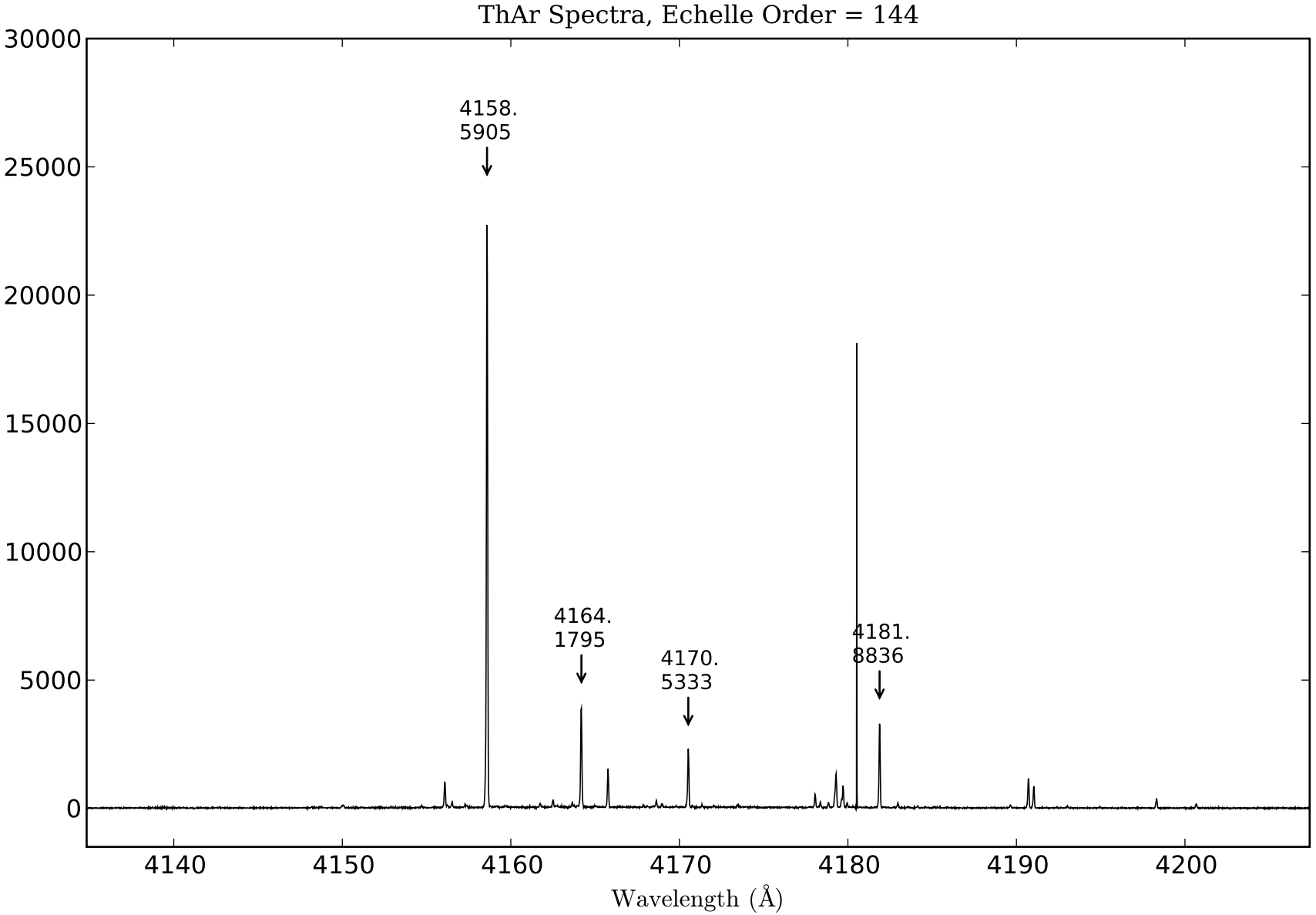

ThAr Spectra, Echelle Order = 139
12000
10000
8000
6000
4000
2000
0
4290
4300
4310
4320
4330
4340
4350
Wavelength (Å)
4331.
1995
4333.
5612
4300.
1008
4309.
2392
4320.
1264
4328.
9154
4348.
0640

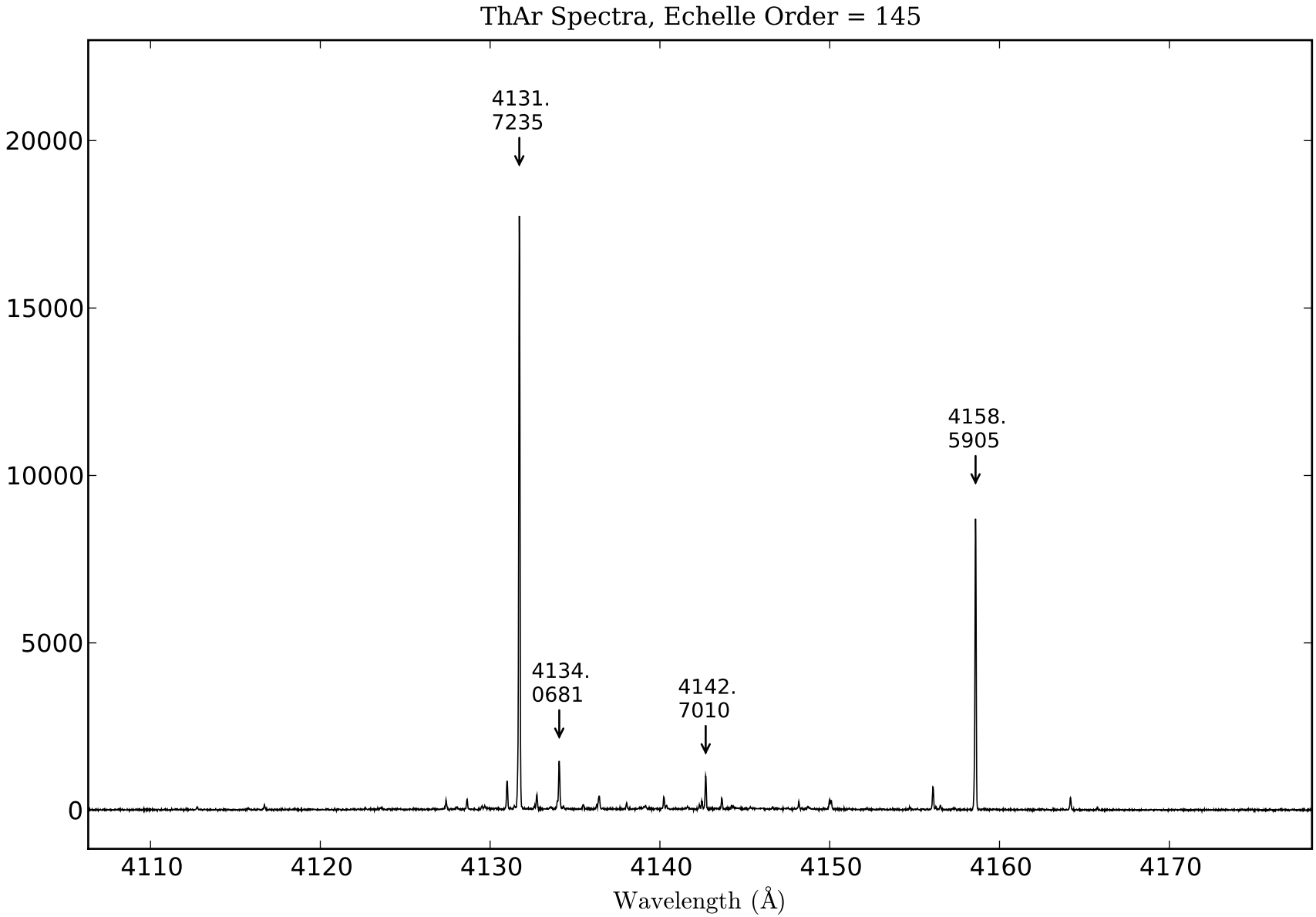

ThAr Spectra, Echelle Order = 140
60000
50000
40000
30000
20000
10000
0
4277.
5282
4272.
1689
4282.
0413
4300.
1008
4260
4270
4280
4290
4300
4310
4320
Wavelength (Å)

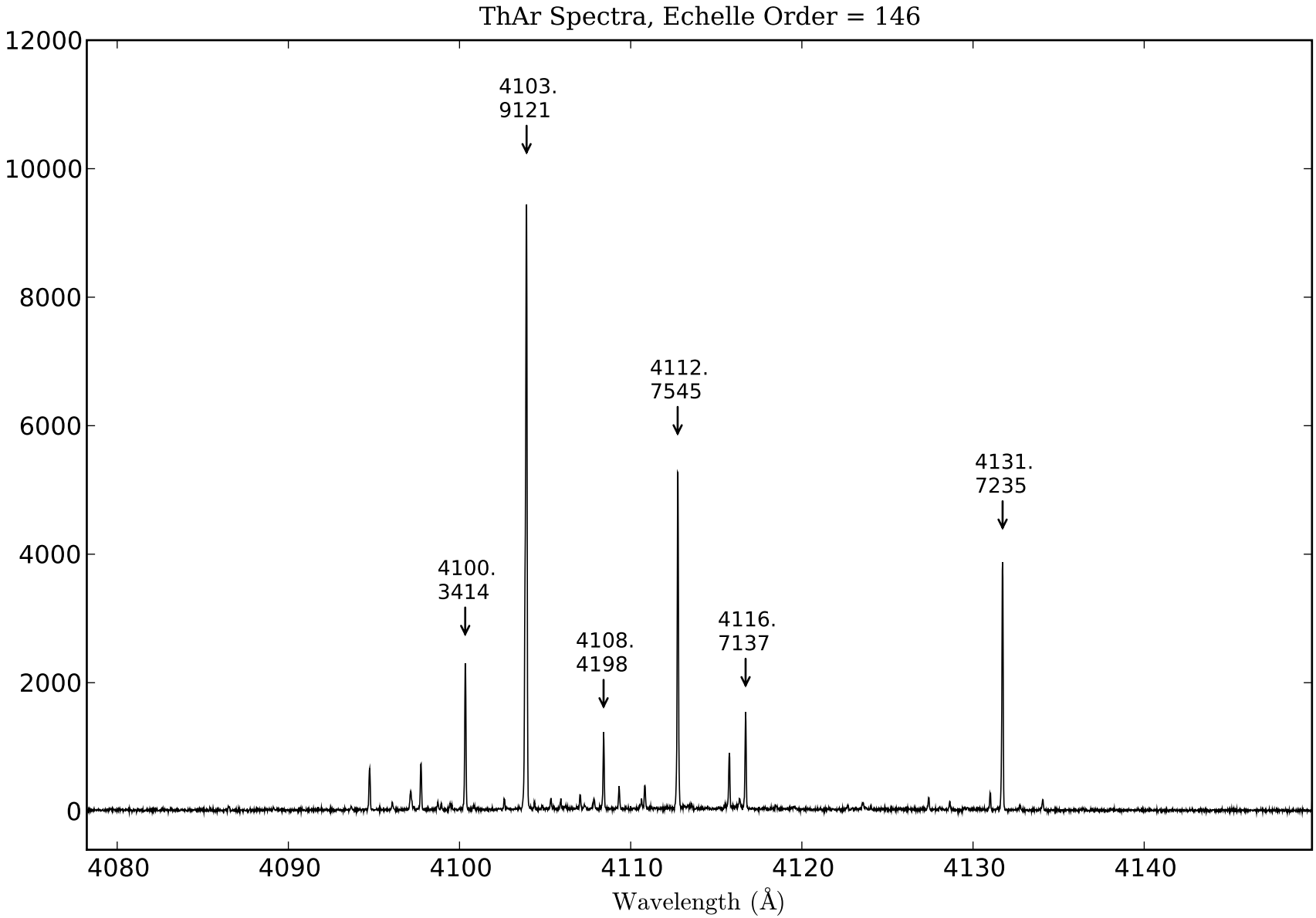

ThAr Spectra, Echelle Order = 141
30000
25000
20000
15000
10000
5000
0
4230
4240
4250
4260
4270
4280
4290
Wavelength (Å)
4259.
3619
4277.
5282
4266.
2864
4272.
1689
4250.
3146
4257.
4963
4237.
2198

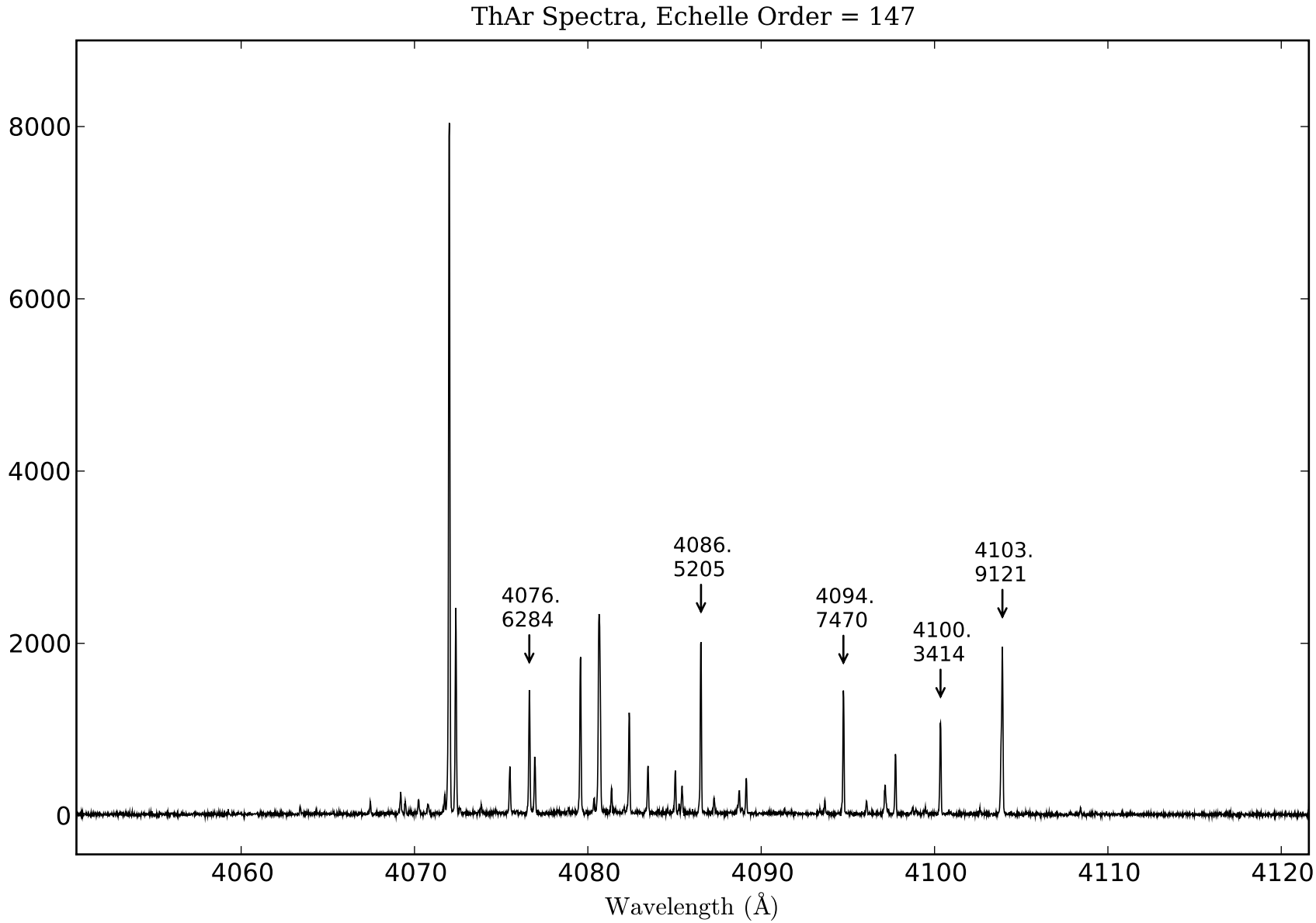

ThAr Spectra, Echelle Order = 142
10000
8000
6000
4000
2000
0
4200
4210
4220
4230
4240
4250
4260
Wavelength (Å)
4200.
6745
4210.
9232
4214.
8285
4222.
6373
4228.
1580
4235.
4636
4237.
2198

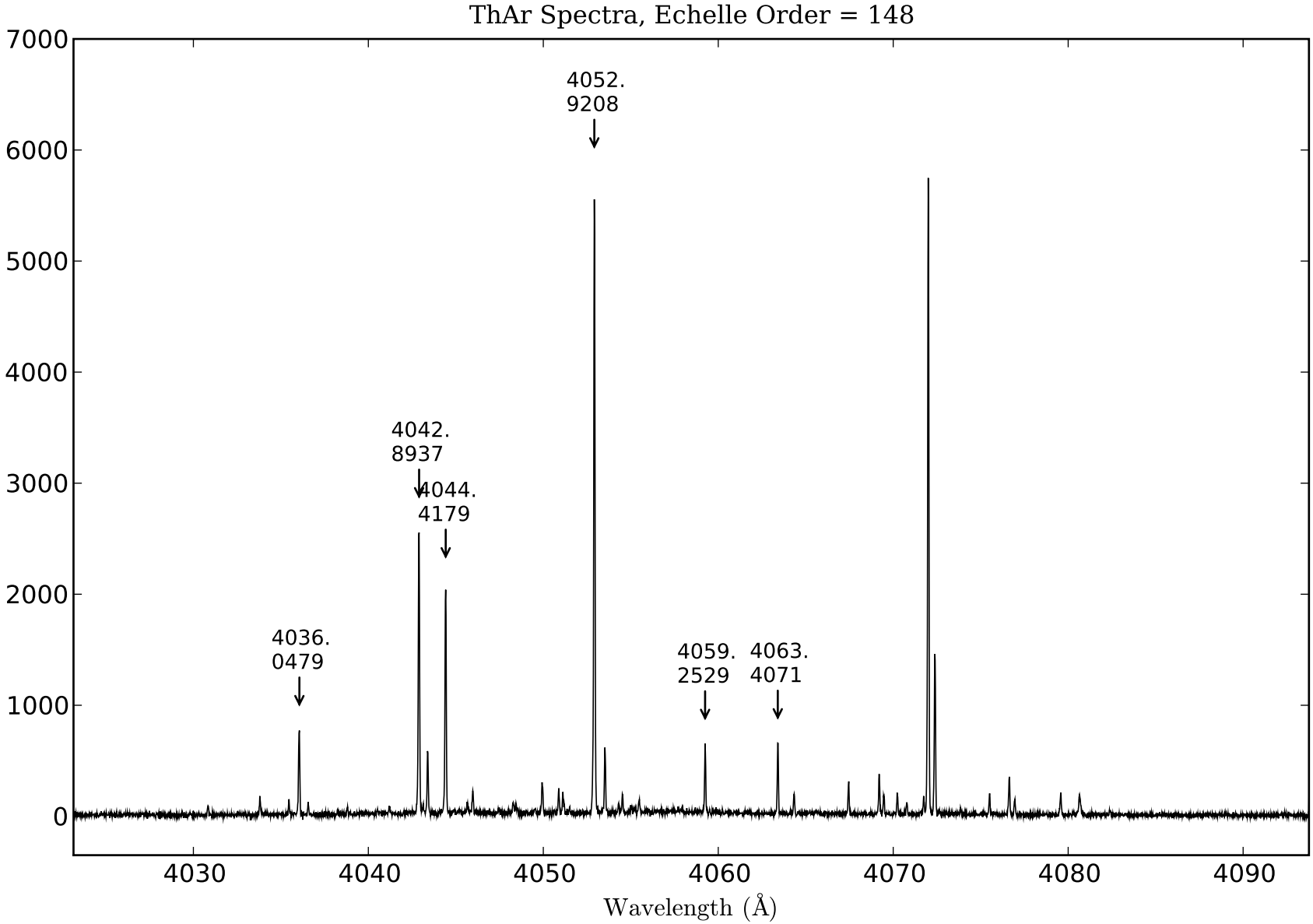

ThAr Spectra, Echelle Order = 143
40000
30000
20000
10000
0
4200.
6745
4198.
3170
4210.
9232
4181.
8836
4194.
9318
4170
4180
4190
4200
4210
4220
4230
Wavelength (Å)


ThAr Spectra, Echelle Order = 144
30000
25000
20000
15000
10000
5000
0
4158.
5905
4164.
1795
4170.
5333
4181.
8836
4140
4150
4160
4170
4180
4190
4200
Wavelength (Å)


ThAr Spectra, Echelle Order = 145
4131.
7235
4134.
0681
4142.
7010
4158.
5905
20000
15000
10000
5000
0
4110
4120
4130
4140
4150
4160
4170
Wavelength (Å)


ThAr Spectra, Echelle Order = 146
12000
10000
8000
6000
4000
2000
0
4080
4090
4100
4110
4120
4130
4140
Wavelength (Å)
4103.
9121
4112.
7545
4131.
7235
4100.
3414
4108.
4198
4116.
7137


ThAr Spectra, Echelle Order = 147
8000
6000
4000
2000
0
4060
4070
4080
4090
4100
4110
4120
Wavelength (Å)
4076.
6284
4086.
5205
4094.
7470
4100.
3414
4103.
9121


ThAr Spectra, Echelle Order = 148
7000
6000
5000
4000
3000
2000
1000
0
4052.
9208
4042.
8937
4044.
4179
4036.
0479
4059.
2529
4063.
4071
4030
4040
4050
4060
4070
4080
4090
Wavelength (Å)