ISAAC

Atlas of Xenon and Argon lines

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Table 1: SW order versus wavelength for higher order wavelength calibration in the M band.

λ_{sw} range (microns)	k_{sw}
[0.83–0.97]	6
[0.98–1.10]	5
[1.10–1.40]	4
[1.40–1.82]	3
[1.82–2.50]	2

1 Introduction

This document provides Argon and Xenon line lists and plots for wavelength calibration of ISAAC data.
It is reminded that due to non perfect reproducibility of the ISAAC grating, it is recommended to use the OH lines for wavelength calibration of the science data in the SW domain. In the LW domain, half cycle frames also provide an intrinsic way of calibrating science data with the atmospheric absorption lines seen in emission against the thermal background, but no detailed atlas of these lines is available yet. Therefore, in the LW domain, wavelength calibration has to resort to arc frames, with the material provided below. Only in the L band (SL filter) are arc lines detectable. In part of the L band, and in the M band, there are no observable lines, and wavelength calibration has to be done with higher orders in the SW domain, and linearly scaling the wavelength dispersion solution according to:

$$\lambda_{lw} = k_{sw} \times \lambda_{sw}$$

using the following table:

2 SW-LR plots

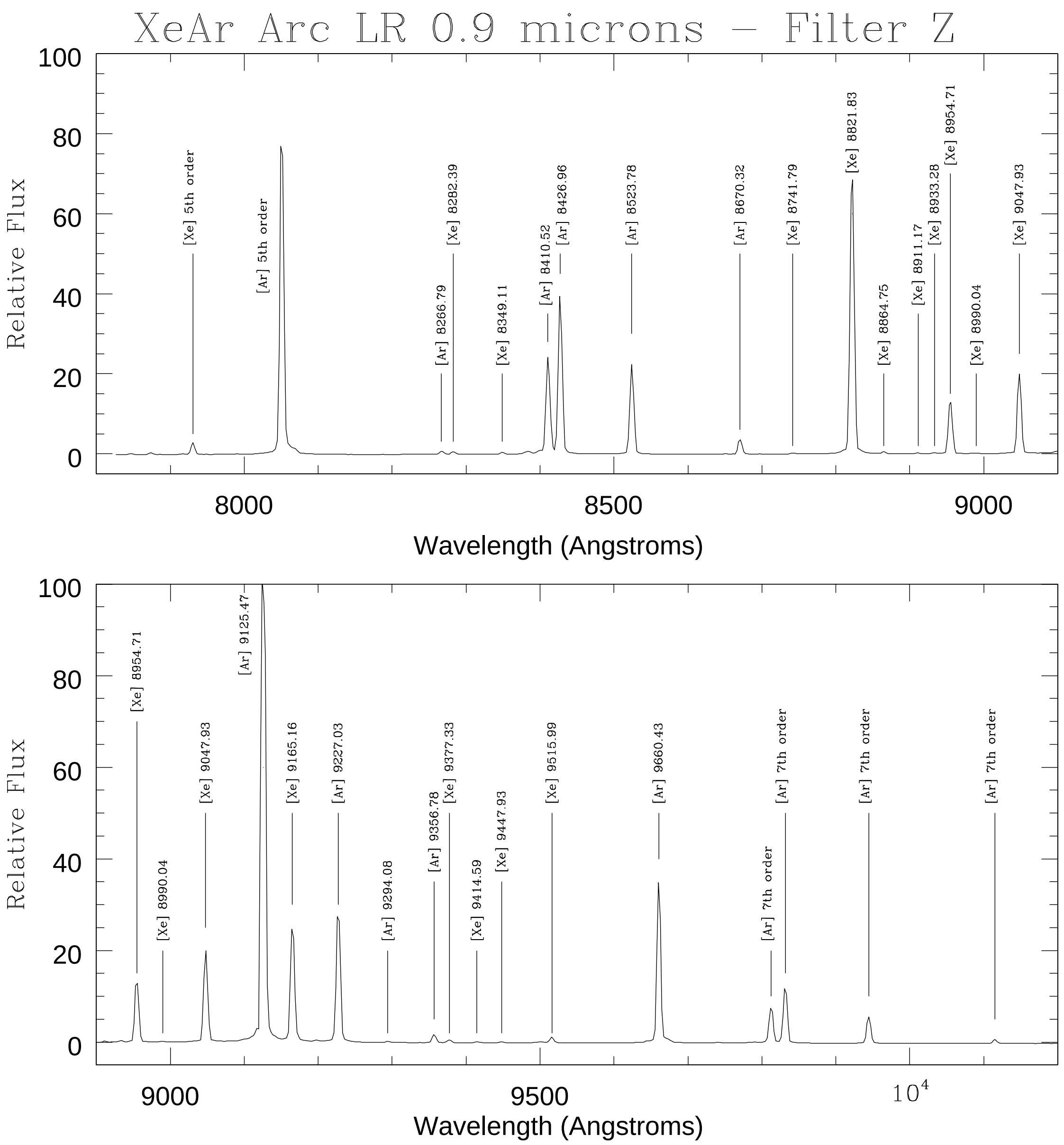

Figure 1: Ar and Xe lines in SWS1-LR mode, Z band

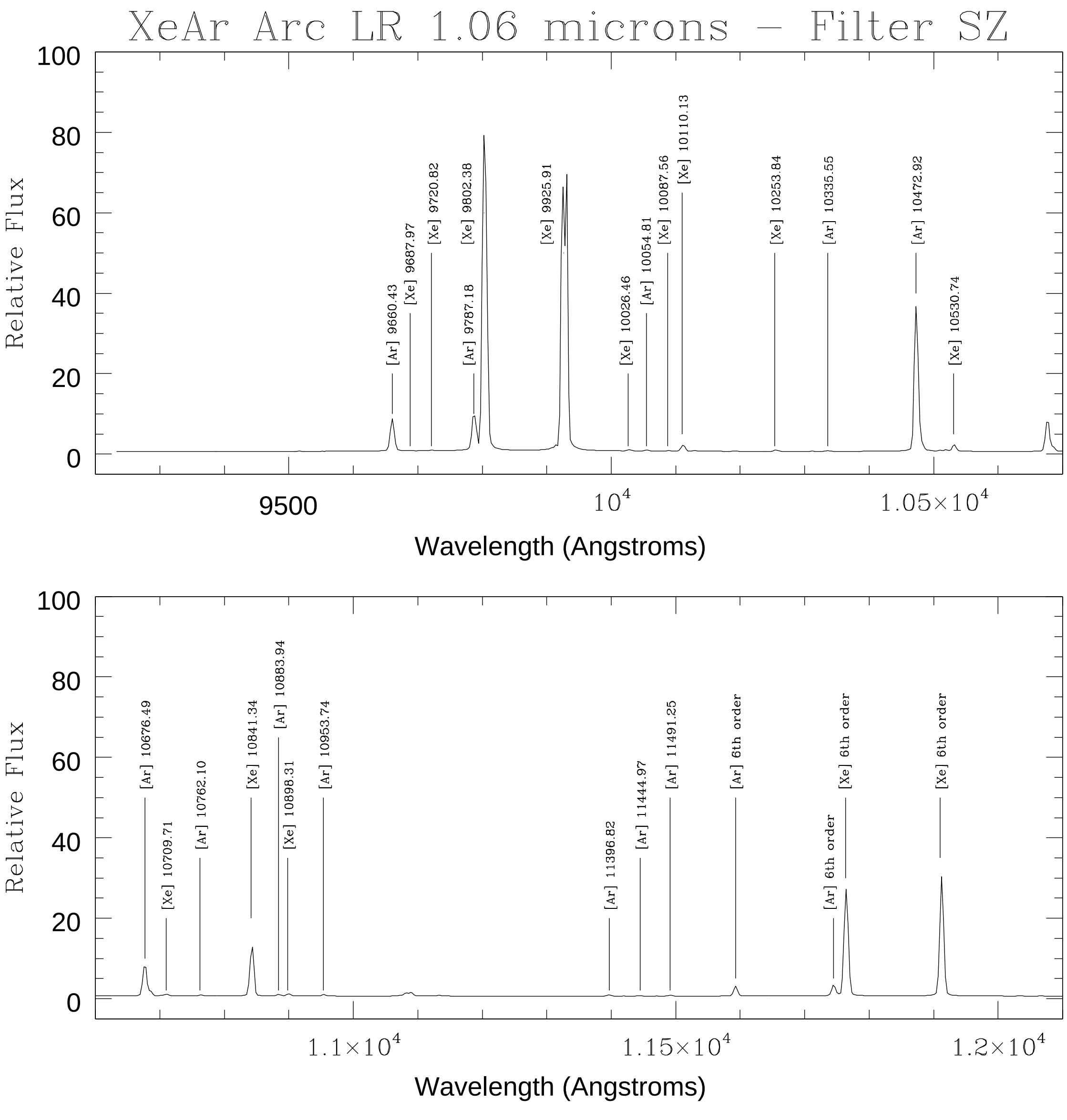

Figure 2: Ar and Xe lines in SWS1-LR mode, SZ band

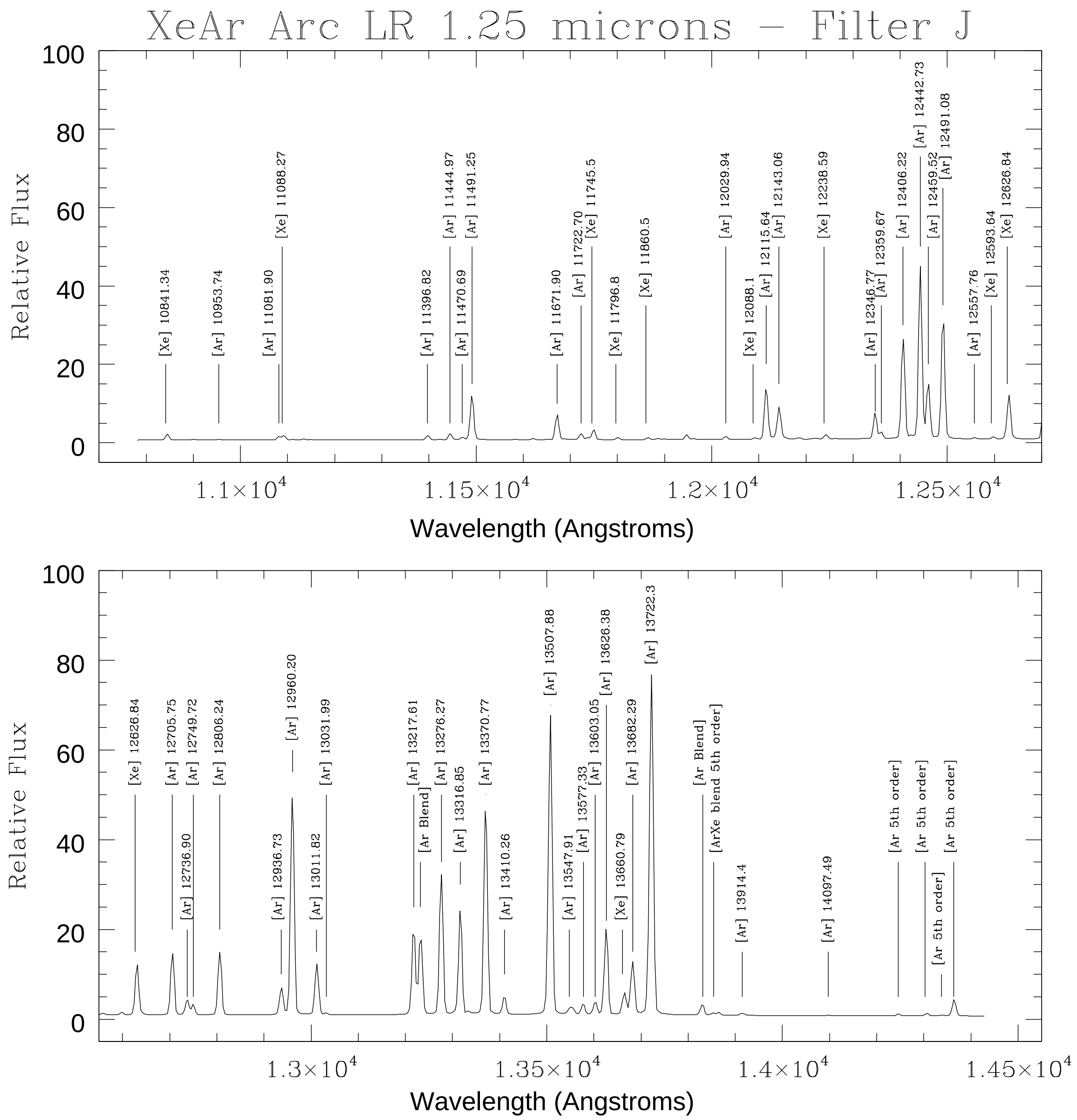

Figure 3: Ar and Xe lines in SWS1-LR mode, J band

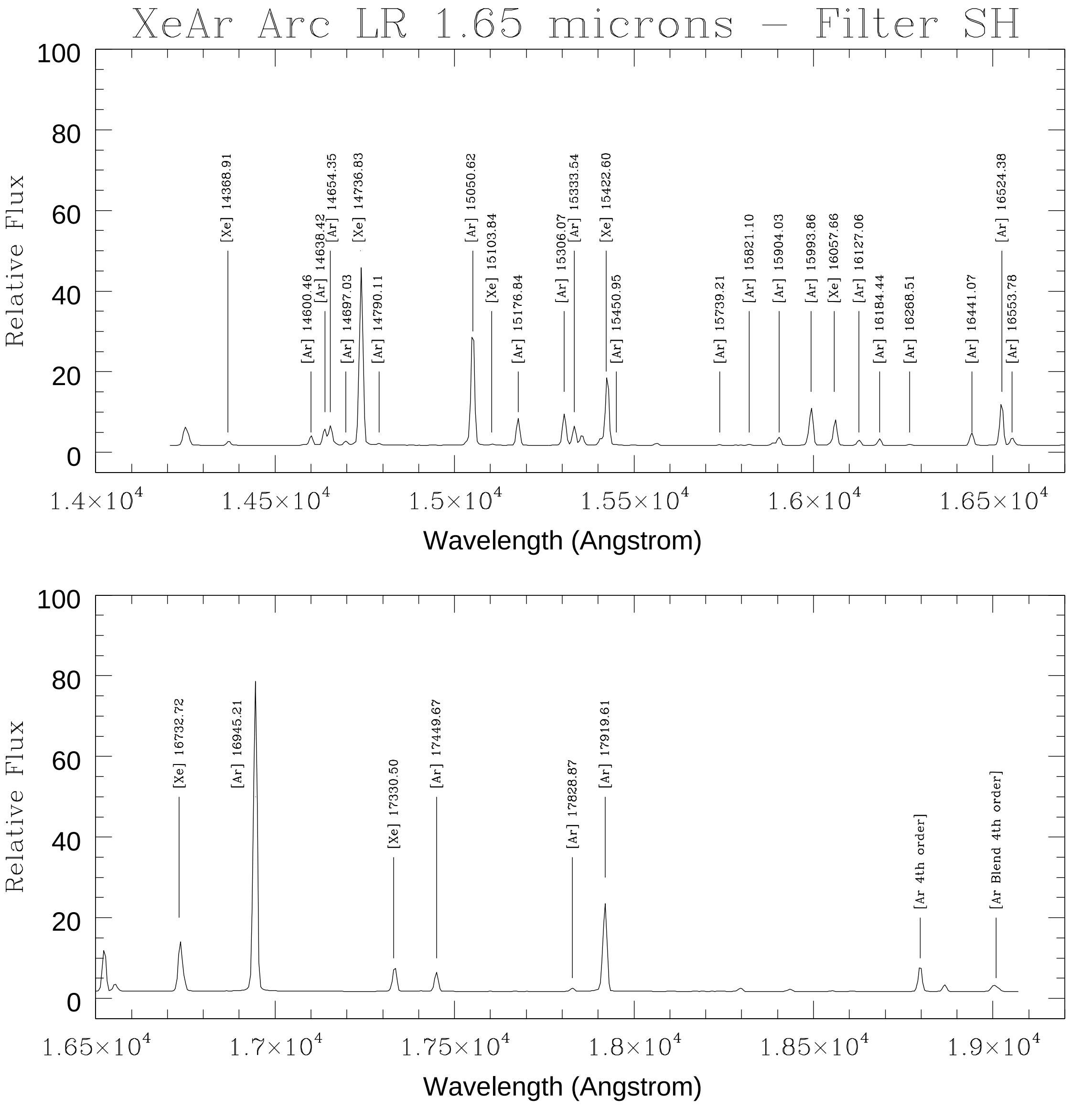

Figure 4: Ar and Xe lines in SWS1-LR mode, SH band

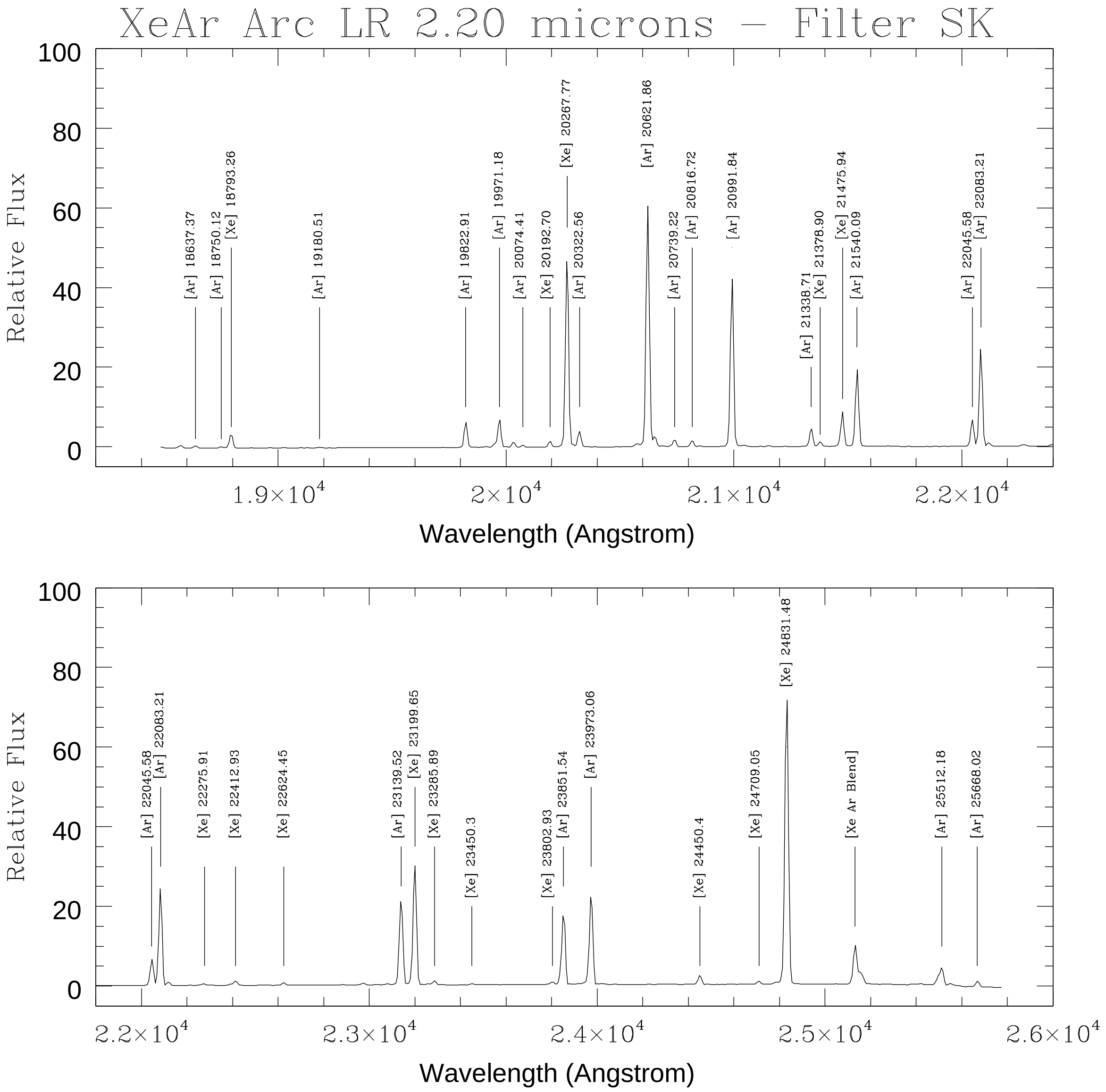

Figure 5: Ar and Xe lines in SWS1-LR mode, SK band

3 SW-MR plots

This section shows the plots in the SWS1-MR mode, scanning the whole [0.9–2.5] μm range. For completeness, some regions of order overlap are plotted through adjacent filters / orders, and some spectra in J are shown through the Js filter instead of the J filter.

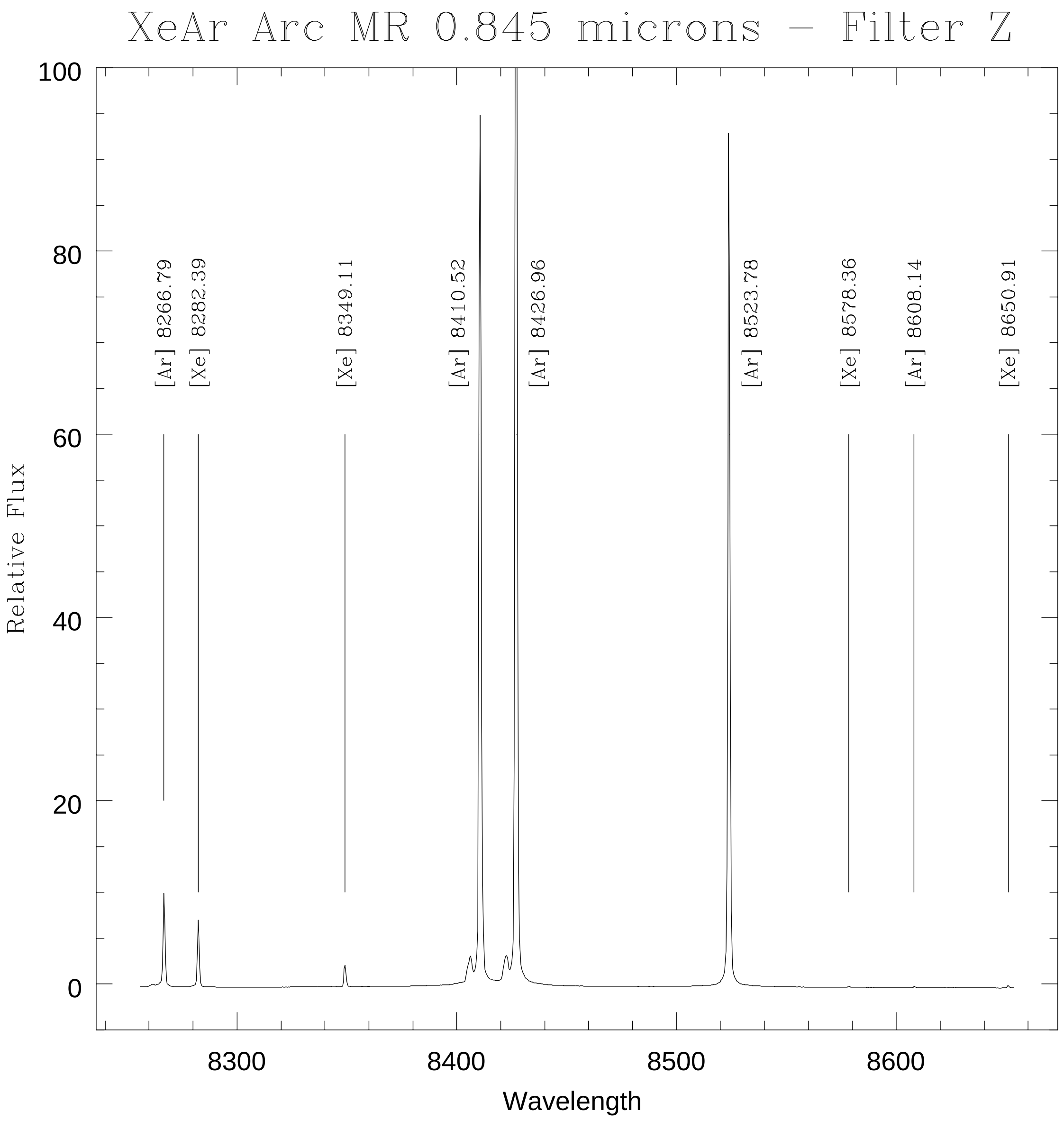

Figure 6: Ar and Xe lines in SWS1-MR mode, Z band, 0.845 μm

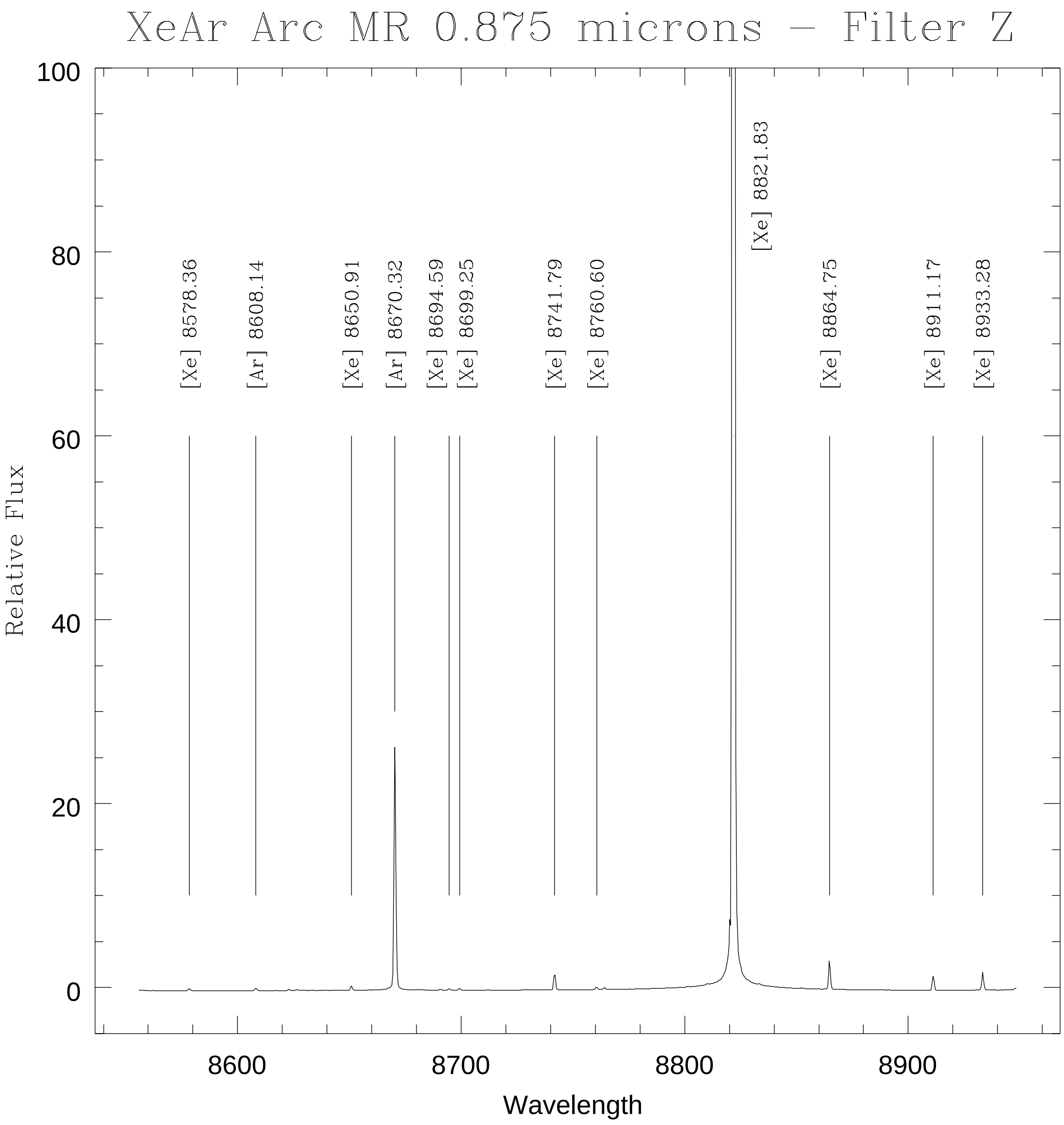

Figure 7: Ar and Xe lines in SWS1-MR mode, Z band, 0.875 μm

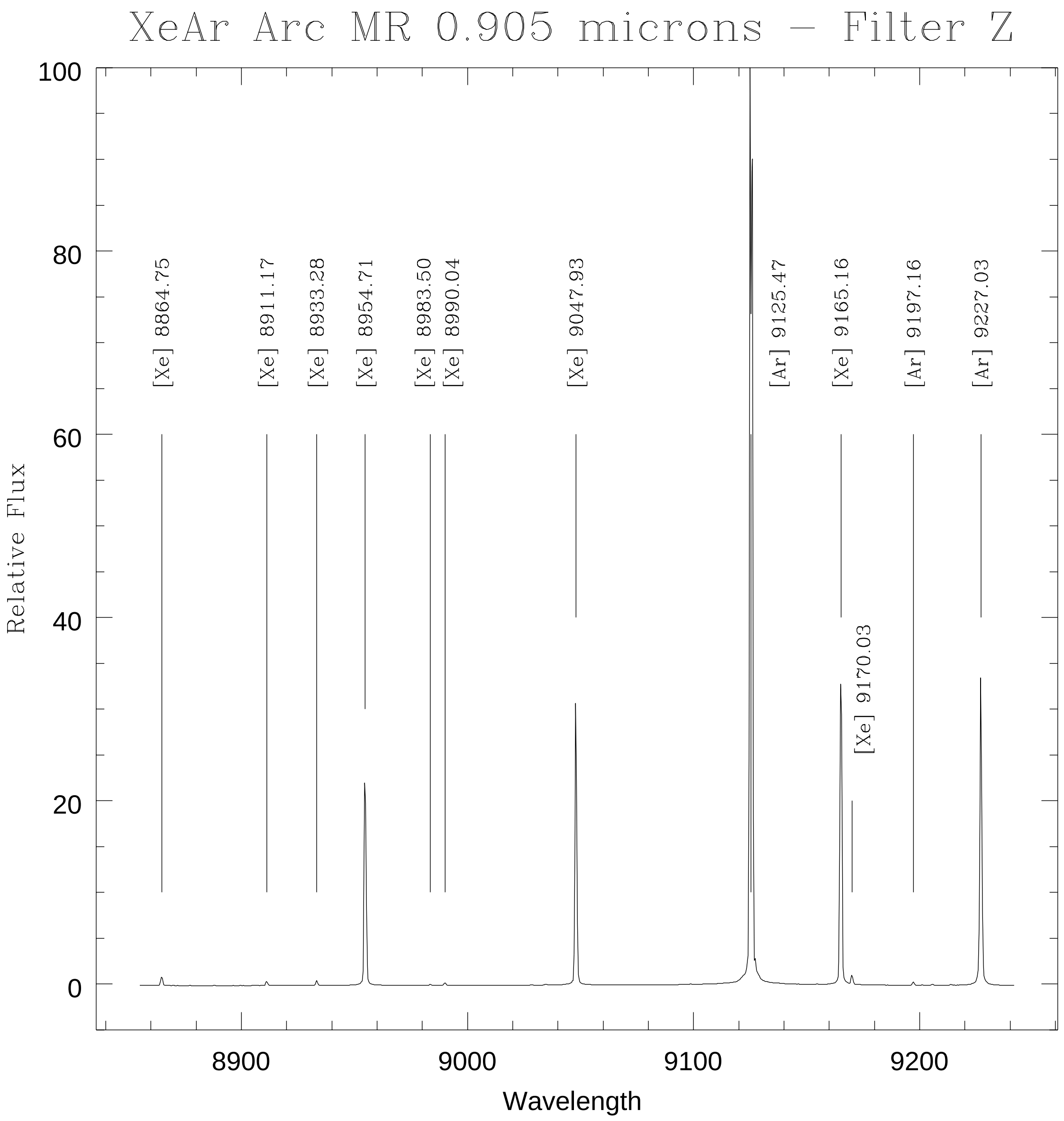

Figure 8: Ar and Xe lines in SWS1-MR mode, Z band, 0.905 μm

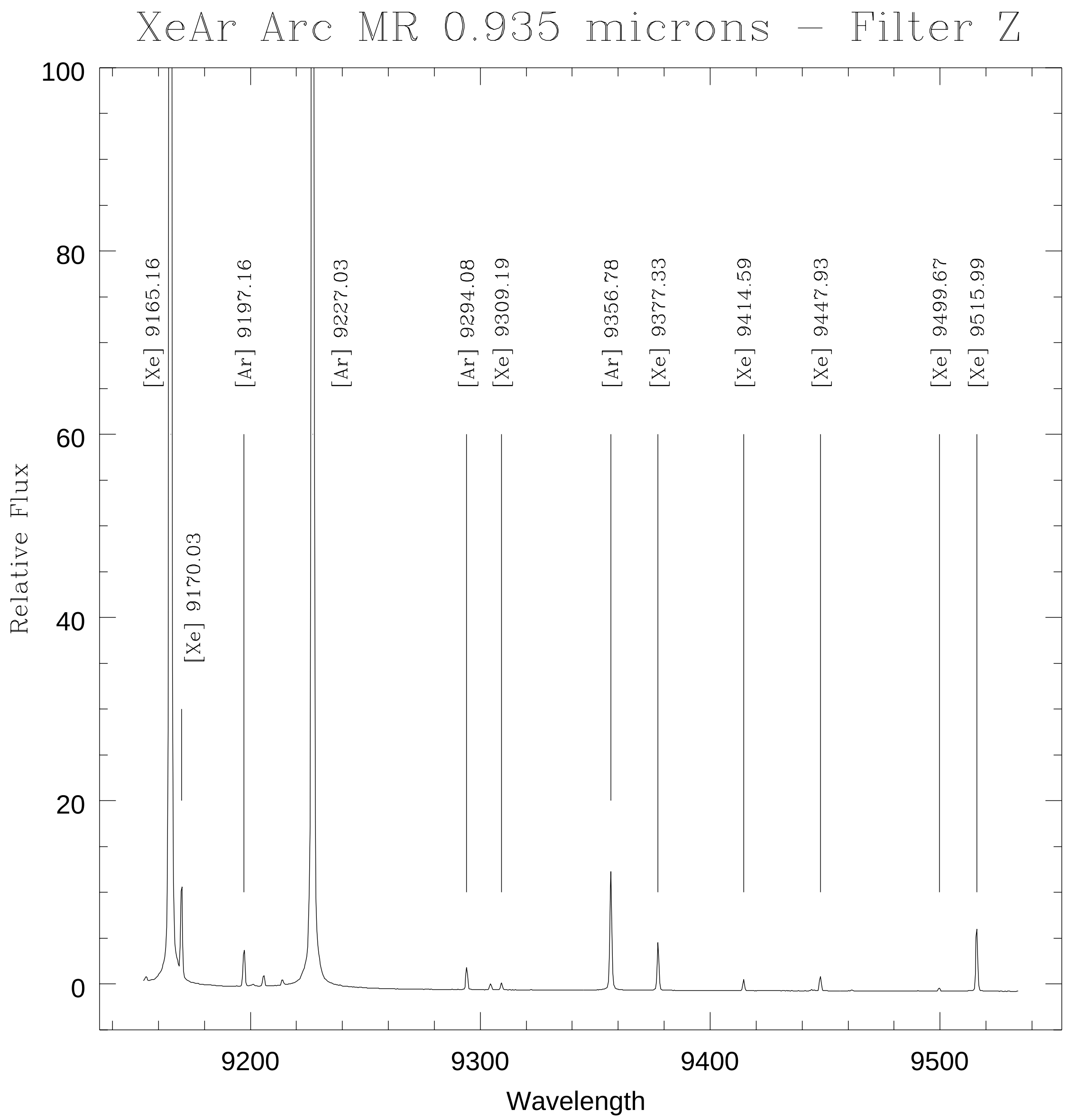

Figure 9: Ar and Xe lines in SWS1-MR mode, Z band, 0.935 μm

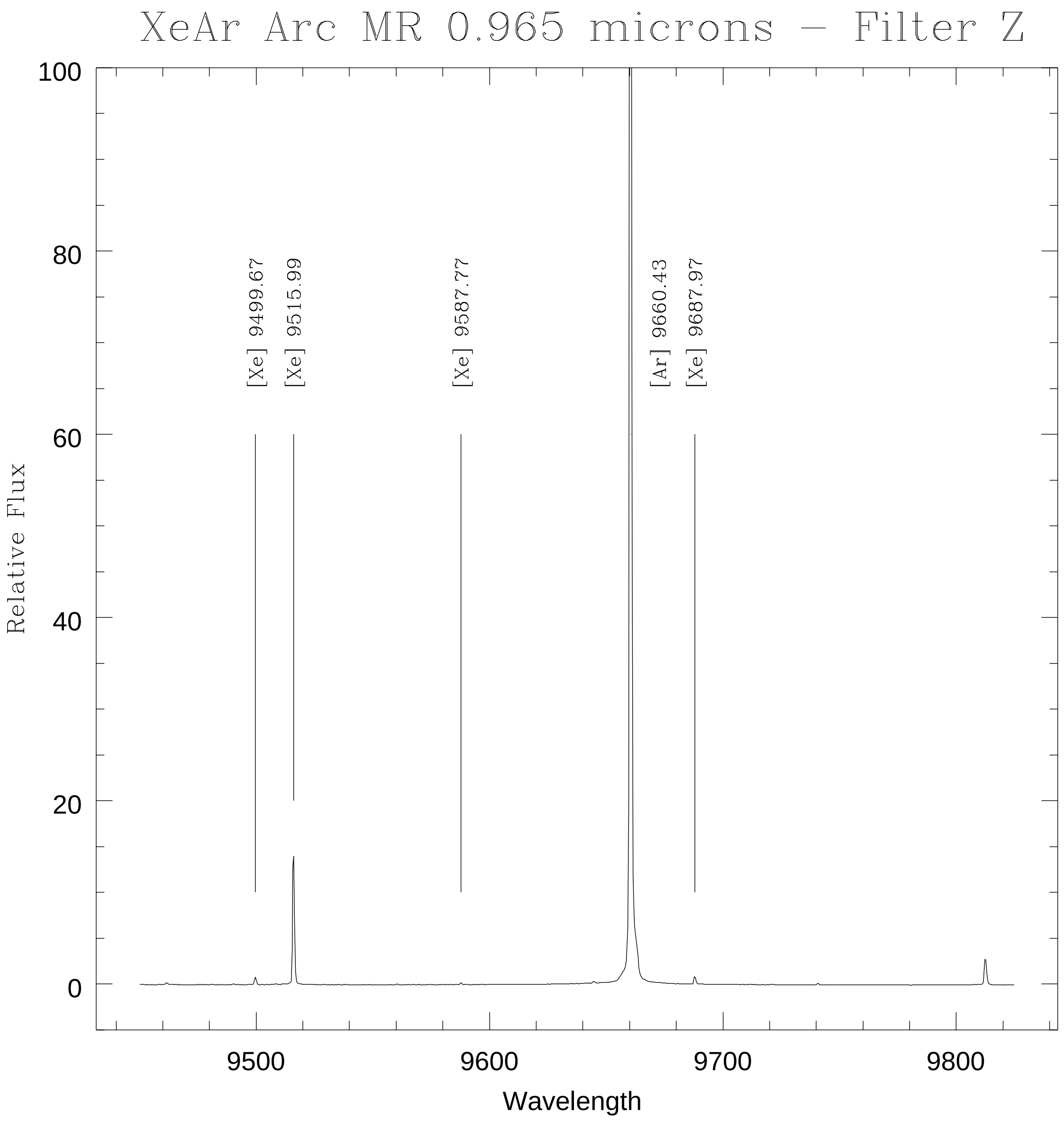

Figure 10: Ar and Xe lines in SWS1-MR mode, Z band, 0.965 μm

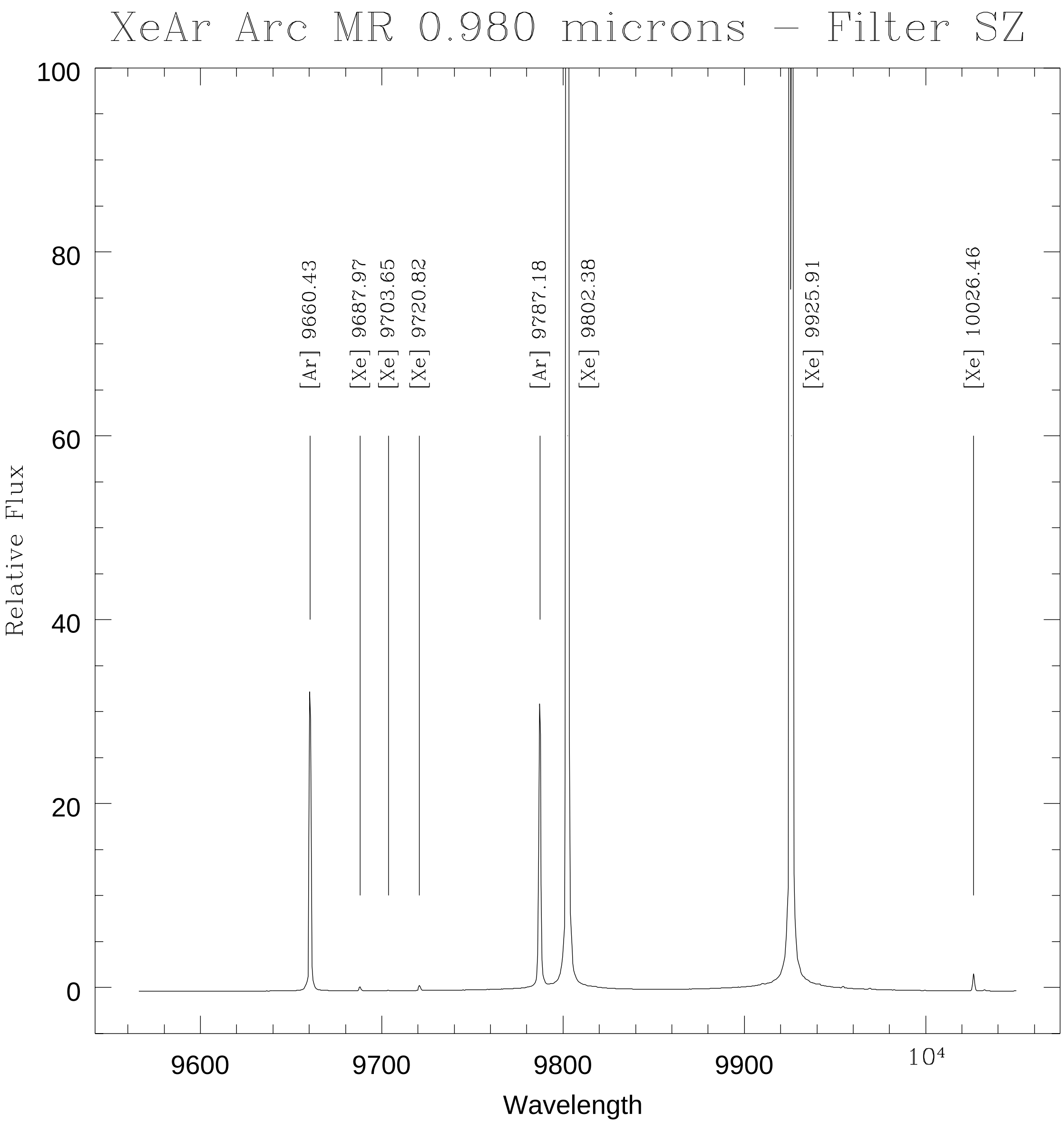

Figure 11: Ar and Xe lines in SWS1-MR mode, SZ band, 0.980 μm

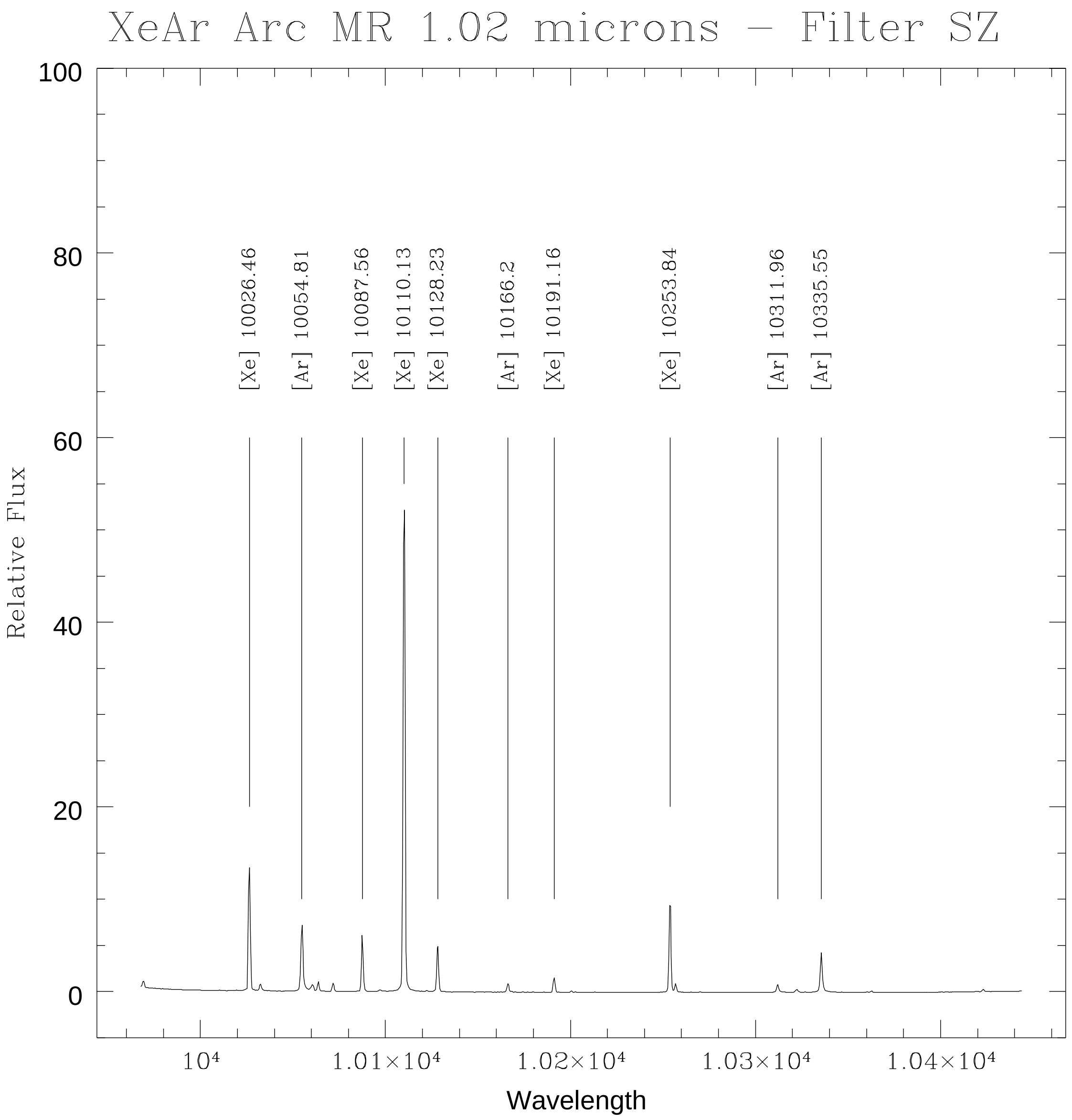

Figure 12: Ar and Xe lines in SWS1-MR mode, SZ band, 1.02 μm

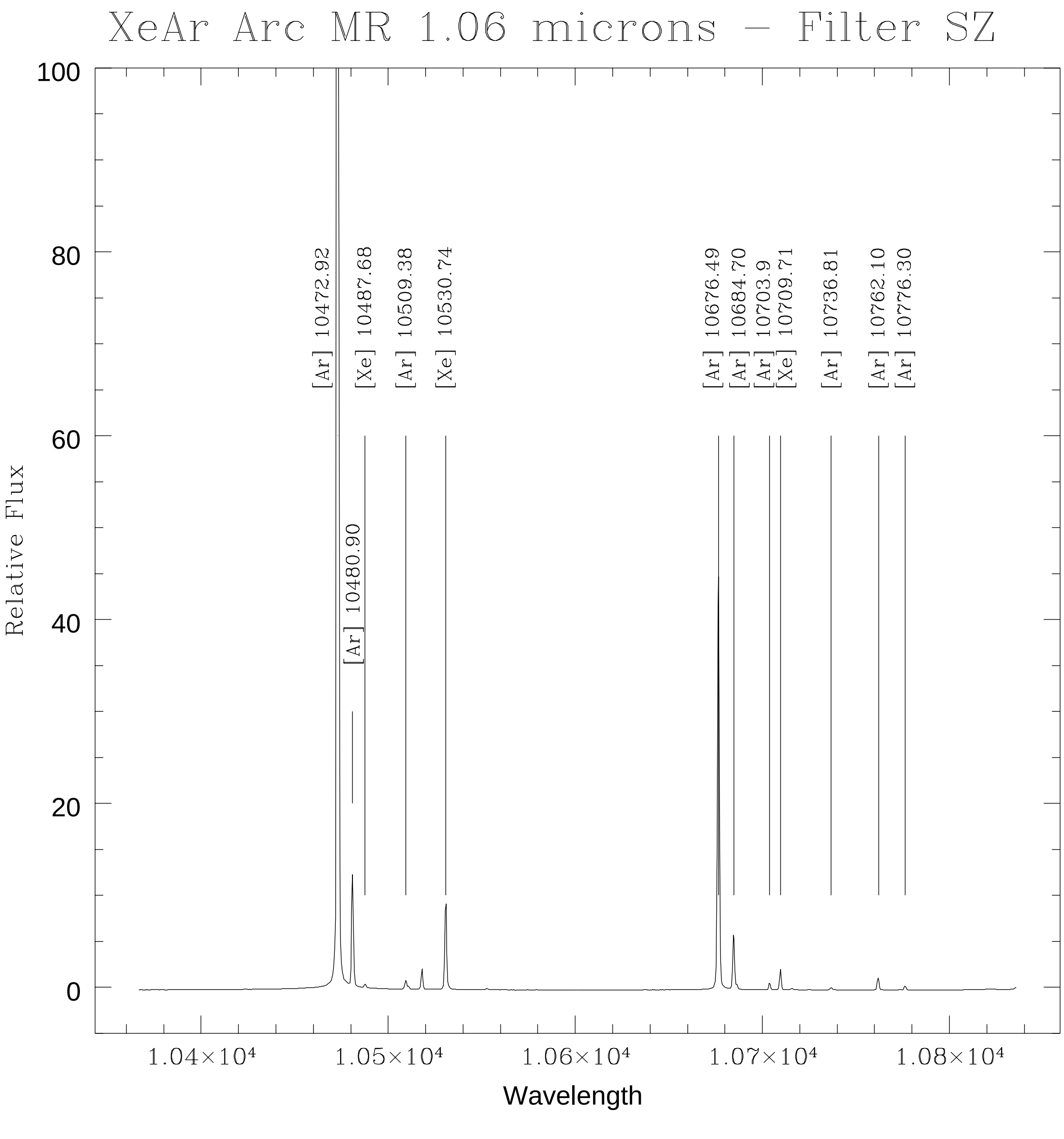

Figure 13: Ar and Xe lines in SWS1-MR mode, SZ band, 1.06 μm

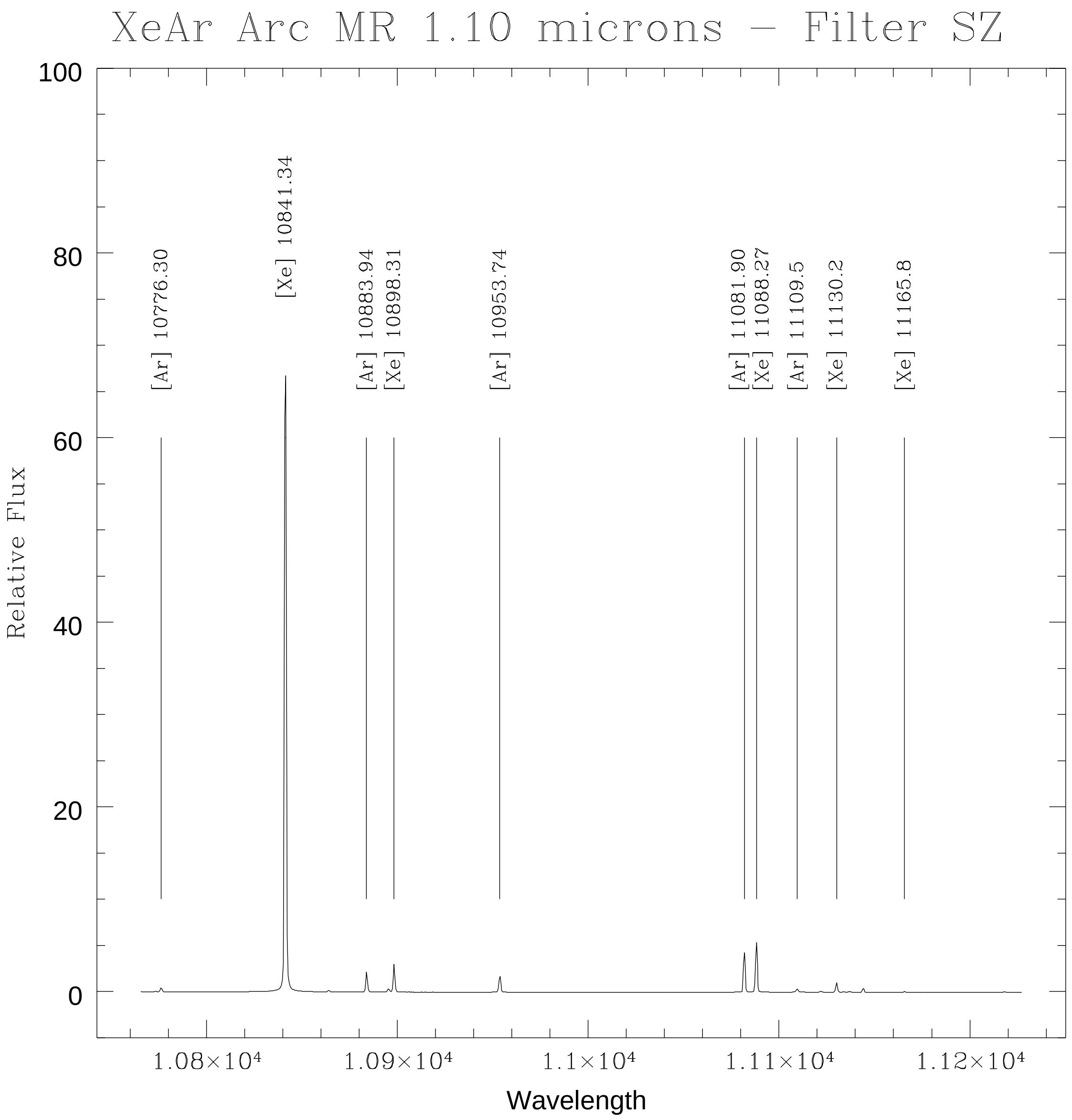

Figure 14: Ar and Xe lines in SWS1-MR mode, SZ band, 1.10 μm

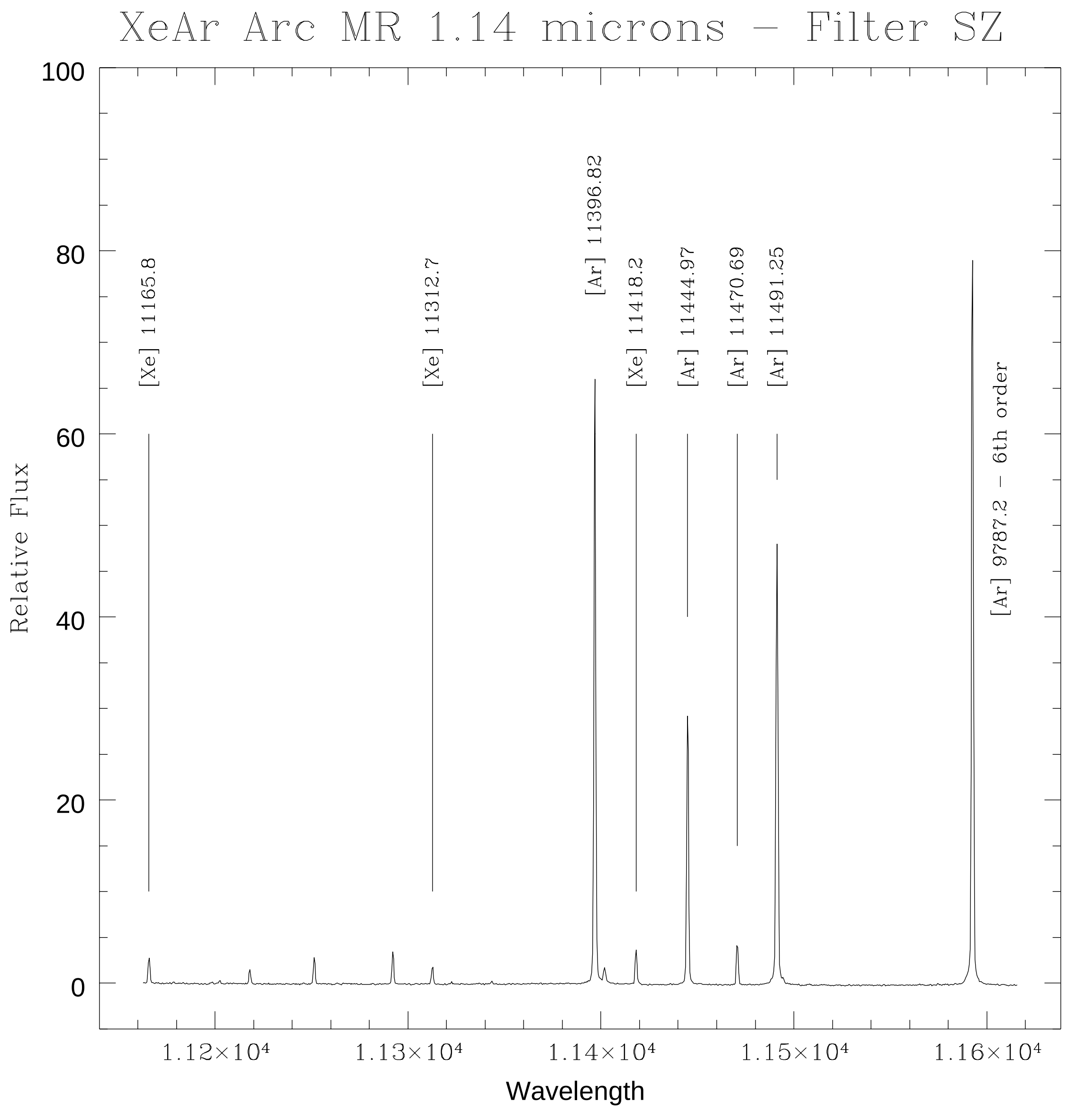

Figure 15: Ar and Xe lines in SWS1-MR mode, SZ band, 1.14 μm

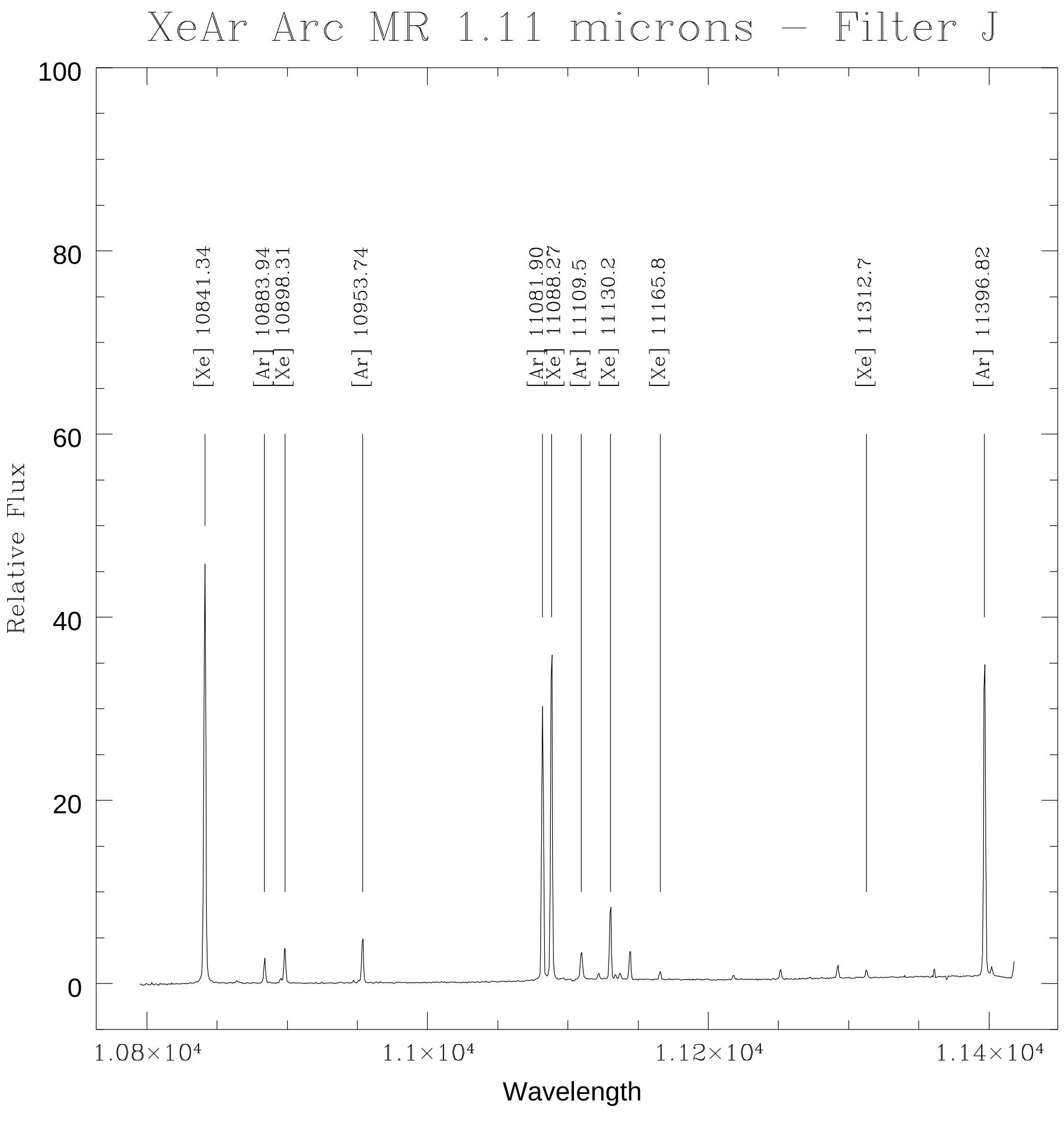

Figure 16: Ar and Xe lines in SWS1-MR mode, J band, 1.11 μm

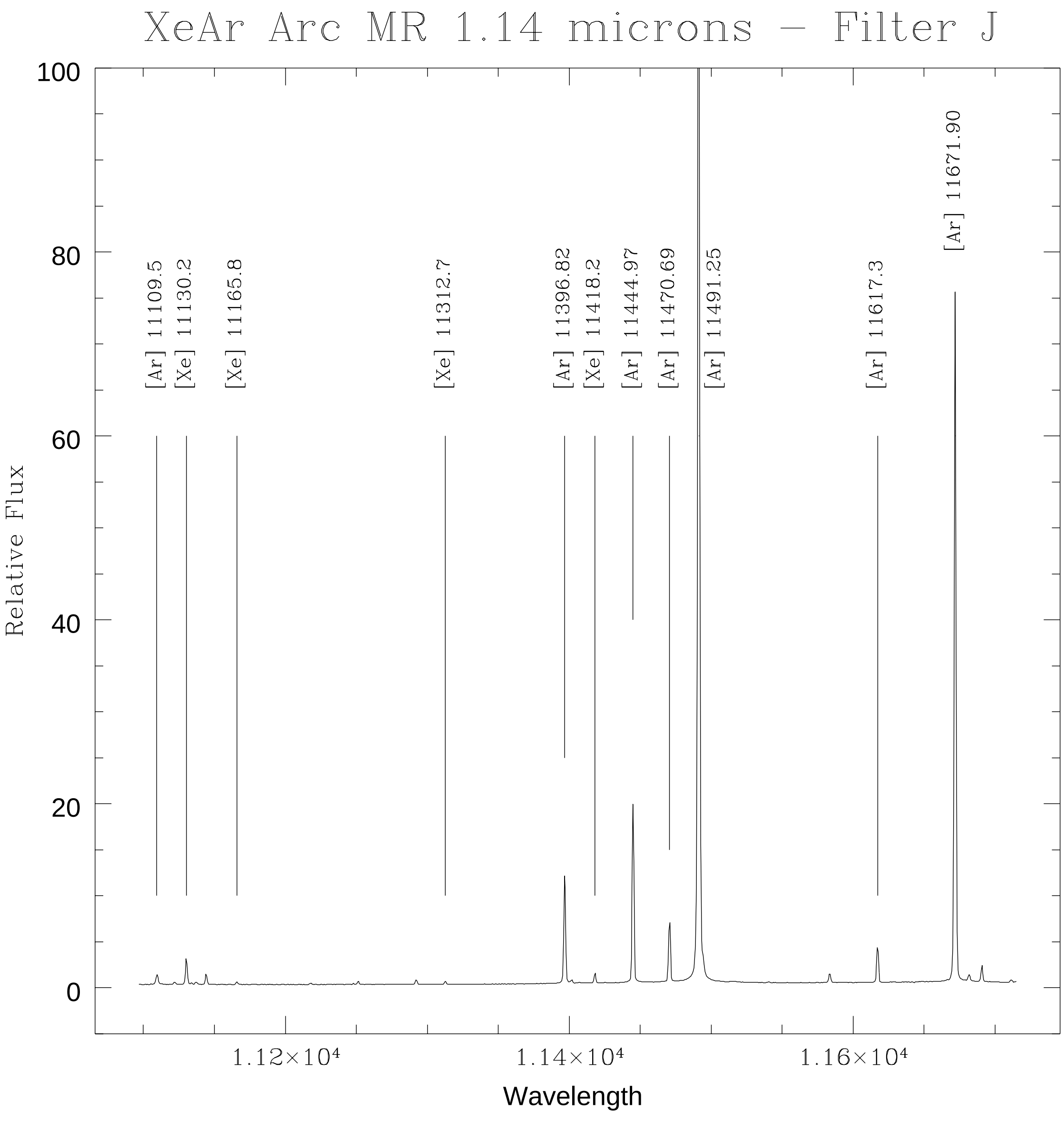

Figure 17: Ar and Xe lines in SWS1-MR mode, J band, 1.14 μm

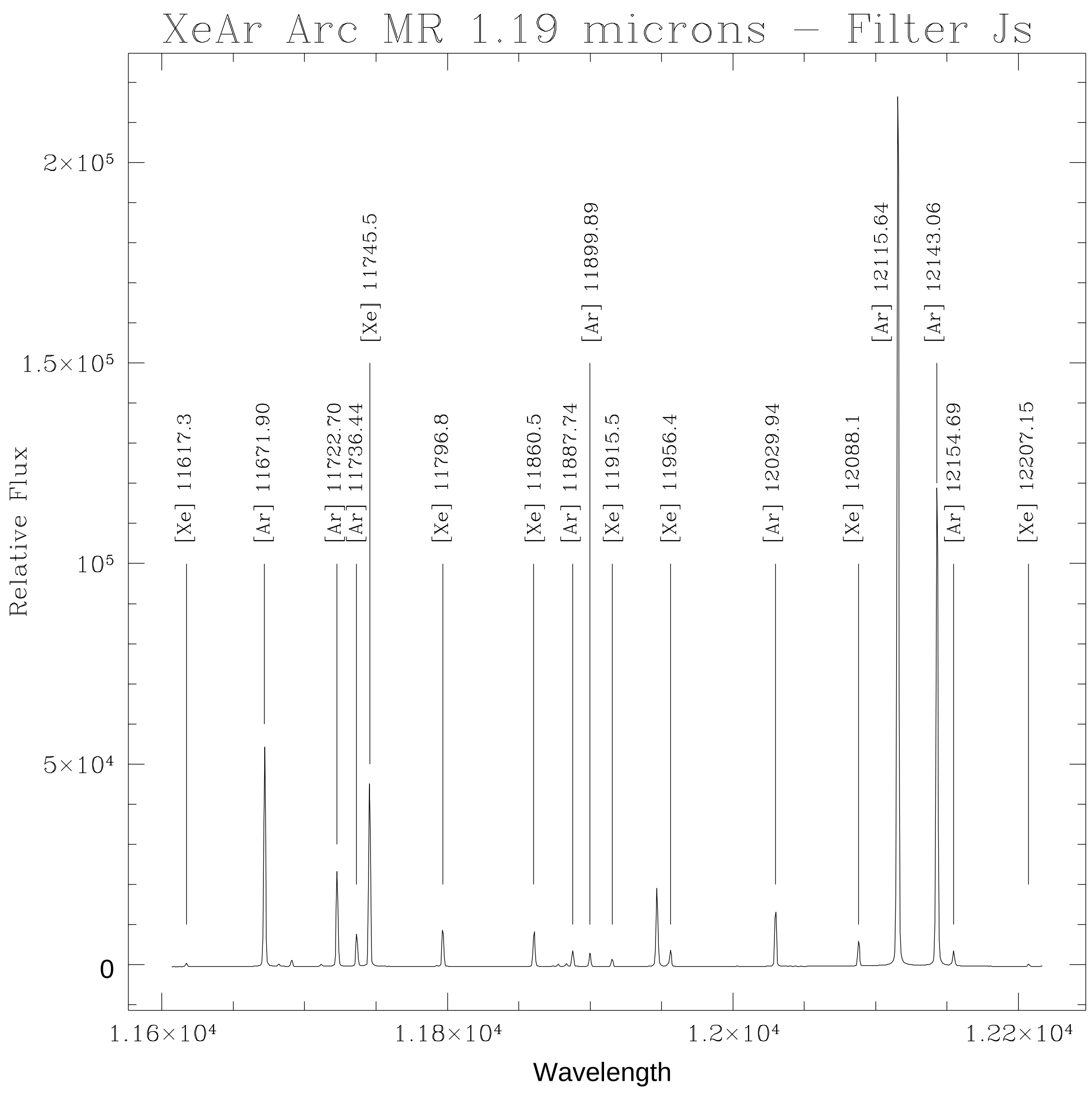

Figure 18: Ar and Xe lines in SWS1-MR mode, J band, 1.19 μm

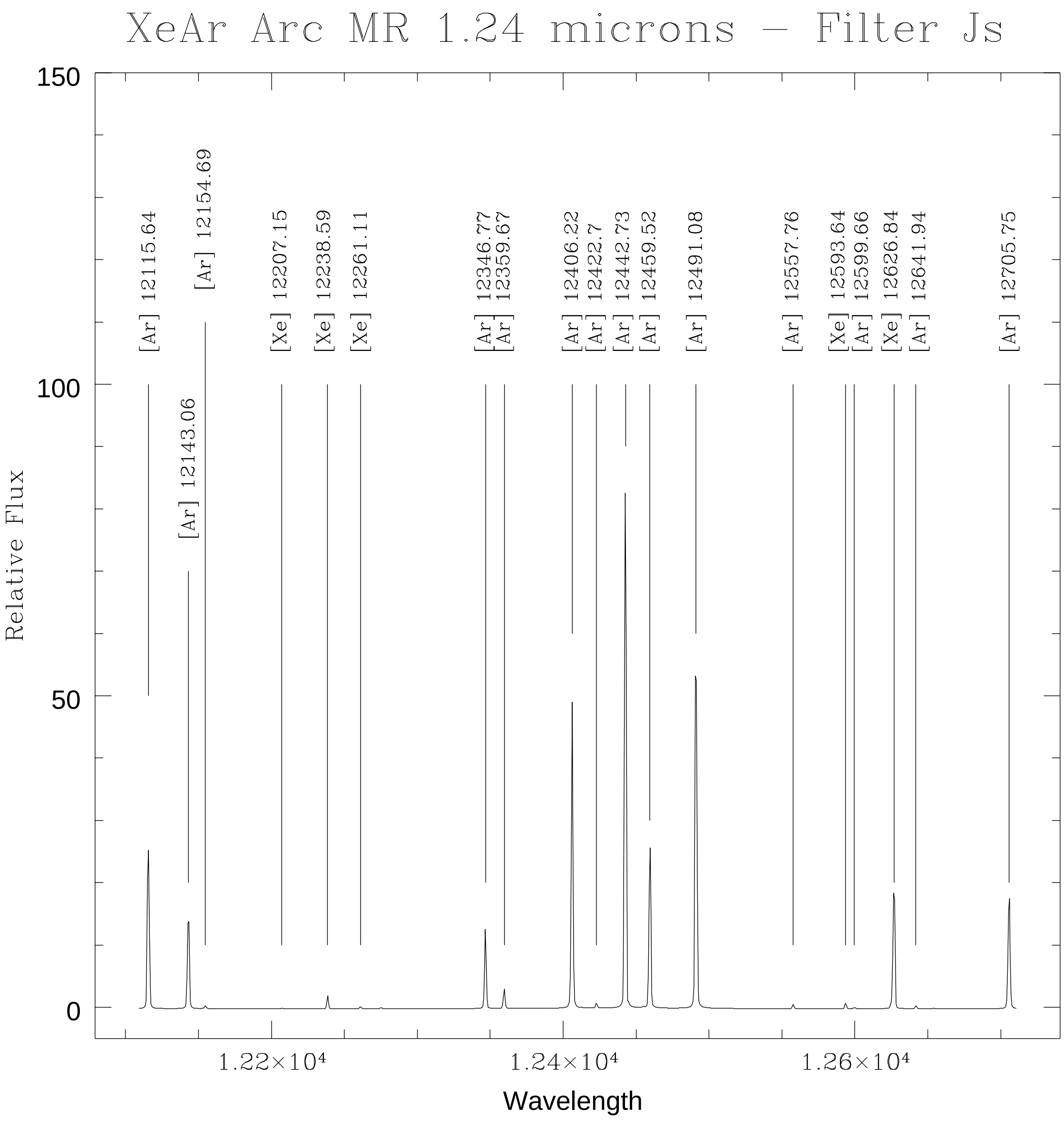

Figure 19: Ar and Xe lines in SWS1-MR mode, J band, 1.24 μm

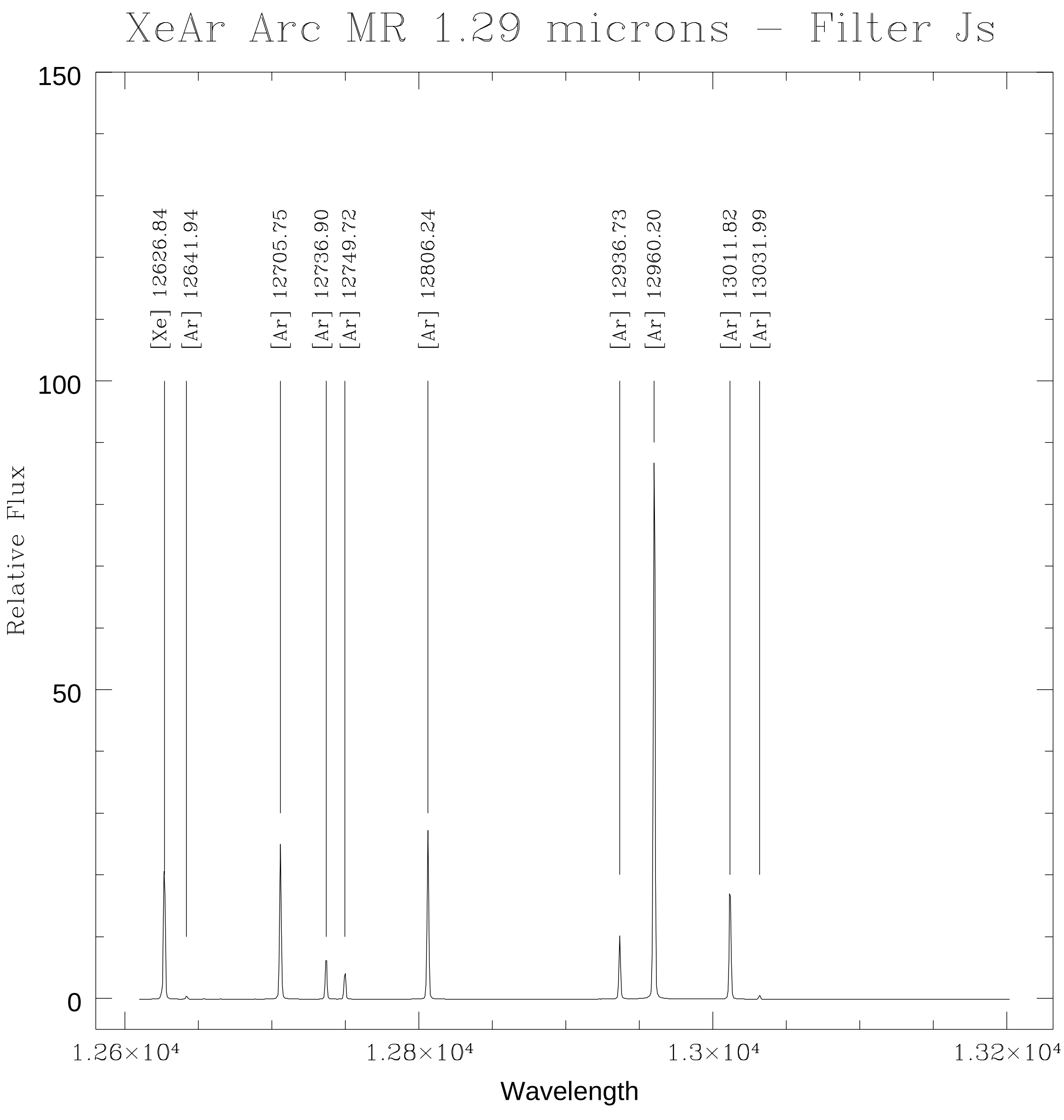

Figure 20: Ar and Xe lines in SWS1-MR mode, J band, 1.29 μm

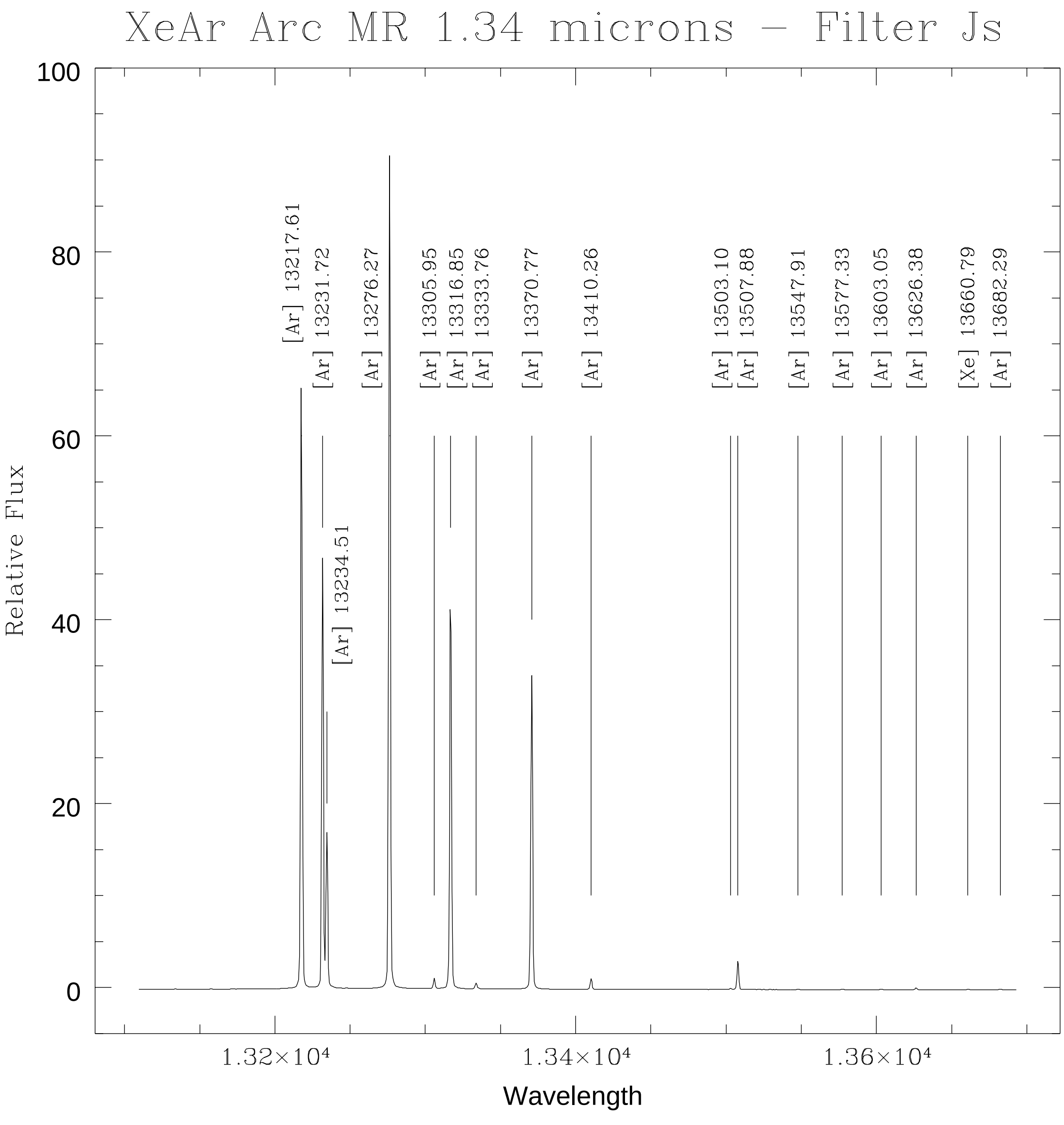

Figure 21: Ar and Xe lines in SWS1-MR mode, J band, 1.34 μm

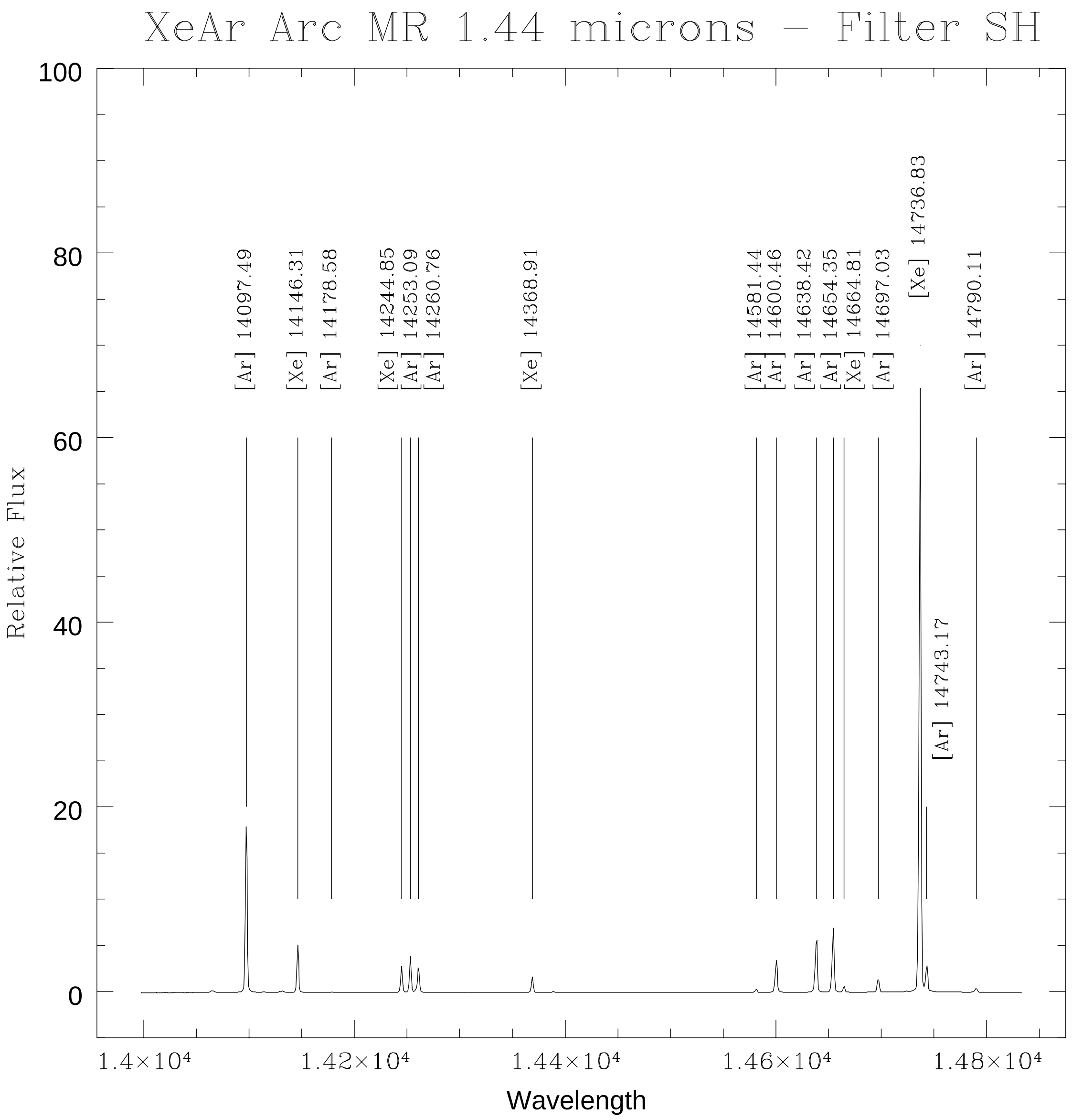

Figure 22: Ar and Xe lines in SWS1-MR mode, SH band, 1.44 μm

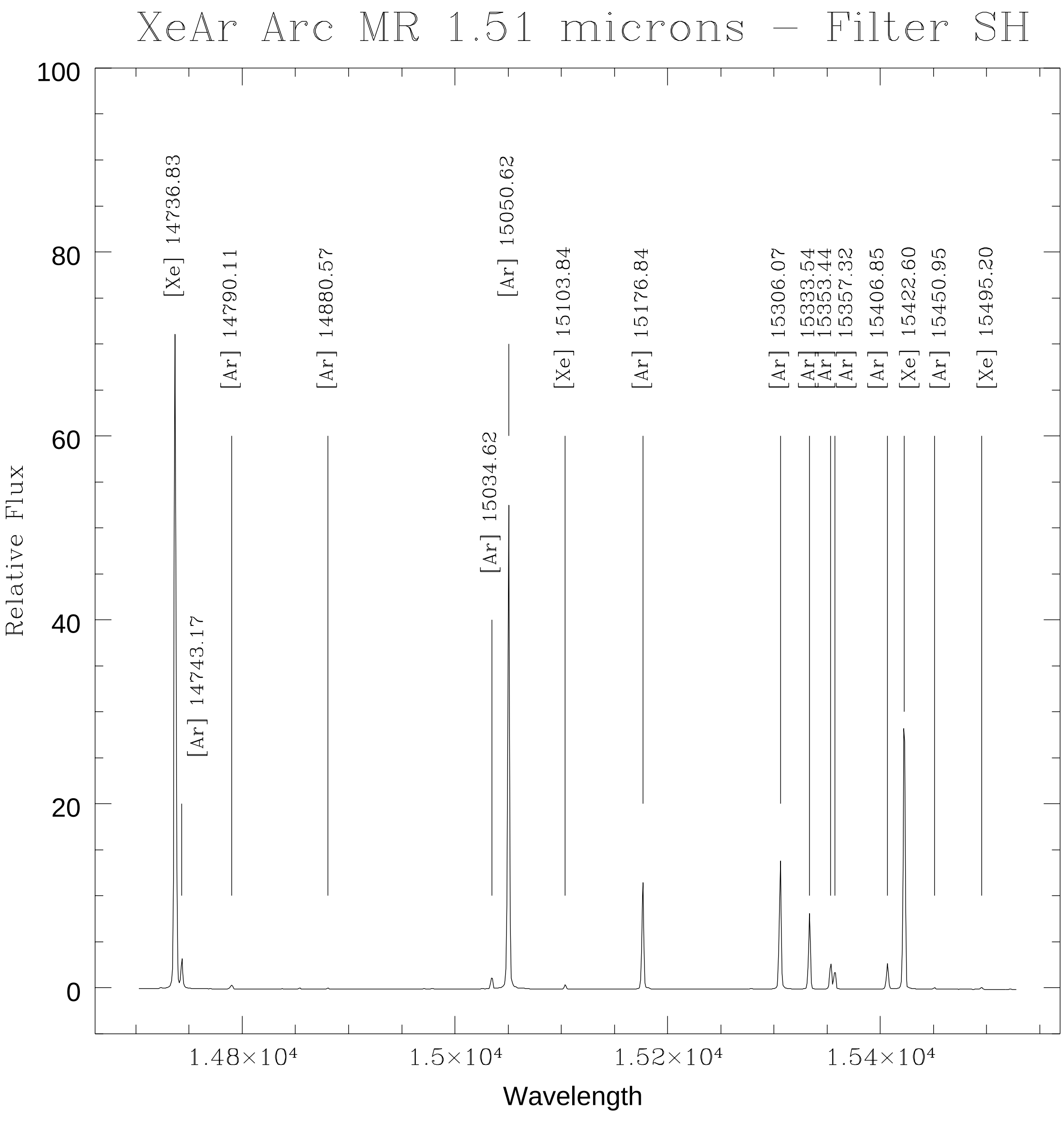

Figure 23: Ar and Xe lines in SWS1-MR mode, SH band, 1.51 μm

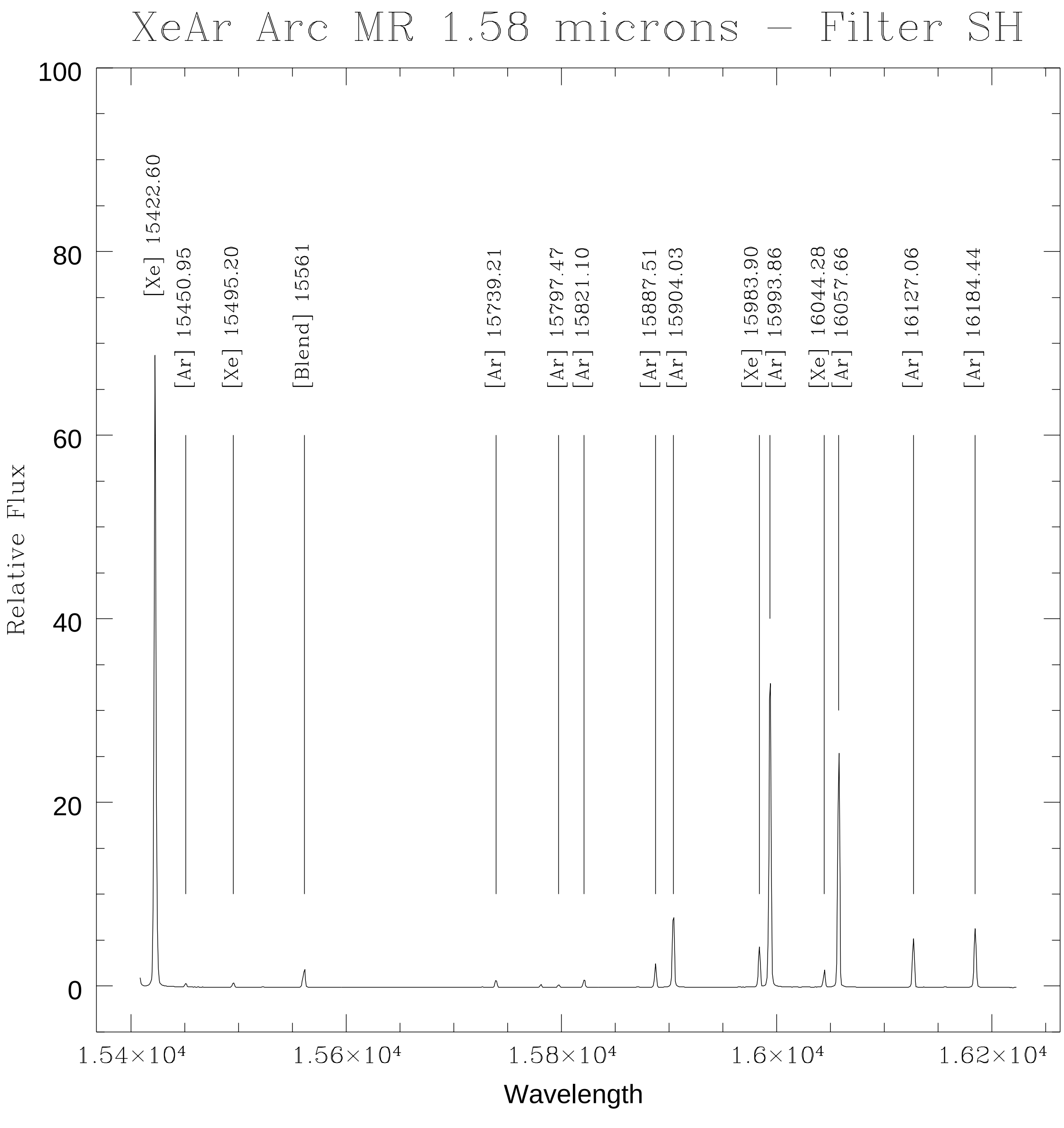

Figure 24: Ar and Xe lines in SWS1-MR mode, SH band, 1.58 μm

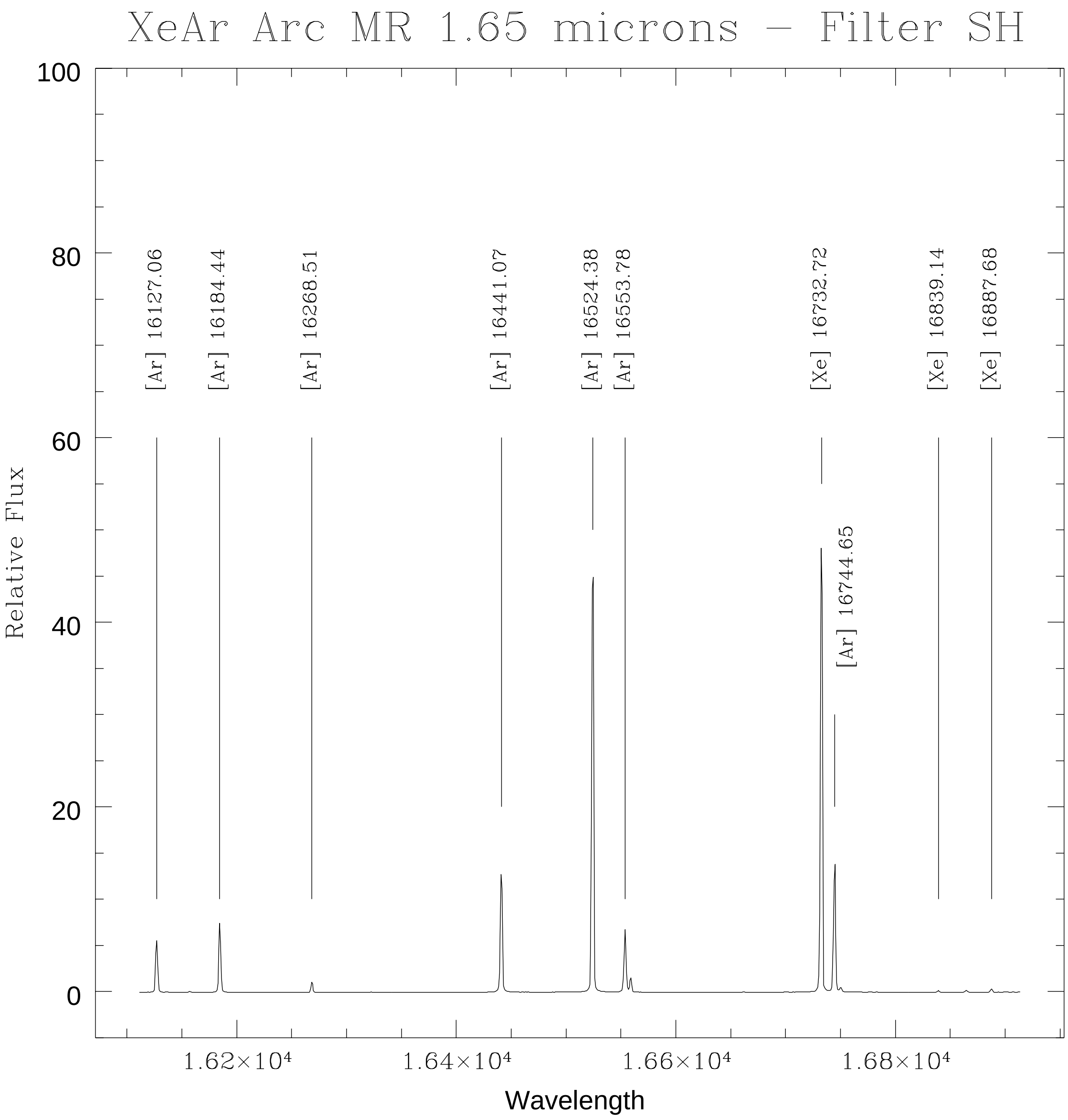

Figure 25: Ar and Xe lines in SWS1-MR mode, SH band, 1.65 μm

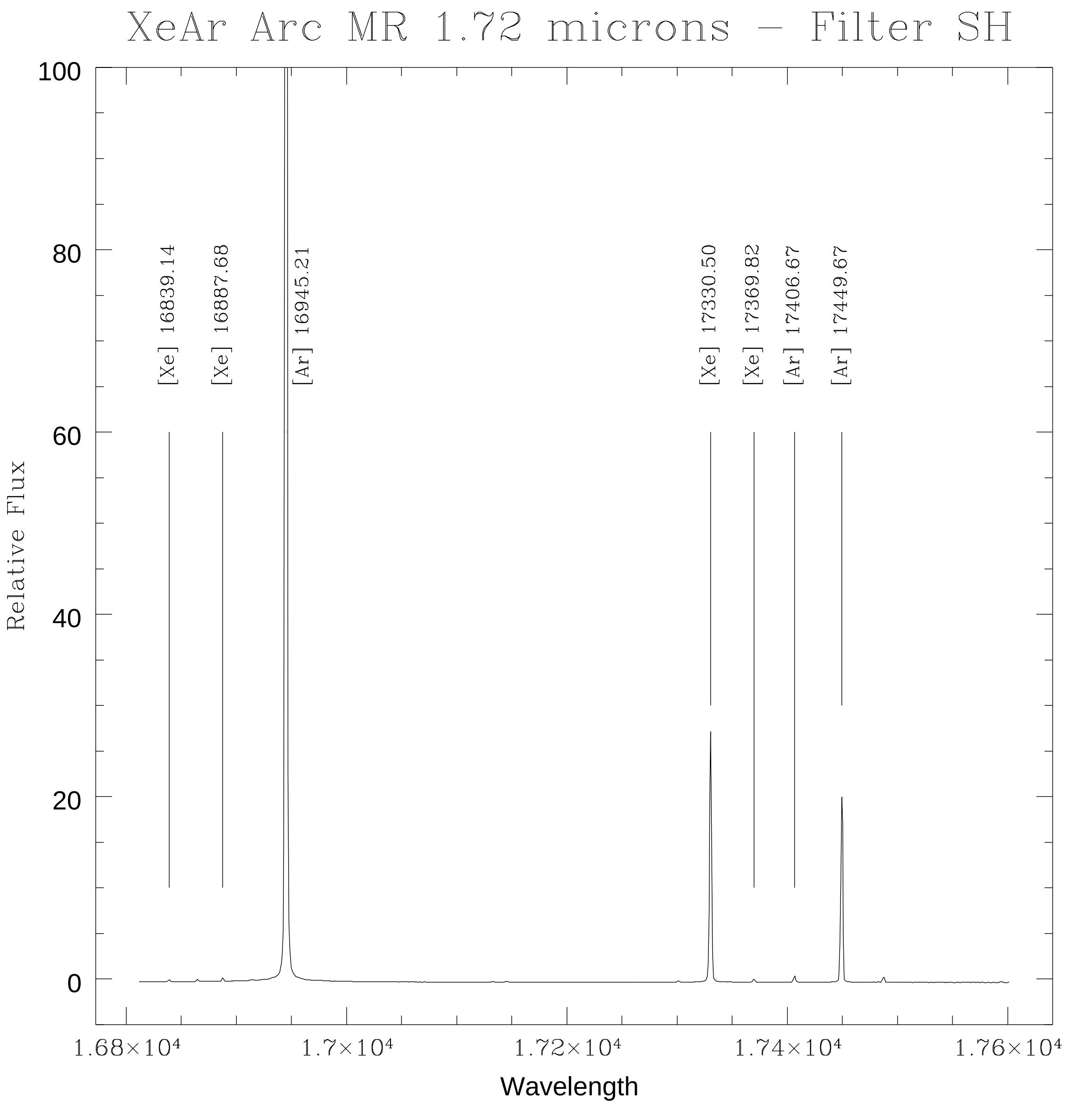

Figure 26: Ar and Xe lines in SWS1-MR mode, SH band, 1.72 μm

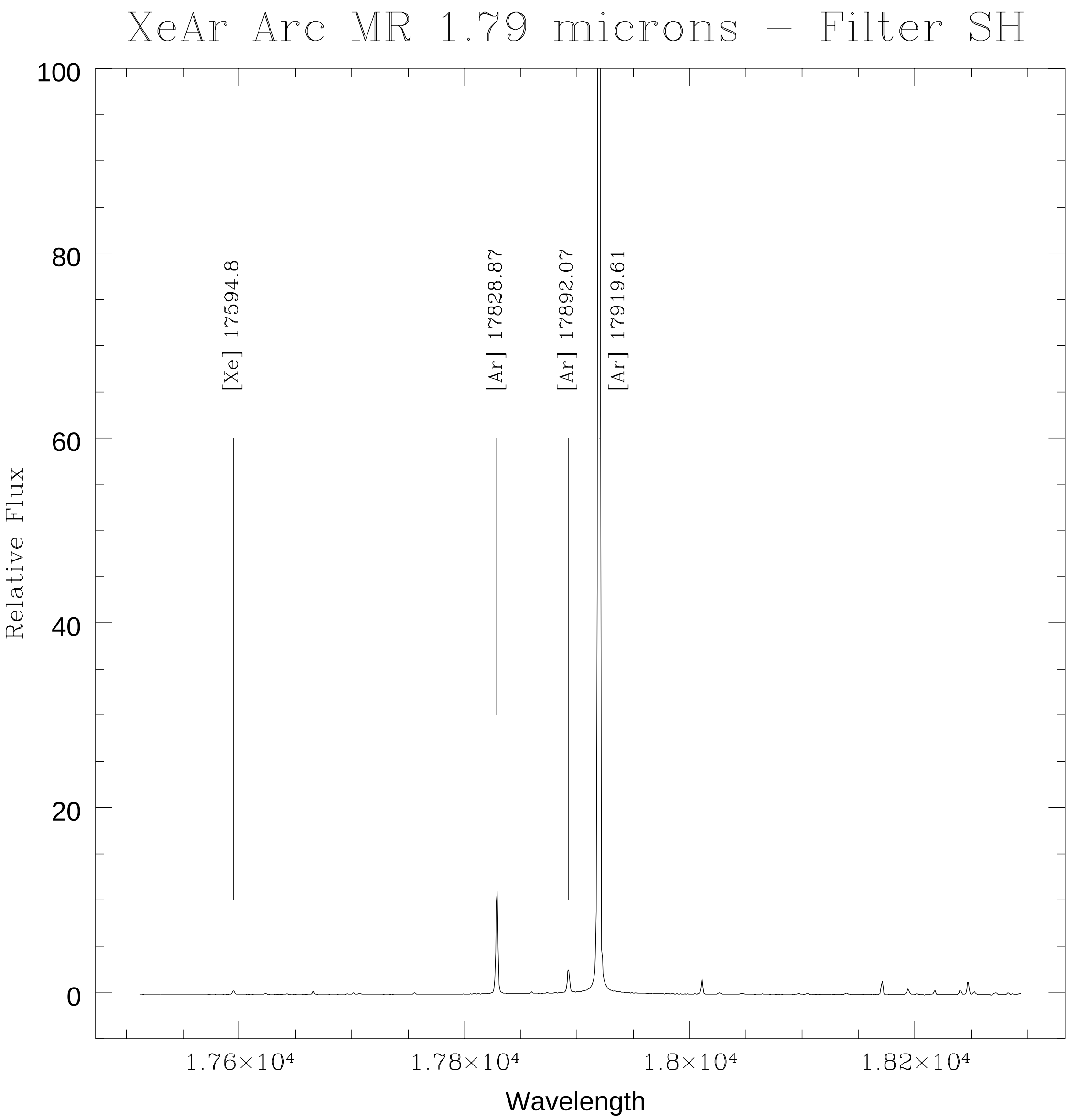

Figure 27: Ar and Xe lines in SWS1-MR mode, SH band, 1.79 μm

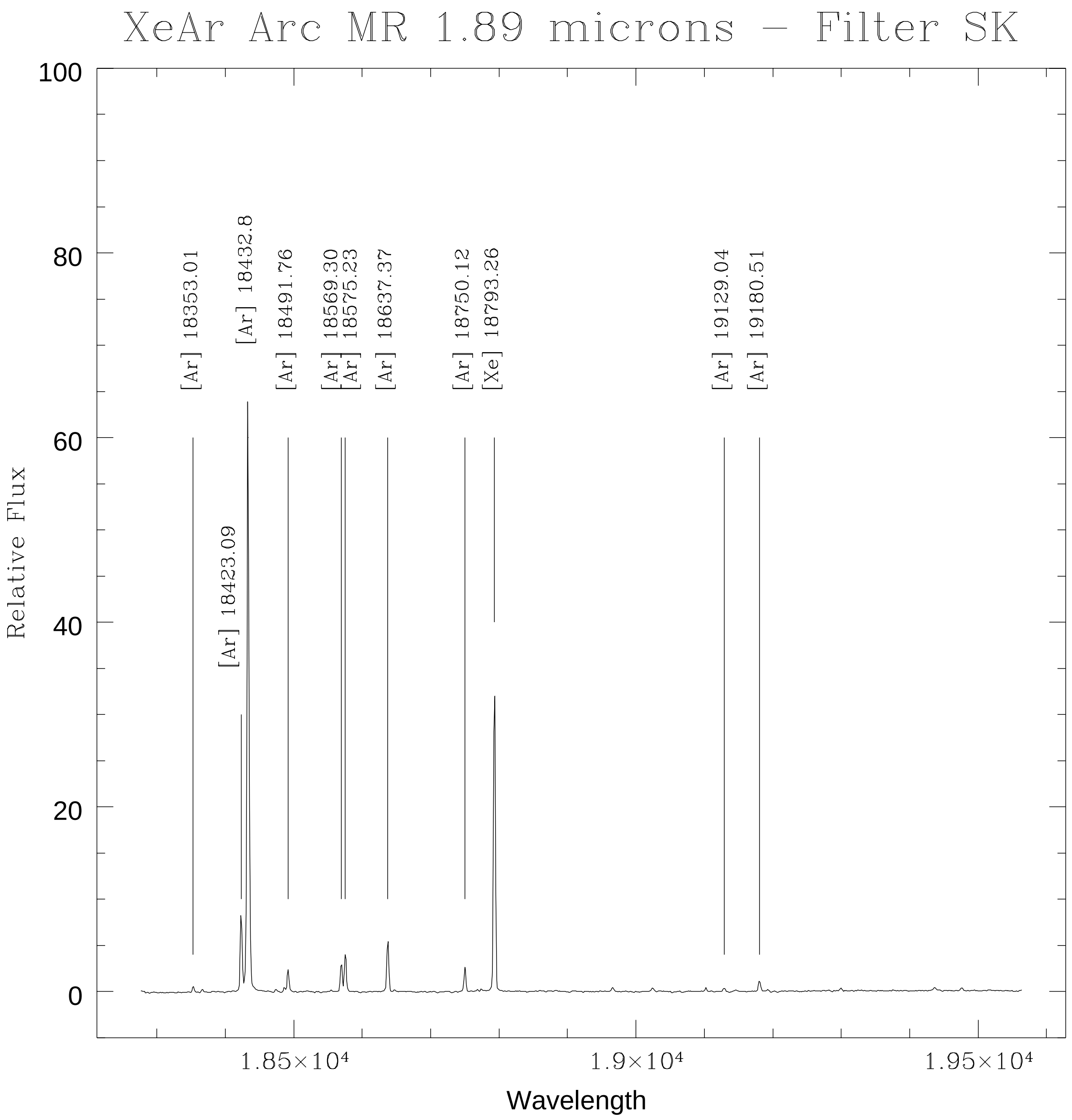

Figure 28: Ar and Xe lines in SWS1-MR mode, SK band, 1.89 μm

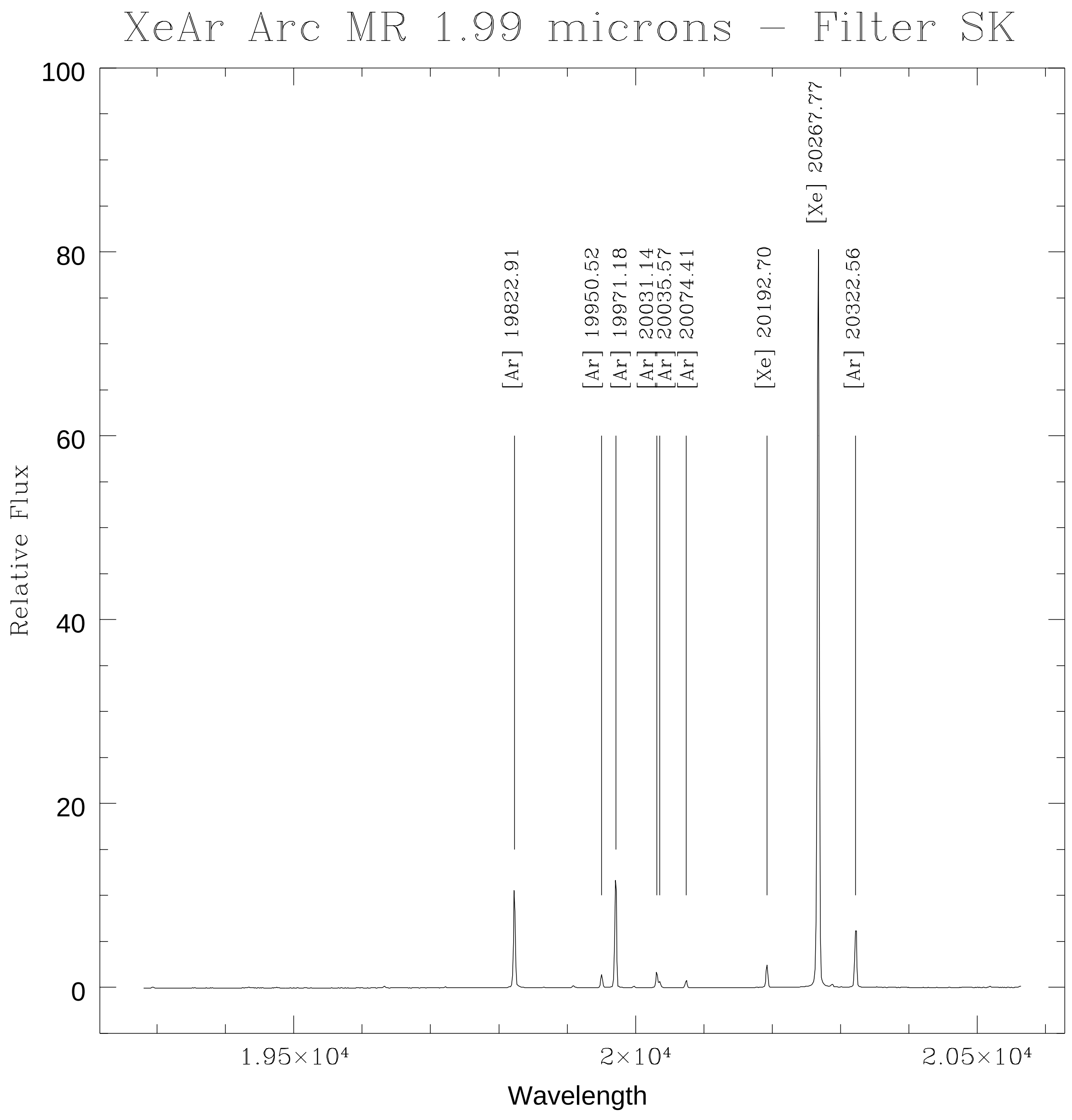

Figure 29: Ar and Xe lines in SWS1-MR mode, SK band, 1.99 μm

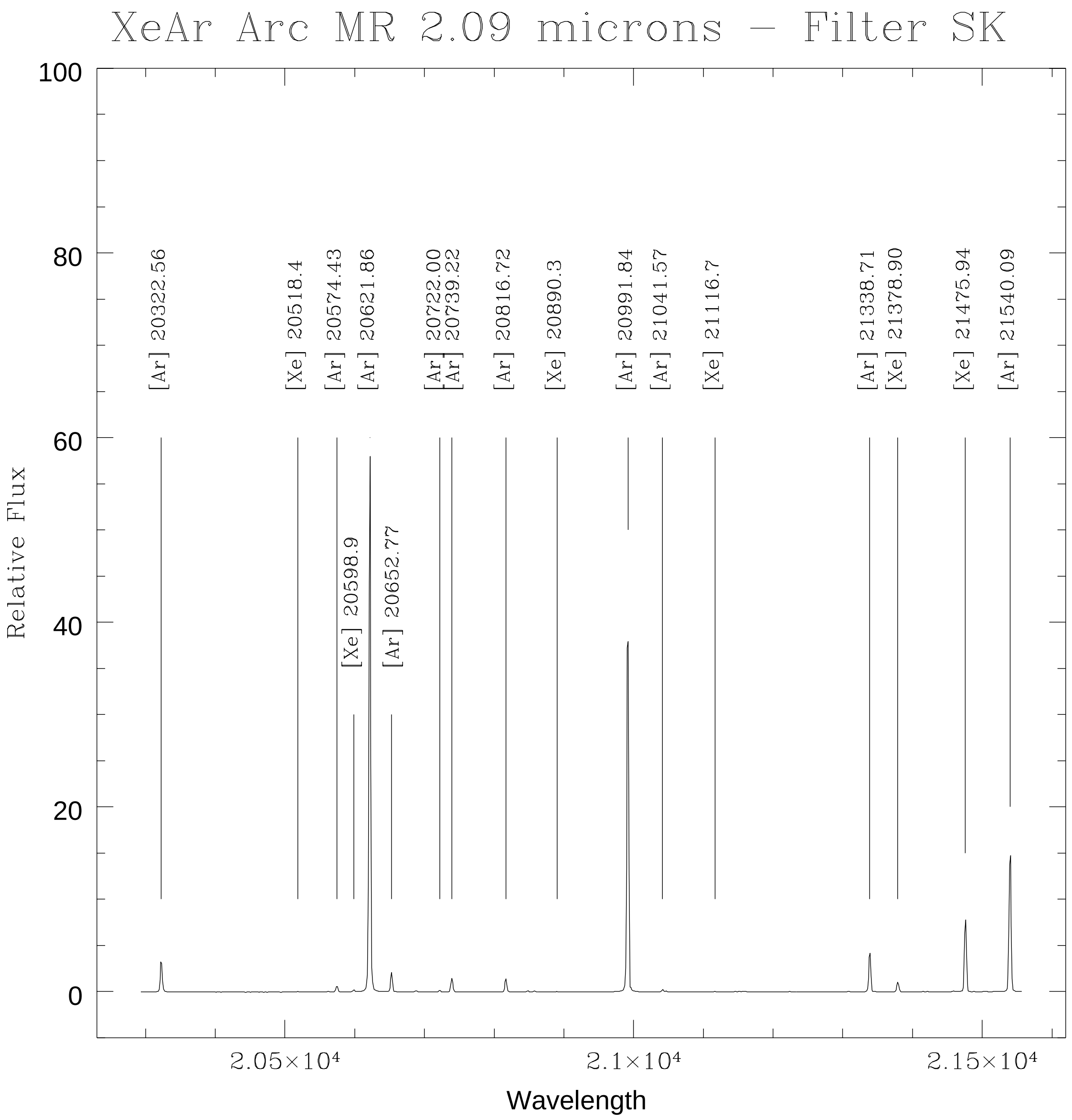

Figure 30: Ar and Xe lines in SWS1-MR mode, SK band, 2.09 μm

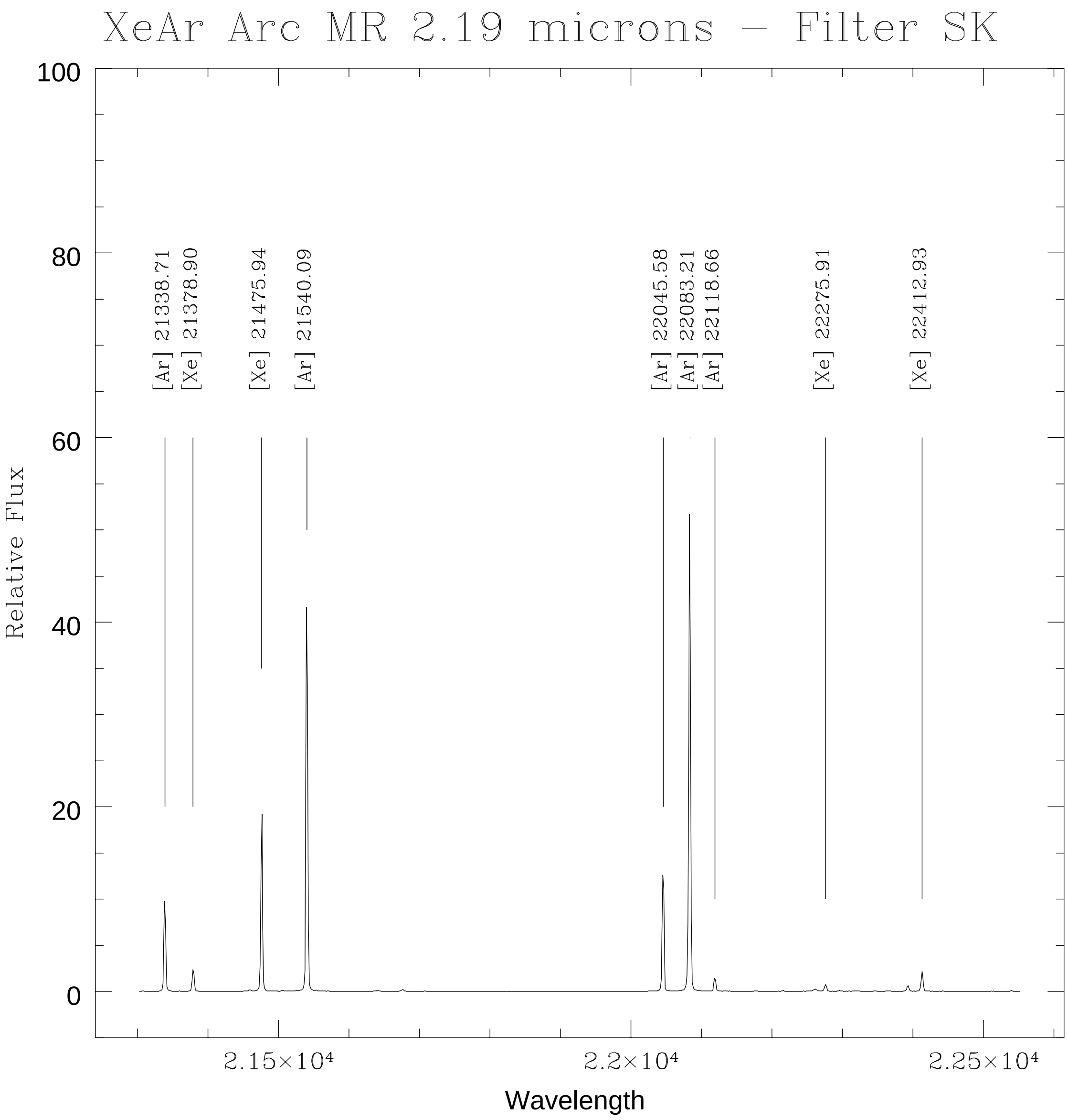

Figure 31: Ar and Xe lines in SWS1-MR mode, SK band, 2.19 μm

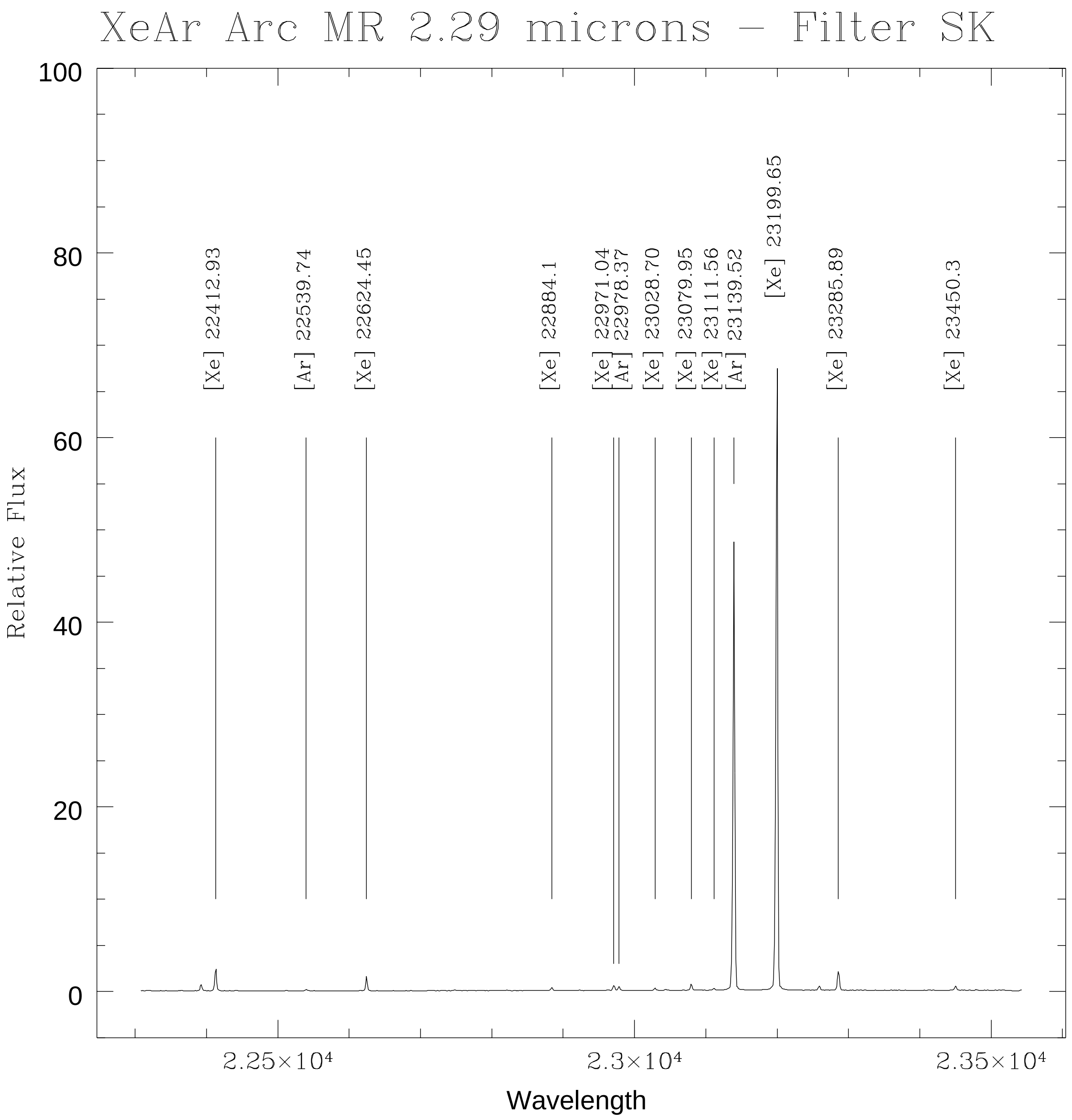

Figure 32: Ar and Xe lines in SWS1-MR mode, SK band, 2.29 μm

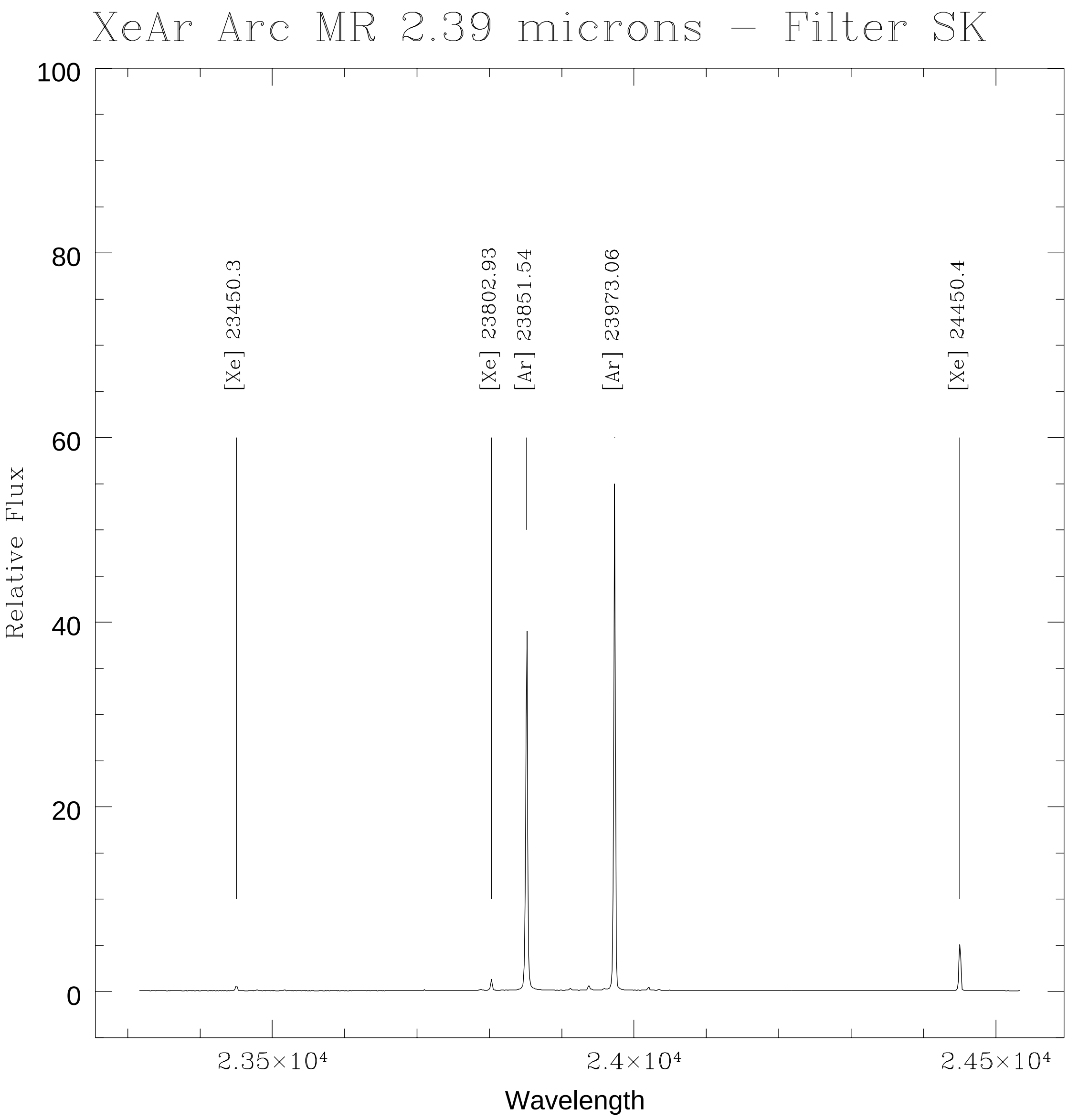

Figure 33: Ar and Xe lines in SWS1-MR mode, SK band, 2.39 μm

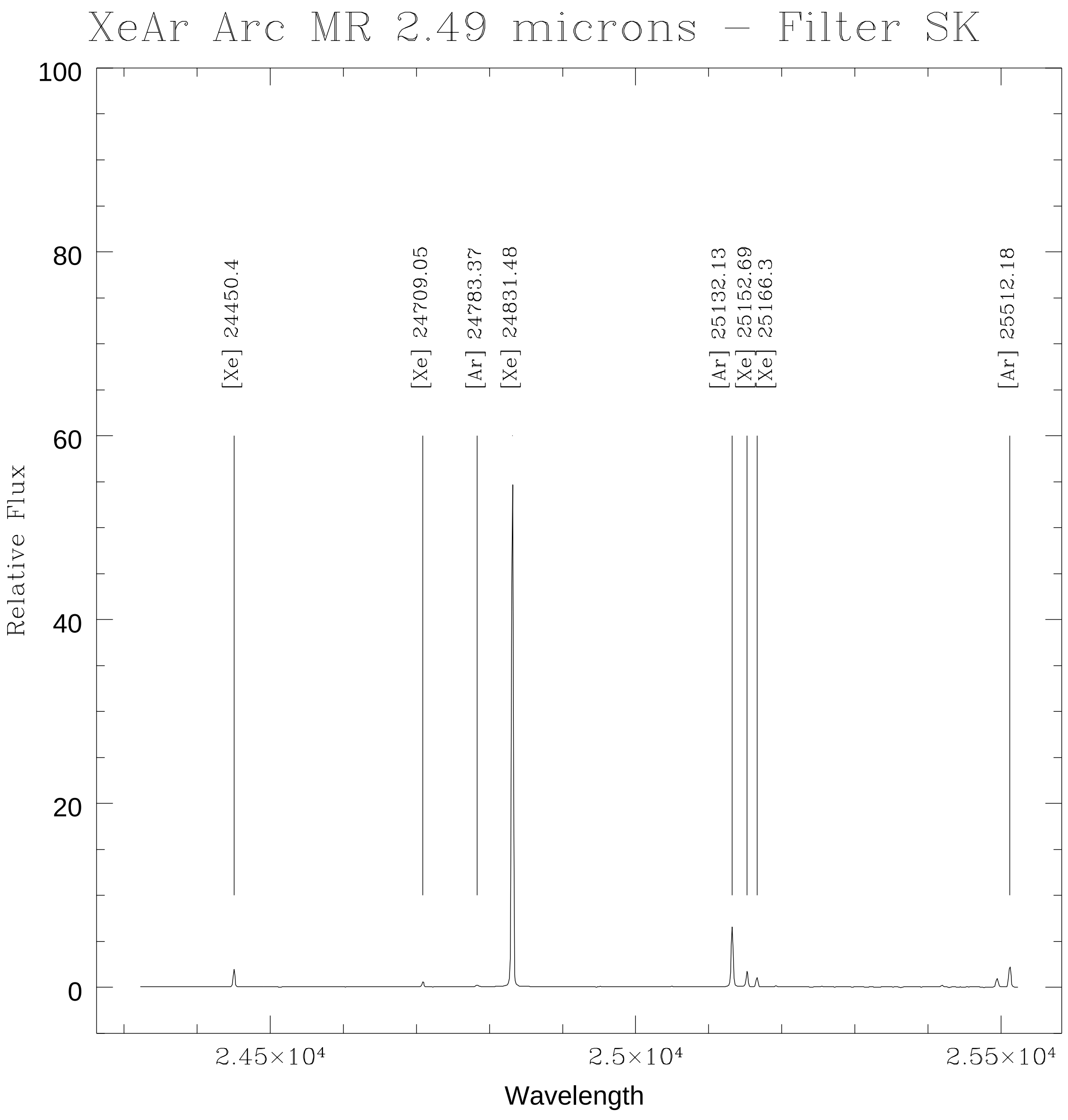

Figure 34: Ar and Xe lines in SWS1-MR mode, SK band, 2.49 μm

4 LW-MR plots

Shown are plots of MR spectra in the LW, in the L band at first order and at some higher orders and shorter wavelengths.

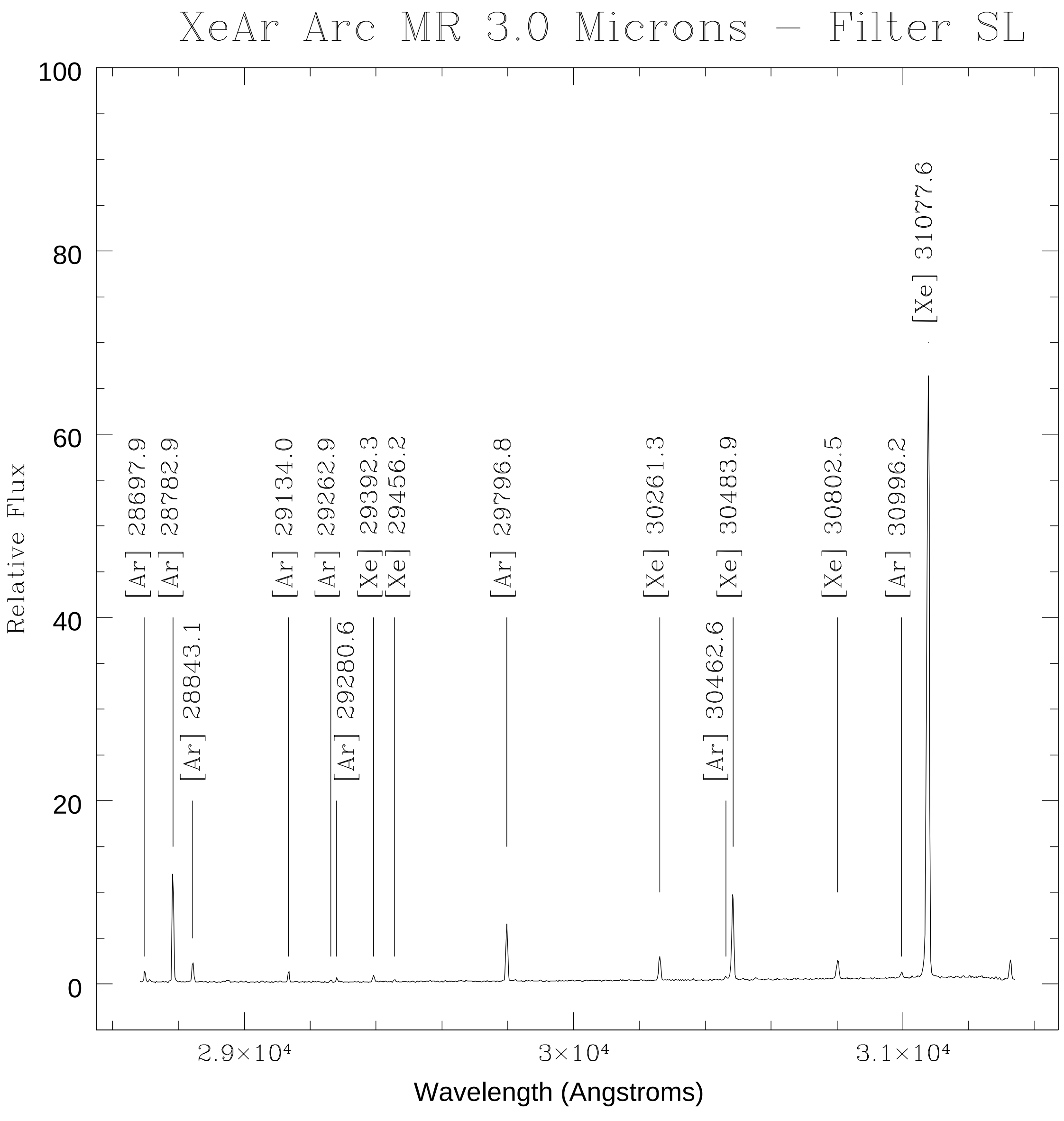

Figure 35: Ar and Xe lines in LWS3-MR mode, 3.0 microns, L band, order 1

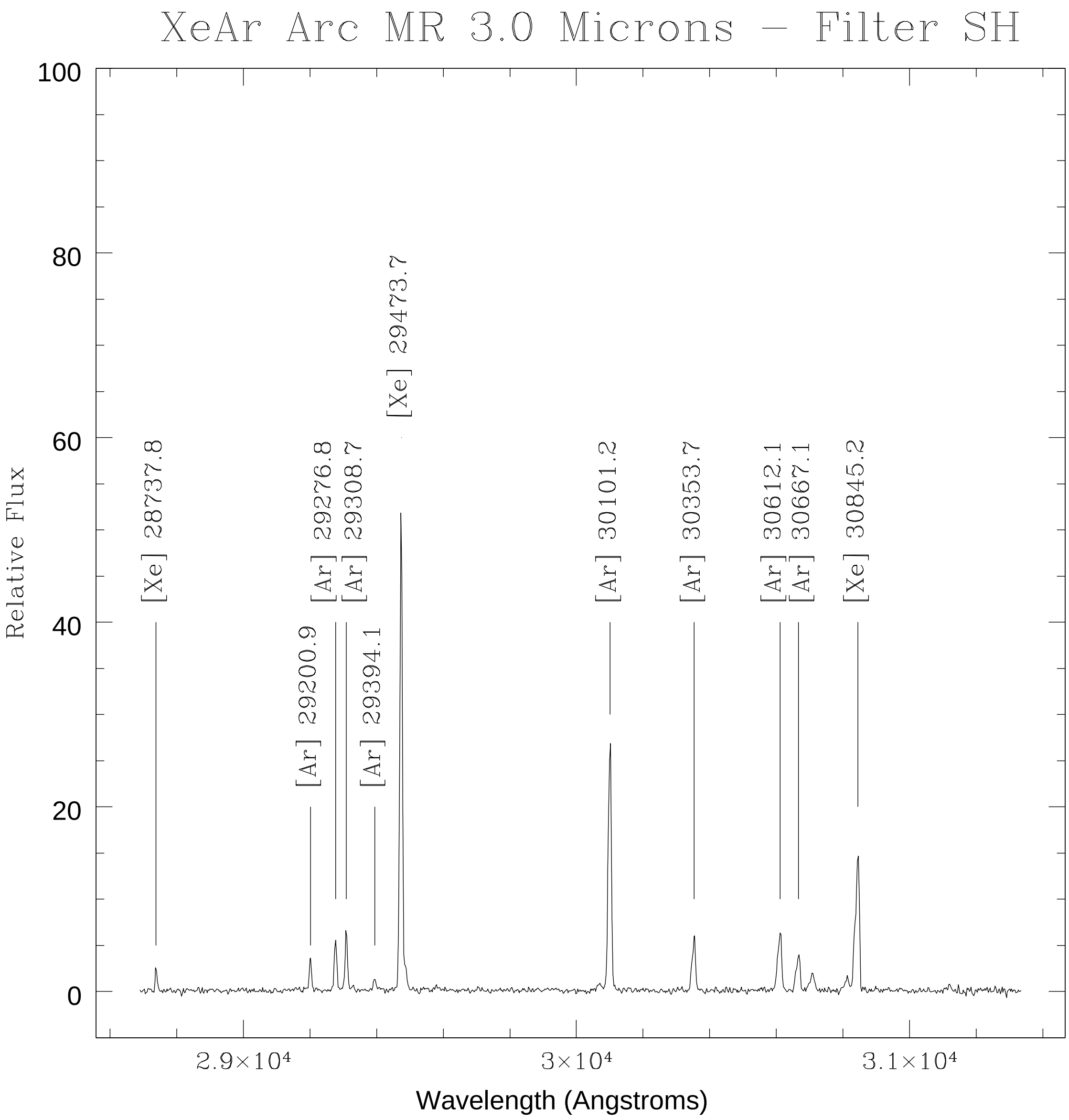

Figure 36: Ar and Xe lines in LWS3-MR mode, 3.0 microns, H band, order 3

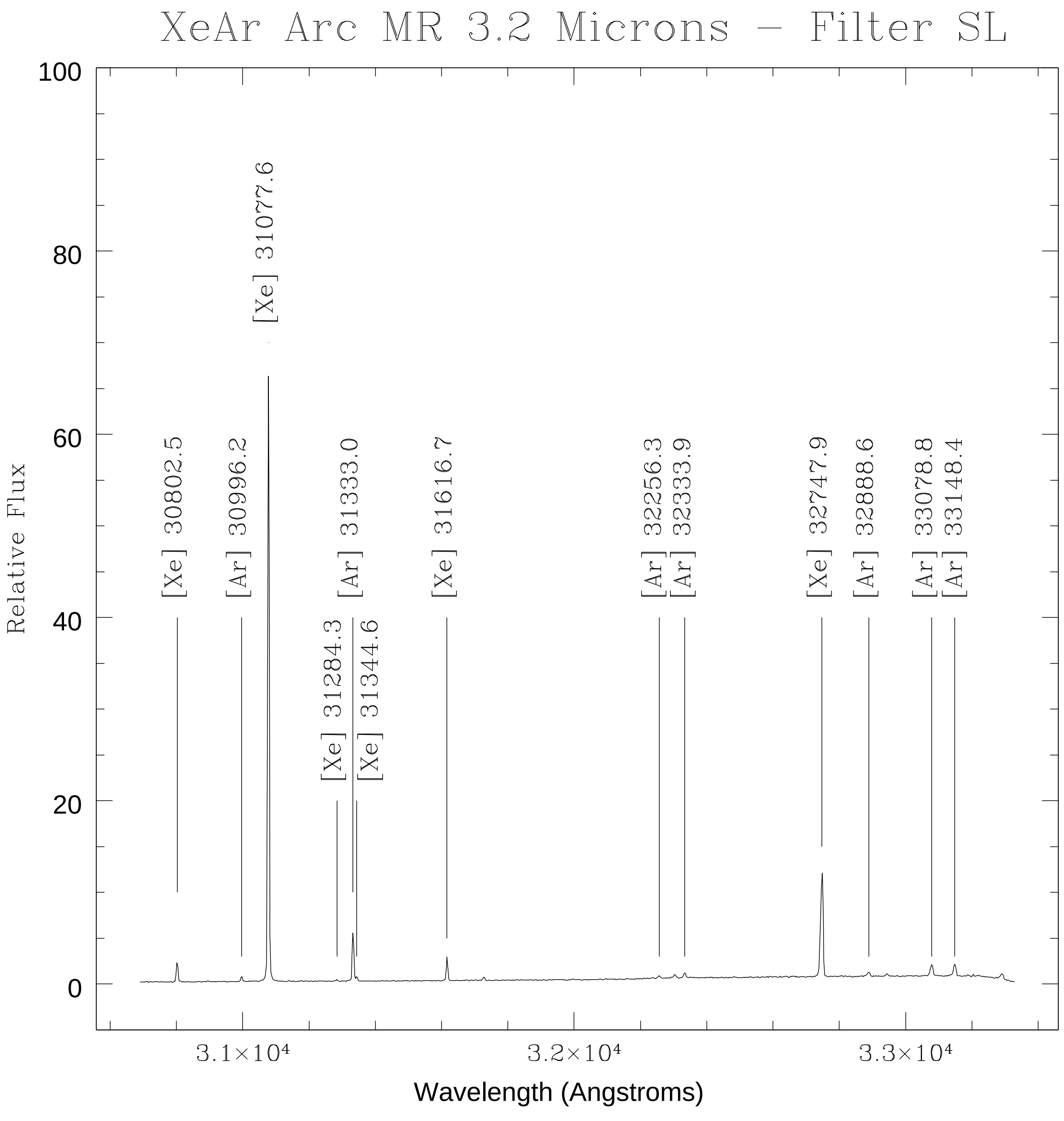

Figure 37: Ar and Xe lines in LWS3-MR mode, 3.2 microns, L band, order 1

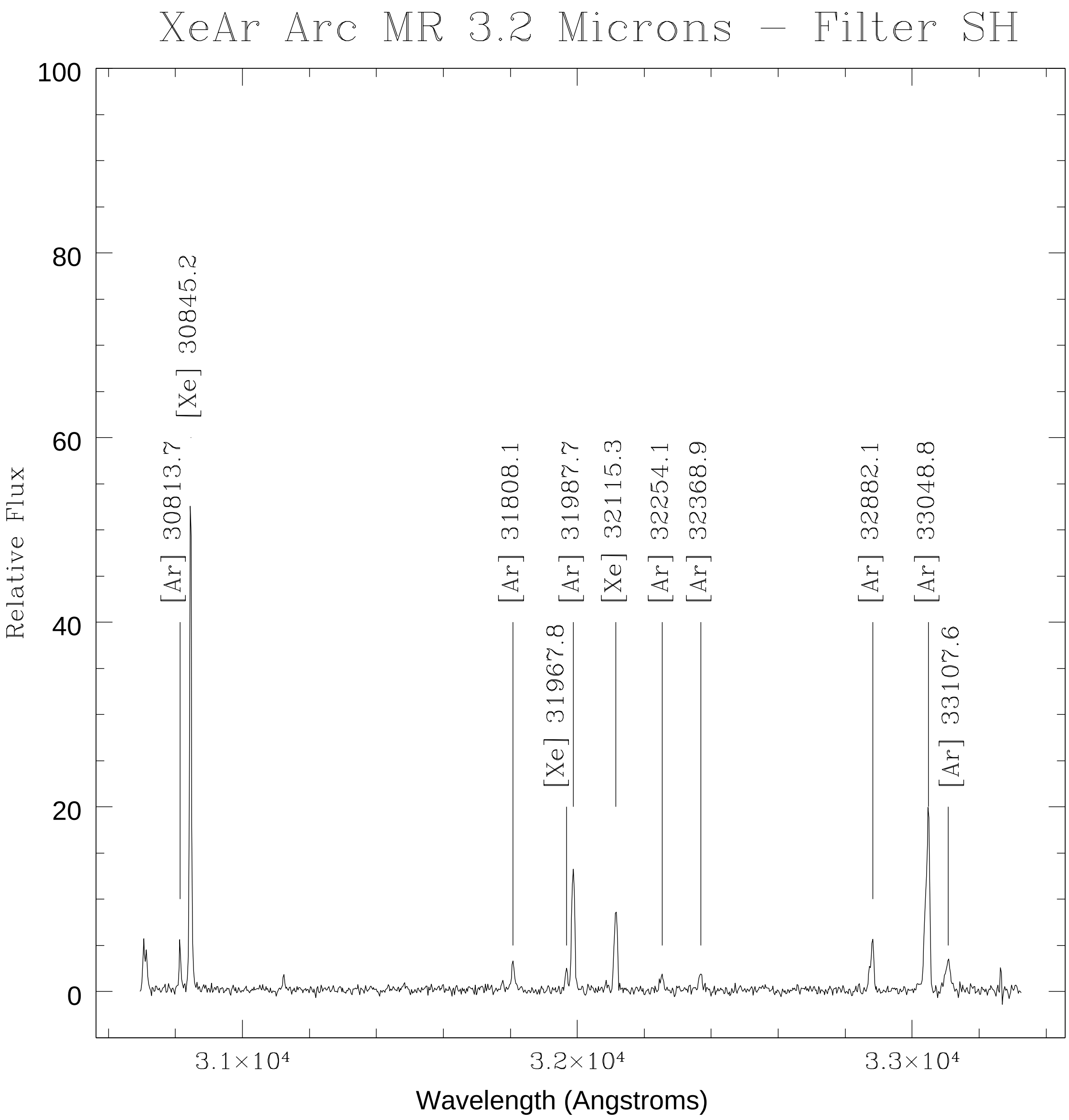

Figure 38: Ar and Xe lines in LWS3-MR mode, 3.2 microns, H band, order 3

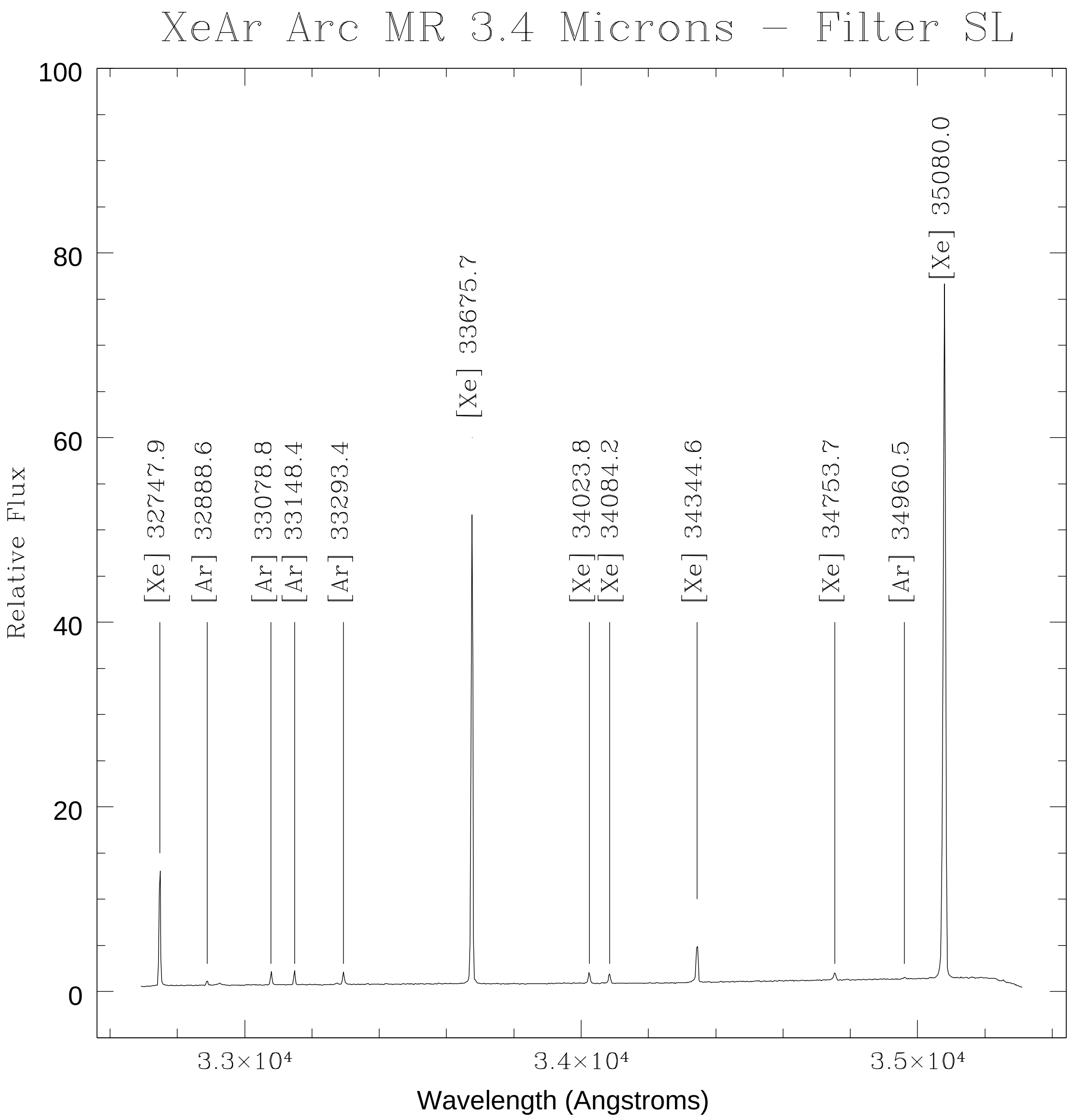

Figure 39: Ar and Xe lines in LWS3-MR mode, 3.4 microns, L band, order 1

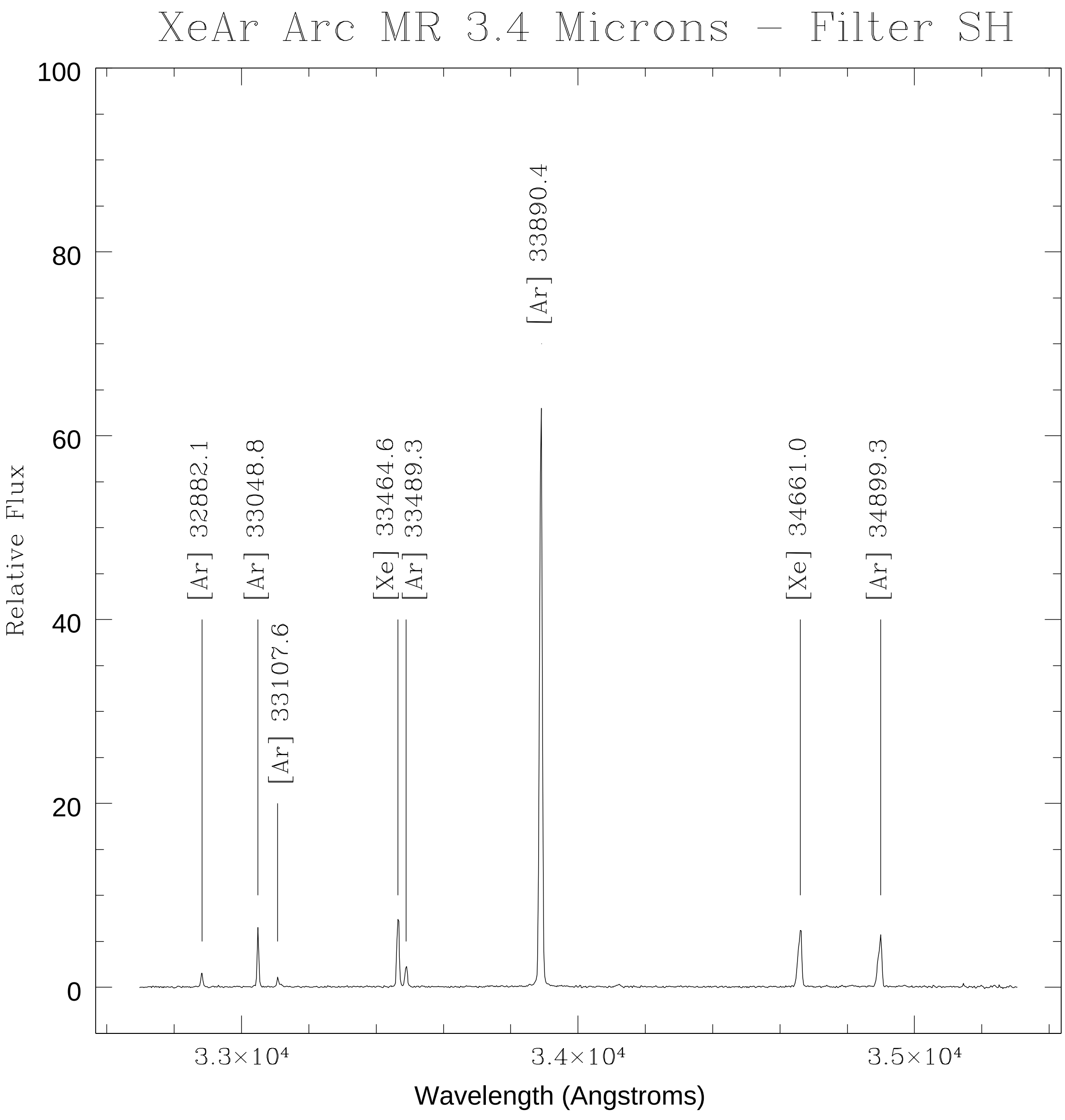

Figure 40: Ar and Xe lines in LWS3-MR mode, 3.4 microns, H band, order 3

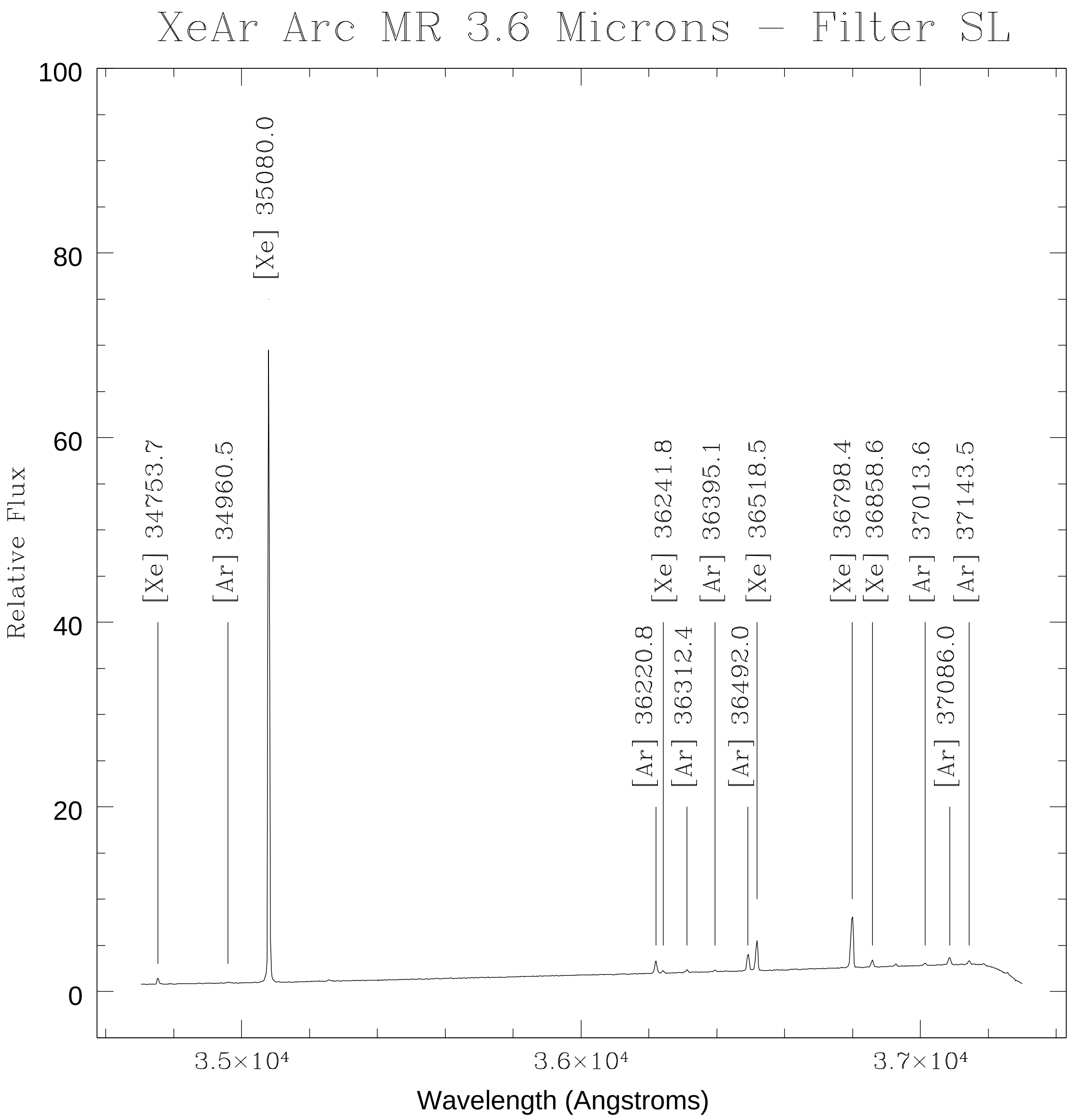

Figure 41: Ar and Xe lines in LWS3-MR mode, 3.6 microns, L band, order 1

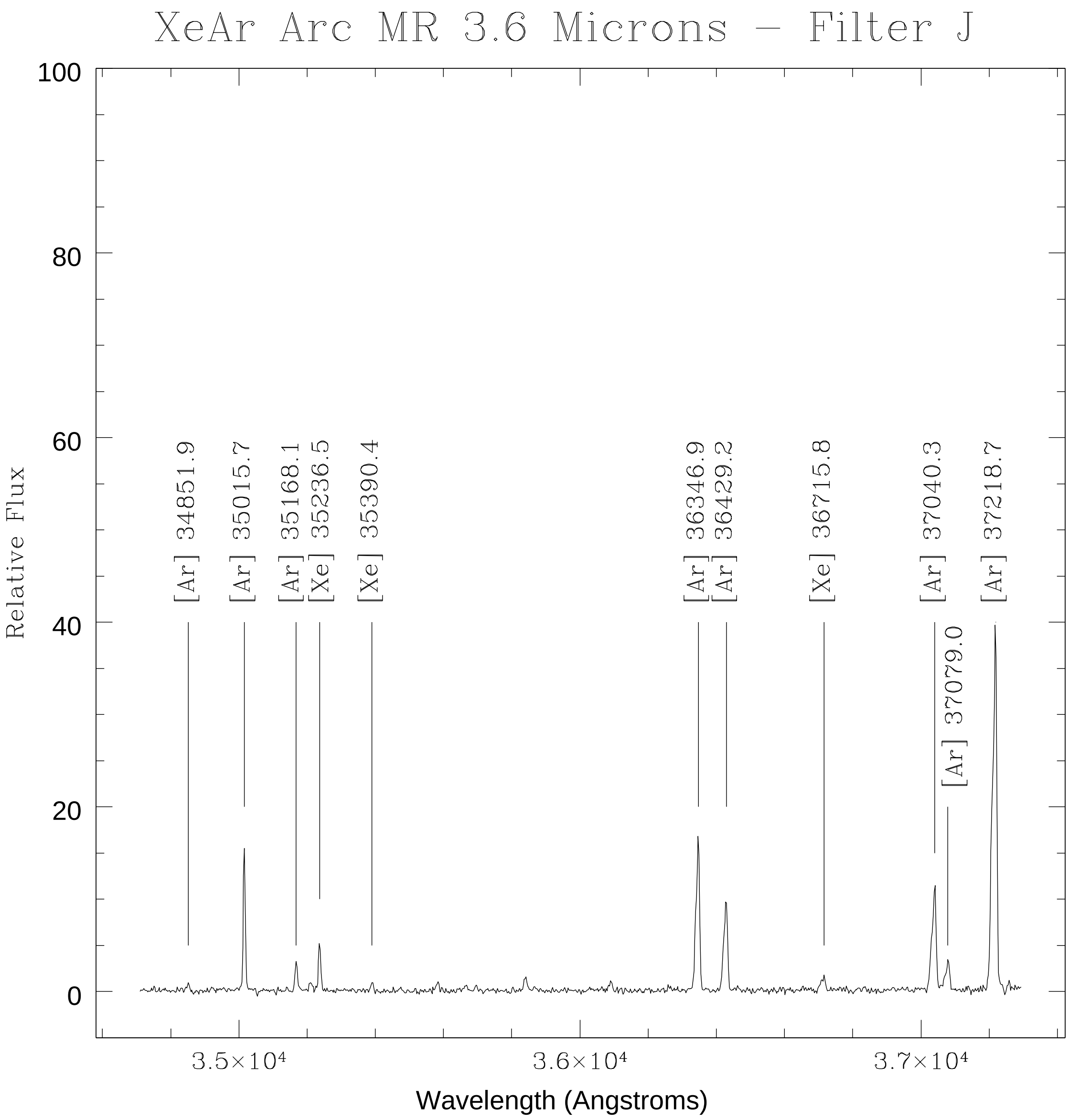

Figure 42: Ar and Xe lines in LWS3-MR mode, 3.6 microns, J band, order 4

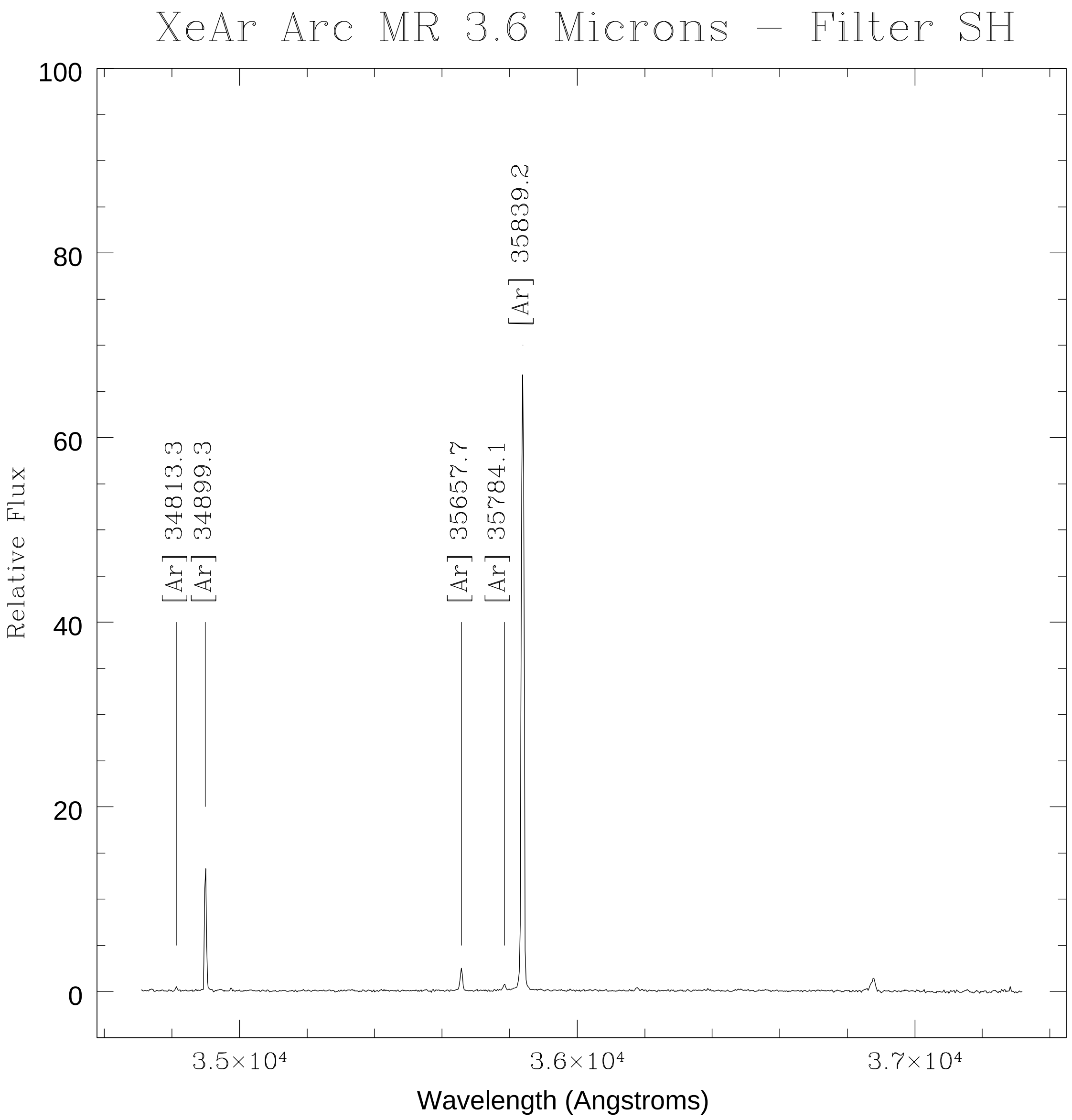

Figure 43: Ar and Xe lines in LWS3-MR mode, 3.6 microns, H band, order 3

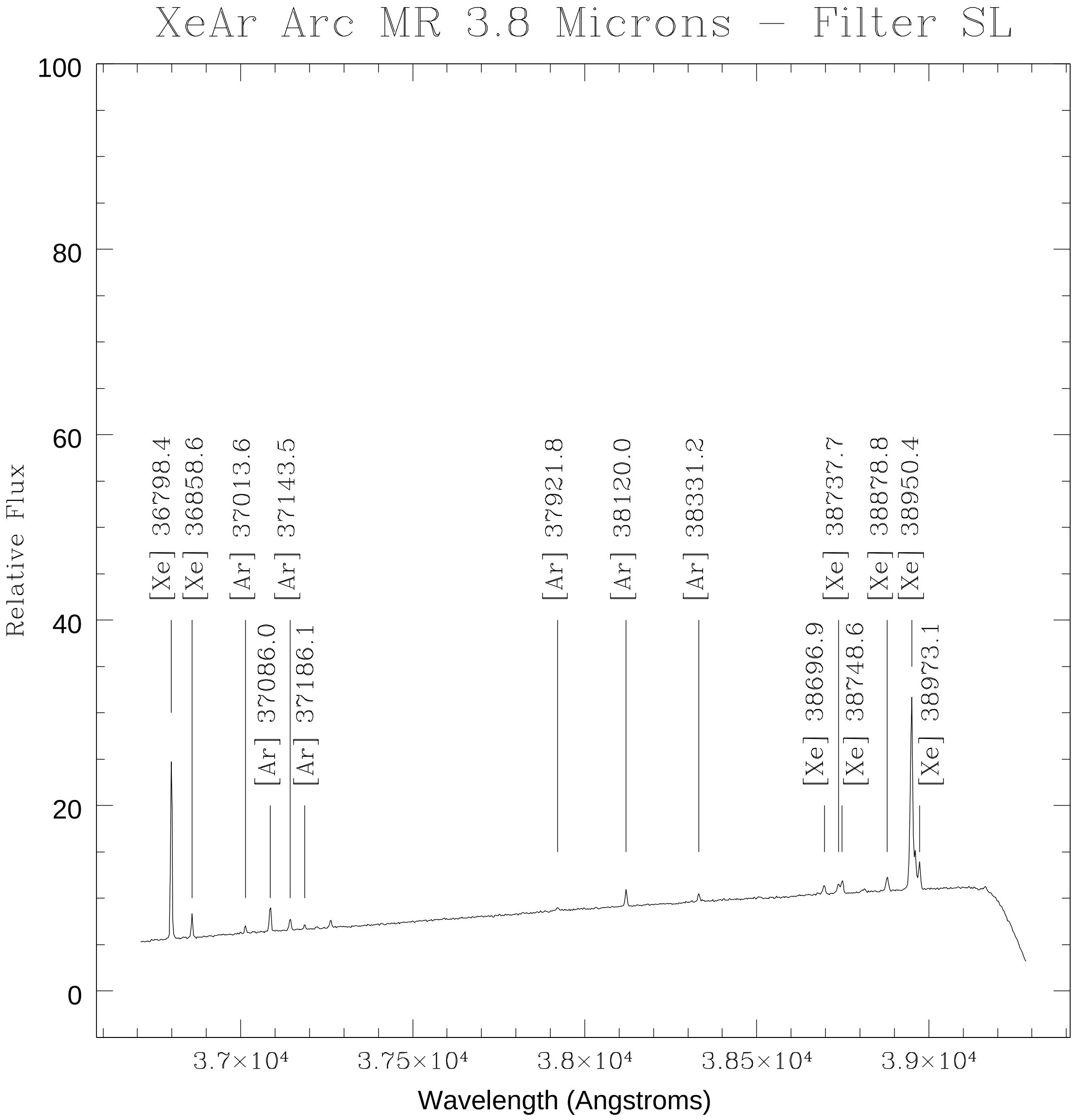

Figure 44: Ar and Xe lines in LWS3-MR mode, 3.8 microns, L band, order 1

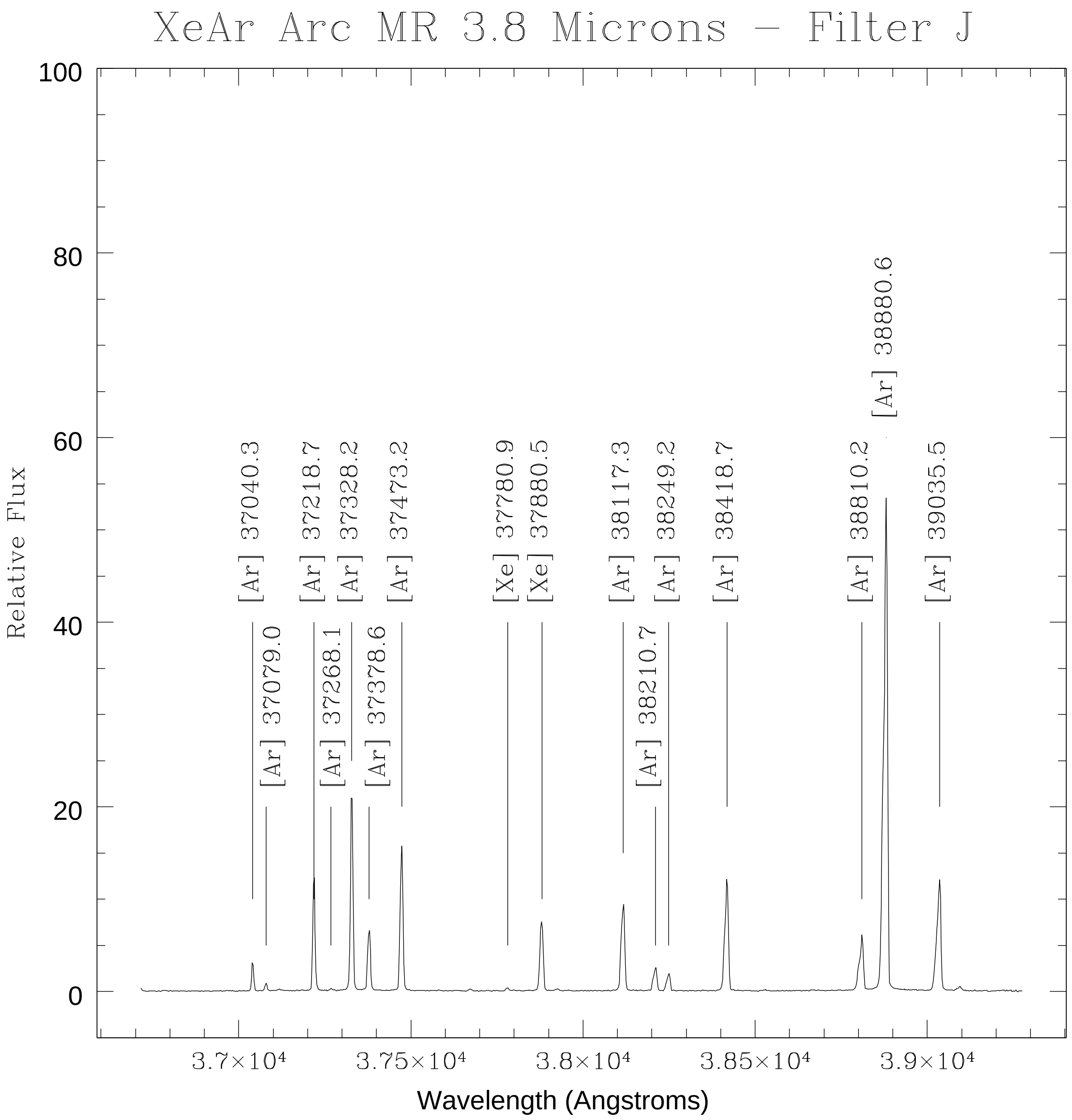

Figure 45: Ar and Xe lines in LWS3-MR mode, 3.8 microns, J band, order 4

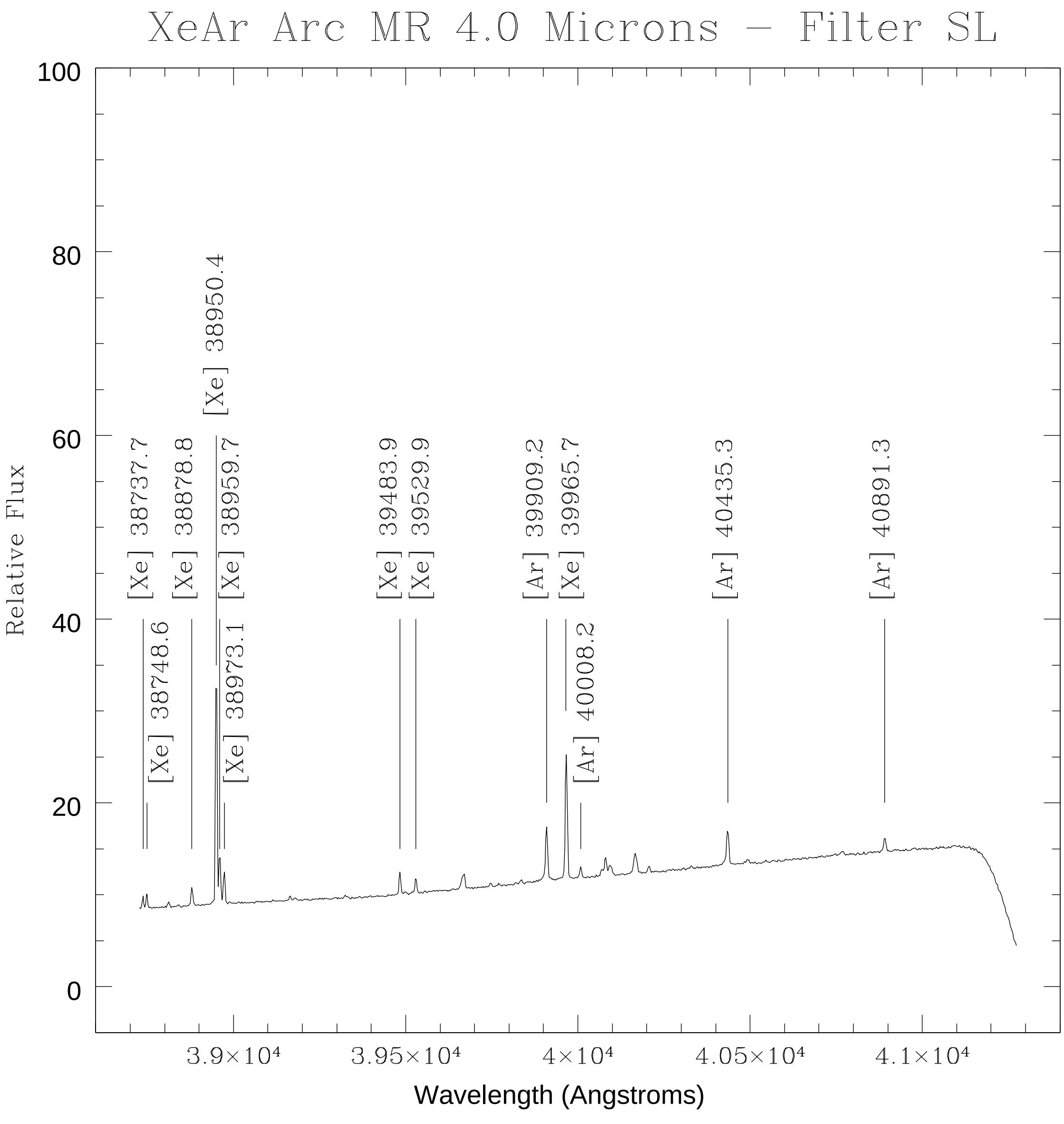

Figure 46: Ar and Xe lines in LWS3-MR mode, 4.0 microns, L band, order 1

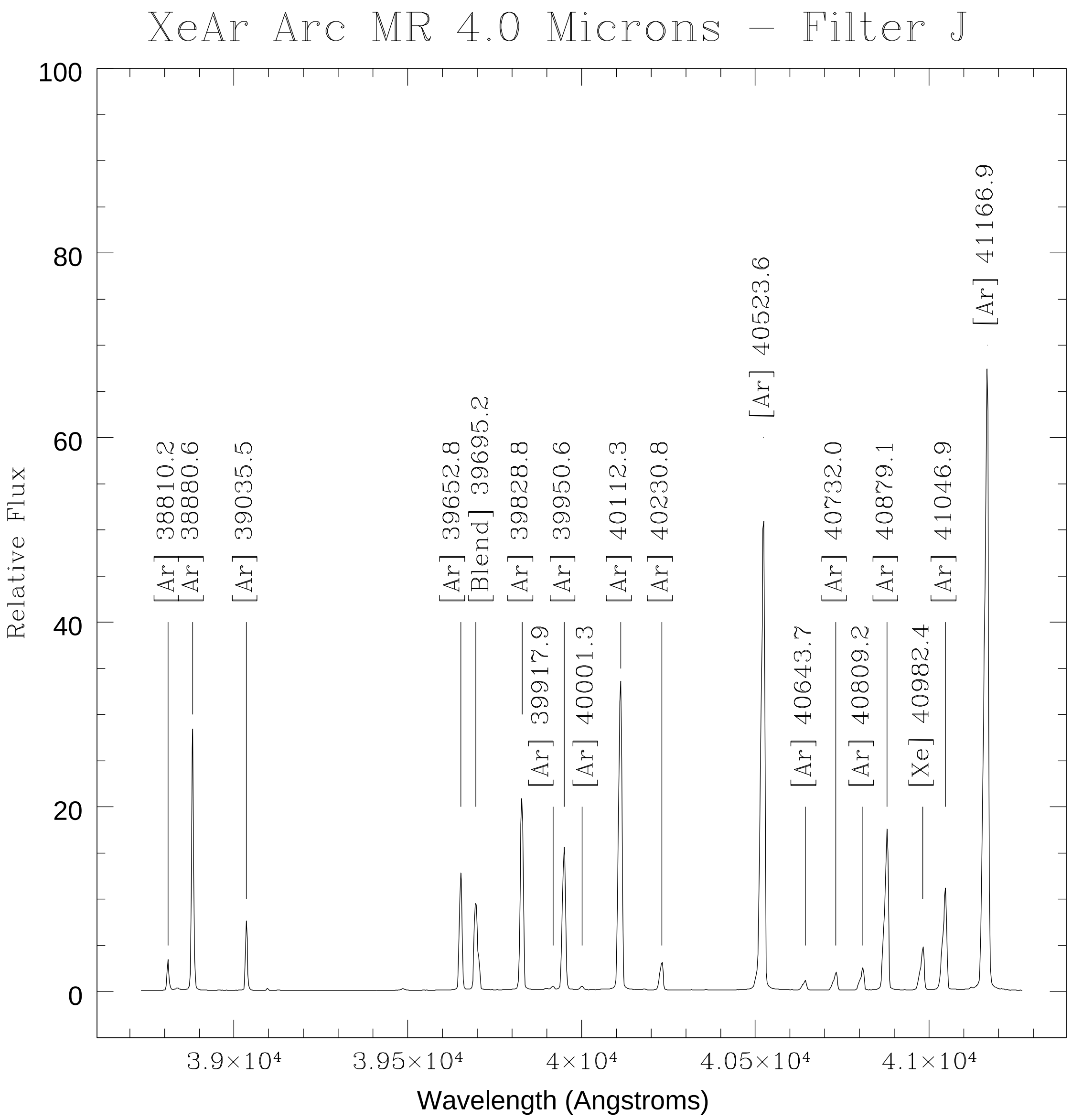

Figure 47: Ar and Xe lines in LWS3-MR mode, 4.0 microns, J band, order 4

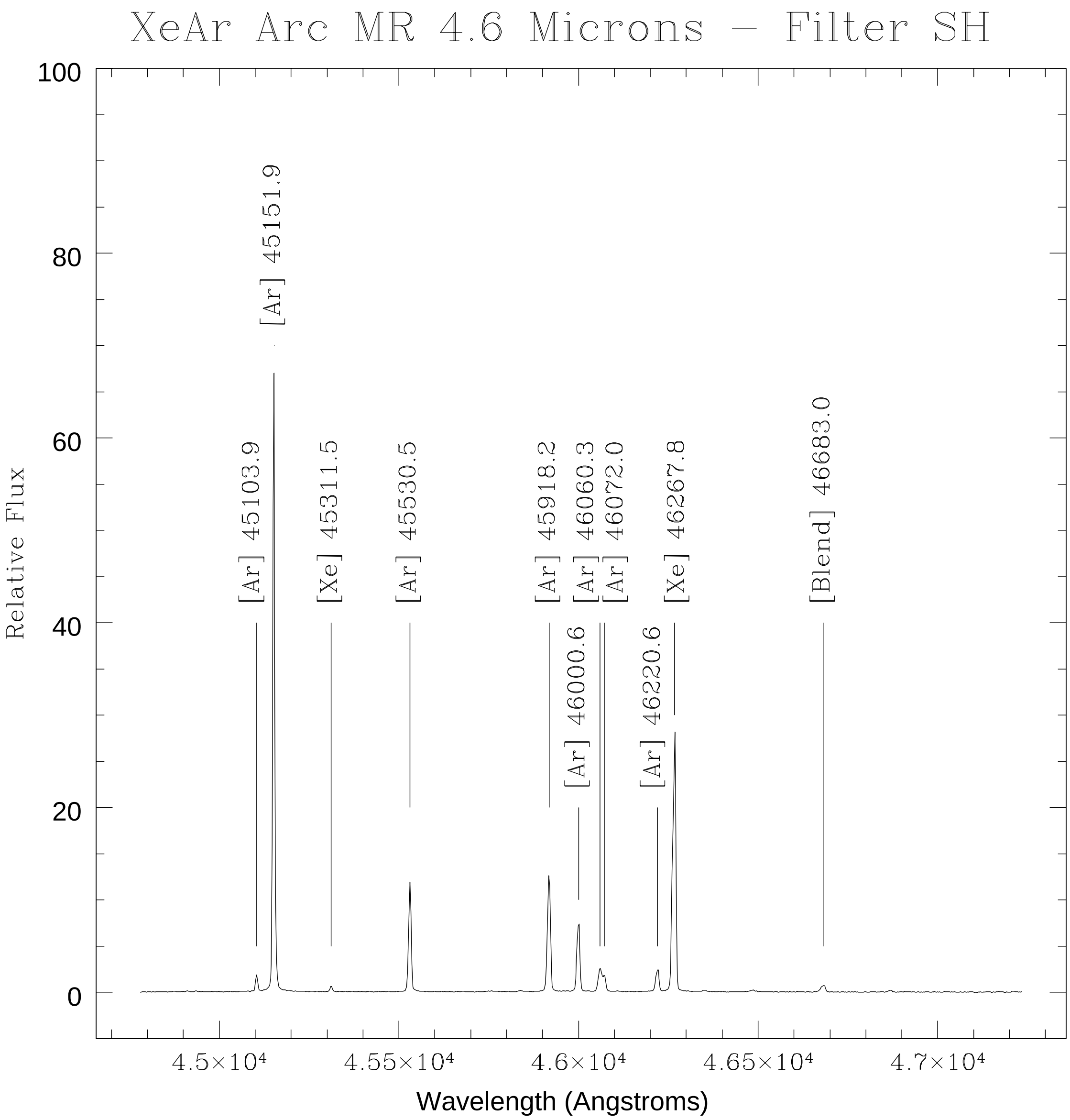

Figure 48: Ar and Xe lines in LWS3-MR mode, 4.6 microns, SH band, order 3

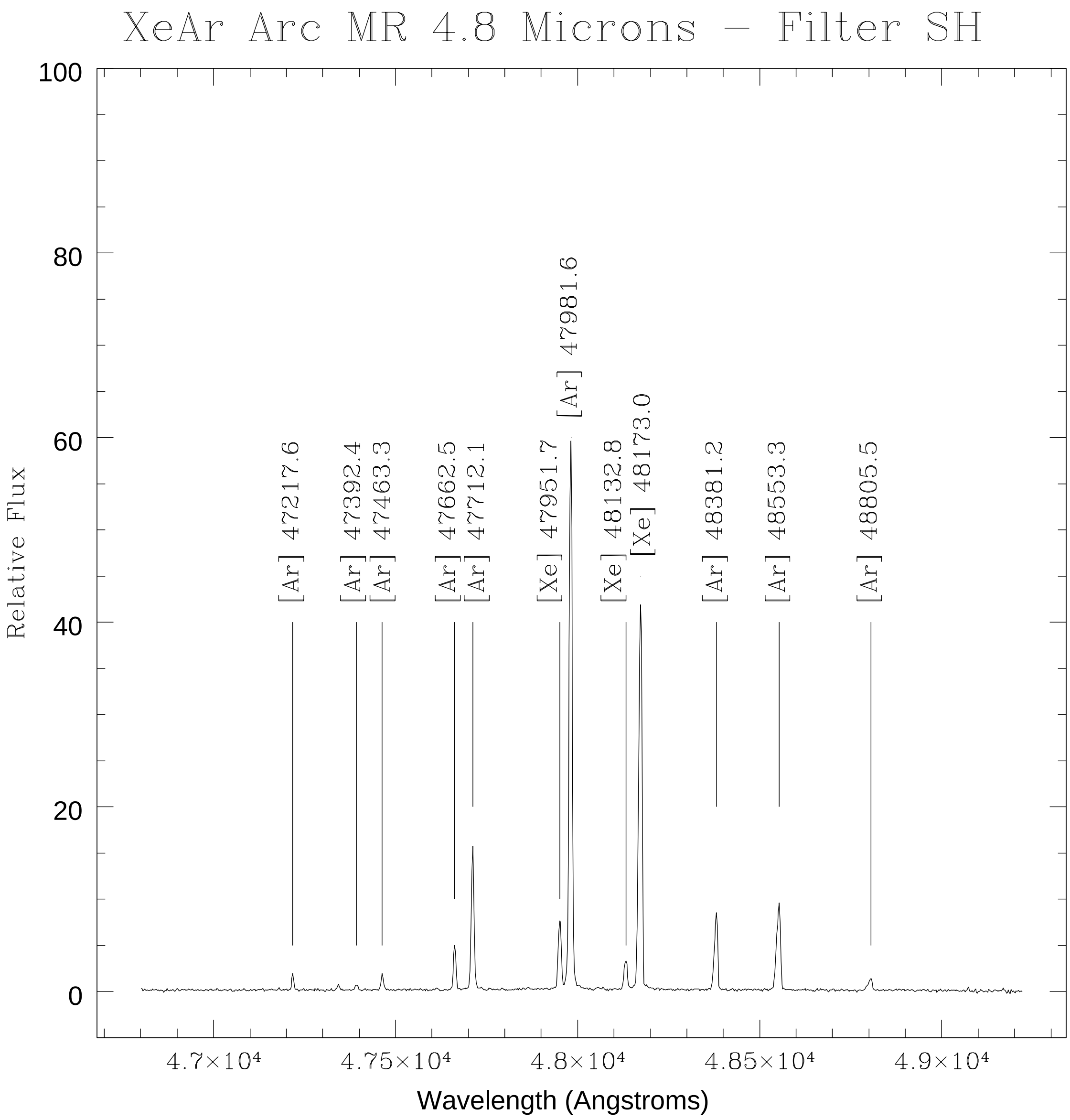

Figure 49: Ar and Xe lines in LWS3-MR mode, 4.8 microns, SH band, order 3

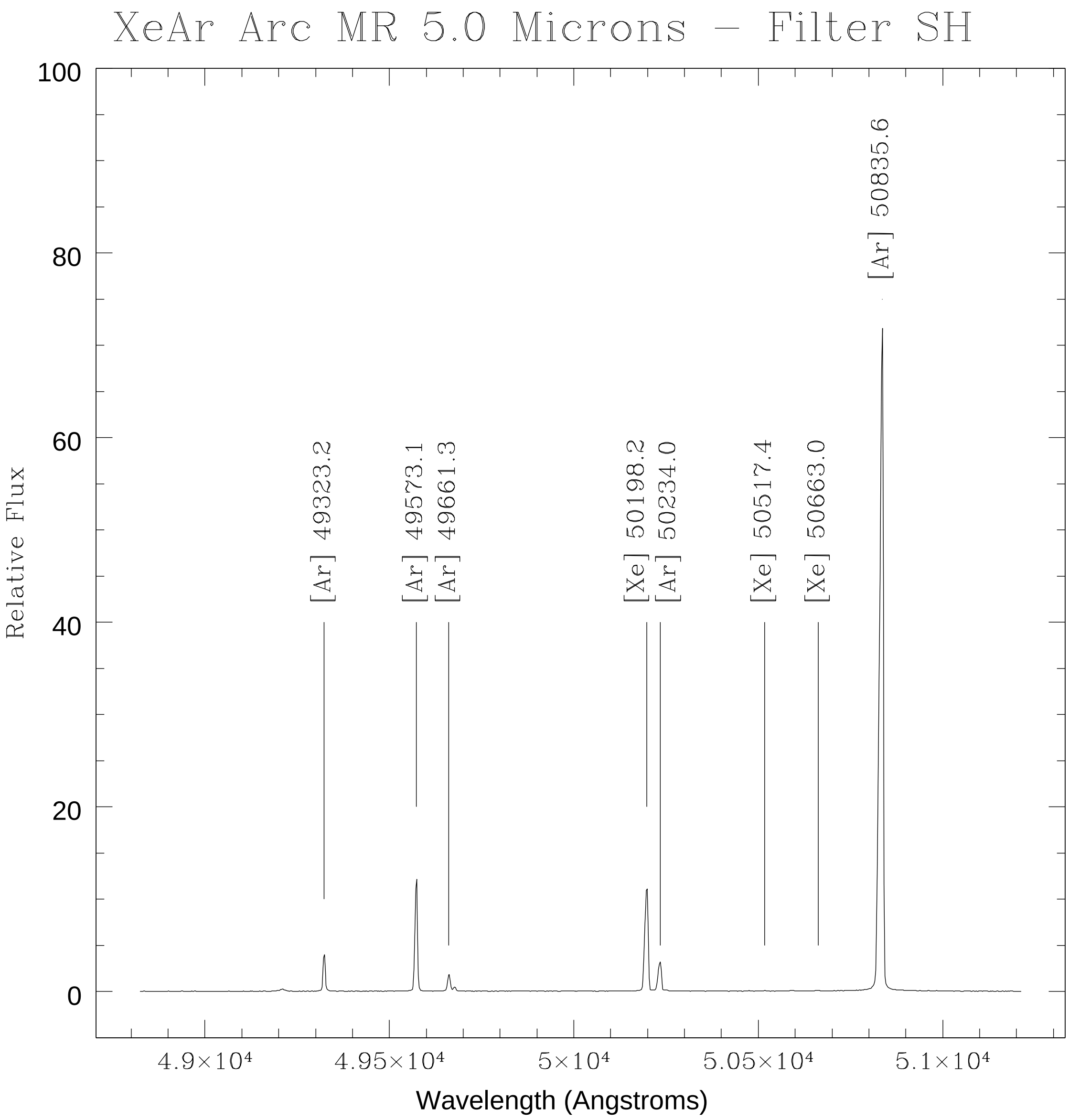

Figure 50: Ar and Xe lines in LWS3-MR mode, 5.0 microns, SH band, order 3

5 SW line list

Xenon-Argon List for ISAAC

Notes

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i) Blended at LR means that the line is blended with some other line at a resolution of 3000. This corresponds to the resolution of the LR grating with the 0.3" slit. Spectra taken with wider slits will have many more blened lines.

ii) Blended at MR means that the lines is blended with some other line at a resolution of 10000. This corresponds to the resolution of the LR grating with the 0.3" slit. Spectra taken with wider slits will have many more blended lines.

iii) Intensities were calculated from spectra taken with the LR grism at the standard settings. The standard LR settings are: 0.90, 1.06, 1.25, 1.65 and 2.20 microns. When lines appear in more than one setting, the intensity is reported for both settings.

iv) Settings at 0.90, 1.06, 1.25 and 1.65 microns suffer from order overlap. The lines from different orders are reported in the last table.

v) Some lines that lie outside the normal LR range are also reported.

vi) The follwoing table lists the details of the LR dispersion solution. The residuals can be reduced by using only the brightest lines and avoiding blends.

Order	FWR	EWR	OSF	Arc	NOL	Dispersion	Residual
6	7850-10300	8300-9700	Z	Xenon	9	2.38	0.06
				Argon	12	2.38	0.12
5	9230-12150	9800-11200	SZ	Xenon	19	2.85	0.14
				Argon	20	2.85	0.21
4	10780-14420	11000-13500	J	Xenon	20	3.56	0.23
				Argon	45	3.56	0.24
3	14210-19060	14200-18200	SH	Xenon	15	4.74	0.25
				Argon	30	4.74	0.19
2	18550-25850	19200-25500	SK	Xenon	17	7.13	0.23
				Argon	26	7.14	0.37

OSF = Order sorting filter
FWR = Full wavelength range
EWR = Effective wavelength range.Includes filter, atmosphere and order overlap.
NOL = number of lines used in the fit.

vii) There are a few unidentified lines in the ISAAC spectra, but most are fainter than 1000 units.

References
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1 - Wavelengths and Transition Probabilities for Atoms and Atomic Ions,
NSRDS-NBS 68, Reader, Corliss, Wiese and Martin.
Converted from air to vacuum wavelengths.

2 - CASPIR User's Manual, P. McGregor (MSSSO).
Converted from air to vacuum

3 - CRSP User's Manual (KPNO) - Already in vacuum wavelengths

4 High resolution Argon Atlas by Lloyd Wallace, Ken Hinkle and Dick Joyce
(KPNO). Already in vacuum wavelengths
See: http://www.noao.edu/kpno/phoenix/tharne/

Conversion from air to vaccuum wavelengths was done via the table in Astrophysical Quantities, Allen, 1973.

Wavelength	Line	Source	Strength	Comments
8266.79	ArI	1	1890	
8282.39	XeI	1	1850	
8349.11	XeI	1	540	
8410.52	ArI	1	27660	
8426.96	ArI	1	49500	
8523.78	ArI	1	27100	
8578.36	XeI	1	50	
8608.14	ArI	1	50	
8650.91	XeI	1	100	
8670.32	ArI	1	4720	
8694.59	XeI	1	--	Blend at LR
8699.25	XeI	1	--	Blend at LR
8741.79	XeI	1	320	
8760.60	XeI	1	70	
8821.83	XeI	1	90480	
8864.75	XeI	1	560	
8911.17	XeI	1	260	
8933.28	XeI	1	360	
8954.71	XeI	1	16350	
8983.51	XeI	1	--	Blend at LR
8990.04	XeI	1	--	Blend at LR
9047.93	XeI	1	24120	

9125.47	ArI 1	>140000	Saturated. Too bright to use.
9165.16	XeI 1	31220	
9170.03	XeI 1	--	Blend at LR
9197.16	ArI 1	340	
9227.03	ArI 1	33200	
9294.08	ArI 1	320	
9309.19	XeI 2	170	
9356.78	ArI 1	2080	
9377.33	XeI 1	780	
9414.59	XeI 2	180	
9447.93	XeI 2	280	
9499.67	XeI 2	--	Blend at LR
9515.99	XeI 1	1390	
9587.77	XeI 2	30	
9660.43	ArI 1	35900	(Z) 11440 (SZ) Overlap b/n Z-SZ
9687.97	XeI 2	40	(Z) 160 (SZ) Overlap b/n Z-SZ
9703.65	XeI 2	20	
9720.82	XeI 1	230	
9787.18	ArI 1	12340	
9802.38	XeI 1	120100	
9925.91	XeI 1	>140000	Saturated. Too bright to use
10026.46	XeI 2	480	
10054.81	ArI 1	300	
10087.56	XeI 2	210	
10110.13	XeI 2	1990	
10128.23	XeI 2	150	
10166.2	Ar 3	40	
10191.16	XeI 2	90	
10253.84	XeI 2	410	
10311.96	ArI 2	50	
10335.55	ArI 1	200	
10472.92	ArI 1	47810	
10480.90	ArI 1	--	Blended at LR
10487.68	XeI 2	80	
10509.38	ArI 1	150	Reference 2 gives 10509.35
10530.74	XeI 2	1880	
10676.49	ArI 1	11160	
10684.70	ArI 1	--	Blended at LR
10703.9	Ar 3	130	
10709.71	XeI 2	510	
10736.81	ArI 1	70	
10761.84	XeI 2	250	
10762.10	ArI 1	80	
10776.30	ArI 2	120	Overlap with J starts.
10841.34	Xe1 1	16390	(SZ) 1910 (J) Ref. 2 gives 10841.30
10883.94	ArI 2	490	(SZ) 130 (J)
10898.31	XeI 2	630	(SZ) 200 (J)
10953.74	ArI 2	550	(SZ) 250 (J)
11081.90	ArI 1	930	(SZ) 1090 (J)
11088.27	XeI 2	1120	(SZ) 1410 (J)
11109.50	ArI 2	110	(SZ) 150 (J) Uncertain ID

11130.2	XeI 2	230 (SZ) 360 (J)	
11165.8	XeI 2	40 (SZ) 40 (J)	
11312.7	XeI 2	25 (SZ) 40 (J)	
11396.82	Ar 4	470 (SZ) 1450 (J)	
11418.2	XeI 2	50 (SZ) 120 (J)	
11444.97	ArI 4	180 (SZ) 11450 (J)	
11470.69	ArI 4	40 (SZ) 690 (J)	
11491.25	ArI 4	380 (SZ) 15000 (J)	End of SZ overlap
11617.3	Xe 3	420	Beginning of Js
11671.90	ArI 4	8220	
11722.70	ArI 4	2170	
11736.44	ArI 4	--	Blended at LR
11745.5	Xe 3	3360	
11796.8	Xe 3	700	
11860.5	Xe 3	760	
11887.74	ArI 4	--	Blended at LR
11899.89	ArI 4	--	Blended at LR
11915.5	XeI 2	140	
11946.55	ArI 4	1580	Blended at MR, ArI 11947.14
11956.4	Xe 3	340	
12029.94	ArI 4	1123	
12088.1	Xe 3	460	
12115.64	ArI 4	17600	
12143.06	ArI 4	11310	
12154.69	ArI 4	--	Blended at LR
12207.15	XeI 2	60	
12238.59	XeI 1	1320	
12261.11	XeI 1	220	
12346.77	ArI 4	120	
12359.67	ArI 4	9210	
12406.22	ArI 4	12406	
12422.79	ArI 4	--	Blended at LR
12442.73	ArI 4	57730	
12459.52	ArI 4	12460	
12491.08	ArI 4	12490	
12557.76	ArI 4	600	
12593.64	XeI 1	560	
12599.66	ArI 4	120	
12626.84	XeI 1	14150	
12641.94	ArI 4	320	
12705.75	ArI 4	17640	
12736.90	ArI 4	5500	
12749.72	ArI 4	4000	
12806.24	ArI 4	18230	
12936.73	ArI 4	8500	
12960.20	ArI 4	67320	
13011.82	ArI 4	15880	
13031.99	ArI 4	850	
13217.61	ArI 4	27410	
13231.72	ArI 4	25290	
13234.51	ArI 4	--	Blended at LR

13276.27	ArI 4	39640	
13305.95	Ar 4	--	Blended at LR
13316.85	ArI 4	29210	
13333.76	ArI 4	1310	
13370.77	ArI 4	61870	
13410.26	ArI 4	5230	
13503.10	ArI 4	--	Blended at LR
13507.88	ArI 4	91140	
13547.91	ArI 4	1450	
13577.33	ArI 4	2740	
13603.05	ArI 4	3480	
13626.38	ArI 4	25460	
13660.79	XeI 1	6460	
13682.29	ArI 4	16020	End of Js
13722.3	Ar IRAF	107900	
13829.5	Ar IRAF	--	Blended at LR
13832.1	Ar IRAF	--	Blended at LR
13914.4	Ar IRAF	630	
14097.49	ArI 4	140	(J) Beginning of SH
14146.31	XeI 1	--	Beyond the normal LR range
14178.58	ArI 4	--	Beyond the normal LR range
14244.85	XeI 1	1790	
14253.09	ArI 4	--	Blended at LR
14260.76	ArI 4	--	Blended at LR, and at MR 14258.04 ArI
14368.91	XeI 1	1070	
14581.44	ArI 4	--	Blended at LR
14600.46	ArI 4	2210	Blended at MR with 14599.73 ArI
14638.42	ArI 4	--	Blended at LR
14654.35	ArI 4	--	Blended at LR
14664.81	XeI 1	360	
14697.03	ArI 4	910	Blended at MR with 14697.69 ArI
14736.83	XeI 1	40000	
14743.17	ArI 4	1700	
14790.11	ArI 4	350	ID uncertain
14880.57	ArI 4	80	
15034.62	ArI 4	--	Blended at LR, and at MR 15035.28 ArI
15050.62	ArI 4	28600	
15103.84	XeI 1	280	
15176.84	ArI 4	6320	
15306.07	ArI 4	7720	
15333.54	ArI 4	4800	
15353.44	ArI 4	--	Blended at LR
15357.32	ArI 4	--	Blended at LR
15406.85	ArI 4	1570	
15422.60	XeI 1	17110	
15450.95	ArI 4	100	
15495.20	XeI 2	110	
15559.71	ArI 4	180	Blended at MR with XeI 15561.38
15561.38	XeI 1	420	Blended at MR with ArI 15559.71
15739.21	ArI 4	200	
15797.47	ArI 4	100	

15821.10	ArI 4	230	
15887.51	ArI 4	--	Blended at LR
15904.03	ArI 4	2500	
15983.90	XeI 1	1060	
15993.86	ArI 4	8700	
16044.28	XeI 1	--	Blended at LR
16057.66	XeI 1	6530	
16127.06	ArI 4	1280	
16184.44	ArI 4	1600	
16268.51	ArI 4	250	
16441.07	ArI 4	3140	
16524.38	ArI 4	10400	
16553.78	ArI 4	16553	Blended at MR with 16554.91 ArI
16559.01	XeI 1	360	
16732.72	XeI 1	11520	
16744.65	ArI 4	3450	
16839.14	XeI 2	60	
16887.68	XeI 2	90	
16945.21	ArI 4	16945	
17330.50	XeI 2	6350	
17369.82	XeI 2	70	
17406.67	ArI 4	190	
17449.67	ArI 4	4900	
17594.8	XeI 2	170	
17828.87	ArI 1	890	
17919.61	ArI 4	23690	End of SH
18353.01	ArI 4	--	Beyond the normal LR range
18423.09	ArI 4	--	Beyond the normal LR range
18432.80	ArI 4	--	Blended with 18434.81, 18433.43 ArI
18491.76	ArI 4	--	Beyond the normal LR range
18569.30	ArI 4	--	Blended at LR
18575.23	ArI 4	--	Blended at LR, + MR 18576.65 ArI
18637.37	ArI 4	330	
18750.12	ArI 4	230	
18793.26	XeI 1	2020	
19129.04	ArI 4	30	
19180.51	ArI 4	90	
19822.91	ArI 4	3340	
19950.52	ArI 4	--	Blended at LR Check ID and Wav.
19971.18	ArI 4	3900	
20031.14	ArI 4	--	Blended at LR
20035.57	ArI 4	--	Blended at LR
20074.41	ArI 4	240	
20192.70	XeI 1	840	
20267.77	XeI 1	25930	
20322.56	ArI 4	1990	
20518.4	XeI 2	50	
20574.43	ArI 4	450	
20598.9	XeI 2	140	
20621.86	ArI 4	31650	
20652.77	ArI 4	890	

20722.00	ArI 4	--	Blended at LR
20739.22	ArI 4	1200	Blended with 20740.10
20816.72	ArI 4	820	
20890.3	XeI 2	50	
20991.84	ArI 4	22440	
21041.57	ArI 4	140	
21116.7	XeI 2	80	
21338.71	ArI 4	2500	
21378.90	XeI 2	660	
21475.94	XeI 1	4640	
21540.09	ArI 4	10150	
22045.58	ArI 4	3500	
22083.21	ArI 4	12942	
22118.66	ArI 4	360	
22275.91	XeI 2	210	
22412.93	XeI 2	810	
22539.74	ArI 2	40	
22624.45	XeI 2	390	
22884.1	XeI 2	80	
22971.04	XeI 2	160	
22978.37	ArI 4	150	
23028.70	XeI 2	100	
23079.75	XeI 2	240	
23111.56	XeI 2	50	
23139.52	ArI 4	11910	
23199.65	XeI 1	18000	
23285.89	XeI 1	700	
23450.3	XeI 2	160	
23802.95	XeI 2	330	
23851.54	ArI 4	10480	
23973.06	ArI 4	13070	
24450.4	XeI 3	1450	
24709.05	XeI 2	490	
24783.37	ArI 4	150	
24831.48	XeI 1	44600	
25132.13	ArI 4	5760	
25152.69	XeI 1	2500	
25166.3	XeI 3	--	Blended at LR
25512.18	ArI 4	3750	
25668.02	ArI 4	900	
26276.24	XeI 1	--	Beyond the normal LR range

Main lines of other orders.
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Line	Lamp	OSF	Order	Location	Intensity
9447.93	Xe	Z	5	7873	760
9515.99	Xe	Z	5	7930	3560
9660.43	Ar	Z	5	8050	42020

8283.39	Xe	Z	7	9664	370	
8349.11	Xe	Z	7	9740	200	
8411	Xe	Z	7	9816	400	
8410.52	Ar	Z	7	9812	8700	
8426.96	Ar	Z	7	9831	14703	
8523.78	Ar	Z	7	9944	6490	
8670.32	Ar	Z	7	10115	860	
9660.43	Ar	SZ	6	11593	3420	
9787.97	Ar	SZ	6	11745	3410	
9802.38	Xe	SZ	6	11763	36925	
9925.38	Xe	SZ	6	11910	40624	
11081.90	Ar	J	5	13852	700	
11396.82	Ar	J	5	14246	660	
11444.97	Ar	J	5	14306	780	
11470.69	Ar	J	5	14338	280	
11491.25	Ar	J	5	14364	4810	
11088.27	Xe	J	5	13860	880	
11130.2	Xe	J	5	13913	200	
14097.49	Ar	SH	4	18797	6700	
14253.09	Ar	SH	4	19004	1860	Blended with 14253.09 Ar
14260.76	Ar	SH	4	19014	1860	Blended with 14260.76 Ar

6 LW line list

References
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1 - CRSP User's Manual (KPNO) - Already in vacuum wavelengths

2 - High resolution Argon Atlas by Lloyd Wallace, Ken Hinkle and Dick Joyce (KPNO). Already in vacuum wavelengths
See: http://www.noao.edu/kpno/phoenix/tharne/

Wavelength	Line	Source	Strength	Comments
28697.9	Ar	2	11.1	
28782.9	Ar	2	108.3	
28843.1	Ar	2	19.5	
29134.0	Ar	2	10.7	
29262.9	Ar	2	2.4	
29280.6	Ar	2	4.4	
29392.3	Xe	1	7.3	
29456.2	Xe	1	3.1	
29796.8	Ar	2	62.2	
30261.3	Xe	1	31.8	
30462.6	Ar	2	8.5	
30483.9	Xe	1	118.8	
30802.5	Xe	1	30.7	
30996.2	Ar	2	8.6	
31077.6	Xe	1	946.1	
31284.3	Xe	1	2.0	
31333.0	Ar	2	74.9	
31344.6	Xe	1	10.9	
31616.7	Xe	1	36.1	
31727.8	Ar	2	7.0	
32256.3	Ar	2	6.0	
32333.9	Ar	2	11.4	
32747.9	Xe	1	234.8	
32888.6	Ar	2	9.8	
33078.8	Ar	2	28.4	
33148.4	Ar	2	31.0	
33293.4	Ar	2	23.4	
33675.7	Xe	1	835.0	
34023.8	Xe	1	20.1	
34084.2	Xe	1	19.7	
34334.6	Xe	1	81.3	
34753.7	Xe	1	18.2	
34960.5	Ar	2	5.8	
35080.0	Xe	1	1833.0	
36220.8	Ar	2	45.9	
36241.8	Xe	1	10.2	
36312.4	Ar	2	12.2	

36492.0	Ar	2	58.0	
36518.5	Xe	1	95.3	
36798.4	Xe	1	193.6	
36858.6	Xe	1	27.8	
37013.6	Ar	2	7.7	
37086.0	Ar	2	10.3	
37143.5	Ar	2	29.5	
37186.1	Ar	2	4.7	
37291.8	Ar	2	6.9	
38120.0	Ar	2	19.9	
38331.2	Ar	2	10.3	
38696.9	Xe	1	14.3	
38737.7	Xe	1	21.9	
38748.6	Xe	1	21.4	
38878.8	Xe	1	25.1	
38950.4	Xe	1	298.2	
38959.7	Xe	1	59.5	Blended with 38950.4
38973.1	Xe	1	47.8	
39483.9	Xe	1	25.0	
39529.9	Xe	1	17.2	
39909.2	Ar	2	71.3	
39965.7	Xe	1	155.2	
40008.2	Ar	2	14.3	
40435.2	Ar	2	52.0	
40891.3	Ar	2	23.7	