Effective Dates: 23 November 1979
18 April 1980
29 August 1980

IUE DATA REDUCTION

XX. High Dispersion Line Libraries

ABSTRACT

The database of Pt-Ne emission lines used to calibrate the high dispersion wavelength scales has been scrutinized to improve the internal consistency of the adopted laboratory wavelength values and provide a homogeneous, documented line list which IUE Guest Observers may use to evaluate quantitatively those Pt-Ne spectra taken to calibrate their data. After delection of incorrect or inappropriate data in the old database (lines with incorrect wavelength assignments; lines which are too faint, too bright, or blended; lines which fall near reseau marks; lines with close companions, etc.) and the addition of several new entries, a total of 146 Pt-Ne lines for the SWP camera and 145 Pt-Ne lines for the LWR camera are now used for routine wavelength calibration in the high dispersion mode. The internal one sigma scatter of the assigned wavelengths corresponds to 0.30 pixels along the dispersion direction for SWP (2.3 km s^{-1} velocity uncertainty) and 0.26 pixels along the dispersion direction for LWR (1.9 km s^{-1} velocity uncertainty). Thermal effects, which can introduce large systematic image shifts, are excluded from these uncertainties but are independently correctable, in principle.

1. Introduction

Memo III in the IUE Data Reduction series (IUE Newsletter No. 5) describes the analysis and resulting changes which were made in 1978 to the wavelength calibration data base for low dispersion IUE spectra. The current memo describes the corresponding and somewhat more exhaustive analysis recently completed on the wavelength calibration data base (line libraries) for both the LWR and SWP cameras in high dispersion. These line libraries are comprised of a list of Pt-Ne emission lines (each designated by an arbitrary identification number generally called the "spot number") and their corresponding laboratory wavelengths and echelle order numbers. The libraries are essential to establishing the correspondence between wavelength and pixel location on IUE images and, hence, the wavelength scales of extracted spectra. The analysis described below was performed in three phases, resulting in a series of new high dispersion line libraries put into routine use on 23 November 1979, refined on 18 April 1980, and then further refined on 29 August 1980. With the final line libraries, the internal precision of the fitted dispersion relations in high resolution corresponds to a typical 1σ uncertainty of 0.30 pixels (2.3 km s^{-1}) in SWP and 0.26 pixels (1.9 km s^{-1}) in LWR.

2. Rationale for the Analysis

Unlike the case for low dispersion prior to the modification of the low dispersion line libraries, there were no known serious deficiencies in the high dispersion wavelength scales for IUE. (The problems of scale shifts and changes due to thermal effects are unrelated to the internal consistency of the wavelength calibrations being addressed here; thermal effects and the limitations they place on absolute wavelength accuracy of IUE spectra will be discussed in another memo of this series). However, a detailed analysis of the high dispersion line libraries was undertaken for several reasons. First, it was observed that many lines in the libraries were chronically rejected during the regression analysis used by the program WAVECAL2 to define the dispersion relations; this was suggestive of erroneous or inappropriate data in the libraries. Second, the data in the libraries were shown by spot checking to be rather inhomogenous in nature and undocumented as to ionic origin and wavelength references. This, too, suggested that inappropriate data might be included in the line libraries. An important reason for eliminating inappropriate entries is that otherwise, noise in the data could occasionally be identified as a non-existent line. Third, it was felt that the organization of the line libraries into a homogeneous, consistent, verified, and documented data base would be of value to IUE observers concerned with maximizing wavelength accuracy in high dispersion by allowing them quantitatively to evaluate those Pt-Ne spectra used to calibrate their data.

3. Analysis

3.1 References for Wavelengths and Ionic Origin

All entries in the original high dispersion line libraries (219 lines in LWR, 243 lines in SWP) were checked in published references for the correct laboratory wavelength and ionic origin. Where necessary, the wavelengths in the libraries were modified to agree with the published references. The references searched included Shenstone (1939), Moore (1950), Meggers, Corliss, and Scribner (1961), Harrison (1969), Kelly and Palumbo (1973), Fastie and Mount (1978), and Kelly (1979). Particular note was made of those cases in which the laboratory wavelengths for a given line published in the sources above differed by more than 0.01 Å. In these and all other cases, the "correct" laboratory wavelengths were adopted on the basis of a hierarchical ordering discussed in section 3.3. In some cases, no identification for the wavelength was found in any of the sources; such lines were ultimately deleted as described in section 3.4. For most cases, an identification of the ionic origin was available from the above references.

3.2 Chronically Rejected Lines

As mentioned above, it was known that numerous lines in both libraries were chronically rejected from the dispersion solutions. A rejection of a line in the regression analysis occurs when the apparent error exceeds 2.5σ in any one of the 6 iterations of the fitting procedure. B. R. Dantzler of CSC compiled statistics from 21 SWP high dispersion standard wavelength calibrations identifying some 65 lines which were rejected in more than one-half of the solutions, including 29 lines which were always rejected. A similar compilation of 24 LWR high dispersion standard wavelength calibrations identified 57 lines which were rejected in more than one-half of the solutions, including 15 lines which were always rejected. The chronically rejected lines were individually examined on annotated prints of Pt-Ne lamp WAVECAL images prepared by T. R. Gull of GSFC from photowrite images of standard Pt-Ne lamp WAVECAL images, and on plots of extracted spectra generated from the WAVECAL images. This inspection showed that most of the chronically rejected lines could be understood as either too faint, too bright, blended, off the edge of the tube face, or having apparently incorrect wavelengths in the published sources. In such cases, these lines were either deleted from the libraries as discussed in section 3.4 or assigned correct wavelengths as discussed in section 3.5. A small number of frequently rejected lines (2 lines in SWP, 4 lines in LWR) which had properly and apparently correct wavelengths (i.e., no apparent errors larger than ~0.05Å) and could not otherwise be explained as above were left in the libraries. These were lines number 173 and 187 in SWP and lines number 351, 149, 155, and 859 in LWR. They may be found in the complete listings of the final libraries in Tables 5 and 6.

3.3 Adopted Hierarchy for Wavelengths

In many cases, the wavelength identifications cited in the several available published references were in disagreement, although usually by small amounts (<0.01Å). In choosing the "correct" values for inclusion in the line libraries, a hierarchical ordering of the preferred reference was adopted:

1. Shenstone (1939)
2. Fastie and Mount (1978)

3. Harrison (1969)

4. Kelly and Palumbo (1973)

5. Kelly (1979)

The Pt-line measurements of Shenstone (1939) and Fastie and Mount (1978) were taken as the primary source of wavelength data, with the compendia of Harrison (1969), Kelly and Palumbo (1973), and Kelly (1979) used as wavelength sources for lines not included in the primary references. Kelly's wavelengths for Ne lines were given relatively low weight on the basis of empirical tests on actual IUE data. Kelly's Ne wavelengths were in poorer agreement with the IUE measurements than the wavelengths of the other sources: the overall standard deviations of the dispersion-constant fits using the Kelly wavelengths were several percent worse than those obtained using the non-Kelly wavelengths. The individual residuals for the Ne lines alone were ~15% greater when the Kelly wavelengths were used.

3.4 Deletions from the Old Line Libraries

As a result of the analyses described above, a substantial number of entries in the original line libraries were deleted: 100 SWP lines and 79 LWR lines. Such lines include those for which no published wavelength reference could be found (see section 3.1). Deleted entries also include those lines which were obviously inappropriate because they were either too bright, too faint, blended, near reseau marks, too close to companion lines, or had apparently incorrect published wavelengths. Tables 1 and 2 list the lines which were deleted from the original SWP and LWR line libraries in defining the final libraries implemented on 29 August 1980. In these Tables the reasons for deletion are noted, along with other identifying information. The wavelengths listed are those used in the old libraries; see the description of Tables 5 and 6 for a discussion of the vacuum and air wavelength systems and a key to the abbreviations used in the "References" column.

Table 3 gives the distribution of reasons for deletion of lines, some being redundant because certain lines could be deleted on several grounds. Particular attention was paid to that category of lines deleted for wavelength errors. Included in this category are those lines for which generally small "apparent wavelength errors" (0.10 to 0.25Å) were identified on the basis of close inspection of the plots of the extracted WAVECAL spectra and the regression analysis printouts. A priori, such apparent wavelength errors could be due to true wavelength errors, local geometric anomalies in the IUE images near those particular lines, or some combination of both reasons. In the case of the LWR library, easily-accessible data from pre-launch calibrations using the LWP camera were used to corroborate the suspicion of true wavelength errors: about 75% of the LWR lines suspected of having wavelength errors greater than 0.10Å also showed apparent wavelength errors of the same sign and similar magnitude when measured on the LWP calibration images. This tends to rule out geometric anomalies as the cause of the apparent error since such anomalies would not in general correlate between the LWP and LWR cameras. For this reason, all lines with measured "apparent wavelength errors" equaling or exceeding ±0.10Å were deleted from the final libraries. Several (but not all) of the "unexplained" chronically rejected lines cited in section 3.2 had possible wavelength errors of ±0.05Å but were not deleted because these errors fell below the somewhat arbitrarily selected rejection limit of 0.10Å. It was not felt that sufficiently reliable evidence existed to rule out geometrically-induced effects at this level for the several lines involved, since wavelength shifts of 0.05Å correspond in most cases to shifts in position of a pixel or less.

In the SWP library, the deleted lines 276, 281, 282, 283, and 285 had incorrectly computed vacuum wavelengths in the old libraries. Even when the correct wavelengths were substituted, however, these lines continued to be unsuitable for the reasons listed in Table 1.

Detailed inspection of the 18 April 1980 libraries revealed that a small number of lines in the libraries exhibited measurable evidence of the presence of close companion lines, as judged by small (~0.1px) but systematic effects in the line-position residuals. In order to cull such lines from the libraries, a set of criteria were developed empirically from LWR data which successfully discriminate against those lines affected by the presence of close companions in the same echelle order. Presumably, the effects seen (systematically increased residuals between "found" and "fitted" positions) are caused by the manner in which the cross-correlation search algorithm of WAVECAL2 finds lines which are near other lines. The empirical criteria for deletion of lines affected by close companions are as follows:

1. Delete a line if its intensity is equal to or less than twice the intensity of any other line which is within a distance of 12 pixels along the order, irrespective of whether the intensity plot goes to zero between the lines.
2. Delete even a line which is more than twice as intense as another line located within 12 pixels if the intensity plot minimum between the lines is not $\leqslant$ 10% of the brighter line intensity.

These empirical criteria were applied uniformly to the LWR and SWP libraries of 18 April 1980, resulting in 19 more deletions for LWR and 17 more deletions for SWP.

We note in passing that the most significant difference between the 23 November 1979 libraries and the 18 April 1980 libraries is the deletion of those lines with apparent wavelength errors >0.10Å. The chief difference between the 18 April 1980 libraries and the final 29 August 1980 libraries is the deletion in the final versions of several marginally faint lines and lines satisfying the "close companion" criteria outlined above.

3.5 Additions and Modifications to the Old Line Libraries

The current analysis did not make a systematic attempt to add new lines to the edited libraries. Because the long wavelength end (low order numbers) of each line library, however, was left sparsely populated by the deletions discussed above, the published references, the photographic prints, and the extracted spectral plots were examined to determine whether appropriate additions to the libraries could be found at the longer wavelengths. Three such lines were found in orders 67-71 for the SWP camera, and three such lines were found in orders 71-75 of the LWR camera. In addition, two other lines at shorter wavelengths were added to the LWR library. These new lines for each camera were tested in WAVECAL2 executions and found to be consistently incorporated in the regression solutions. For SWP, the line and sample residuals (the difference between actual emission-line location on an image compared to its calculated location using the fitted dispersion relations) for lines longward of 1856Å ($m \leq 74$) decreased in average absolute value from 0.24 pixels to 0.20 pixels when the new lines were included in the line library. In addition to the inclusion of the new lines, a number of modifications were made to the data in the line libraries. Most often, such changes were made in the wavelength values (generally less than 0.01Å), using the hierarchical system of wavelength identifications (see section 3.3). In one case, a misidentified line caused larger wavelength changes. In several other cases, incorrect vacuum wavelengths were corrected by large amounts. In one case, the assigned echelle order number was found to be in error in the original line library and hence was corrected in the new version. Data on all modifications to the line libraries may be found within the comments to Tables 5 and 6 in section 4.1, except for deletions, which have been addressed separately in Tables 1, 2, and 3.

4. The New Line Libraries

4.1 Tabulations

Table 4 summarizes the evolution of the line libraries from original to final form. In the row marked "No. of Chronically Rejected Lines", the numbers in parentheses indicate the number of lines always thrown out.

Tables 5 and 6 list the new high dispersion line libraries for SWP and LWR. The format of both tables is identical:

Column 1 - Spot number, an arbitrary indexing parameter. An asterisk denotes those lines identified in Section 3.2 as chronically rejected but left in the new libraries.

Column 2 - Wavelength in angstroms as measured in vacuum

Column 3 - Wavelength in angstroms as measured in air, given for $\lambda > 2000$Å only, in accordance with the usual UV spectroscopic convention. The formula used to calculate the λ_{air} corresponding to λ_{vac} is that used in the standard IUE data reduction algorithms, namely $\lambda_{air} = \lambda_{vac} / f(\lambda_{vac})$, where

$$f(\lambda) = 1.0 + 2.735182 \times 10^{-4} + \frac{131.4182}{\lambda^2} + \frac{2.7624 \times 10^8}{\lambda^4}$$

Note that we list air wavelengths for SWP even though the IUE data reduction algorithms apply the vacuum-to-air correction only for LWR spectra at $\lambda > 2000$Å.

Column 4 - Echelle order number

Column 5 - Ion responsible for the emission

Column 6 - The primary reference for the wavelength identification. S - Shenstone (1939), KP - Kelly and Palumbo (1973), F - Fastie and Mount (1978) H - Harrison (1969), and K - Kelly (1979). The notation F^* indicates that the line is referenced, but not explicitly measured, in F.

Column 7 - Alternate references, with same key as Col. 6.

Column 8 - Alternate vacuum wavelengths, given only in the case of a discrepancy ≥ 0.01Å.

Column 9 - The vacuum wavelength used in the old line library.

Column 10 - Comments

These new line libraries have been used in the standard wavelength calibration reductions since 29 August 1980.

Figures 1 and 2 show the distribution of line library entries across the image for LWR and SWP, respectively. A symbol is plotted at the fitted location in geometrically corrected space of each line in the library for each camera.

4.2 Tests

The new line libraries were subjected to testing to insure their validity and ascertain whether any significant improvement in the overall scale or internal accuracy of high dispersion wavelength calibrations has been realized by their use. For both cameras, the new line libraries, as well as the libraries installed on 23 November 1979 and 18 April 1980, yield dispersion relations consistent with those obtained with the old libraries. This consistency was judged by the fact that with any library, old or new, the pixel locations for a given wavelength calculated using the fitted dispersion relations were always the same to better than one-tenth of a pixel unit. That is, the changes to the line libraries have made no practical difference to the final wavelength scale. This is not a surprising result since the majority of the lines deleted in arriving at the new libraries were customarily rejected from the solutions using the original libraries. The new libraries do, however, yield somewhat higher internal accuracy as judged by the standard deviations of emission-line positions calculated from the fitted dispersion relations compared to the actual positions found by the cross-correlation search algorithm of WAVECAL2. These standard deviations are measured separately in the line direction, σ (L), and the sample direction, σ (S). Table 7 summarizes the behavior of the solutions using the various old and new libraries for several different calibration images in each camera. Note that the dispersion relations using the new libraries consistently employ a large fraction of the total number of available lines in the final regression solutions. This indicates that the major sources of systematic error in the library data have probably been eliminated, lending further credence to the consistency of the final libraries. The typical 1 σ error in the dispersion direction of 0.30 px for SWP and 0.26 px for LWR corresponds to a 1 σ velocity uncertainty of 2.3 km s^{-1} and 1.9 km s^{-1} for SWP and LWR, respectively. These values can be ascribed largely to inherent inaccuracies in the IUE geometric correction and line-finding algorithms and should be close to the errors expected in an arbitrary spectrum of an astronomical source, taken in the small aperture. Any additional errors should be caused only by thermal shifts in the cameras and spectrographs.

4.3 Plots

Wavelength calibration images are routinely processed as standard spectral images after they have been used to define dispersion relations. In the series of plots in Figs. 3 and 4, extracted spectra from two such high dispersion calibration images, SWP 6349 and LWR 5483, are displayed, and the members of the new line libraries are identified by wavelength in angstrom units. SWP 6349 was a 120 second Pt-Ne exposure superposed on a 5 second tungsten flood; LWR 5483 was a 16 second Pt-Ne exposure superposed on a 7 second tungsten flood. Care should be taken to note the following points about the plots.

1. They have been generated from net IUE spectra reduced in the standard fashion. No ripple correction has been applied.
2. In accordance with standard IUE convention, the plotted data and the wavelength annotations for SWP have no vacuum-to-air correction applied, whereas the LWR data are corrected to air values for $\lambda > 2000$Å.
3. For SWP, echelle orders 125 through 66 are plotted; for LWR, echelle orders 125 through 72 are plotted. These are the standard limits on IUE extracted spectra, and hence the library entries for order 71 in LWR do not appear on the plots.
4. These plots illustrate qualitatively the relative intensities of the Pt-Ne spectral lines generated by the on-board calibration lamps, as detected by the IUE spectrograph/camera combinations. A number of the lines are saturated; accurate intensity measurements for such lines are impossible.

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References

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Table 1 - Lines Deleted from Old Line Library: SWP

SPOT NUMBER	VACUUM WAVELENGTH	AIR WAVELENGTH	ORDER	ION	REFERENCE	REASON FOR DELETION
6	1175.131		117	PT II	S	FAINT
7	1176.403		117	PT II	S	FAINT
8	1178.412		117	PT II	S	FAINT
12	1180.242		117	PT II	S	FAINT
14	1180.711		117	PT II	S	FAINT
16	1181.104		117	PT II	S	FAINT
18	1182.343		117	PT II	S	FAINT
19	1182.343		116	PT II	S	FAINT
22	1188.689		116	PT II	S	FAINT
24	1198.781		115	PT II	S	APPARENT WAVELENGTH ERROR (0.1A)
33	1232.867		112	PT II	S	ADJACENT TO RESEAU
34	1237.455		112	PT II	S	FAINT
37	1237.455		111	PT II	S	DIFFUSE
35	1238.847		112	PT II	S	FAINT
39	1245.676		111	–	–	NO IDENTIFICATION, FAINT
40	1245.676		110	–	–	NO IDENTIFICATION, FAINT
42	1257.190		110	–	–	NO IDENTIFICATION
43	1257.190		109	–	–	NO IDENTIFICATION
50	1281.340		108	PT II	S	FAINT
51	1281.340		107	PT II	S	FAINT
52	1283.689		108	–	F	FAINT
56	1291.137		107	PT II	S	FAINT
58	1291.695		107	PT II	S	ADJACENT TO RESEAU
59	1293.953		107	PT II	S	FAINT
60	1293.953		106	PT II	S	FAINT
62	1296.821		106	PT II	S	FAINT
64	1309.517		106	PT II	S	FAINT
67	1322.834		104	–	–	NO IDENTIFICATION
889	1374.878		101	PT II	S	FAINT
981	1393.386		99	PT II	S	FAINT
99	1403.896		98	PT II	S	CLOSE COMPANION
100	1404.736		98	PT II	S	FAINT

7319/80

Table 1 - (continued)

SPOT NUMBER	VACUUM WAVELENGTH	AIR WAVELENGTH	ORDER	ION	REFERENCE	REASON FOR DELETION
102	1410.127		97	PT II	S	NOT ON SWP TUBE
110	1437.813		96	PT II	S	FAINT, BLENDED
1203	1460.303		95	PT II	S	FAINT
1211	1467.056		94	PT II	S	FAINT
1221	1477.257		94	PT II	S	FAINT
128	1491.800		93	PT II	S	FAINT, BLENDED, APPARENT WAVELENGTH ERROR (0.15A)
1301	1495.470		92	PT II	S	BLENDED, APPARENT WAVELENGTH ERROR (0.1A)
138	1507.509		91	PT II	S	FAINT, BLENDED, APPARENT WAVELENGTH ERROR (–0.1A)
137	1507.640		92	–	–	NO IDENTIFICATION
1371	1507.640		91	–	–	NO IDENTIFICATION
147	1524.725		91	PT II	S	BLENDED
148	1524.725		90	PT II	S	BRIGHT, BLENDED
1531	1536.640		90	PT II	S	FAINT
1532	1540.530		90	–	–	NO IDENTIFICATION
155	1544.130		89	PT II	S	CLOSE COMPANION
1549	1544.130		90	PT II	S	FAINT
1559	1545.241		90	PT II	S	BLENDED
156	1545.241		89	PT II	S	BLENDED
1569	1546.814		90	PT II	S	FAINT
1659	1568.530		88	PT II	S	ADJACENT TO RESEAU
167	1568.893		87	PT II	S	NOT ON SWP TUBE
168	1573.830		88	PT II	S	CLOSE COMPANION
169	1573.830		87	PT II	S	CLOSE COMPANION
171	1574.301		87	–	F	OUTSIDE OBSERVED RESEAU GRID
176	1613.976		86	PT II	S	CLOSE COMPANION
177	1613.976		85	PT II	S	CLOSE COMPANION
180	1622.183		85	PT II	S	CLOSE COMPANION
182	1630.508		85	–	–	NO IDENTIFICATION
183	1630.508		84	–	–	NO IDENTIFICATION
192	1654.122		83	–	F	APPARENT WAVELENGTH ERROR (–0.15A)
202	1708.736		81	PT II	S	CLOSE COMPANION
206	1723.128		80	PT II	S	TOO BRIGHT

7319/80

Table 1 - (continued)

SPOT NUMBER	VACUUM WAVELENGTH	AIR WAVELENGTH	ORDER	ION	REFERENCE	REASON FOR DELETION
2101	1740.354		79	PT II	S	CLOSE COMPANION
214	1752.864		79	PT II	S	ADJACENT TO RESEAU
222	1769.485		78	PT II	S	CLOSE COMPANION
229	1781.858		77	PT II	S	TOO BRIGHT
2303	1811.038		76	PT II	S	CLOSE COMPANION
2305	1833.375		75	PT II	S	CLOSE COMPANION
235	1848.749		75	PT II	S	CLOSE COMPANION
236	1856.959		74	PT II	S	CLOSE COMPANION
2361	1866.150		74	PT II	S	CLOSE COMPANION
241	1879.094		74	PT II	S	NEAR EDGE OF SWP TUBE
242	1879.094		73	PT II	S	OUTSIDE OBSERVED RESEAU GRID
243	1883.051		73	PT II	S	TOO BRIGHT
244	1889.516		73	PT II	S	TOO BRIGHT
248	1909.336		72	PT II	S	APPARENT WAVELENGTH ERROR (–0.1A)
249	1911.702		72	PT II	S	TOO BRIGHT
250	1916.160		72	NE II	F	SATURATED
252	1919.954		70	PT II	S	BLENDED (ACTUALLY IN ORDER 72)
254	1926.153		72	PT II	S	APPARENT WAVELENGTH ERROR (–0.1A)
258	1934.008		71	PT II	S	BRIGHT, BLENDED
259	1944.455		71	PT II	S	BRIGHT, BLENDED
261	1949.901		71	PT II	S	BLENDED
266	1958.492		70	PT II	S	NOT ON SWP TUBE
267	1969.994		70	PT II	S	BLENDED
269	1978.690		70	PT II	S	BLENDED
271	1979.872		70	PT II	S	BRIGHT, BLENDED
275	1990.567		69	PT II	S	TOO BRIGHT
276	2005.632	2004.984	69	PT II	S	BLENDED (INCORRECT WAVELENGTHS LISTED HERE WERE USED IN OLD LIBRARY)
281	2031.934	2031.281	68	PT I	H	TOO BRIGHT (INCORRECT WAVELENGTHS LISTED HERE WERE USED IN OLD LIBRARY)
282	2033.714	2033.060	68	PT I	H	TOO BRIGHT (INCORRECT WAVELENGTHS LISTED HERE WERE USED IN OLD LIBRARY)

7319/80

Table 1 - (Continued)

SPOT NUMBER	VACUUM WAVELENGTH	AIR WAVELENGTH	ORDER	ION	REFERENCE	REASON FOR DELETION
283	2037.774	2037.120	68	PT II	S	TOO BRIGHT (INCORRECT WAVELENGTHS LISTED HERE WERE USED IN OLD LIBRARY)
285	2042.883	2042.228	68	PT II	S	NOT ON SWP TUBE (INCORRECT WAVELENGTHS LISTED HERE WERE USED IN OLD LIBRARY)
287	2050.024	2049.367	67	PT II	S	NOT ON SWP TUBE
288	2057.662	2057.003	67	PT II	S	BRIGHT, BLENDED
289	2069.290	2068.629	67	PT II	S	NOT ON SWP TUBE
293	2086.082	2085.418	66	PT II	S	DIFFUSE, NEAR EDGE OF SWP TUBE
294	2098.102	2097.435	66	PT II	S	NEAR EDGE OF SWP TUBE

7319/80

Table 2 - Lines Deleted from Old Line Library: LWR

SPOT NUMBER	VACUUM WAVELENGTH	AIR WAVELENGTH	ORDER	ION	REFERENCE	REASON FOR DELETION
860	1813.153		128	PT II	S	FAINT
861	1813.153		127	PT II	S	FAINT
862	1845.492		126	–	F	FAINT
863	1845.492		125	–	F	FAINT, APPARENT WAVELENGTH ERROR (0.2A)
864	1870.404		124	PT II	S	FAINT
865	1870.404		123	PT II	S	FAINT
868	1916.160		121	NE II	F	APPARENT WAVELENGTH ERROR (0.15A)
869	1929.677		120	PT II	S	TOO BRIGHT
9201	2040.355	2039.700	113	PT	H	BLENDED
22	2050.024	2049.367	113	PT I	S, H	BLENDED
23	2057.661	2057.003	113	PT II	S, H	BLENDED
34	2102.252	2101.585	110	PT II	S, H	APPARENT WAVELENGTH ERROR (–0.1A)
353	2132.231	2122.560	109	PT	H	FAINT
362	2135.824	2135.150	108	PT	H	CLOSE COMPANION
37	2143.174	2142.499	108	PT II	S, H	FAINT
381	2145.702	2145.026	108	PT	H	FAINT
382	2145.702	2145.026	108	PT	H	FAINT
44	2180.994	2180.311	106	PT	H	BLENDED
45	2181.173	2180.490	106	PT I	H	BLENDED
46	2183.454	2182.770	106	PT I	H	CLOSE COMPANION
50	2203.265	2202.577	105	PT II	S, H	BLENDED
52	2210.538	2209.848	105	PT II	S, H	FAINT
521	2218.031	2217.340	105	PT I	H	FAINT, APPARENT WAVELENGTH ERROR (0.1A)
551	2233.804	2233.110	104	PT II	S, H	BLENDED, APPARENT WAVELENGTH ERROR (0.2A)
561	2236.095	2235.400	104	PT	S, H	BLENDED, DIFFUSE
58	2245.667	2244.970	103	PT I	H	CLOSE COMPANION
61	2249.998	2249.300	103	PT I	H	CLOSE COMPANION
62	2250.598	2249.900	103	PT	H	CLOSE COMPANION
621	2251.325	2250.627	103	PT II	S, H	BLENDED
622	2252.219	2251.521	103	PT II	S, H	CLOSE COMPANION
623	2252.624	2251.926	103	PT II	S, H	FAINT
64	2264.688	2263.987	102	PT II	S, H	APPARENT WAVELENGTH ERROR (0.15A)

7319/80

Table 2 - (Continued)

SPOT NUMBER	VACUUM WAVELENGTH	AIR WAVELENGTH	ORDER	ION	REFERENCE	REASON FOR DELETION
67	2275.544	2274.840	102	PT	H	ADJACENT TO RESEAU
671	2277.114	2276.410	102	PT	H	CLOSE COMPANION
672	2277.564	2276.860	102	PT	H	BLENDED, FAINT
673	2281.185	2280.480	101	PT	H	BLENDED
674	2281.975	2281.270	101	PT	H	APPARENT WAVELENGTH ERROR (0.15A)
68	2287.278	2286.572	101	PT II	S, H	APPARENT WAVELENGTH ERROR (0.15A)
69	2288.205	2287.499	101	PT II	S, H	BLENDED, APPARENT WAVELENGTH ERROR (0.2A)
73	2296.572	2295.864	101	PT II	S, H	BLENDED
772	2326.816	2326.101	100	PT I	H	BLENDED
773	2327.046	2326.331	100	PT II	S, H	BLENDED
774	2335.907	2335.190	99	PT II	S, H	ADJACENT TO RESEAU
801	2347.879	2347.160	99	PT	H	FAINT, DIFFUSE
81	2357.051	2356.330	98	PT	H	CLOSE COMPANION
83	2358.299	2357.577	98	PT	H	FAINT
941	2396.897	2396.167	97	PT I	H	CLOSE COMPANION
95	2397.416	2396.686	97	PT II	S, H	CLOSE COMPANION
111	2451.183	2450.441	95	PT II	S, H	CLOSE COMPANION
112	2451.713	2450.970	95	PT I	H	CLOSE COMPANION
113	2451.713	2450.970	94	PT I	H	CLOSE COMPANION
114	2468.340	2467.593	94	PT II	S,F,H	BLENDED, APPARENT WAVELENGTH ERROR (0.2A)
122	2496.570	2495.817	93	PT I	H	ADJACENT TO RESEAU
124	2504.797	2504.042	92	PT I	H	CLOSE COMPANION
128	2515.792	2515.034	92	PT I	F, H	CLOSE COMPANION
136	2581.857	2581.084	90	PT II	S,F,H	APPARENT WAVELENGTH ERROR (0.25A)
153	2660.240	2659.448	87	PT I	F, H	TOO BRIGHT
154	2675.370	2674.575	87	PT I	F, H	ADJACENT TO RESEAU
1551	2677.941	2677.145	86	PT I	F, H	CLOSE COMPANION
1552	2678.855	2678.059	86	–	–	NO IDENTIFICATION, APPARENT WAVELENGTH ERROR (0.2A)
1553	2679.925	2679.129	86	PT II	H	FAINT, CLOSE TO MUCH BRIGHTER LINE, POSSIBLE MISIDENTIFICATION (MAY BE NE I 2679.208)
164	2744.303	2743.491	84	PT II	S, H	DIFFUSE
166	2754.670	2753.856	84	PT I	H	ADJACENT TO RESEAU
1811	2819.703	2818.873	82	PT II	S,F,H	FAINT

7319/80

Table 2 - (Continued)

SPOT NUMBER	VACUUM WAVELENGTH	AIR WAVELENGTH	ORDER	ION	REFERENCE	REASON FOR DELETION
183	2831.128	2830.295	82	PT I	H, F	TOO BRIGHT
187	2878.364	2877.521	80	PT II	S,F,H	APPARENT WAVELENGTH ERROR (0.25A)
1891	2906.750	2905.899	79	PT I	F, H	FAINT, NEAR EDGE OF LWR TUBE
193	2968.063	2967.197	78	NE II	F,H,K	ADJACENT TO RESEAU
1951	2983.533	2982.663	77	NE I	H, K	NEAR EDGE OF LWR TUBE
203	3036.864	3035.980	76	NE II	H, K	CLOSE COMPANION
204	3037.335	3036.451	76	PT I	F, H	CLOSE COMPANION
210	3048.468	3047.582	76	NE II	F,H,K	ADJACENT TO RESEAU
211	3055.578	3054.690	76	NE II	H, K	CLOSE COMPANION
5212	3065.608	3064.717	76	PT I	F, H	TOO BRIGHT
2122	3065.608	3064.717	75	PT I	F, H	TOO BRIGHT
214	3089.917	3089.020	75	–	F	FAINT
852	3142.570	3141.660	74	PT	H	FAINT
856	3234.353	3233.420	71	PT I	H	NOT ON LWR TUBE
857	3241.135	3240.200	71	PT I	H	NOT ON LWR TUBE

7319/80

TABLE 3 - DISTRIBUTION OF REASONS FOR DELETION OF LINES

(SOME REDUNDANT)

	SWP	LWR
Blended or close companions	32	35
Too Faint	33	20
Too Bright	15	5
Wavelength errors	7	13
Near Reseau	4	7
No Identification	10	1
Other (Diffuse, edge of tube, etc.)	12	7

TABLE 4 - IUE HIGH DISPERSION LINE LIBRARY STATISTICS

	SWP	LWR
No. Lines in Old Library	243	219
No. Chronically Rejected Lines	65 (29)	57 (15)
Lines Deleted	100	79
Lines Added	3	5
No. Lines in New Library	146	145

Table 5 - New Line Library for High Dispersion: SWP

(1) Spot No.	(2) Vacuum Wavelength	(3) Air Wavelength	(4) Order	(5) Ion	(6) Prime Reference	(7) Alternate Reference	(8) Alternate Vacuum Wavelengths	(9) Old Vacuum Wavelength	(10) Comments
1	1164.406		118	Pt II	S				
4	1169.741		118	Pt II	S				
10	1178.957		117	Pt II	S				
21	1186.216		116	Pt II	S				
28	1219.501		113		F*				
32	1229.007		112	Pt II	S				
38	1238.847		111	Pt II	S				
36	1248.600		111	Pt II	S				
41	1248.600		110	Pt II	S				
44	1259.494		110	Pt II	S				
45	1259.494		109	Pt II	S				
48	1271.784		109	Pt II	S				
49	1271.784		108	Pt II	S				
53	1283.689		107		F*				
55	1286.442		107	Pt II	S				
54	1289.940		107	Pt II	S				
61	1302.446		106	Pt II	S				
65	1309.517		105	Pt II	S				
66	1320.158		104	Pt II	S				
68	1323.276		104	Pt II	S				
69	1327.421		104	Pt II	S				
71	1330.051		104	Pt II	S				
72	1330.051		103	Pt II	S				
73	1337.856		103	Pt II	S				
74	1340.132		103	Pt II	S				
78	1345.435		103	Pt II	S				

Table 5 - (Continued)

(1) Spot No.	(2) Vacuum Wavelength	(3) Air Wavelength	(4) Order	(5) Ion	(6) Prime Reference	(7) Alternate Reference	(8) Alternate Vacuum Wavelengths	(9) Old Vacuum Wavelength	(10) Comments
79	1345•435		102	Pt II	S				
80	1348•265		102	Pt II	S				
83	1362•672		101	Pt II	S				
86	1369•362		101	Pt II	S				
87	1373•164		101	Pt II	S				
88	1373•164		100	Pt II	S				
89	1374•878		100	Pt II	S				
90	1378•947		100	Pt II	S				
92	1380•475		100	Pt II	S				
94	1382•040		100	Pt II	S				
95	1383•266		100	Pt II	S				
96	1383•266		99	Pt II	S				
98	1389•875		99	Pt II	S				
982	1402•236		98	Pt II	S				
101	1410•127		98	Pt II	S				
103	1429•524		97	Pt II	S				
104	1429•524		96	Pt II	S				
106	1432•905		96	Pt II	S				
107	1435•126		96	Pt II	S				
108	1436•309		96	Pt II	S				
1139	1446•278		96	Pt II	S				
114	1446•278		95	Pt II	S				
115	1447•797		95	Pt II	S				
116	1449•802		95	Pt II	S				
118	1455•879		95	Pt II	S				
119	1457•668		95	Pt II	S				
120	1457•668		94	Pt II	S				
1201	1458•619		95	Pt II	S				
1202	1458•619		94	Pt II	S				
1204	1460•303		94	Pt II	S				
1205	1462•664		95	Pt II	S				
121	1462•664		94	Pt II	S				
1212	1475•632		94	Pt II	S				
122	1475•632		93	Pt II	S				
123	1477•257		93	Pt II	S				
124	1478•027		93	Pt II	S				
126	1482•823		93	Pt II	S				
130	1494•724		92	Pt II	S				
131	1499•380		92	Pt II	S				
133	1505•240		92	Pt II	S				
134	1505•240		91	Pt II	S				
135	1506•279		92	Pt II	S				
136	1506•279		91	Pt II	S				
139	1509•288		92	Pt II	S				
140	1509•288		91	Pt II	S				
141	1514•492		91	Pt II	S				
142	1516•740		91	Pt II	S				
143	1517•460		91	Pt II	S				
146	1520•010		91	Pt II	S				
149	1528•290		90	Pt II	S				
1491	1529•460		90	Pt II	S				
150	1530•190		90	Pt II	S				

Table 5 - (Continued)

(1) Spot No.	(2) Vacuum Wavelength	(3) Air Wavelength	(4) Order	(5) Ion	(6) Prime Reference	(7) Alternate Reference	(8) Alternate Vacuum Wavelengths	(9) Old Vacuum Wavelength	(10) Comments
151	1531.524		90	Pt II	S				
153	1534.900		90	Pt II	S				
1533	1541.830		90	Pt II	S				
157	1546.814		89	Pt II	S				
158	1548.900		89	Pt II	S				
160	1549.500		89	Pt II	S				
162	1552.330		89	Pt II	S				
1621	1553.055		89	Pt II	S				
164	1554.940		89	Pt II	S	F*	F 1554.90		
165	1554.940		88	Pt II	S	F*	F 1554.90		
166	1568.893		88	Pt II	S				
170	1574.301		88		F*				
1719	1579.450		88	Pt II	S				
172	1579.450		87	Pt II	S				
1729	1581.420		88		F*				
173 *	1581.420		87		F*				
174	1587.674		87	Pt II	S				
175	1588.679		87	Pt II	S				
178	1621.658		85	Pt II	S				
184	1631.122		85		F*				
185	1631.122		84		F*				
186	1634.265		85	Pt II	S				
187 *	1634.265		84	Pt II	S				
188	1636.169		84		F*				
189	1648.256		84	Pt II	S				
190	1650.233		84	Pt II	S				
1901	1650.233		83	Pt II	S				
193	1659.484		83	Pt II	S				
194	1686.246		82	Pt II	S				
197	1696.278		82	Pt II	S				
198	1696.278		81	Pt II	S				
199	1704.765		81	Pt II	S				
201	1705.914		81	Pt II	S				
203	1710.852		81	Pt II	S				
205	1717.960		80	Pt II	S				
207	1724.563		80	Pt II	S				
208	1726.366		80	Pt II	S				
209	1735.858		80	Pt II	S				
210	1735.858		79	Pt II	S				
211	1747.180		79	Pt II	S				
213	1751.703		79	Pt II	S				
215	1753.823		79	Pt II	S				
218	1758.118		78	Pt II	S				
219	1764.595		78	Pt II	S				
220	1766.023		78	Pt II	S				

Table 5 - (Continued)

(1) Spot No.	(2) Vacuum Wavelength	(3) Air Wavelength	(4) Order	(5) Ion	(6) Prime Reference	(7) Alternate Reference	(8) Alternate Vacuum Wavelengths	(9) Old Vacuum Wavelength	(10) Comments
221	1767•151		78	Pt II	S				
224	1775•012		78	Pt II	S				
228	1781•858		78	Pt II	S				
230	1785•867		77	Pt II	S				
2301	1796•481		77	Pt II	S				
2302	1805•013		76	Pt II	S				
2304	1820•799		76	Pt II	S				
231	1835•063		75	Pt II	S				
234	1840•877		75	Pt II	S				
237	1867•122		74	Pt II	S				
238	1868•968		74	Pt II	S				
239	1870•404		74	Pt II	S				
246	1891•526		73	Pt II	S				
247	1894•995		73	Pt II	S				
2491	1912•730		72	Pt II	S				
257	1933•529		71	Ne II	KP			1933.345	OLD IDENT. Pt II (S) ADDED TO LIBRARY
300	1951•764		71	Pt II	S				
263	1954•734		71	Pt II	S				
2661	1965•426		70	Pt II	S				
273	1983•737		70	Pt II	S				
301	2002•523	2001•875	69	Ne II	K				ADDED TO LIBRARY
303	2025•282	2024•630	68	Pt	H				ADDED TO LIBRARY
2811	2032•103	2031•450	68	Pt II	S				

Table 6 - New Line Library for High Dispersion: LWR

(1) Spot No.	(2) Vacuum Wavelength	(3) Air Wavelength	(4) Order	(5) Ion	(6) Prime Reference	(7) Alternate Reference	(8) Alternate Vacuum Wavelengths	(9) Old Vacuum Wavelength	(10) Comments
866	1883.051	1883.051	123	Pt II	S				
902	1911.702	1911.702	121	Pt II	S				ADDED TO LIBRARY
903	1944.455	1944.455	119	Pt II	S				ADDED TO LIBRARY
870	2015.577	2014.927	115	Pt II	S	H		2014.927	
16	2031.283	2030.630	114	Pt I	H				
17	2033.064	2032.410	114	Pt I	H				
9191	2036.434	2035.780	114	Pt	H				
20	2037.117	2036.463	113	Pt II	H	F*			
18	2037.117	2036.463	114	Pt II	H	F*			
9202	2040.985	2040.330	113	Pt	H				
21	2042.225	2041.570	113	Pt II	S	H			
19	2042.225	2041.570	114	Pt II	S	H			
24	2061.409	2060.750	112	Pt II	H				
25	2063.439	2062.780	112	Pt I	H				
27	2068.160	2067.500	112	Pt I	H				
9271	2071.591	2070.930	112	Pt I	H				
9272	2076.050	2075.388	111	Pt II	S	H			
29	2085.254	2084.590	111	Pt I	H				
30	2086.082	2085.418	111	Pt II	S	H			
33	2098.101	2097.435	110	Pt II	S	H		2098.106	
35	2103.998	2103.330	110	Pt I	H				
351 *	2116.239	2115.569	109	Pt II	S	F, H		2116.243	
352	2120.551	2119.880	109	Pt	H				
354	2128.074	2127.402	109	Pt II	S	H	H 2128.089		
5036	2129.279	2128.606	108	Pt I	F	H			
36	2129.279	2128.606	109	Pt I	F	H			
361	2131.362	2130.689	109	Pt II	S	H			
38	2144.920	2144.244	108	Pt II	S	H	H 2144.907		
383	2152.757	2152.080	108	Pt I	H				
384	2154.228	2153.550	108	Pt I	H				
40	2165.850	2165.170	107	Pt I	H	F*			

Table 6 - (Continued)

(1) Spot No.	(2) Vacuum Wavelength	(3) Air Wavelength	(4) Order	(5) Ion	(6) Prime Reference	(7) Alternate Reference	(8) Alternate Vacuum Wavelengths	(9) Old Vacuum Wavelength	(10) Comments
41	2167.311	2166.630	107	Pt I	H				
42	2175.352	2174.670	107	Pt I	H	F*			
43	2175.352	2174.670	106	Pt I	H	F*			
47	2191.000	2190.315	106	Pt II	S	H			
48	2200.387	2199.700	105	Pt	H				
511	2207.415	2206.726	105	Pt II	S	H		2207.419	
56	2235.610	2234.915	104	Pt I	H				
59	2246.215	2245.518	103	Pt II	S	F, H		2246.219	
60	2247.202	2246.505	103	Pt II	S	H			
63	2263.363	2262.662	102	Pt II	S	F, H		2263.362	
65	2269.542	2268.840	102	Pt	H				
66	2275.083	2274.380	102	Pt I	H	F*			
70	2288.903	2288.197	101	Pt II	S	F, H		2288.902	
71	2289.977	2289.270	101	Pt I	H				
72	2293.085	2292.378	101	Pt I	F	H	H 2293.102	2293.087	
731	2303.910	2303.200	100	Pt I	H				
74	2308.751	2308.040	100	Pt I	H	F*			
75	2311.668	2310.957	100	Pt II	S	F, H			
76	2316.207	2315.495	100	Pt I	H				
77	2319.007	2318.294	100	Pt I	F	H			
771	2320.595	2319.882	100	Pt II	S	H		2320.601	
79	2340.894	2340.176	99	Pt I	F	H		2340.896	
802	2349.264	2348.544	99	Pt II	S	H		2349.268	
82	2357.826	2357.104	98	Pt I	H	F*			
88	2369.000	2368.276	98	Pt I	H				
89	2378.002	2377.276	97	Pt II	S	F, H			
92	2384.369	2383.641	97	Pt I	H				
94	2390.262	2389.533	97	Pt I	H	F*			
96	2401.733	2401.002	96	Pt I	H				
97	2402.606	2401.874	96	Pt I	H				
98	2403.821	2403.089	96	Pt I	H				
99	2406.454	2405.722	96	Pt II	S	H		2406.460	
100	2418.793	2418.058	96	Pt I	H				
101	2421.547	2420.811	96	Pt II	S	H		2421.553	
102	2425.608	2424.871	96	Pt II	S	F, H			
103	2425.608	2424.871	95	Pt II	S	F, H			
107	2435.191	2434.452	95	Pt II	S	H		2435.197	
108	2437.429	2436.689	95	Pt I	H				
109	2440.797	2440.057	95	Pt I	F	H			
110	2443.358	2442.617	95	Pt II	S	H		2443.367	
115	2471.754	2471.007	94	Pt I	H				
119	2487.919	2487.168	93	Pt I	H	F*			

Table 6 - (Continued)

(1) Spot No.	(2) Vacuum Wavelength	(3) Air Wavelength	(4) Order	(5) Ion	(6) Prime Reference	(7) Alternate Reference	(8) Alternate Vacuum Wavelengths	(9) Old Vacuum Wavelength	(10) Comments
121	2490.877	2490.125	93	Pt I	H				
5123	2499.254	2498.500	92	Pt I	F	H			
123	2499.254	2498.500	93	Pt I	F	H			
125	2506.681	2505.926	92	Pt I	H			2506.675	
126	2509.249	2508.493	92	Pt I	F	H		2509.252	
129	2516.337	2515.579	92	Pt I	F	H			
130	2525.068	2524.308	92	Pt I	F	H			
132	2537.257	2536.494	91	Pt I	F	H			
133	2539.963	2539.200	91	Pt I	F	H			
134	2550.230	2549.464	91	Pt I	H				
135	2553.020	2552.254	91	Pt I	F	H			
139	2596.777	2596.000	89	Pt I	H				
140	2603.913	2603.135	89	Pt I	F	H			
142	2620.352	2619.570	88	Pt I	F	H			
143	2626.121	2625.338	88	Pt II	S	F, H		2626.118	
144	2628.815	2628.031	88	Pt I	F	H			
148	2640.132	2639.345	88	Pt I	F	H			
149*	2647.670	2646.881	88	Pt I	F	H			
150	2651.642	2650.852	87	Pt I	F	H			
155*	2677.941	2677.145	87	Pt I	F	H			
156	2699.223	2698.422	86	Pt I	F	H			
1571	2703.205	2702.403	85	Pt I	F	H			
157	2703.205	2702.403	86	Pt I	F	H			
1581	2706.696	2705.893	86	Pt I	F	H			OLD ORDER = 85
158	2706.696	2705.893	85	Pt I	F	H			
159	2713.931	2713.127	85	Pt I	F	H			
162	2730.725	2729.917	85	Pt I	F	H			
163	2734.770	2733.961	85	Pt I	F	H			
1631	2739.295	2738.484	84	Pt I	H				
165	2748.422	2747.609	84	Pt I	H				
167	2755.740	2754.926	84	Pt I	F	H			
170	2763.766	2762.950	84	Ne II	F	H, K	H2763.786, K2763.738		
171	2770.655	2769.837	84	Pt I	H				
172	2772.491	2771.672	84	Pt I	F	H			
1721	2772.491	2771.672	83	Pt I	F	H			
178	2795.037	2794.213	83	Pt II	S	F, H	F2795.049, H2795.032	2795.049	
179	2804.074	2803.248	83	Pt I	F	H			
1791	2810.316	2809.488	82	Ne II	F	H, K			
181	2819.080	2818.250	82	Pt I	F	H		2819.078	
184	2835.554	2834.720	82	Pt I	F	H		2835.547	
188	2894.720	2893.872	80	Pt I	F	H			
189	2898.729	2897.880	80	Pt I	F	H			
1894	2913.110	2912.257	79	Pt I	F	H			
190	2930.652	2929.795	79	Pt I	F	H			
1901	2931.647	2930.790	79	Pt	F	H			
191	2956.594	2955.730	78	Ne II	H	K			
192	2964.156	2963.290	78	Ne II	H	K	K 2964.102		
195	2975.582	2974.714	78	Ne I	H	K			
196	2993.311	2992.438	77	Ne I	H	K			
197	2998.845	2997.971	77	Pt I	F	H			
200	3027.911	3027.030	76	Ne II	F	H, K	H 3027.921, K 3027.897		

Table 6 - (Continued)

(1) Spot No.	(2) Vacuum Wavelength	(3) Air Wavelength	(4) Order	(5) Ion	(6) Prime Reference	(7) Alternate Reference	(8) Alternate Vacuum Wavelengths	(9) Old Vacuum Wavelength	(10) Comments
201	3029.722	3028.840	76	Ne II	H	K	K 3029.744		
202	3035.363	3034.480	76	Ne II	H	K	K 3035.343		
205	3038.614	3037.730	76	Ne II	H	K	K 3038.604		
206	3040.535	3039.650	76	Ne II	H				
207	3043.523	3042.638	76	Pt I	F	H			
208	3045.046	3044.160	76	Ne II	H	K	K 3044.973		
209	3046.466	3045.580	76	Ne II	H	K	K 3046.442		
212	3058.277	3057.388	76	Ne I	H	K			
213	3072.837	3071.944	75	Pt I	F	H			
904	3089.127	3088.230	75	Ne II	H	K	K 3089.062		ADDED TO LIBRARY
215	3093.808	3092.910	75	Ne II	H	K			
216	3094.978	3094.080	75	Ne II	H	K	K 3094.904		
850	3100.938	3100.038	75	Pt I	F	H		3101.838	
851	3140.295	3139.386	74	Pt I	H			3140.299	
905	3142.260	3141.350	74	Ne II	H	K	K 3142.242		ADDED TO LIBRARY
853	3157.479	3156.565	73	Pt I	H			3157.474	
854	3201.639	3200.714	72	Pt I	H			3201.635	
855	3204.966	3204.040	72	Pt I	H			3203.966	
858	3251.293	3250.355	71	Pt, Ne II	H	K		3251.288	
859*	3252.920	3251.982	71	Pt I	H			3252.918	
901	3256.855	3255.916	71	Pt I	H				ADDED TO LIBRARY

Table 7 - IUE HIGH DISPERSION WAVELENGTH CALIBRATION IMPROVEMENTS

Image No.	August 1980 Library			April 1980 Line Library			Nov. 1979 Line Library			Old Line Library		
	σ(L) px.	σ(S) px.	Fraction of lines used	σ(L) px.	σ(S) px.	Fraction of lines used	σ(L) px.	σ(S) px.	Fraction of lines used	σ(L) px.	σ(S) px.	Fraction of lines used
SWP 5419	.31	.29	.92	.35	.31	.93	.34	.32	.90	.40	.36	.72
SWP 6349	.32	.28	.95	.34	.29	.93	.34	.29	.91	.38	.37	.74
SWP 6699	.33	.29	.95	.34	.30	.90	.38	.32	.91	.40	.36	.74
SWP 8266	---	---	---	.36	.29	.91	.36	.29	.88	---	---	---
MEAN	.32	.29		.35	.30		.36	.31		.39	.36	
LWR 4656	.26	.27	.96	.26	.28	.95	.26	.29	.91	.26	.28	.76
LWR 5483	.24	.28	.92	.27	.30	.93	.26	.30	.88	.27	.34	.75
LWR 5725	.25	.27	.95	.26	.27	.93	.25	.26	.86	.26	.30	.73
LWR 7208	---	---	---	.26	.24	.93	.26	.24	.88	---	---	---
MEAN	.25	.27		.26	.27		.26	.27		.26	.31	
No. of lines in library: SWP:			146			172		179			243	
LWR:			145			164		181			219	

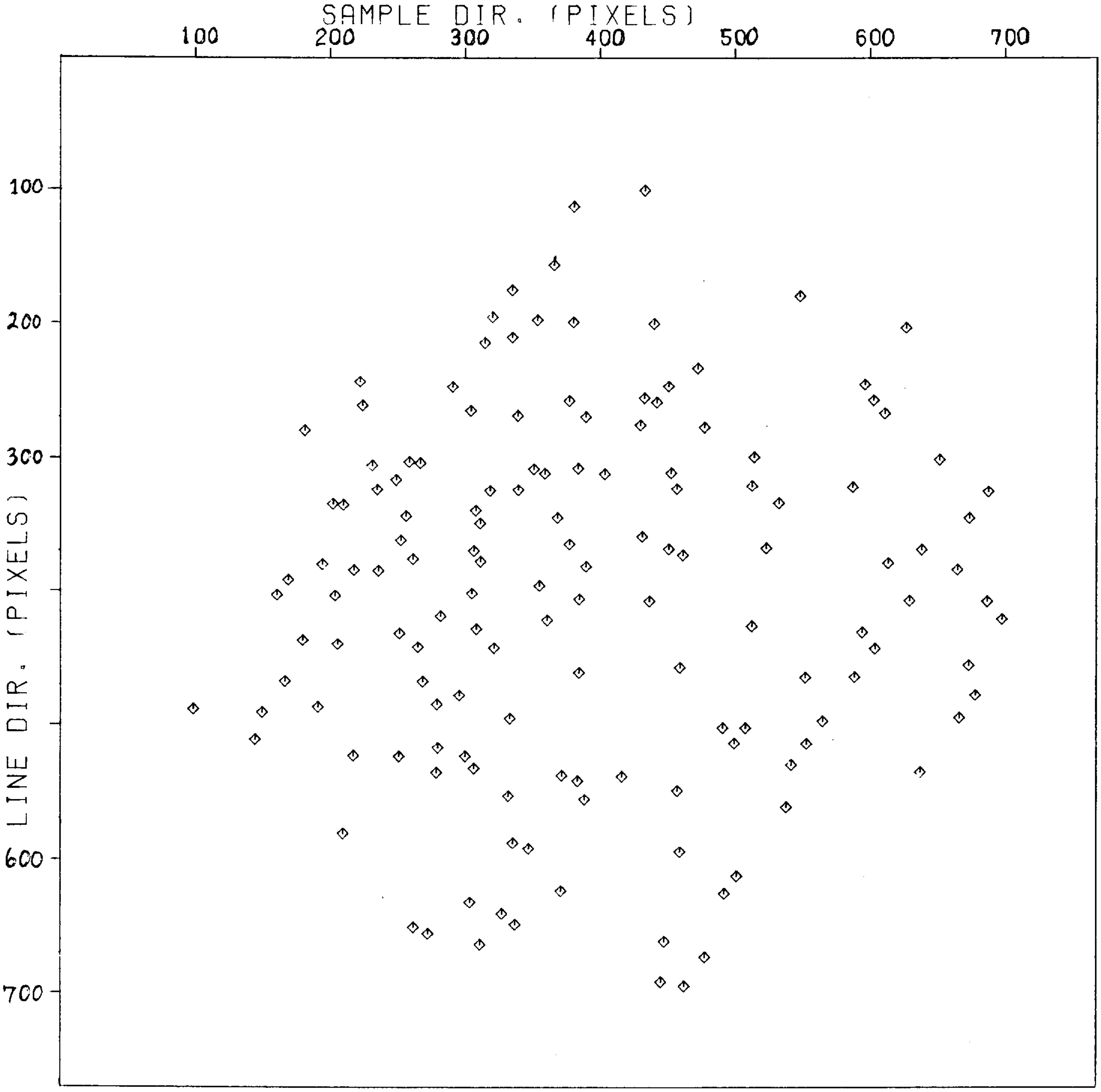


Figure 1 - Positions of emission lines in LWR high dispersion line library shown in geometrically corrected space

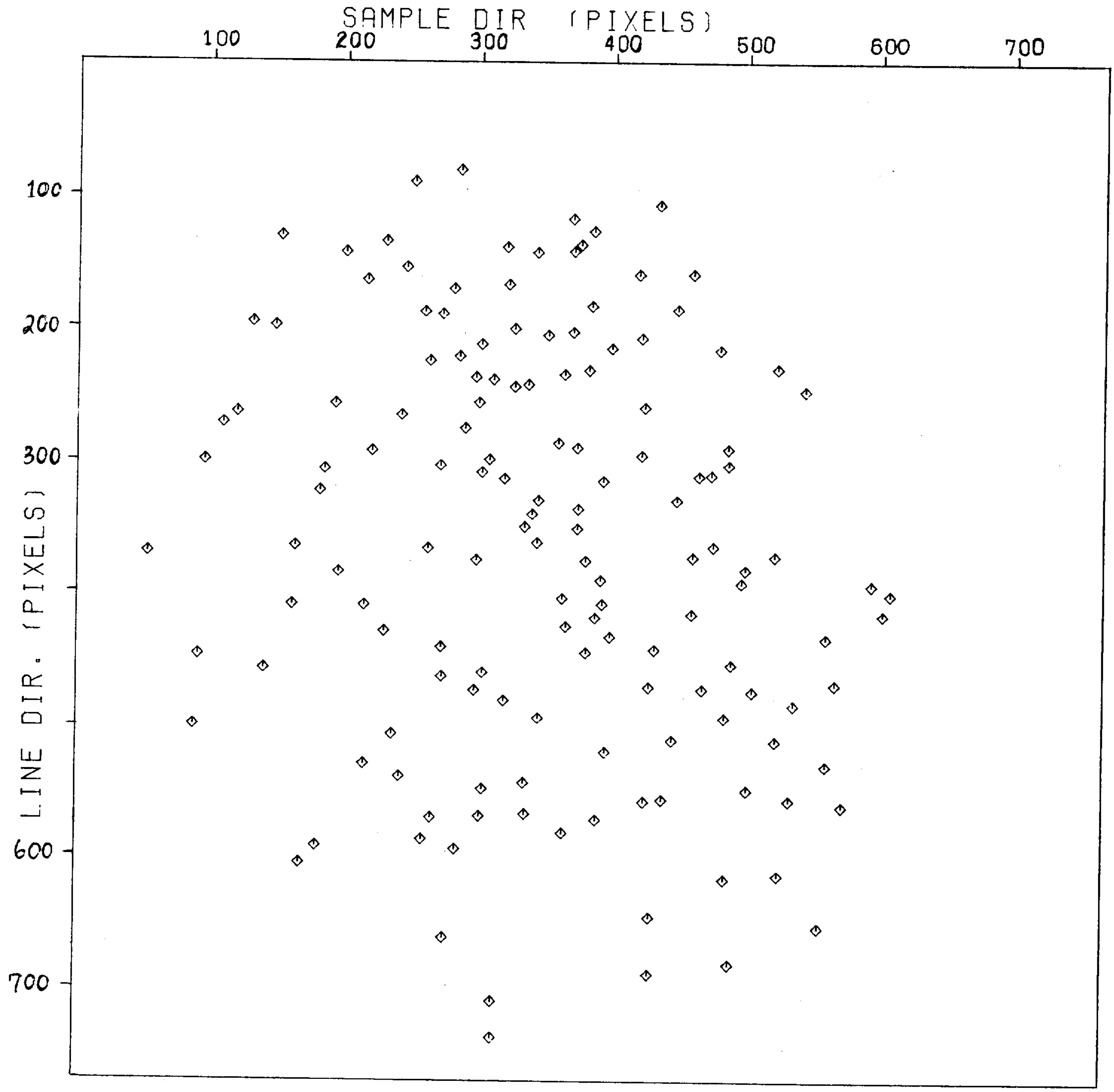
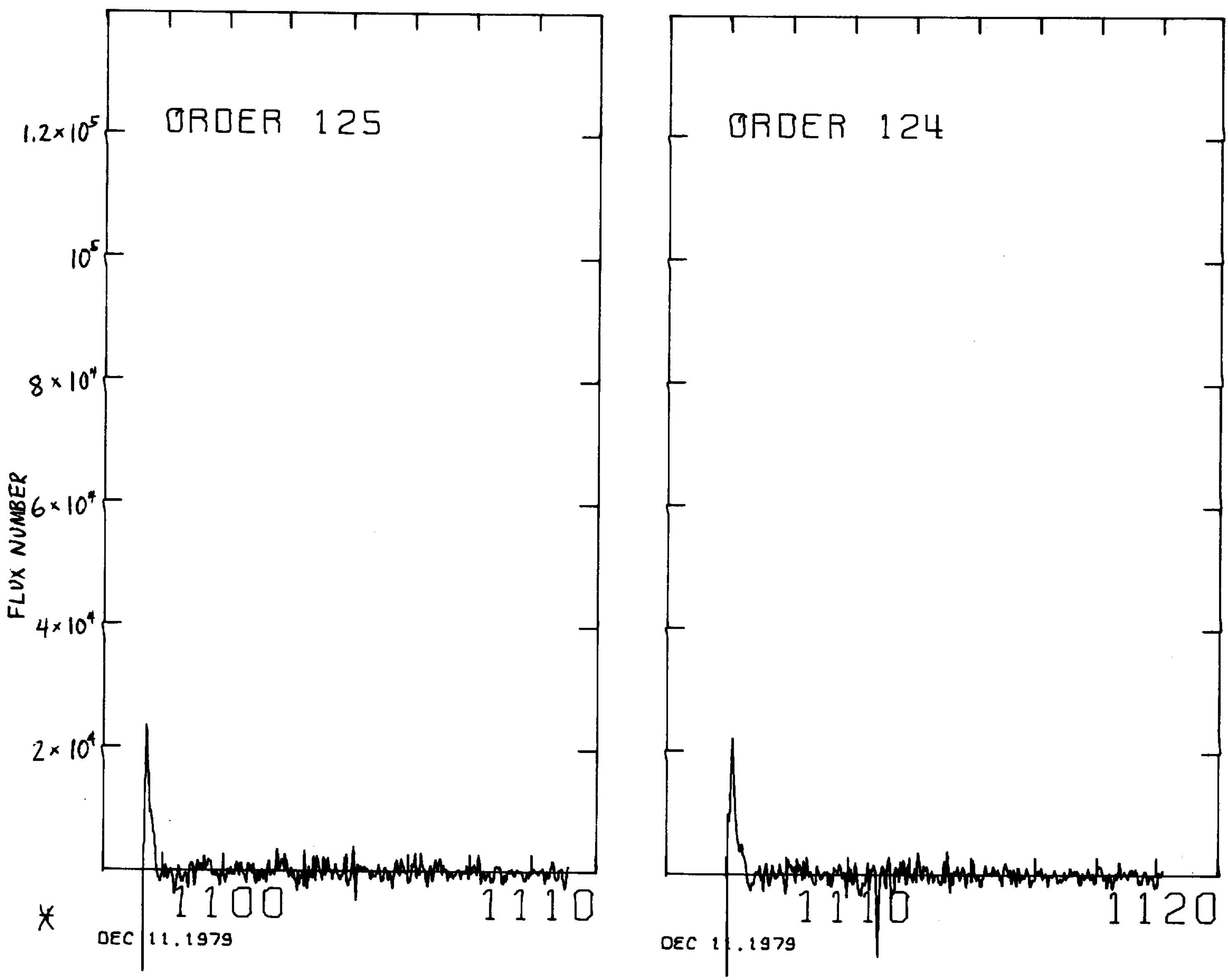
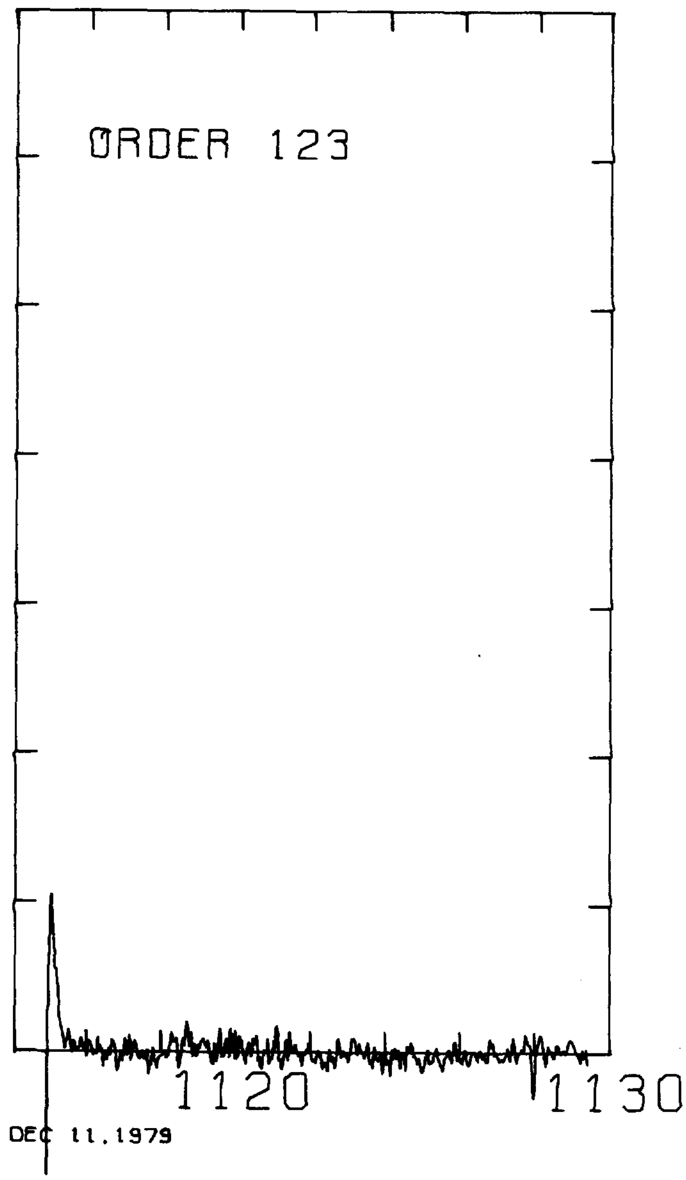
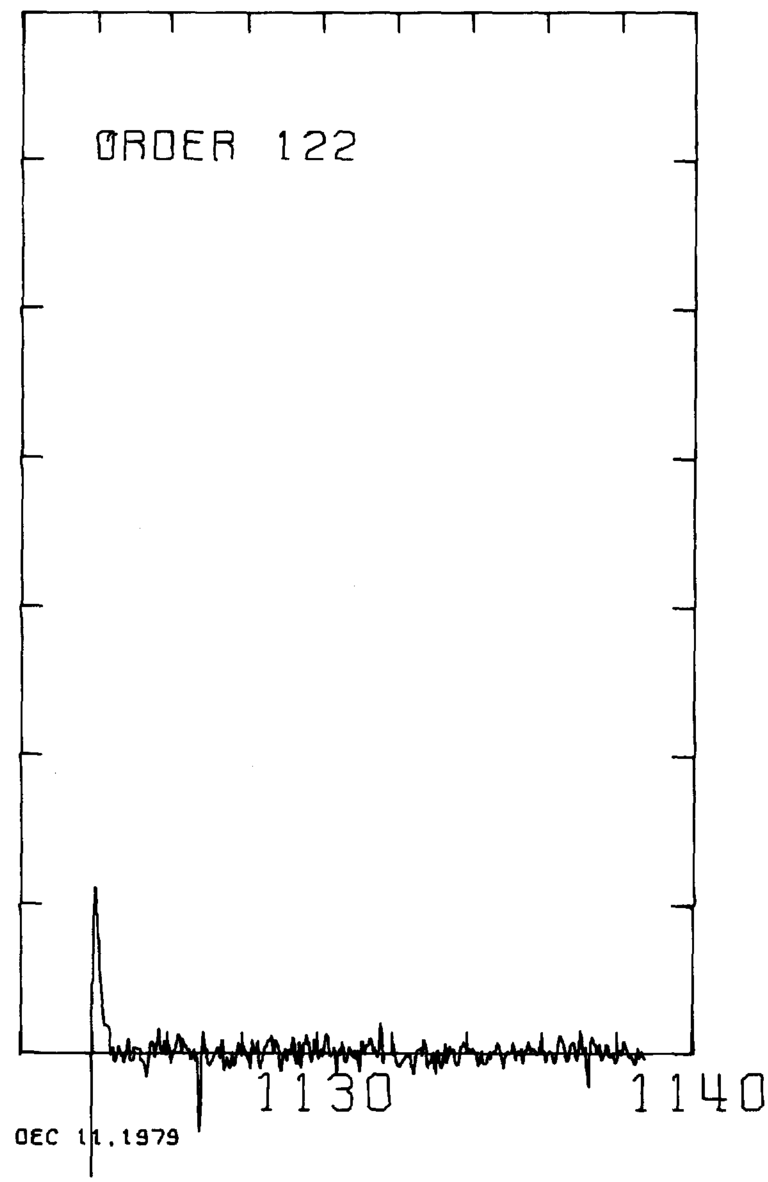


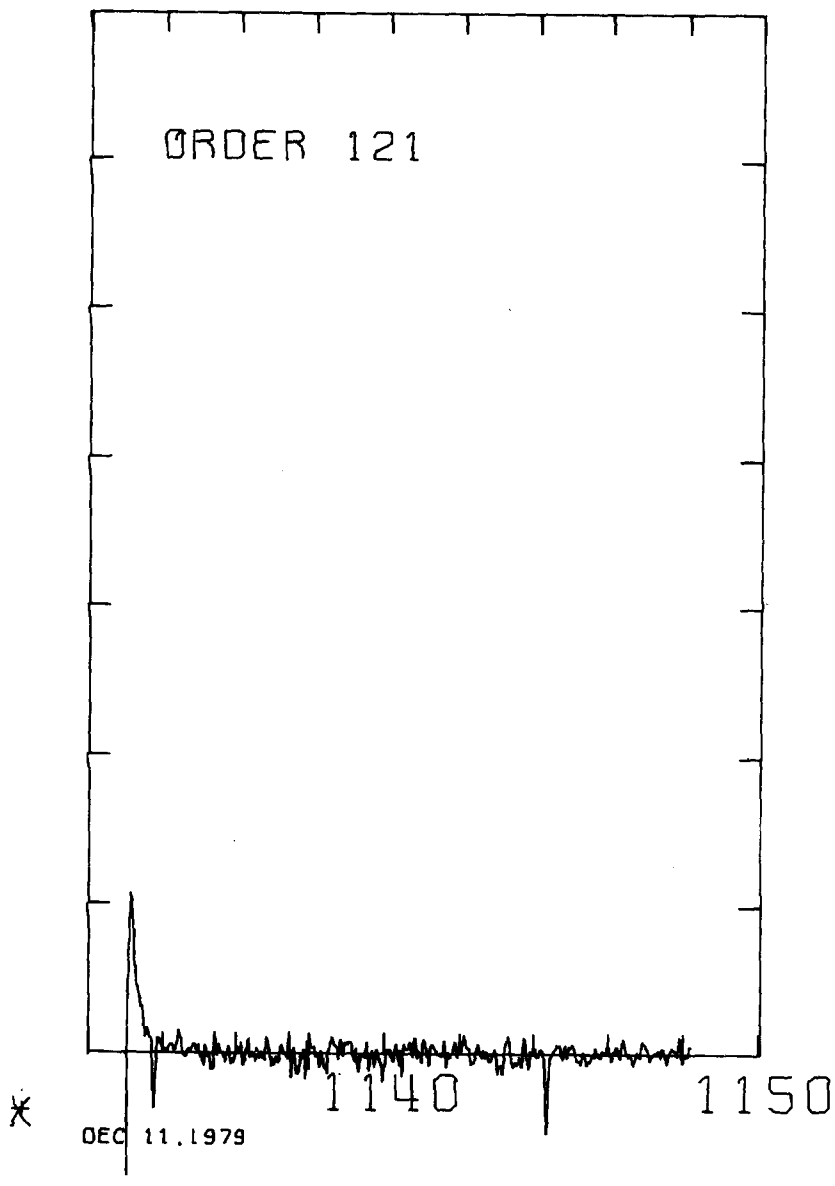
Figure 2 - Positions of emission lines in SWP high dispersion line library shown in geometrically corrected space

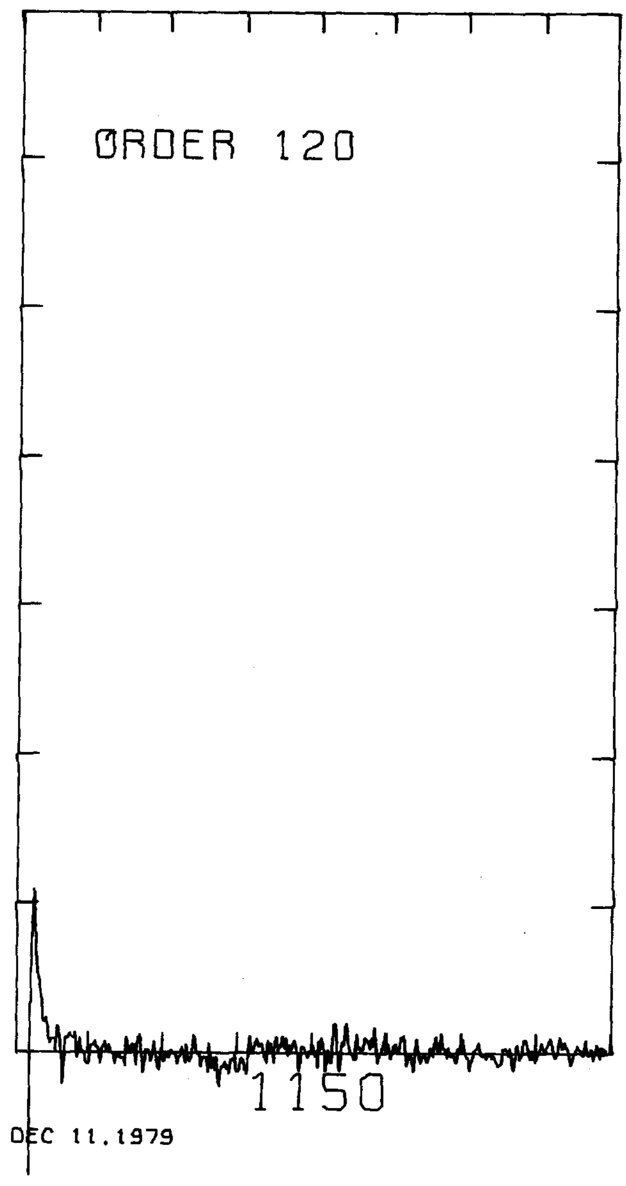
FIGURE 3

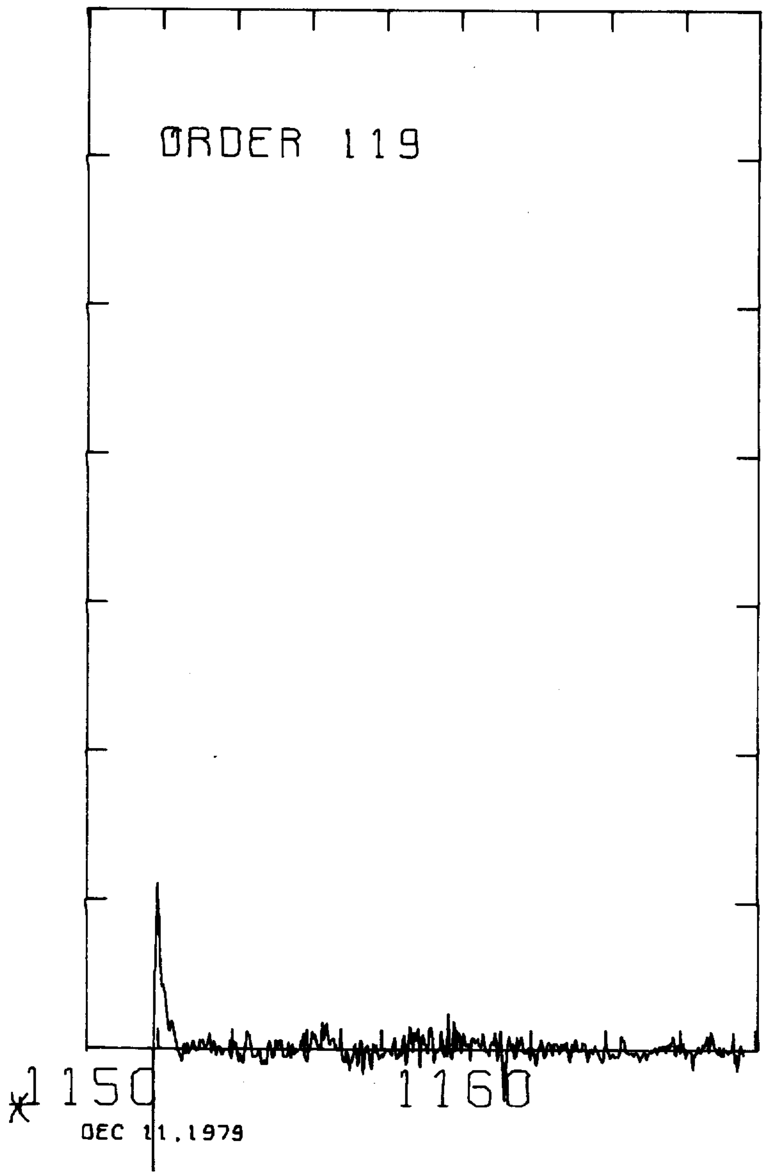

ORDER 125
ORDER 124
1.2×10^5
10^5
8×10^4
6×10^4
4×10^4
2×10^4
FLUX NUMBER
1100
1110
1110
1120
DEC 11,1979
DEC 11,1979


ORDER 123
1120
1130
DEC 11,1979

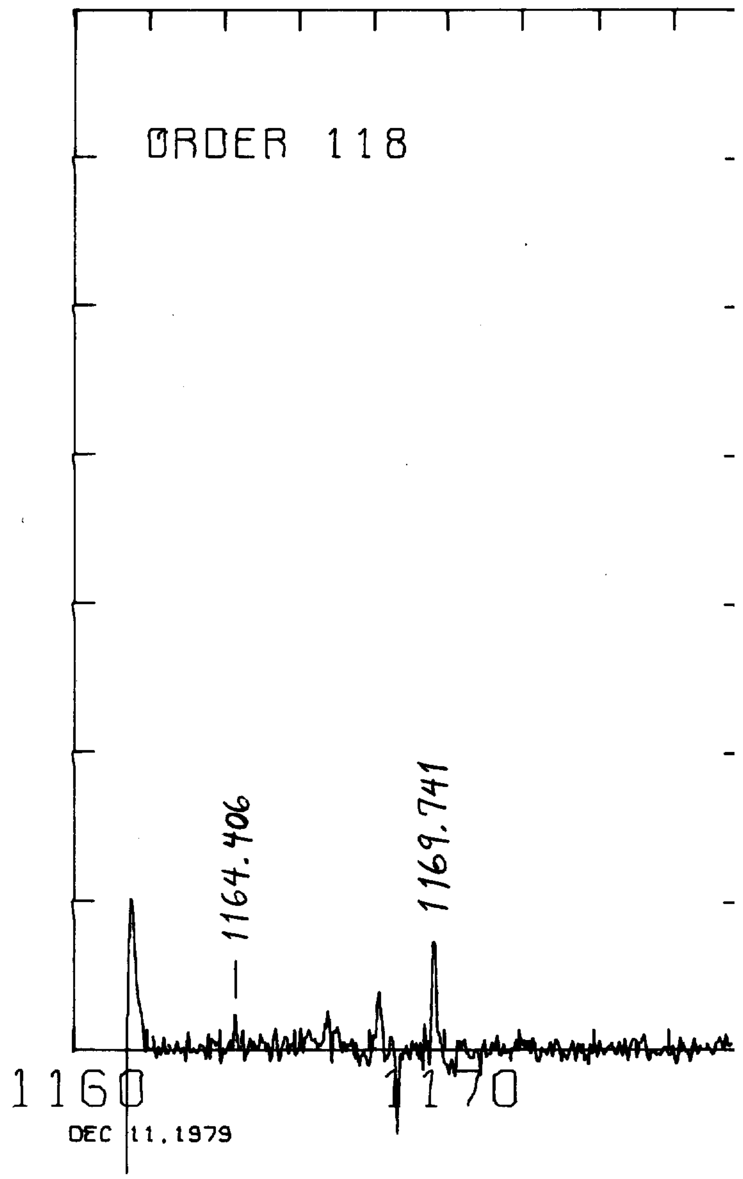

ORDER 122
1130
1140
DEC 11,1979


ORDER 121
1140
1150
DEC 11,1979

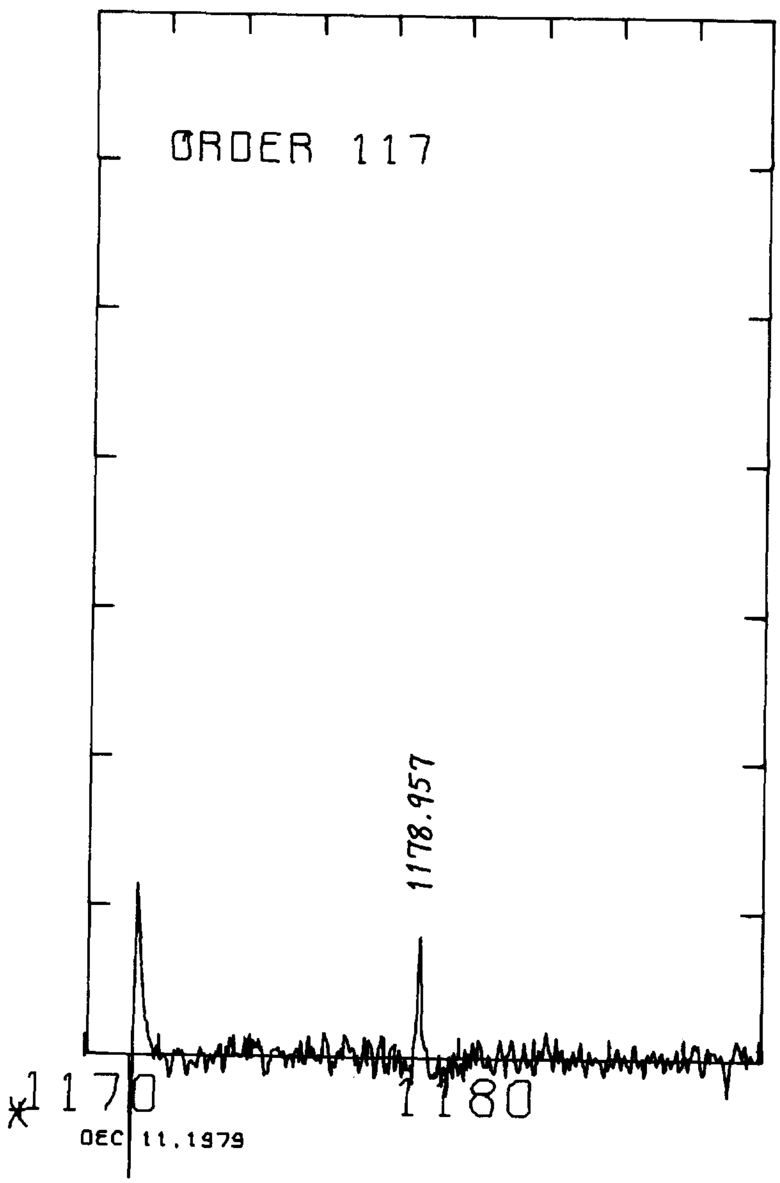

ORDER 120
1150
DEC 11,1979



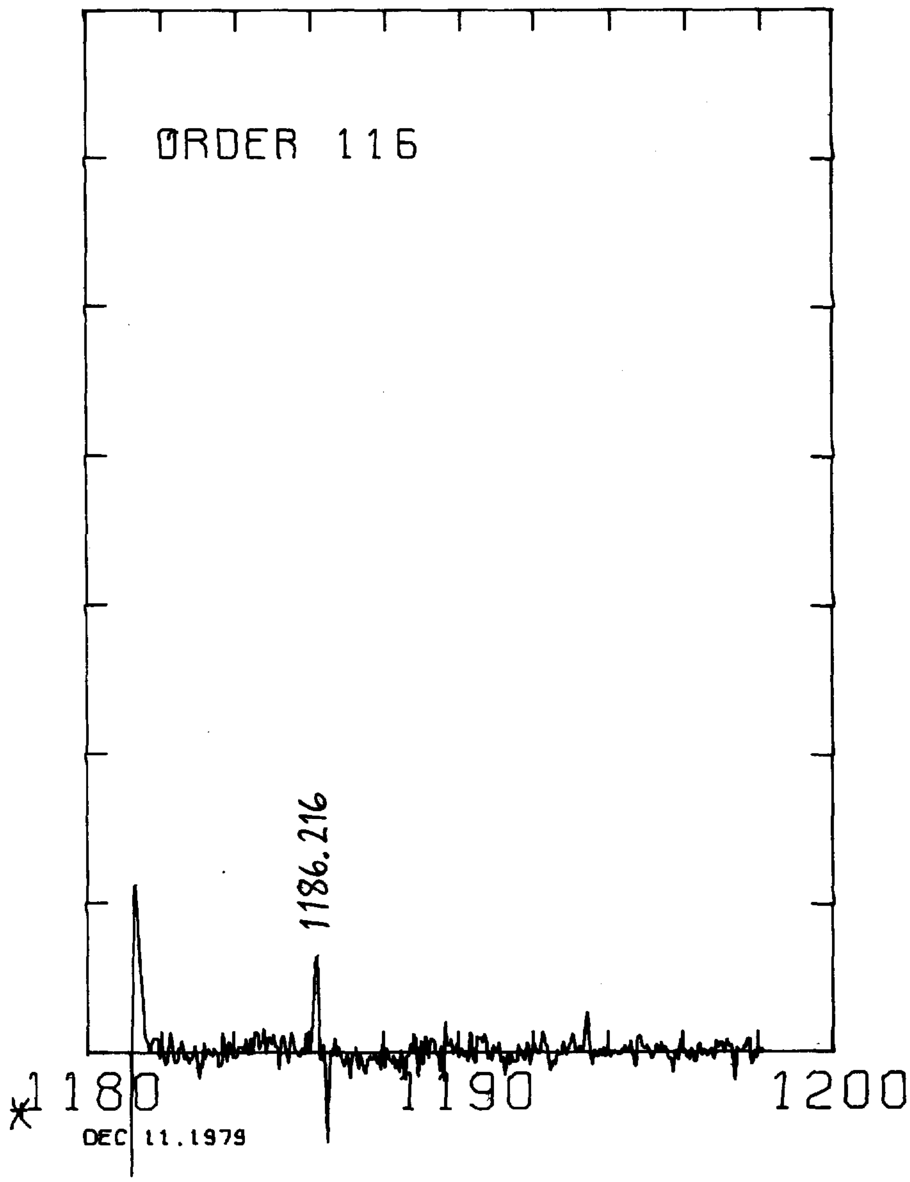
ORDER 119
1150
1160
DEC 11,1979



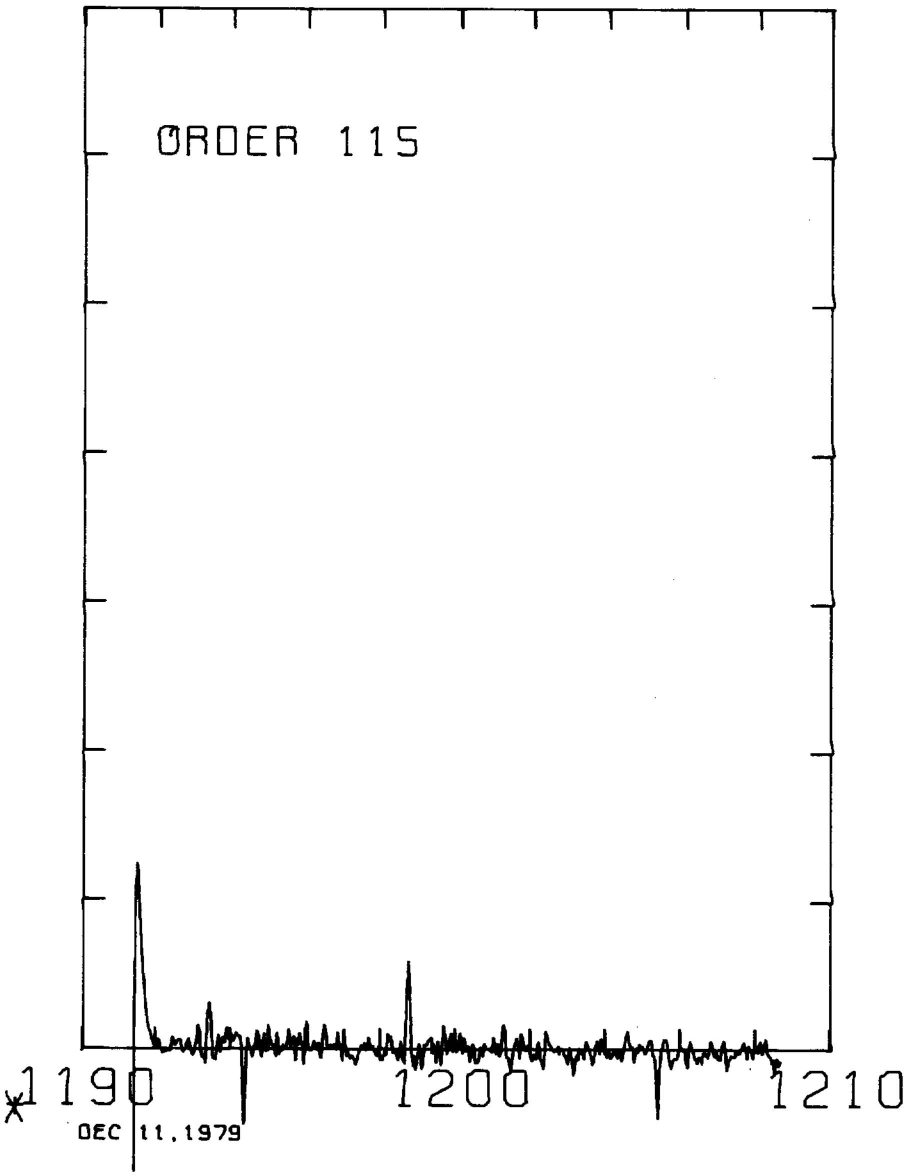
ORDER 118
1164.406
1169.741
1160
1170
DEC 11,1979



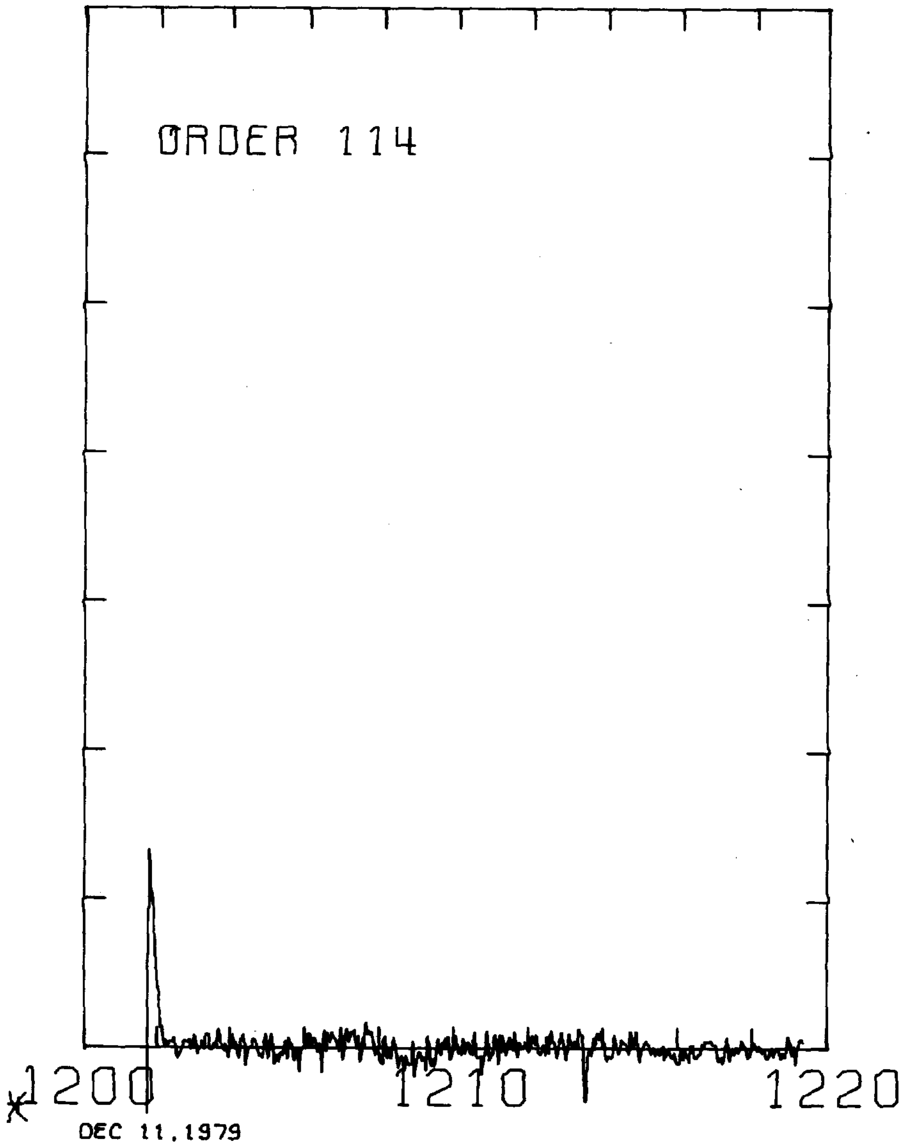
ORDER 117
1178.957
1170
1180
DEC 11,1979

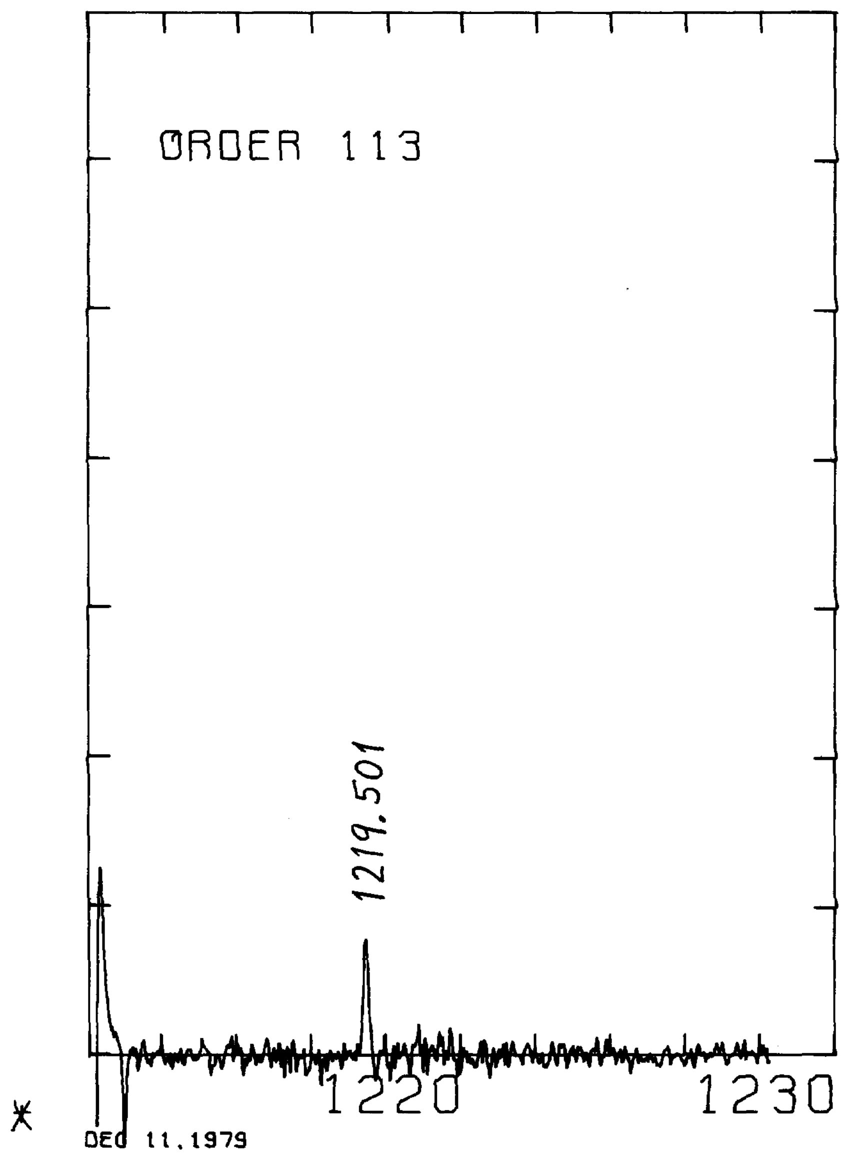


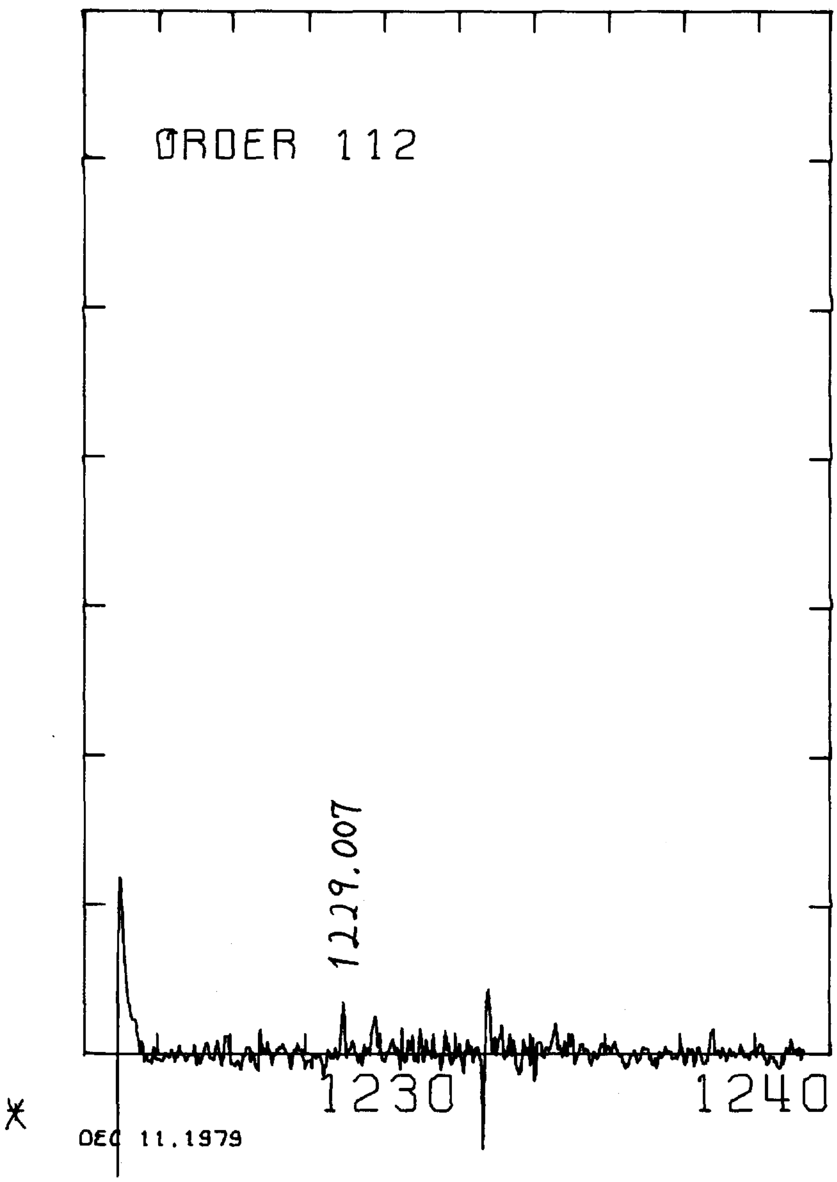
ORDER 116
1186.216
1180
1190
1200
DEC 11.1979



ORDER 115
1190
1200
1210
DEC 11,1979


ORDER 114
1200
1210
1220
DEC 11,1979


ORDER 113
1219.501
1220
1230
*
DEC 11,1979


ORDER 112
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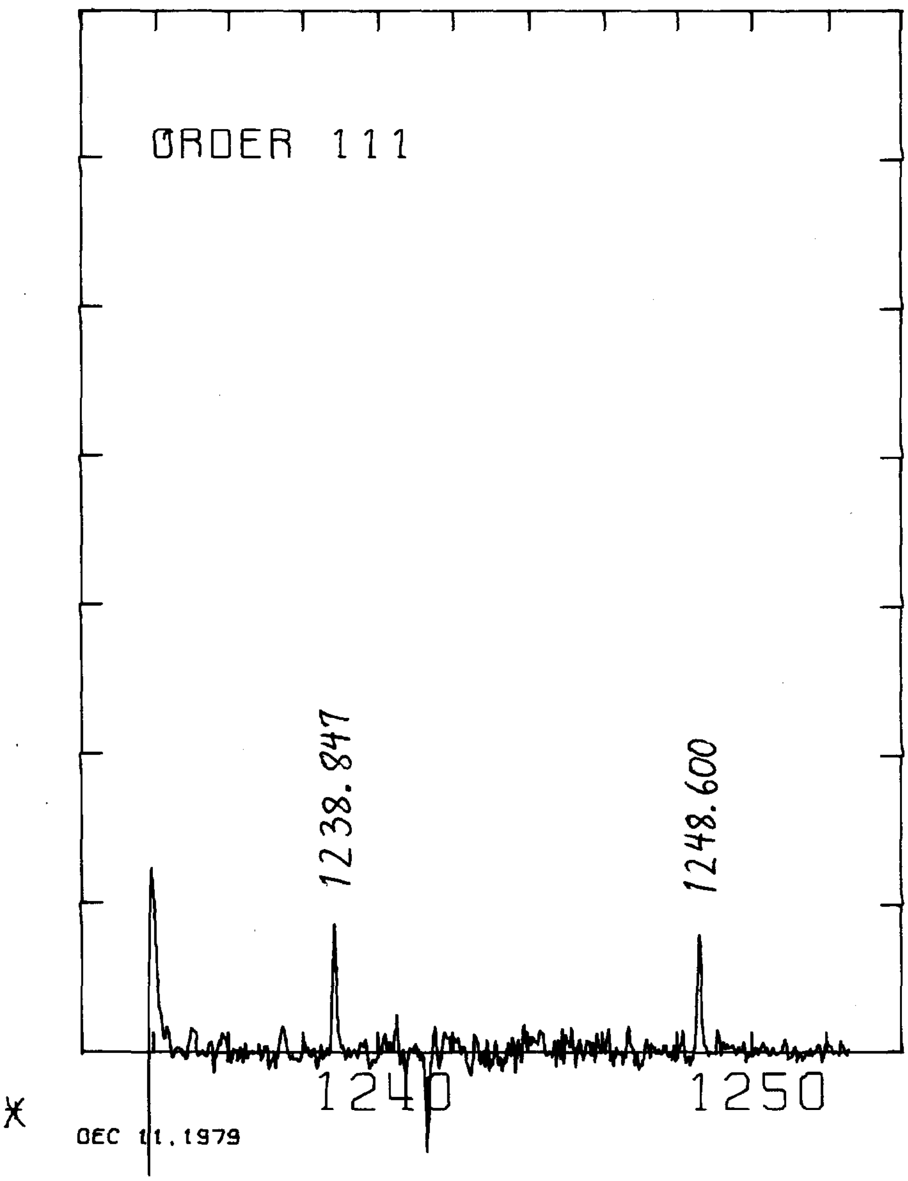
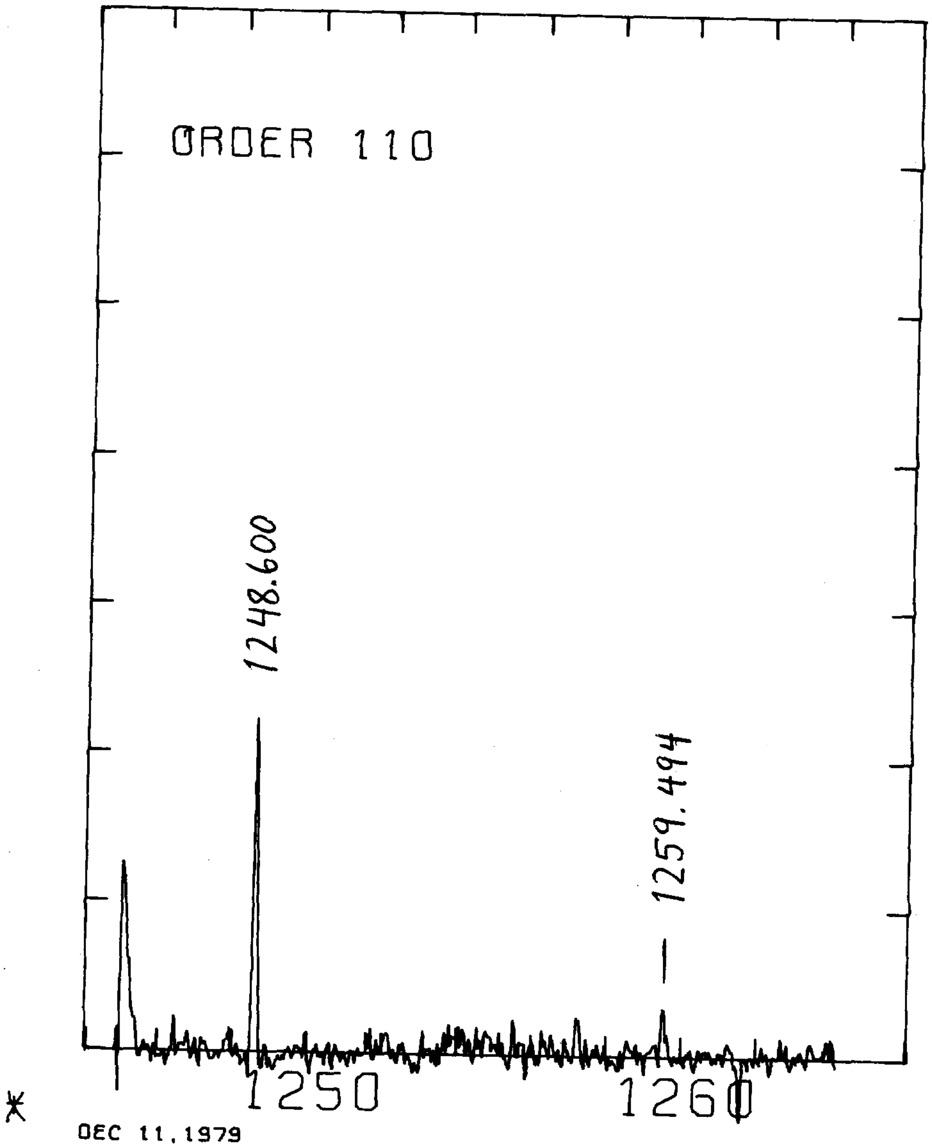
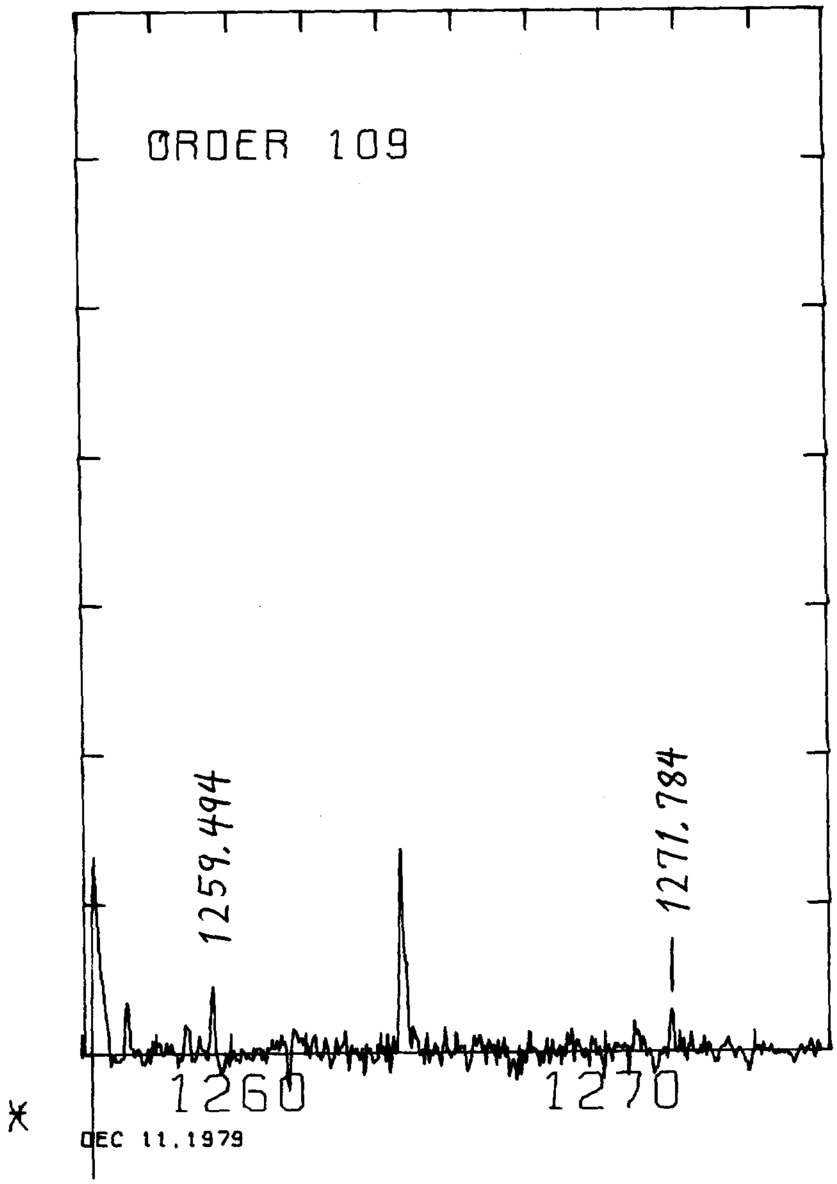
1230
1240
DEC 11,1979

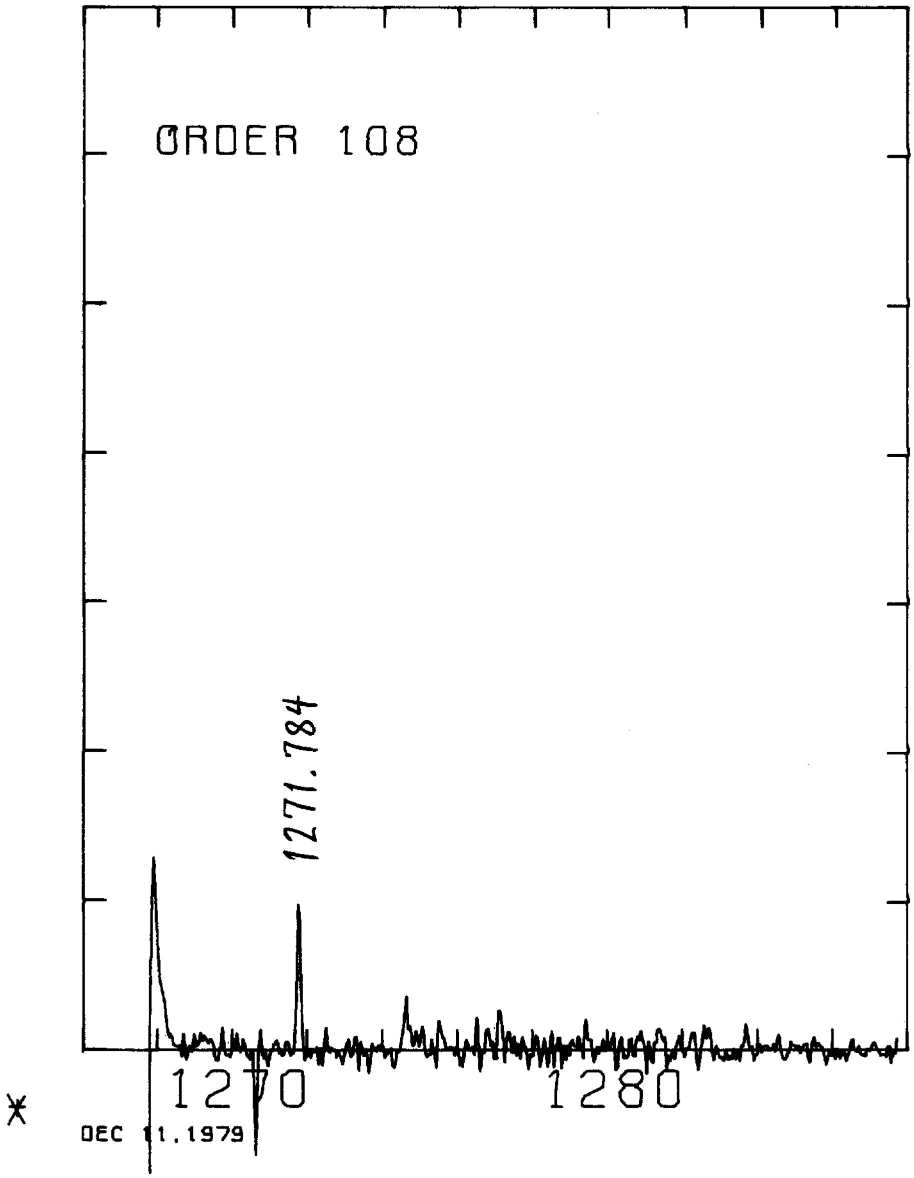


ORDER 111
1238.847
1248.600
1240
1250
DEC 11,1979

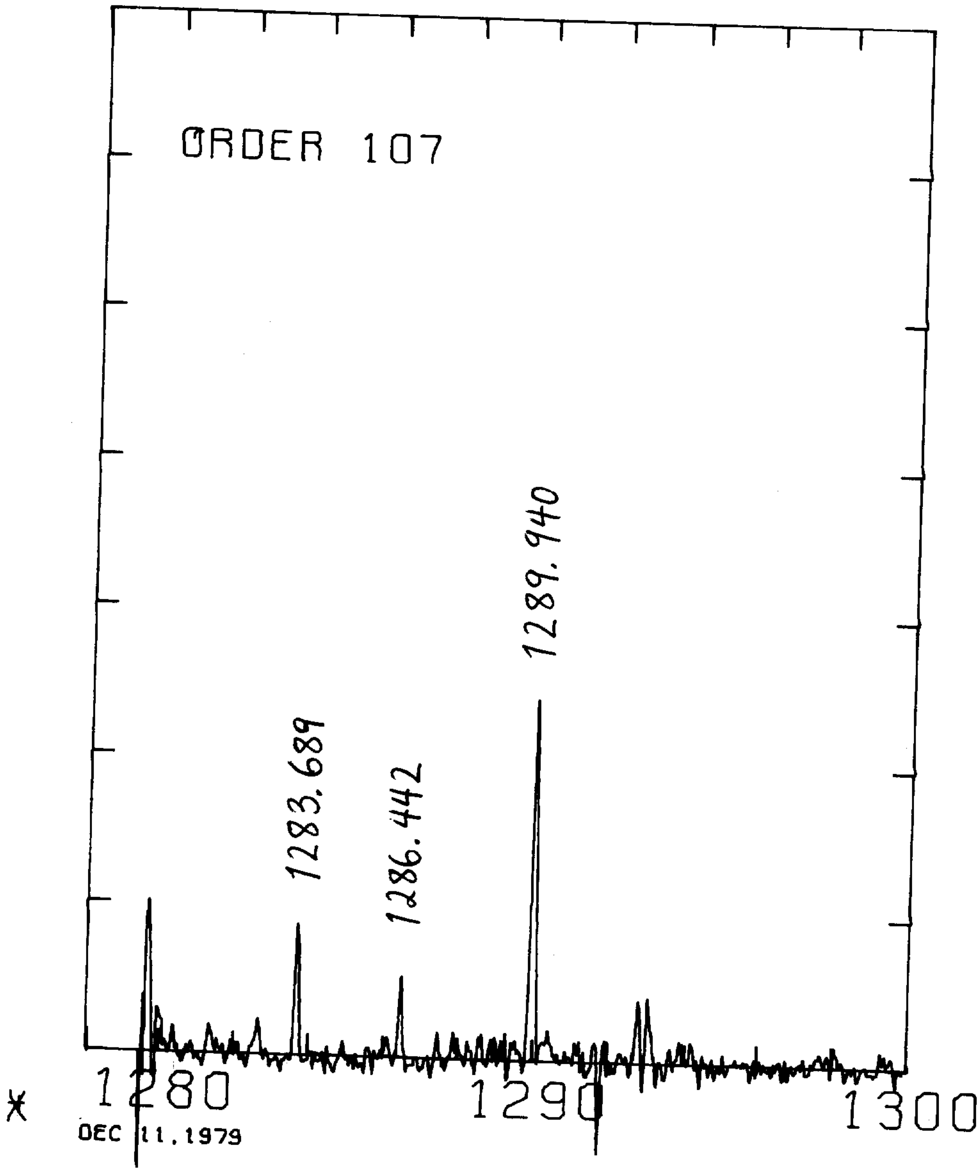


ORDER 110
1248.600
1259.494
1250
1260
DEC 11,1979

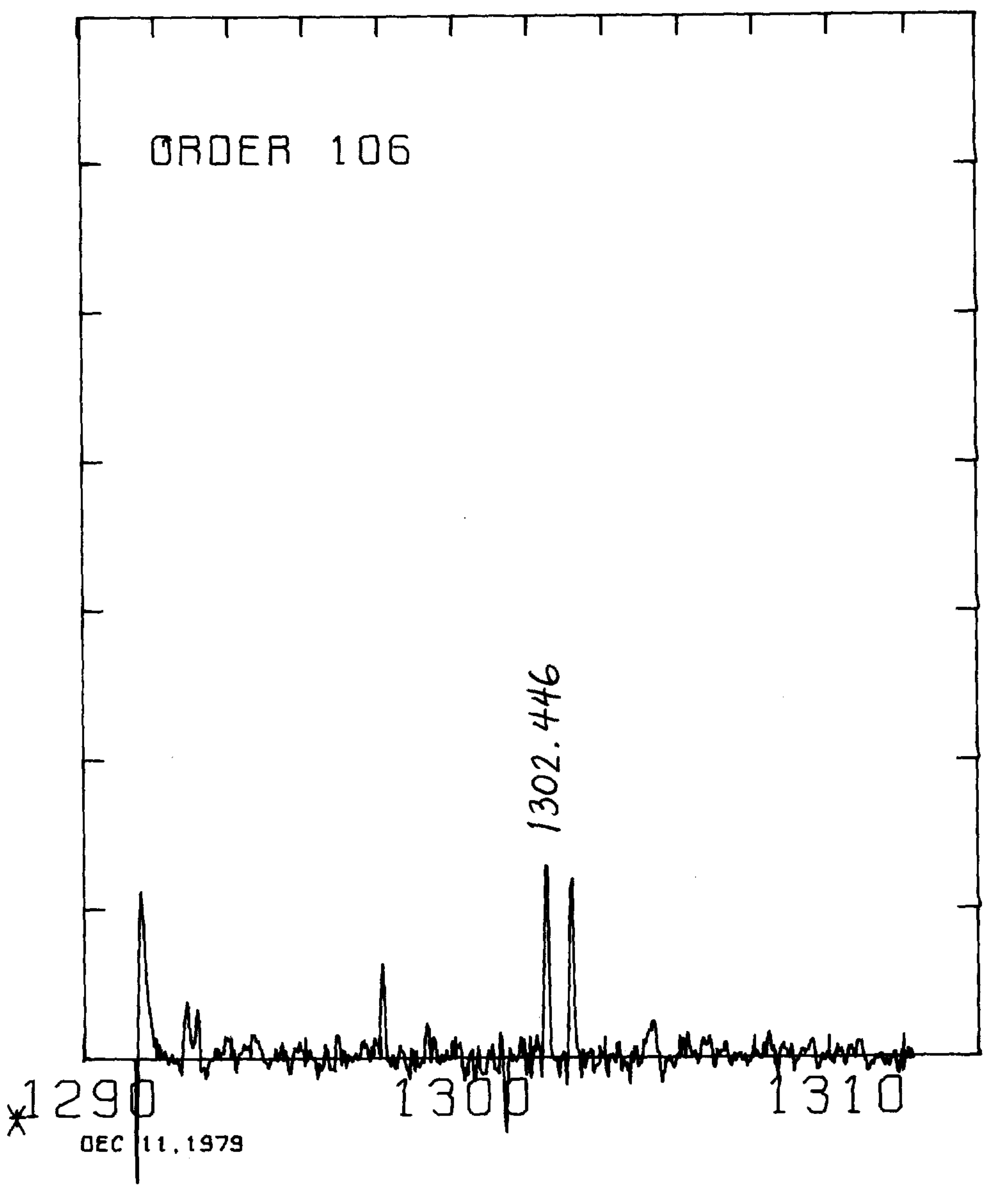

ORDER 109
1259.494
1271.784
1260
1270
DEC 11,1979

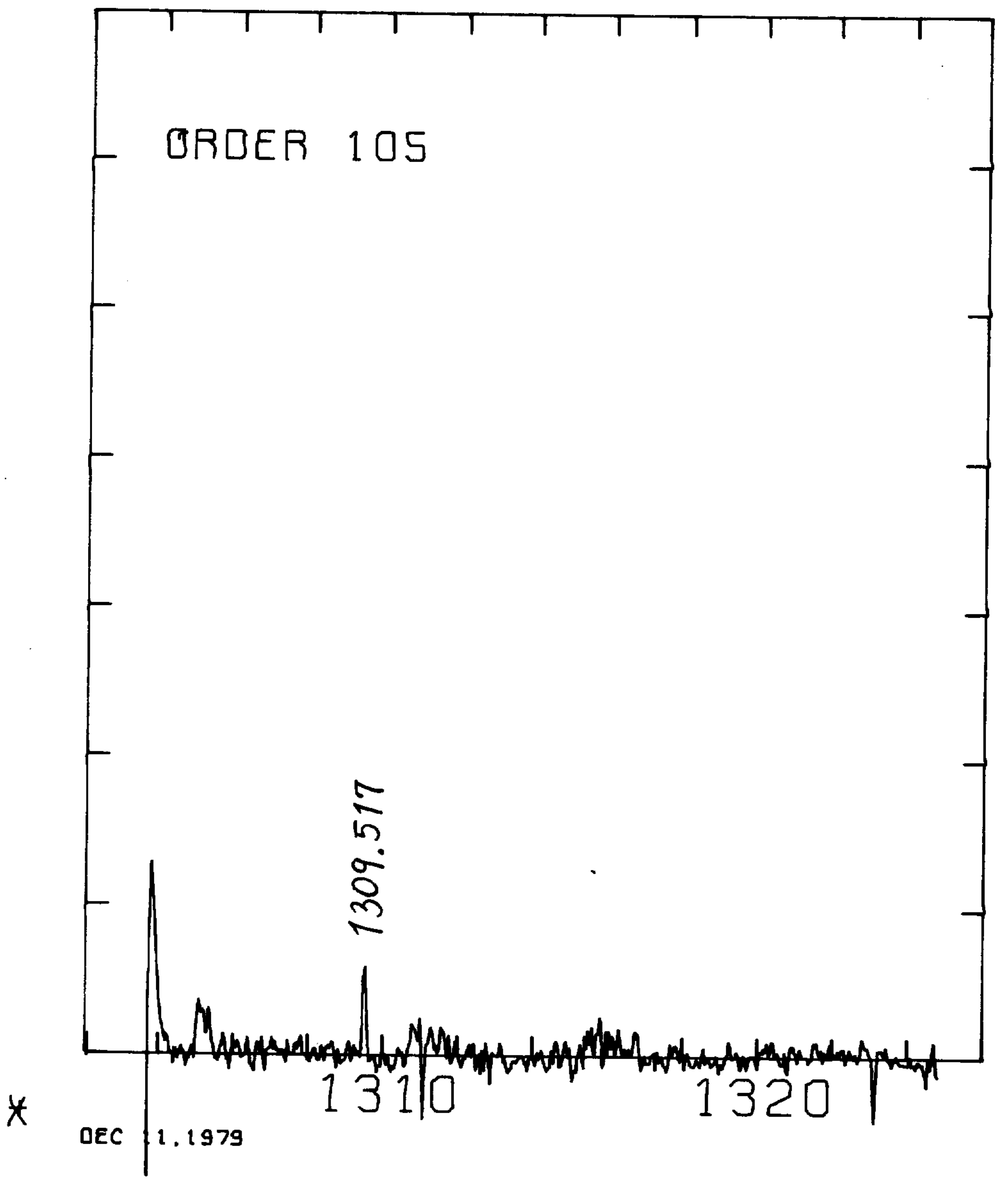


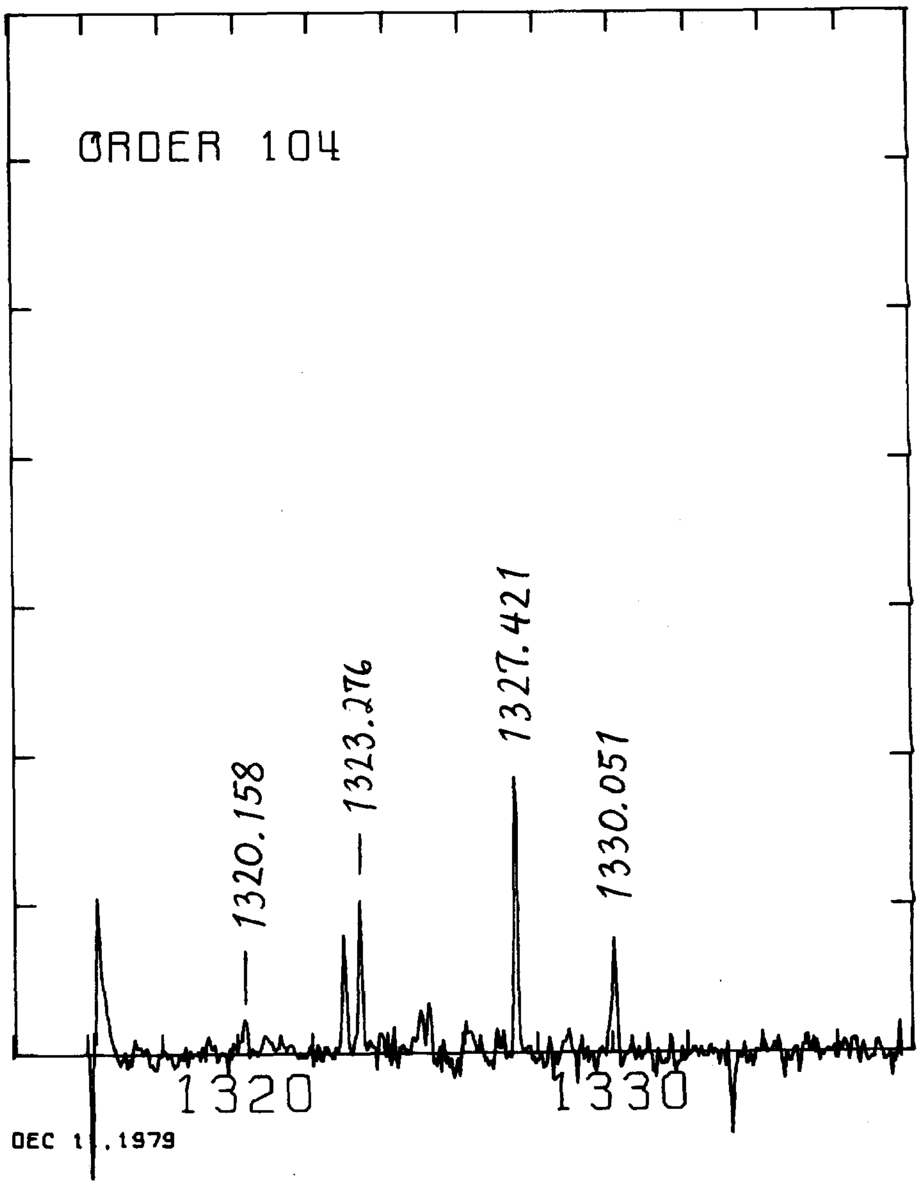
ORDER 108
1271.784
1270
1280
DEC 11,1979



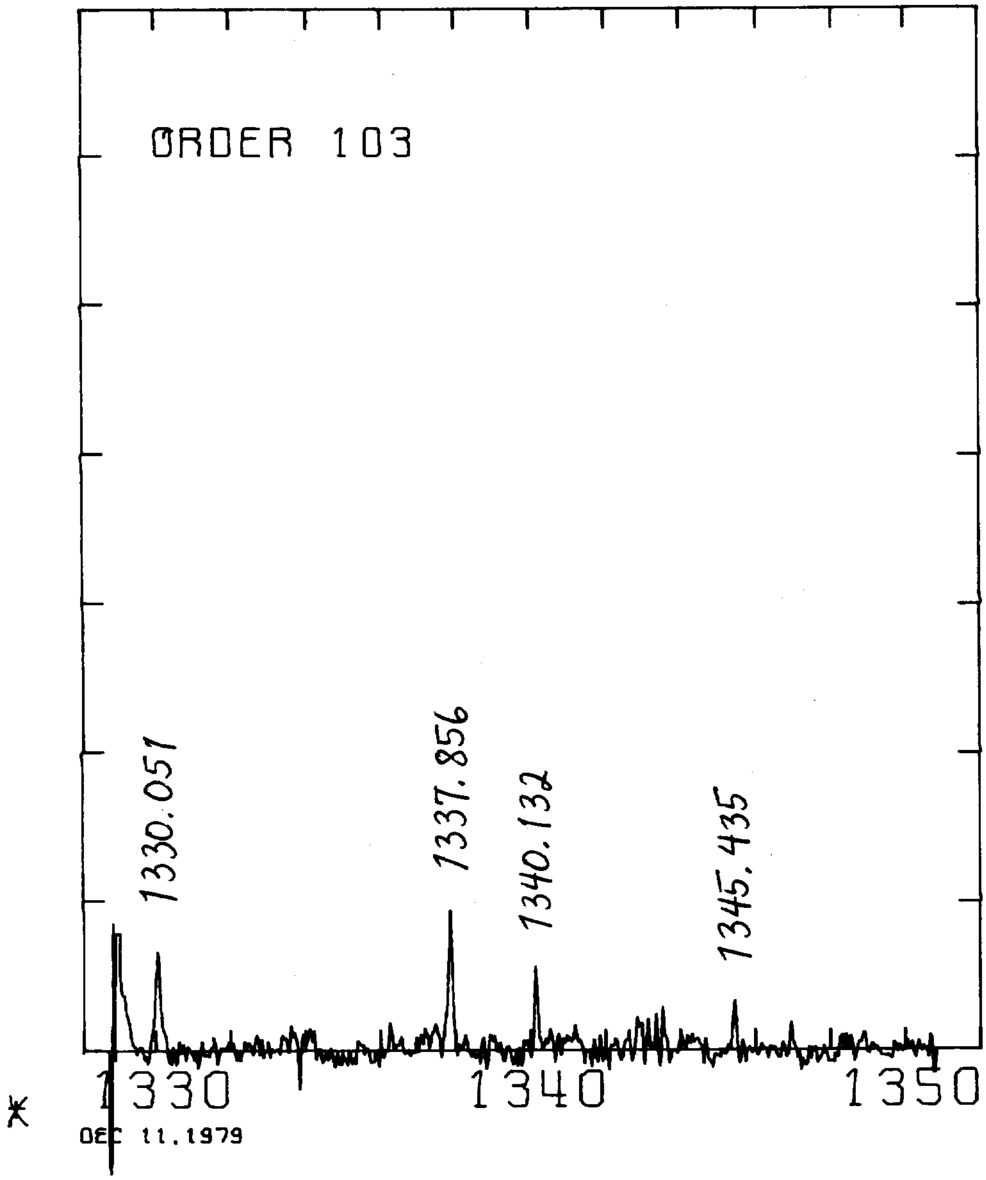
ØRDER 107
1283.689
1286.442
1289.940
1280
1290
1300
DEC 11,1979

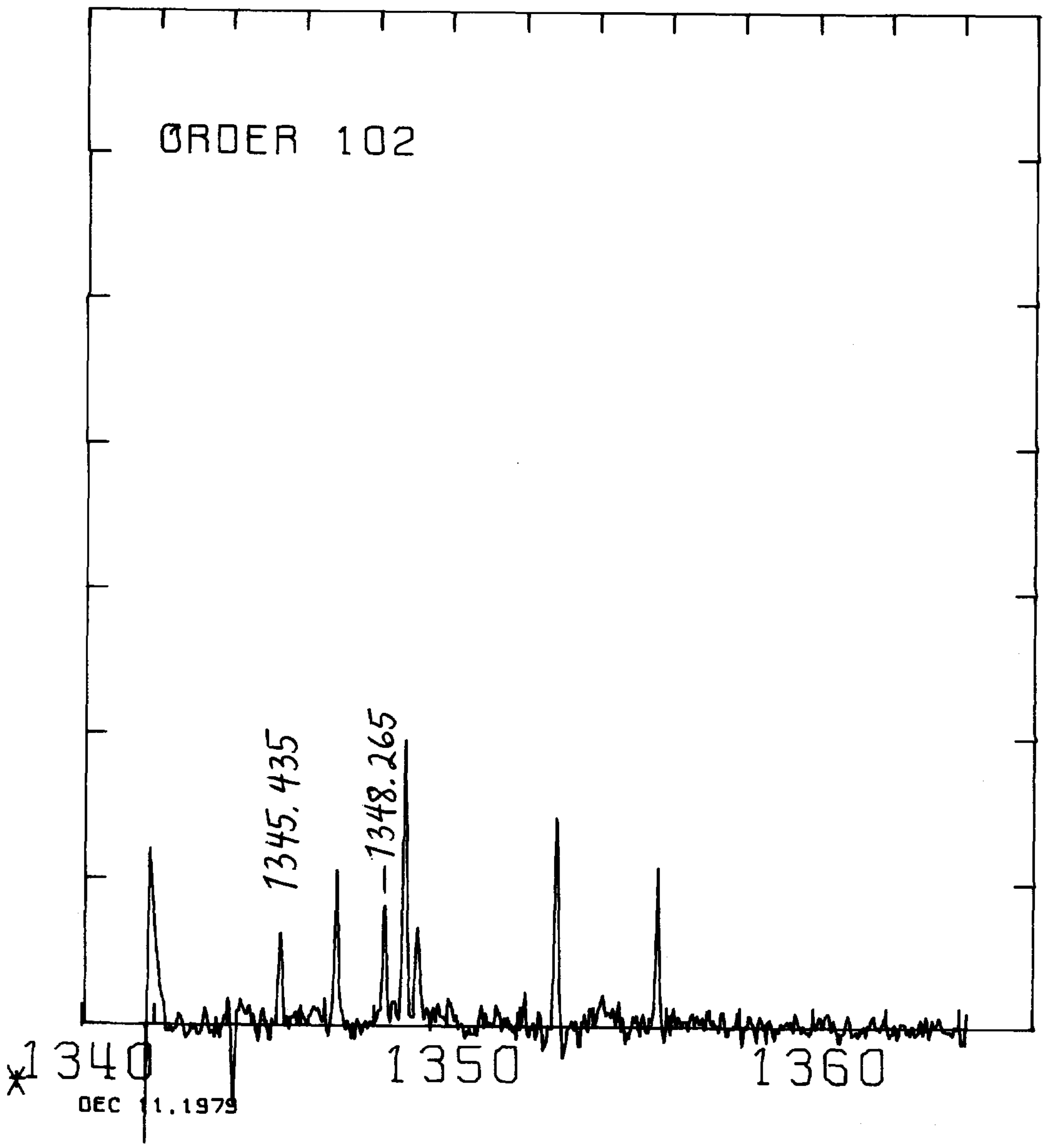

ORDER 106
1302.446
1290
1300
1310
DEC 11,1979

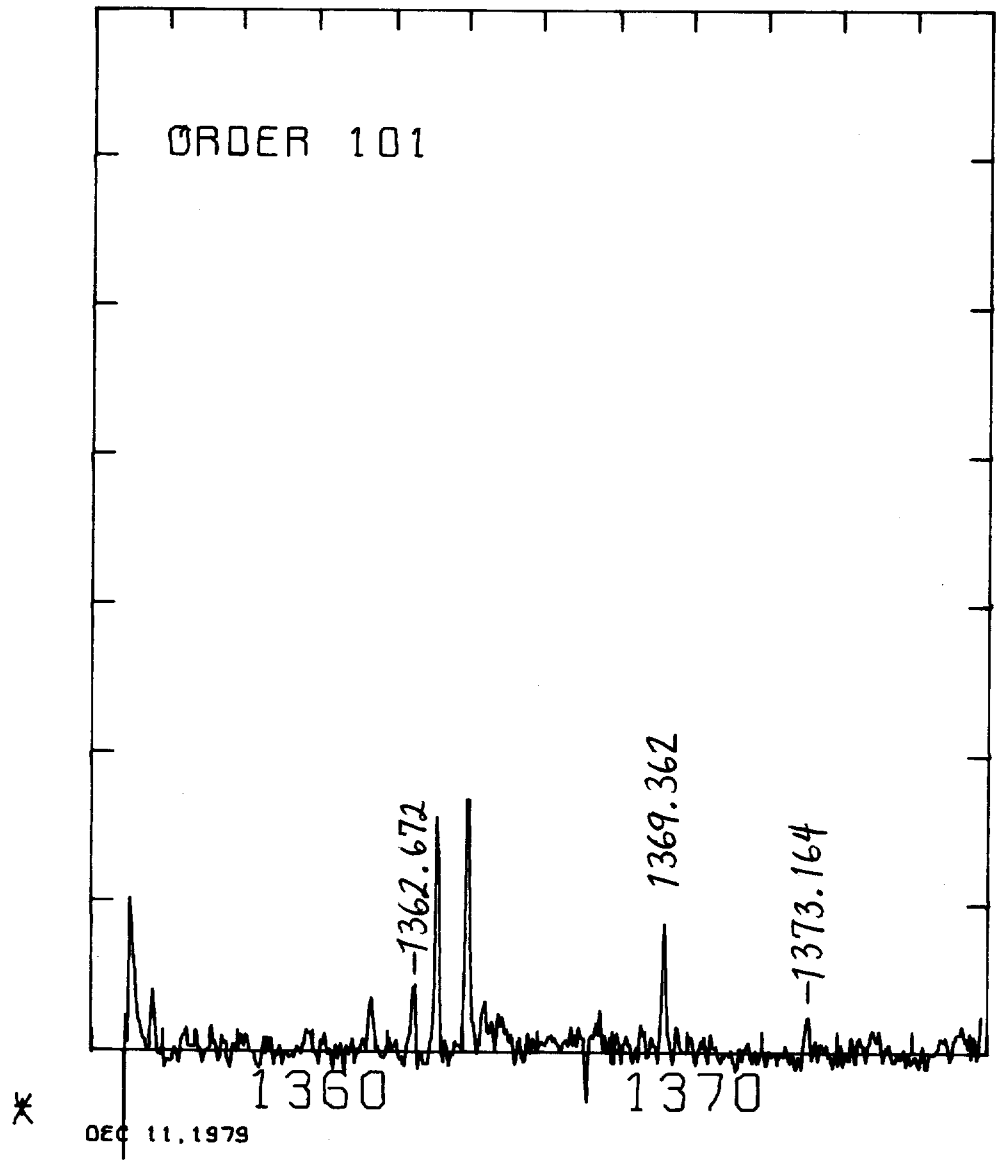

ORDER 105
1309.517
1310
1320
DEC 11,1979

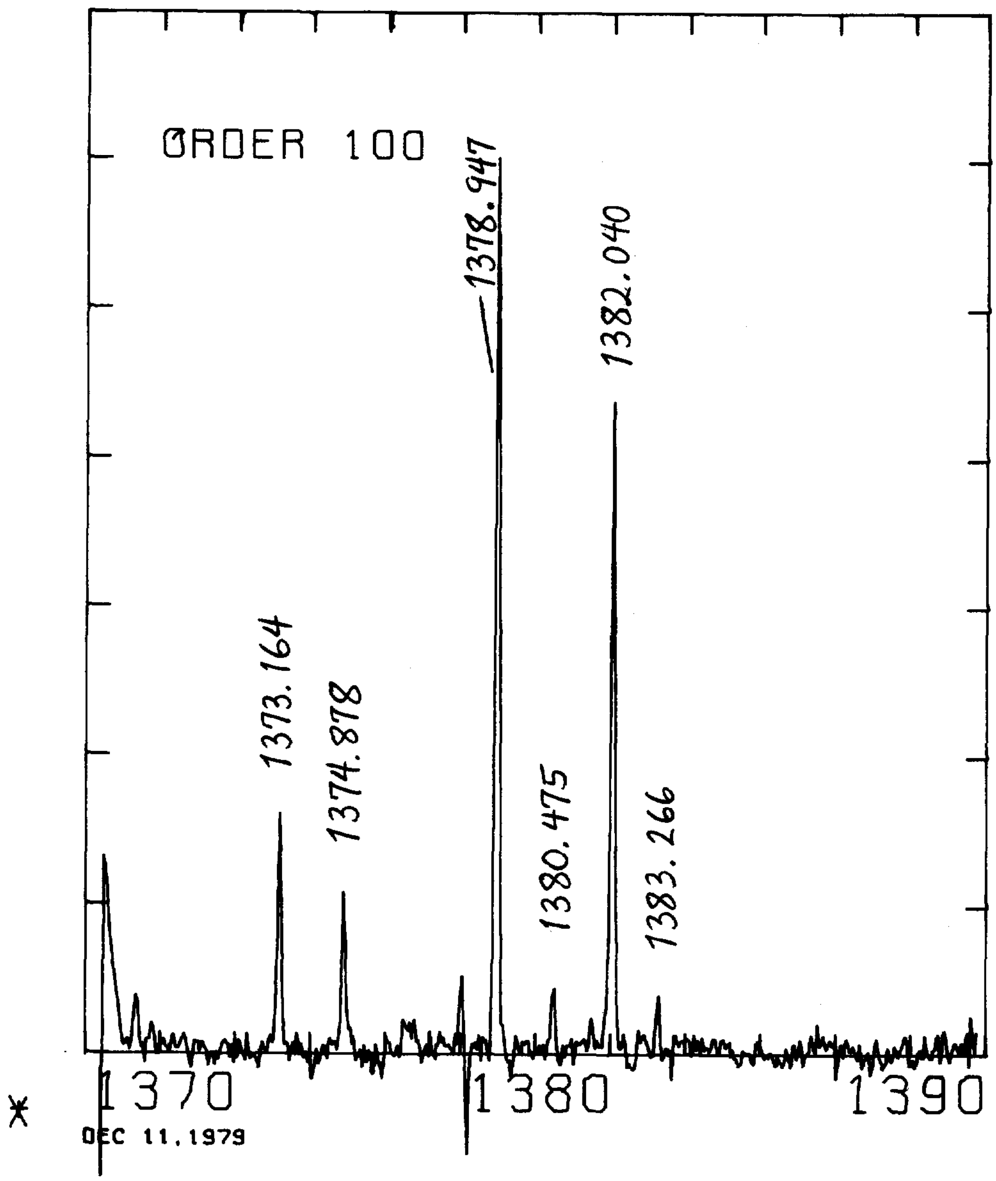


DEC 1 ,1979

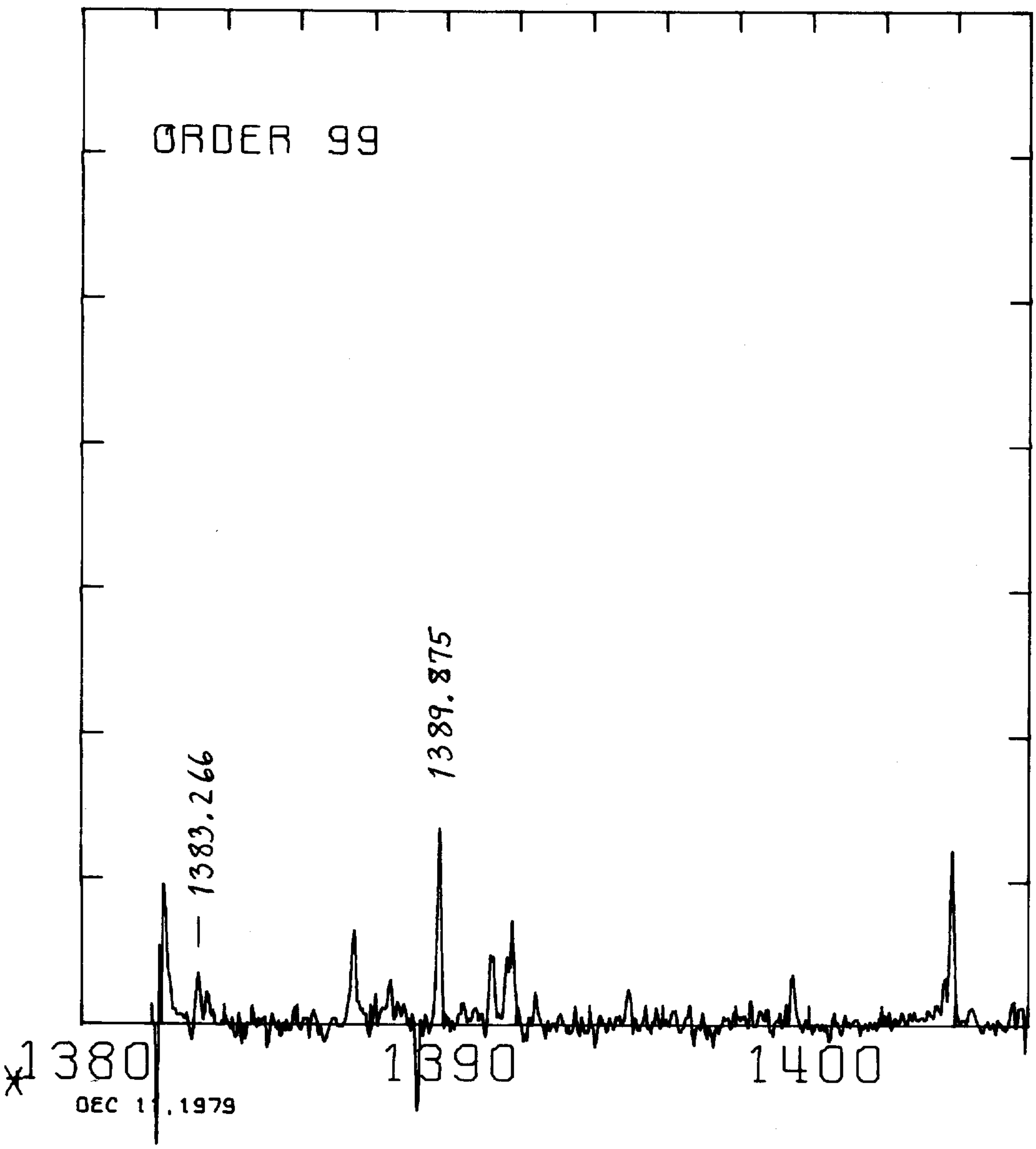

ORDER 103
1330.051
1337.856
1340.132
1345.435
1330
1340
1350
DEC 11,1979


ØRDER 102
1345.435
1348.265
1340
1350
1360
DEC 11,1979

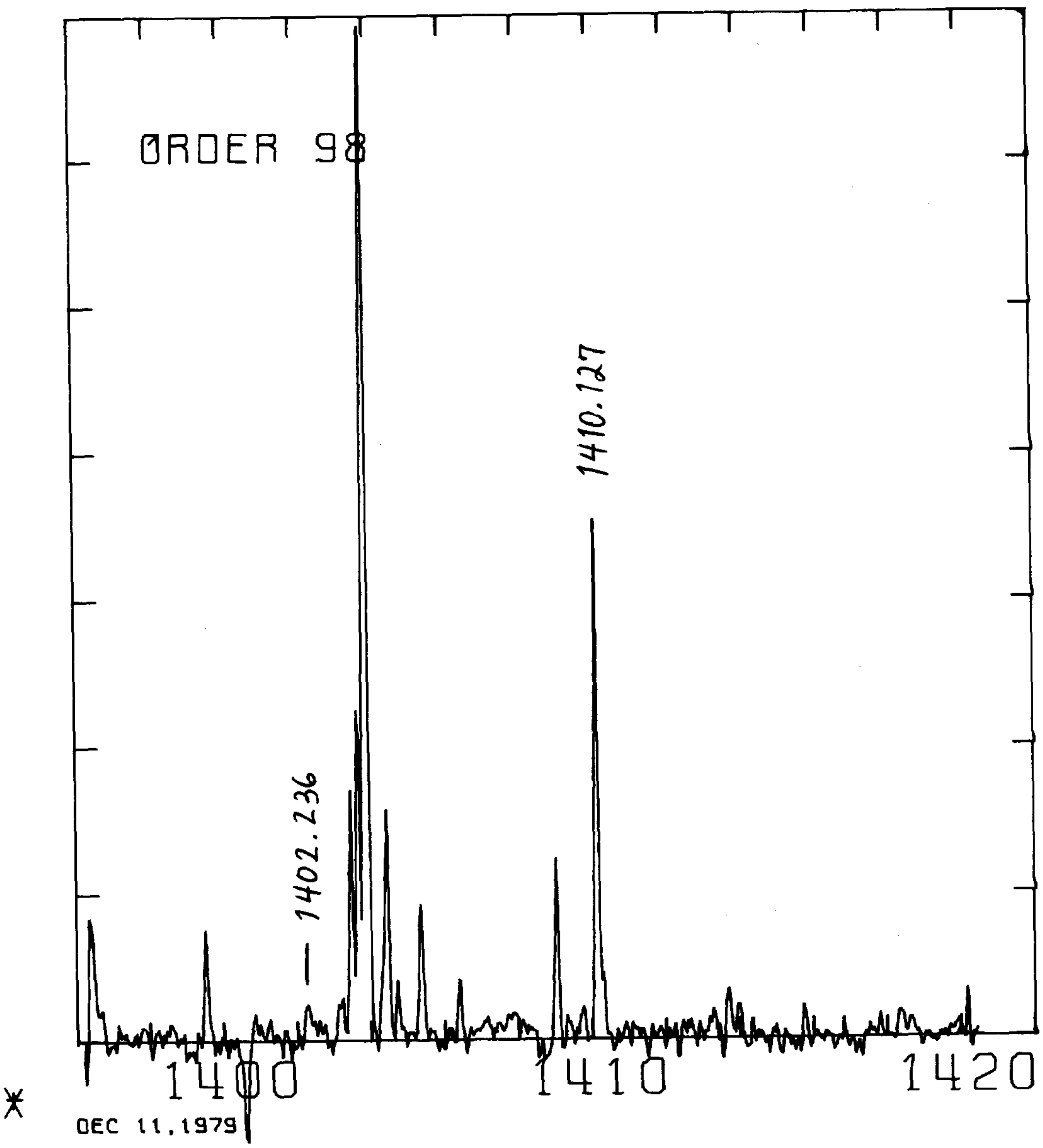

ORDER 101
1362.672
1369.362
1373.164
1360
1370
DEC 11,1979

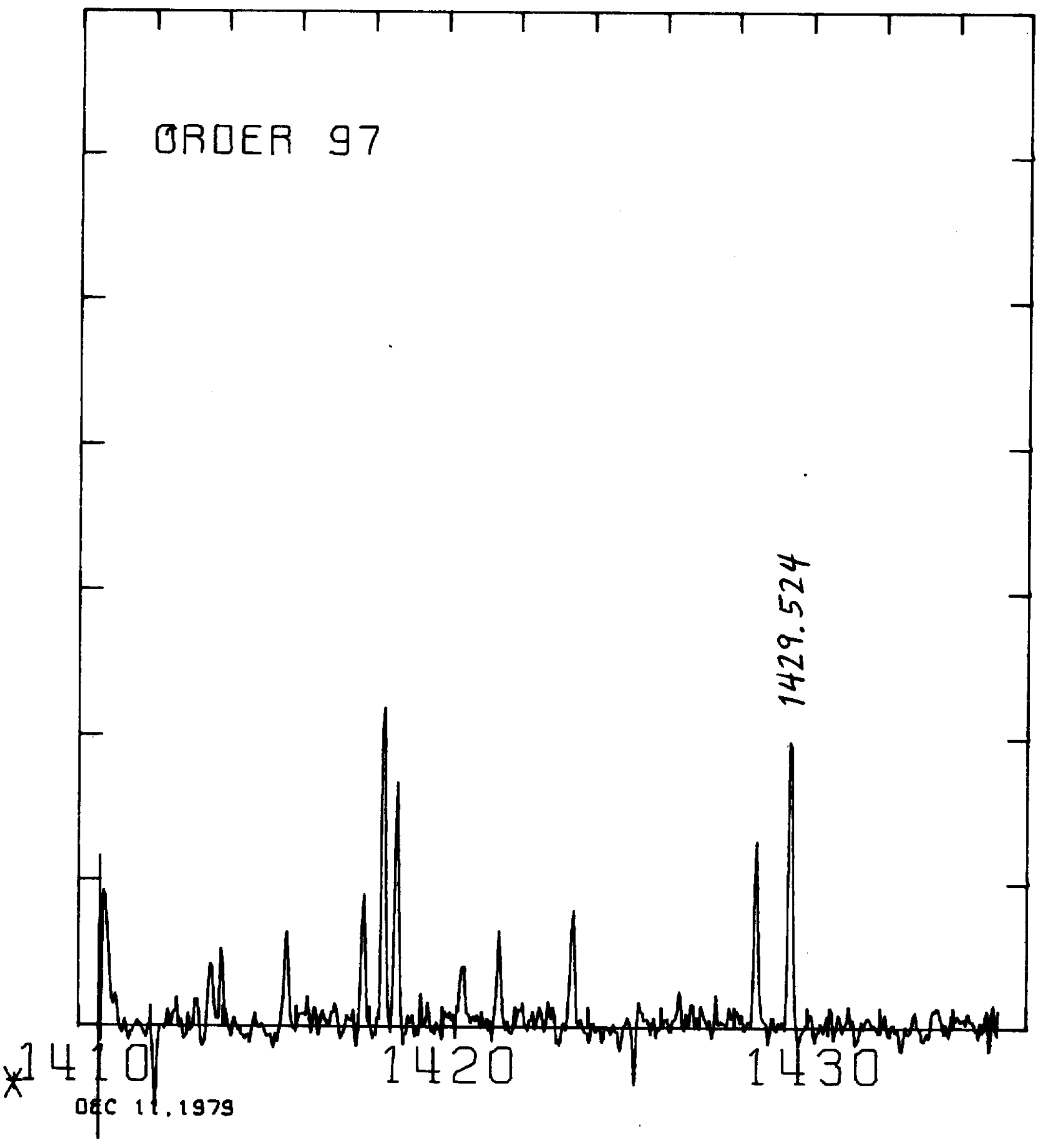


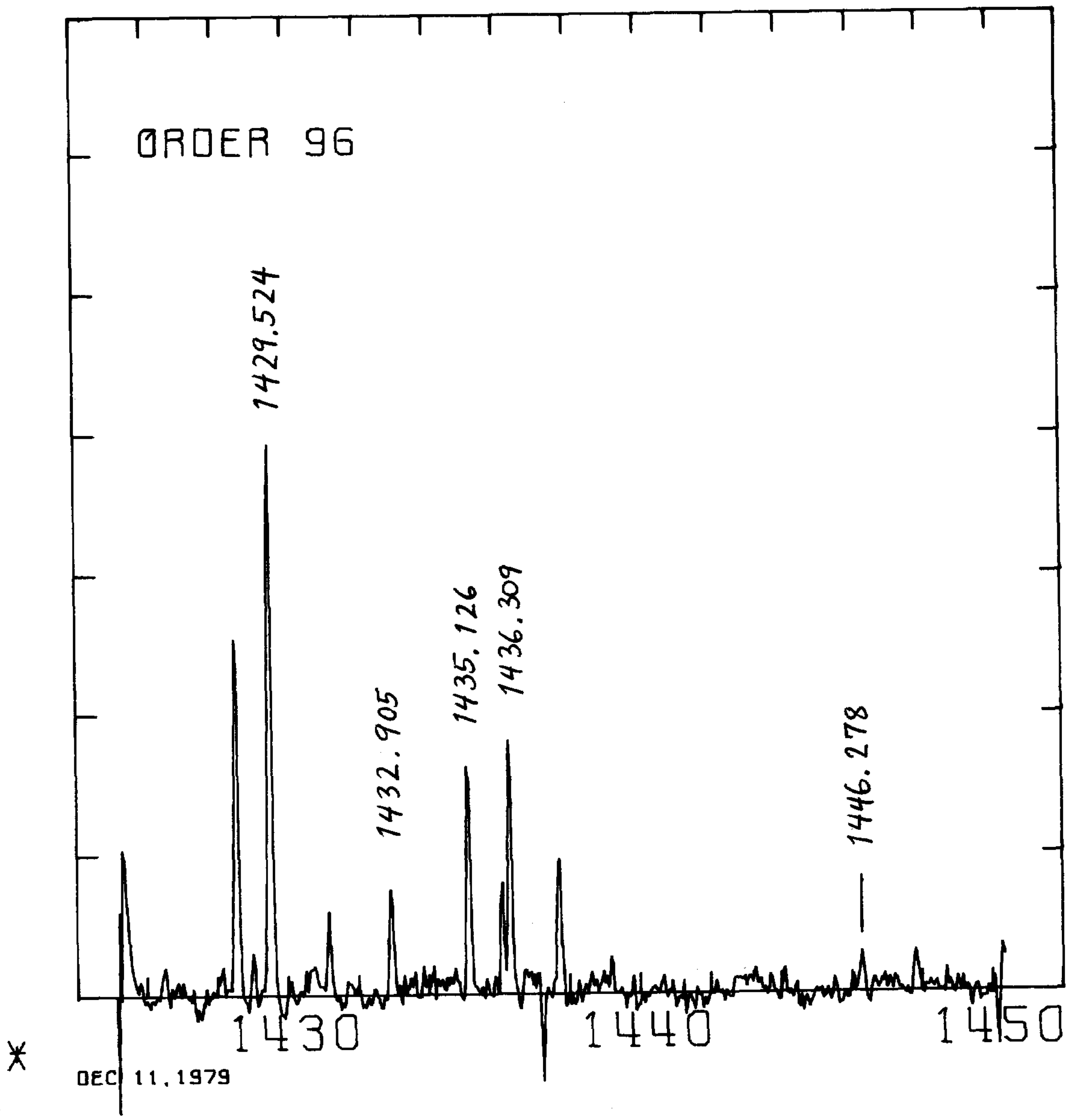
ØRDER 100
1373.164
1374.878
1378.947
1380.475
1382.040
1383.266
1370
1380
1390
*
DEC 11,1979



ORDER 99
1383.266
1389.875
1380
1390
1400
DEC 1[illegible], 1979


ORDER 98
1402.236
1410.127
1400
1410
1420
DEC 11,1979


ORDER 97
1429.524
1410
1420
1430
DEC 11,1979



ORDER 96
1429.524
1432.905
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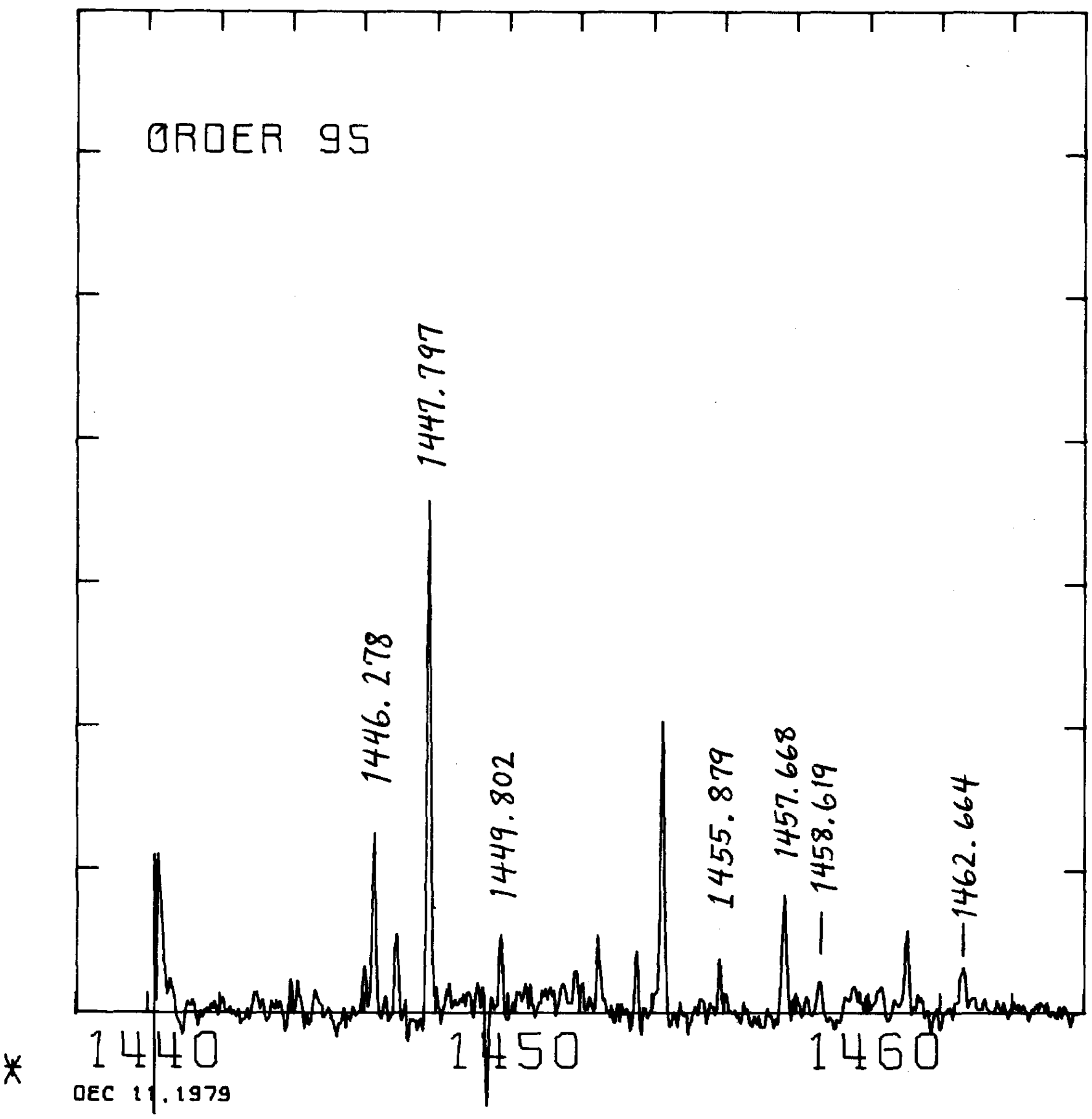
1436.309
1446.278
1430
1440
1450
DEC 11,1979



ORDER 95
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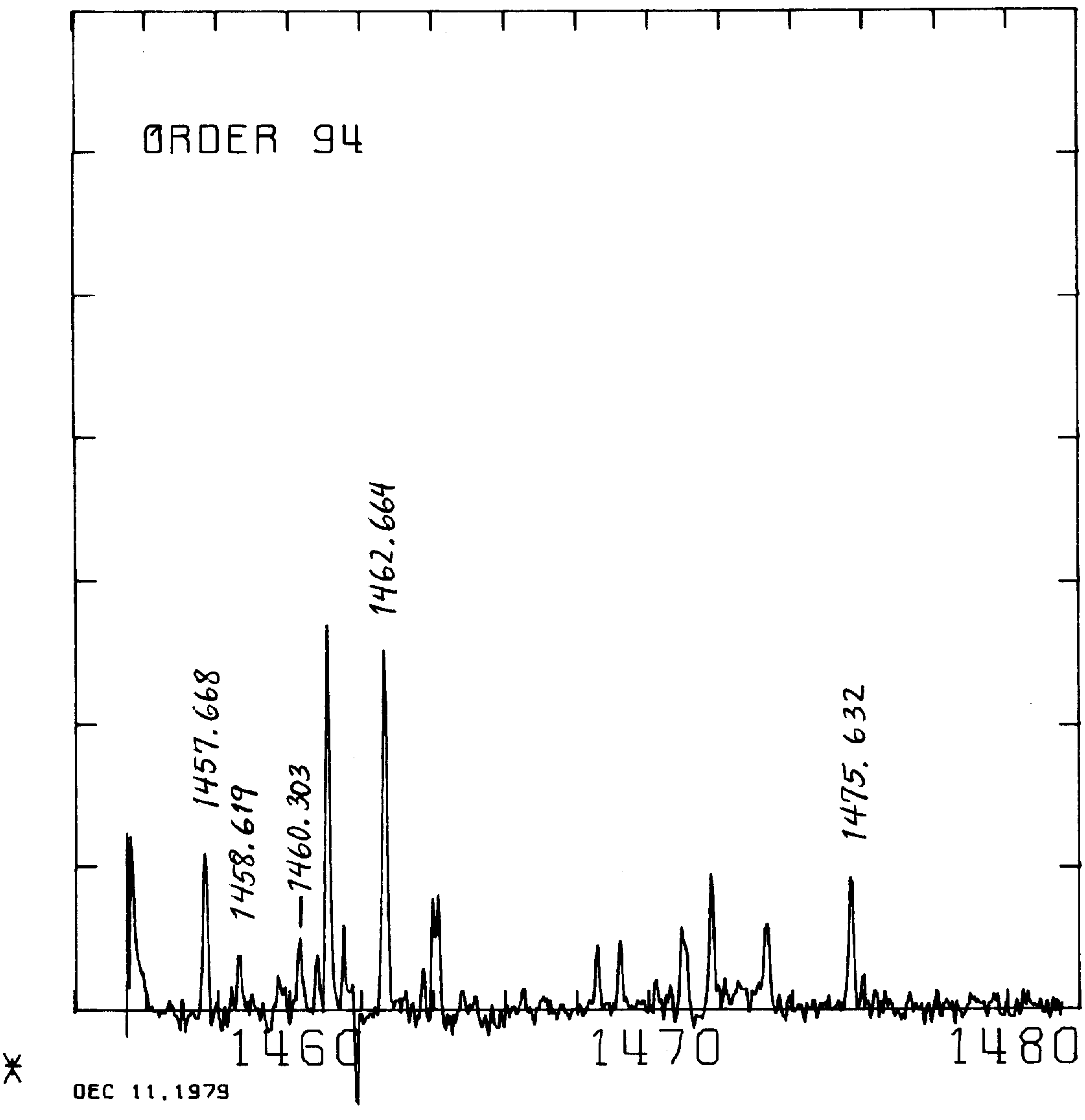
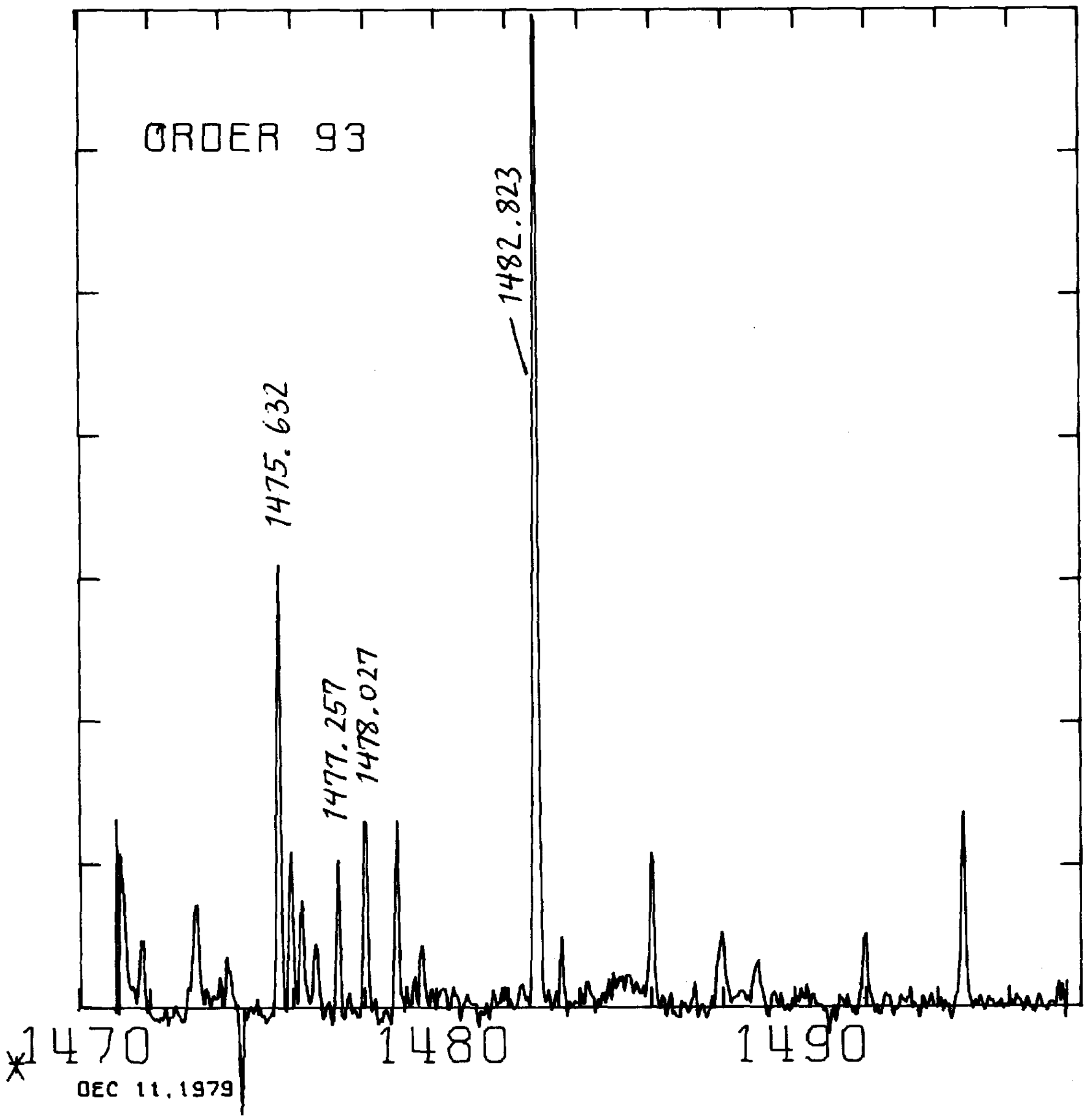
1455.879
1457.668
1458.619
1462.664
1440
1450
1460
DEC 11,1979


ØRDER 94
1457.668
1458.619
1460.303
1462.664
1475.632
1460
1470
1480
DEC 11,1979



ORDER 93
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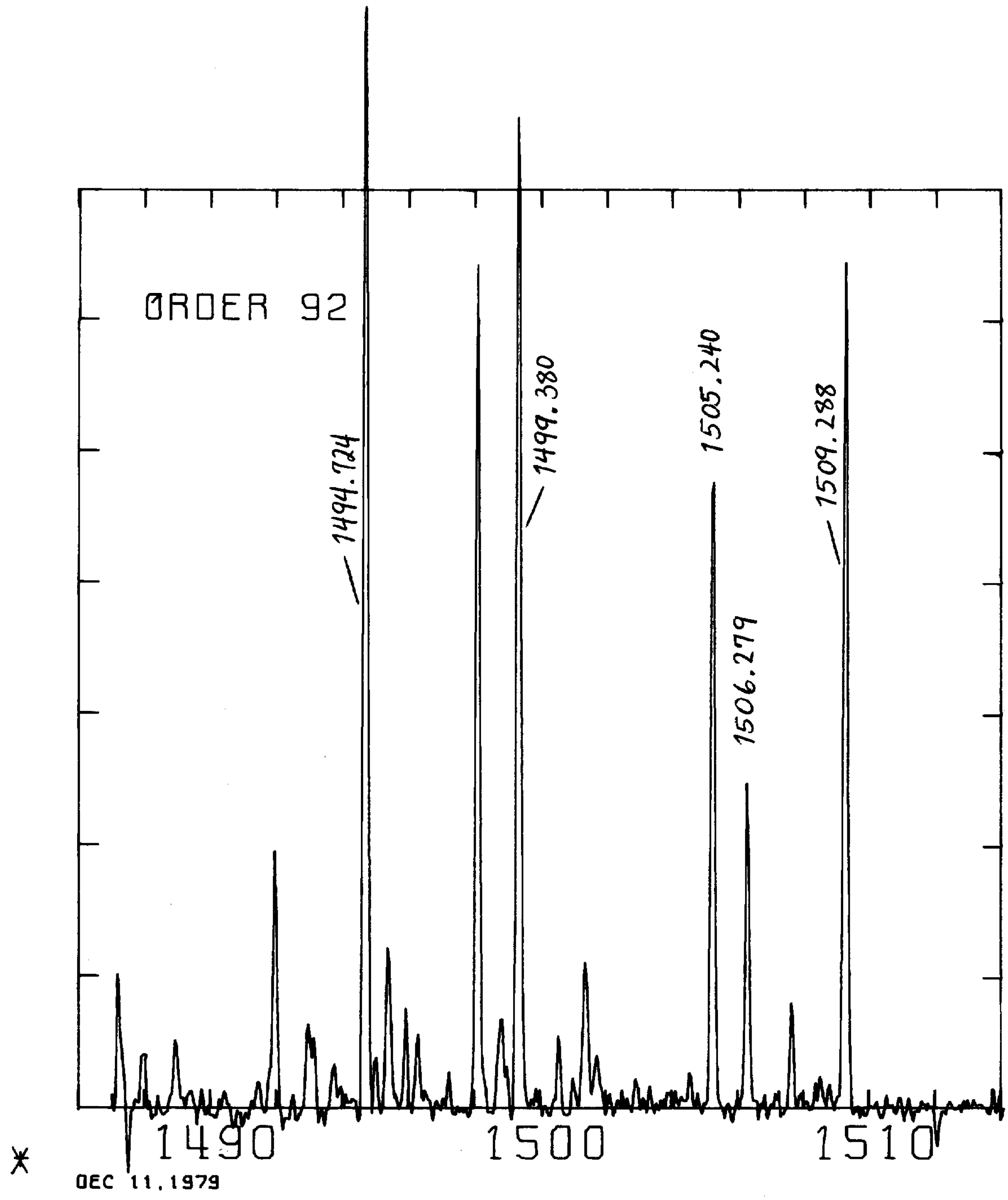
1475.632
1477.257
1478.027
1470
1480
1490
DEC 11,1979


ORDER 92
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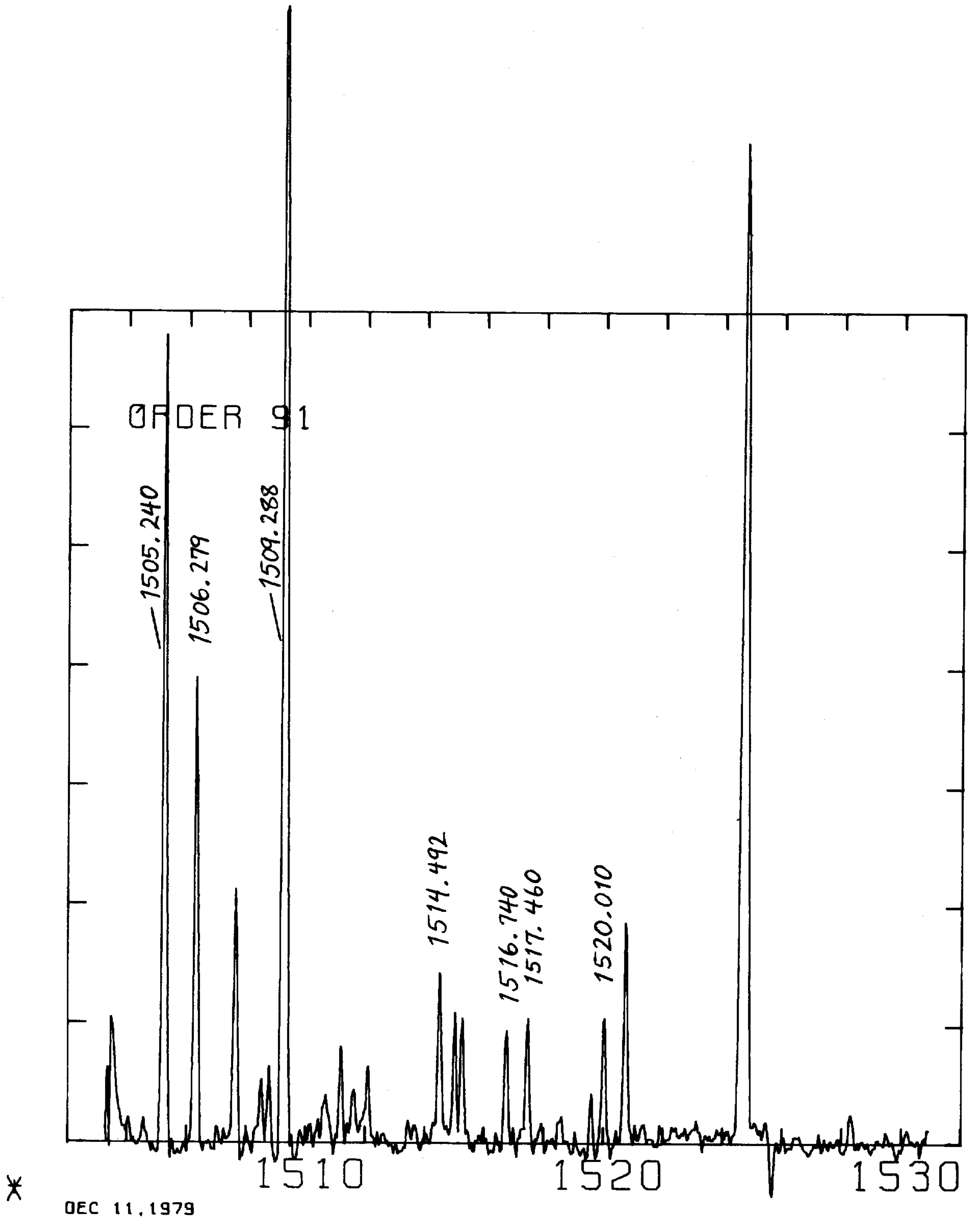
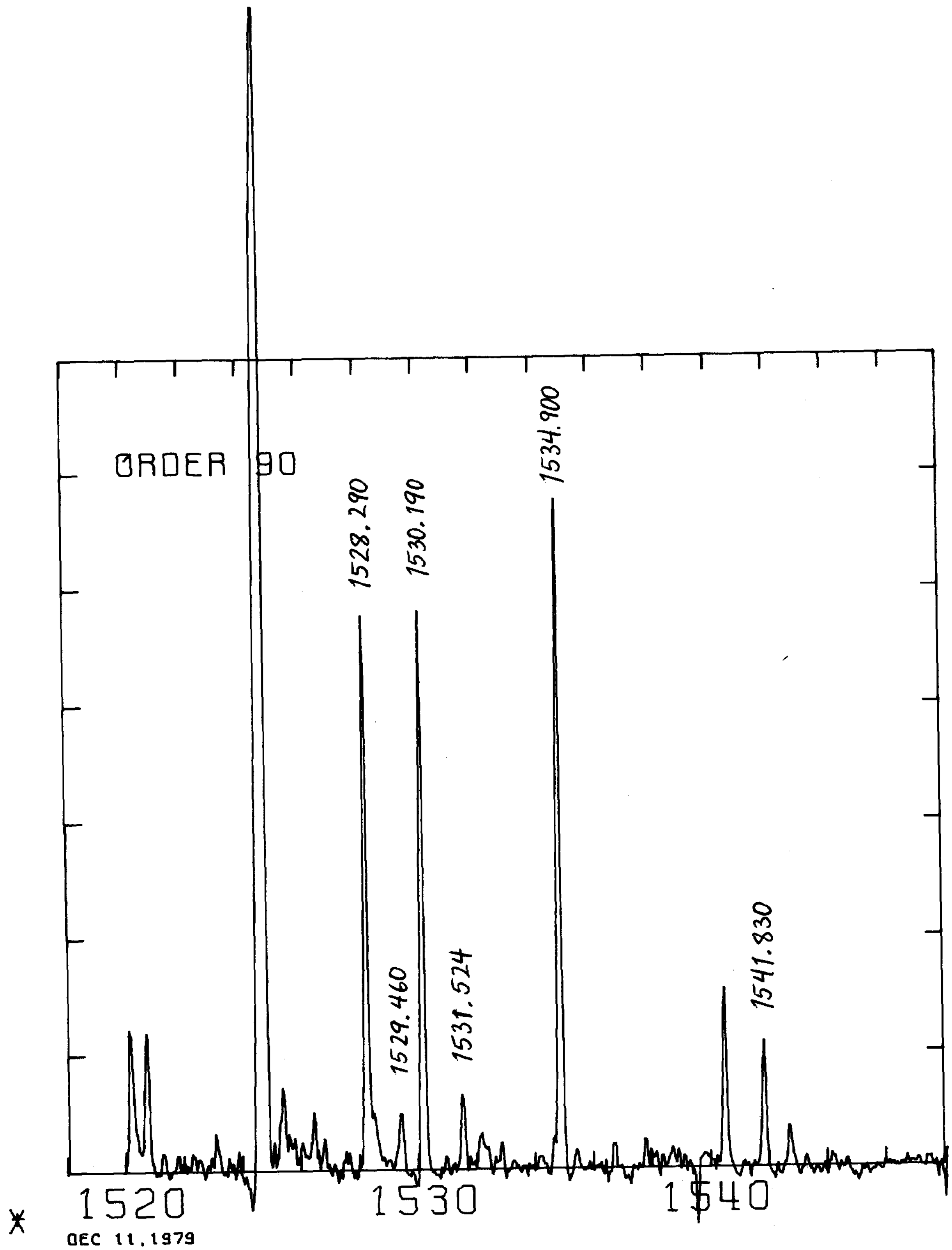
1499.380
1505.240
1506.279
1509.288
1490
1500
1510
DEC 11,1979


ORDER 91
1505.240
1506.279
1509.288
1514.492
1516.740
1517.460
1520.010
1510
1520
1530
DEC 11,1979



ORDER 90
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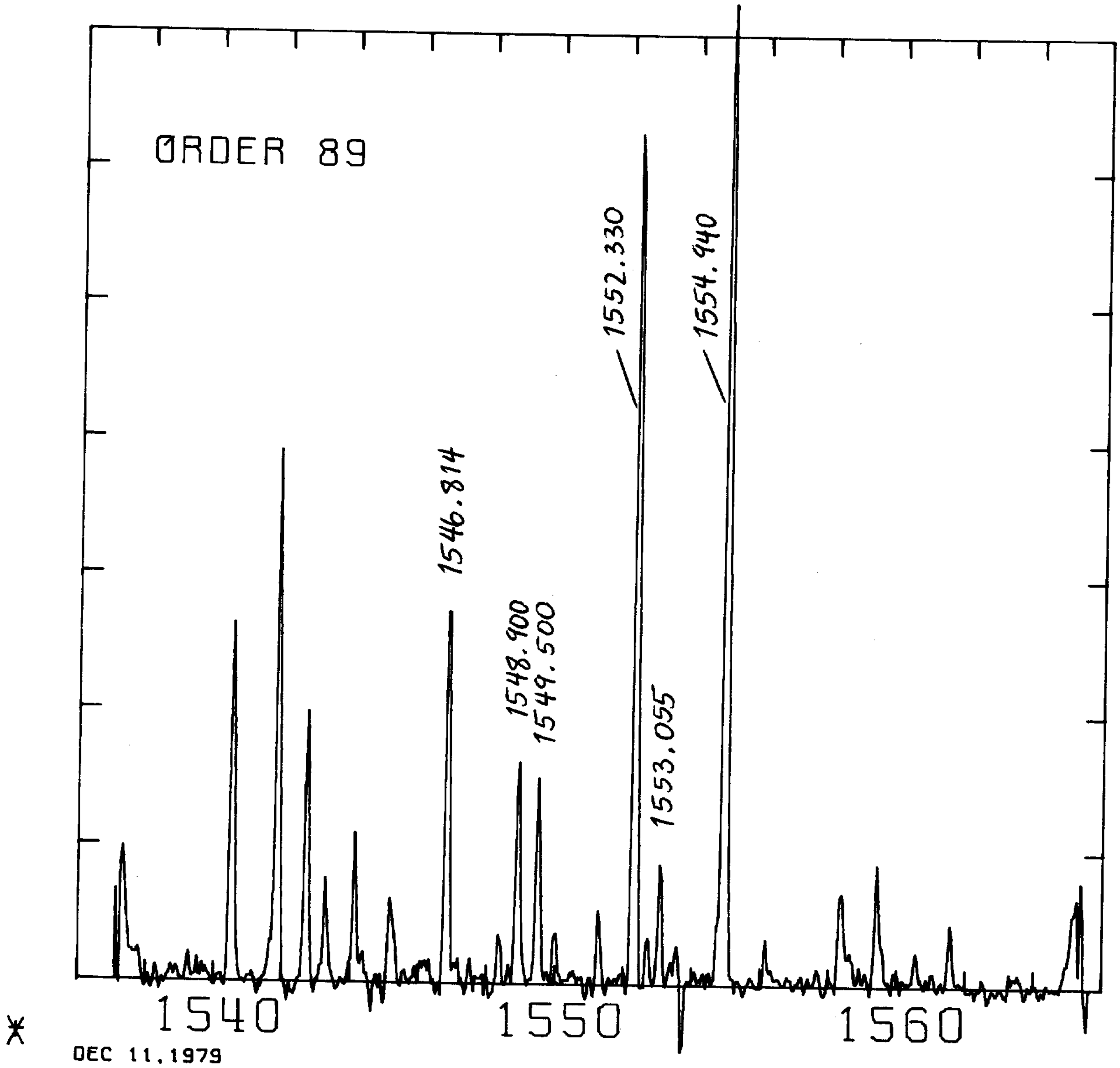
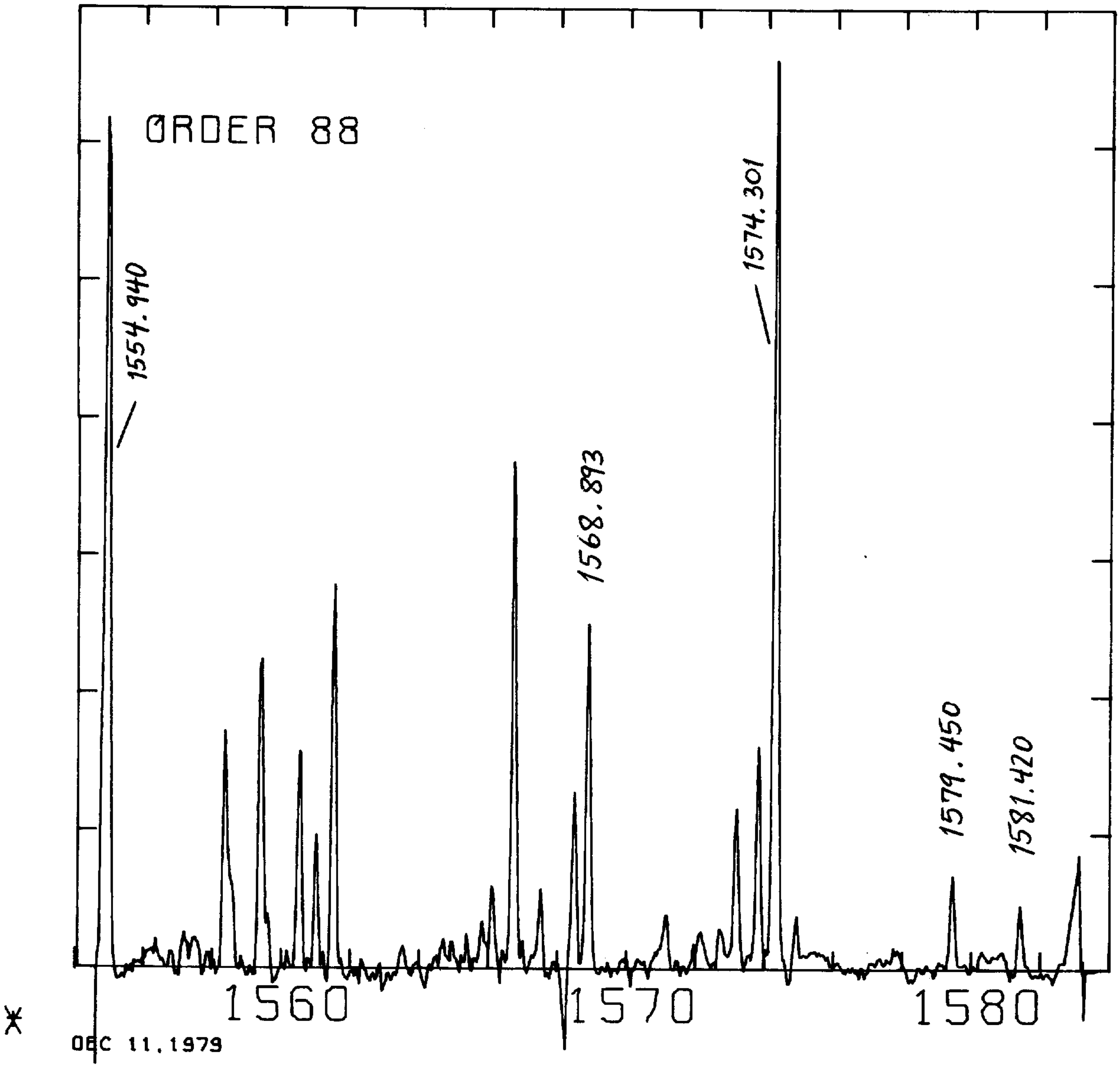
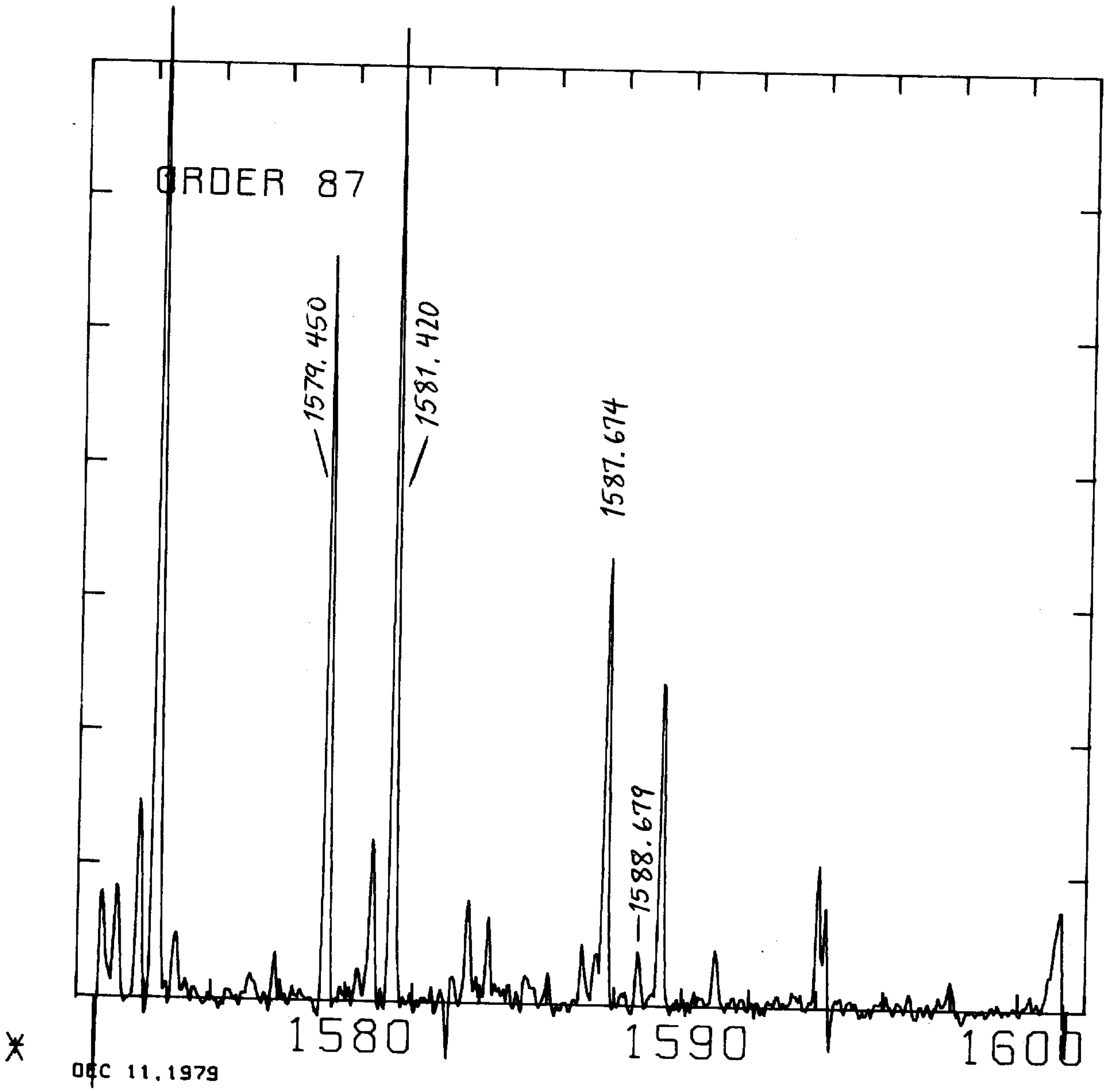
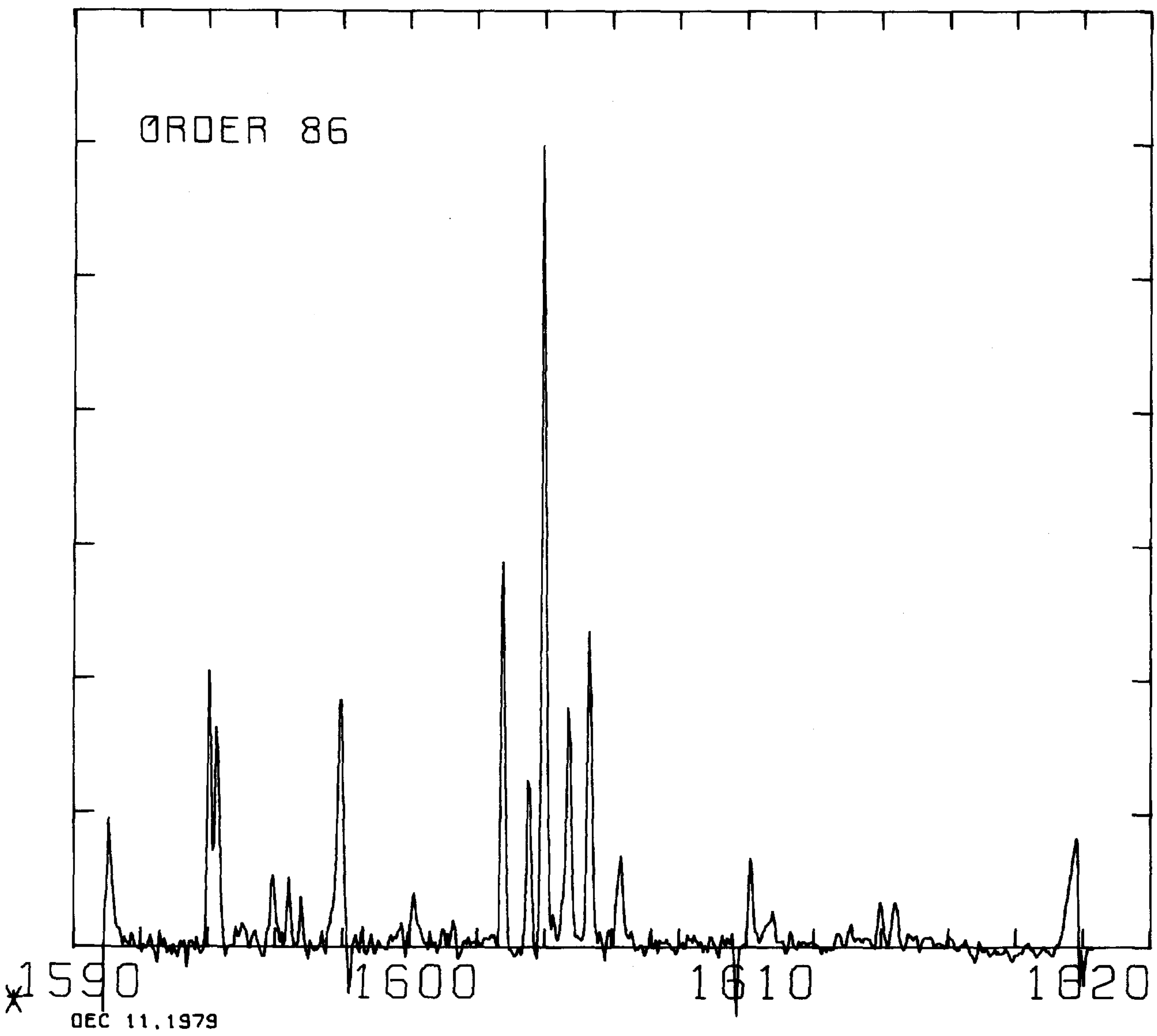
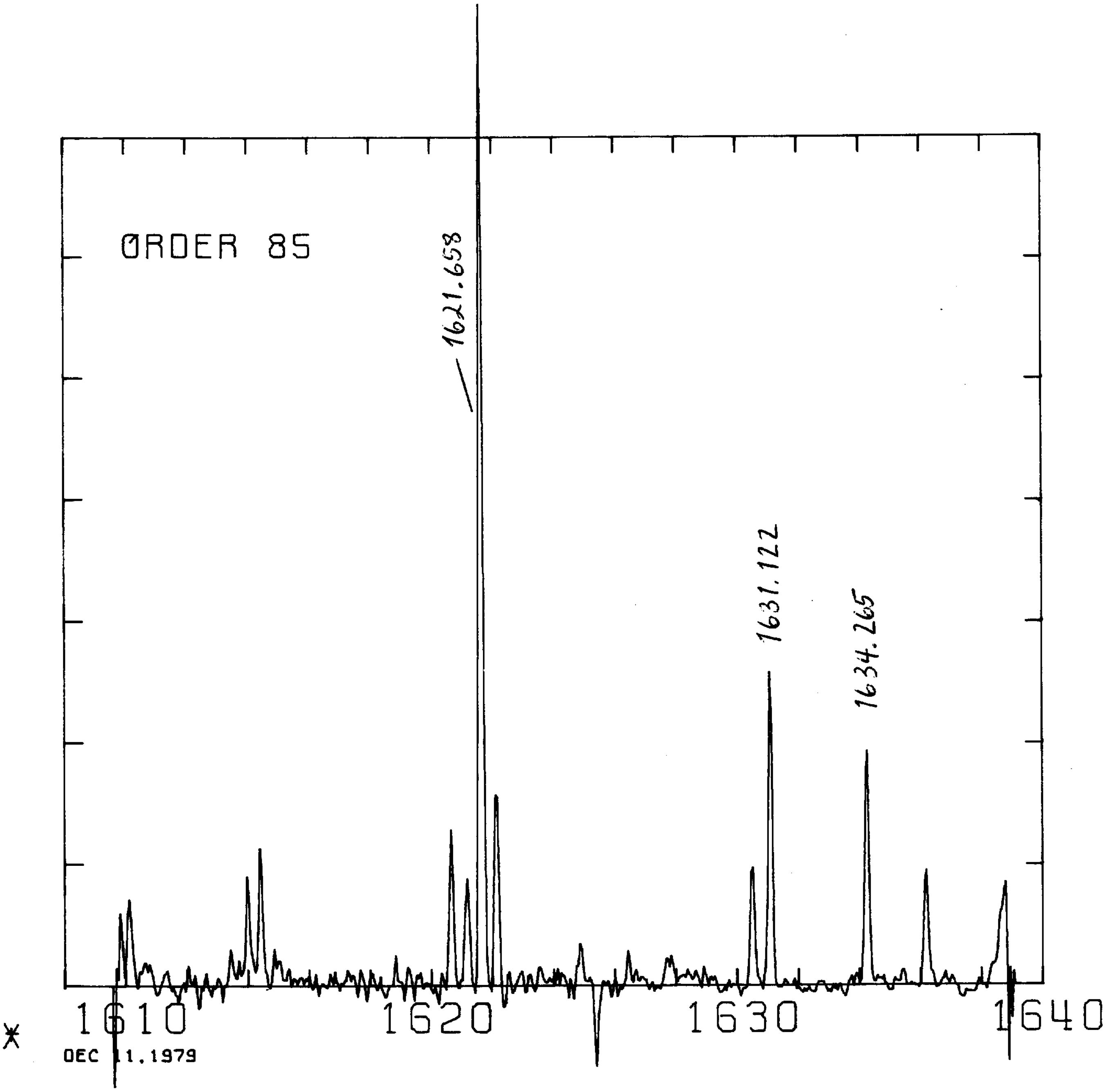
1530.190
1534.900
1529.460
1531.524
1541.830
1520
1530
1540
DEC 11,1979


ØRDER 89
1552.330
1554.940
1546.814
1548.900
1549.500
1553.055
1540
1550
1560
DEC 11,1979

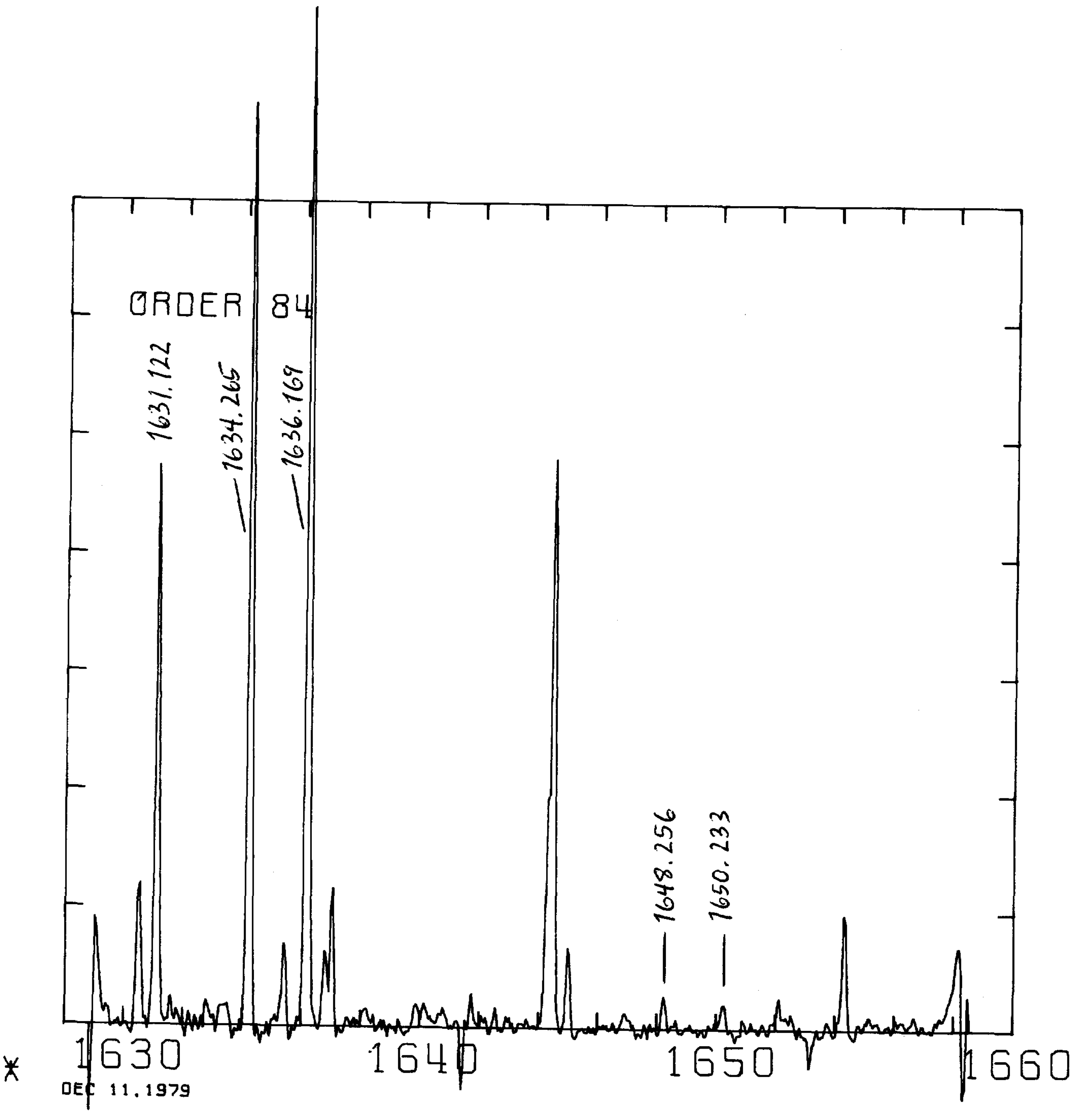

ØRDER 88
1554.940
1568.893
1574.301
1579.450
1581.420
1560
1570
1580
DEC 11,1979


ORDER 87
1579.450
1581.420
1587.674
1588.679
1580
1590
1600
DEC 11,1979


ORDER 86
1590
1600
1610
1620
DEC 11,1979



ØRDER 85
1621.658
1631.122
1634.265
1610
1620
1630
1640
DEC 11,1979



ORDER 84
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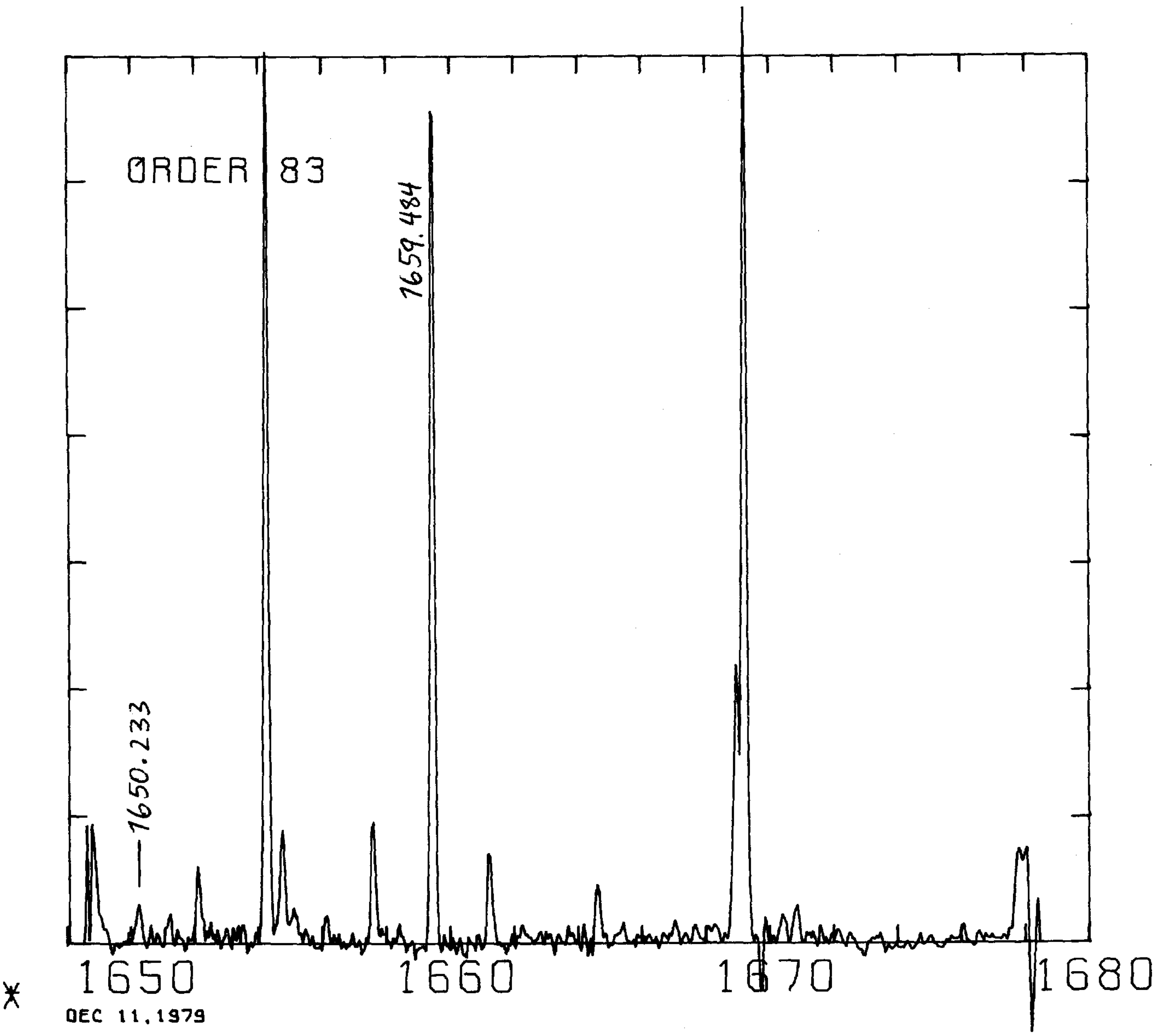
1634.265
1636.169
1648.256
1650.233
1630
1640
1650
1660
DEC 11,1979


ORDER 83
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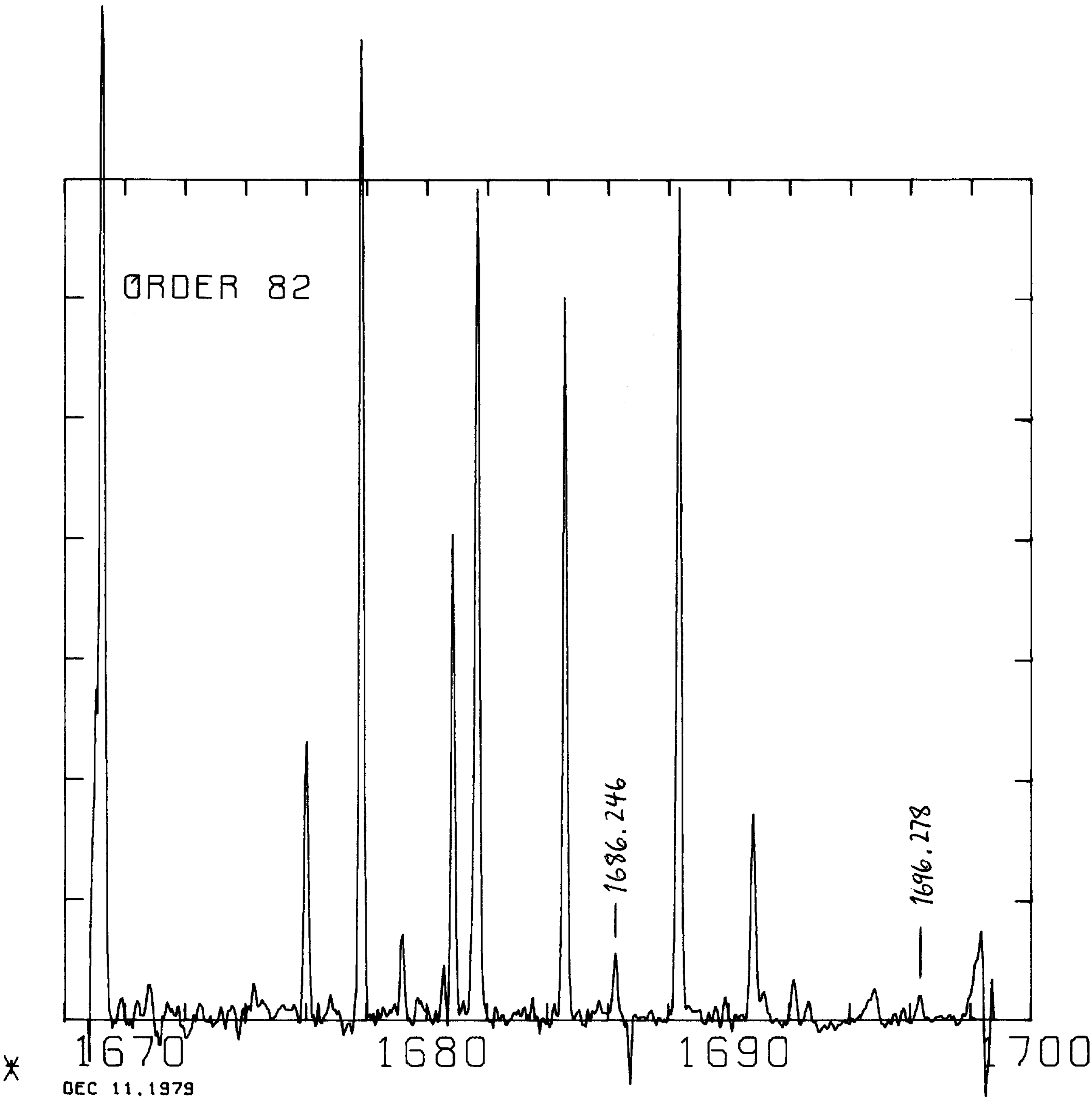
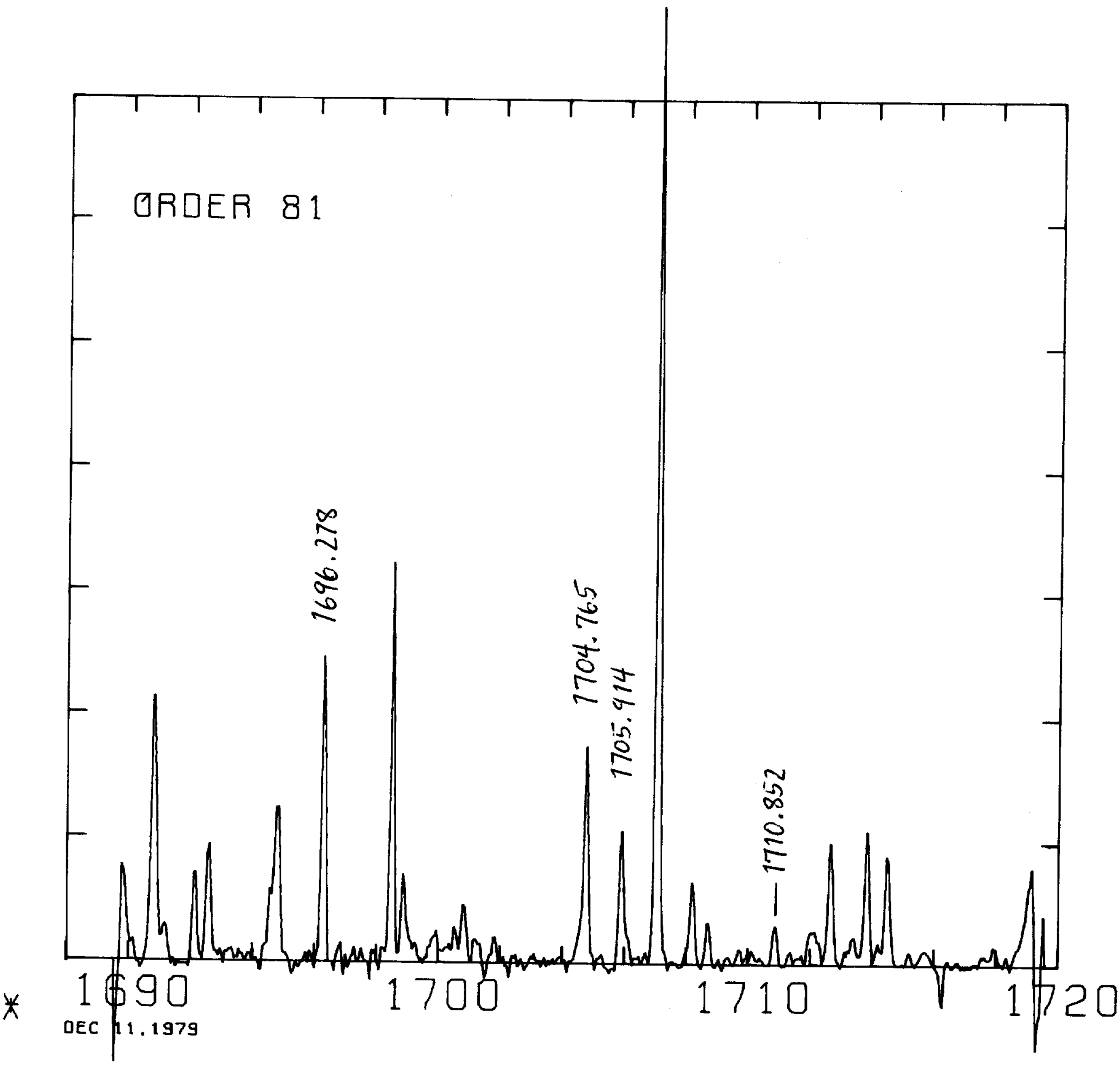
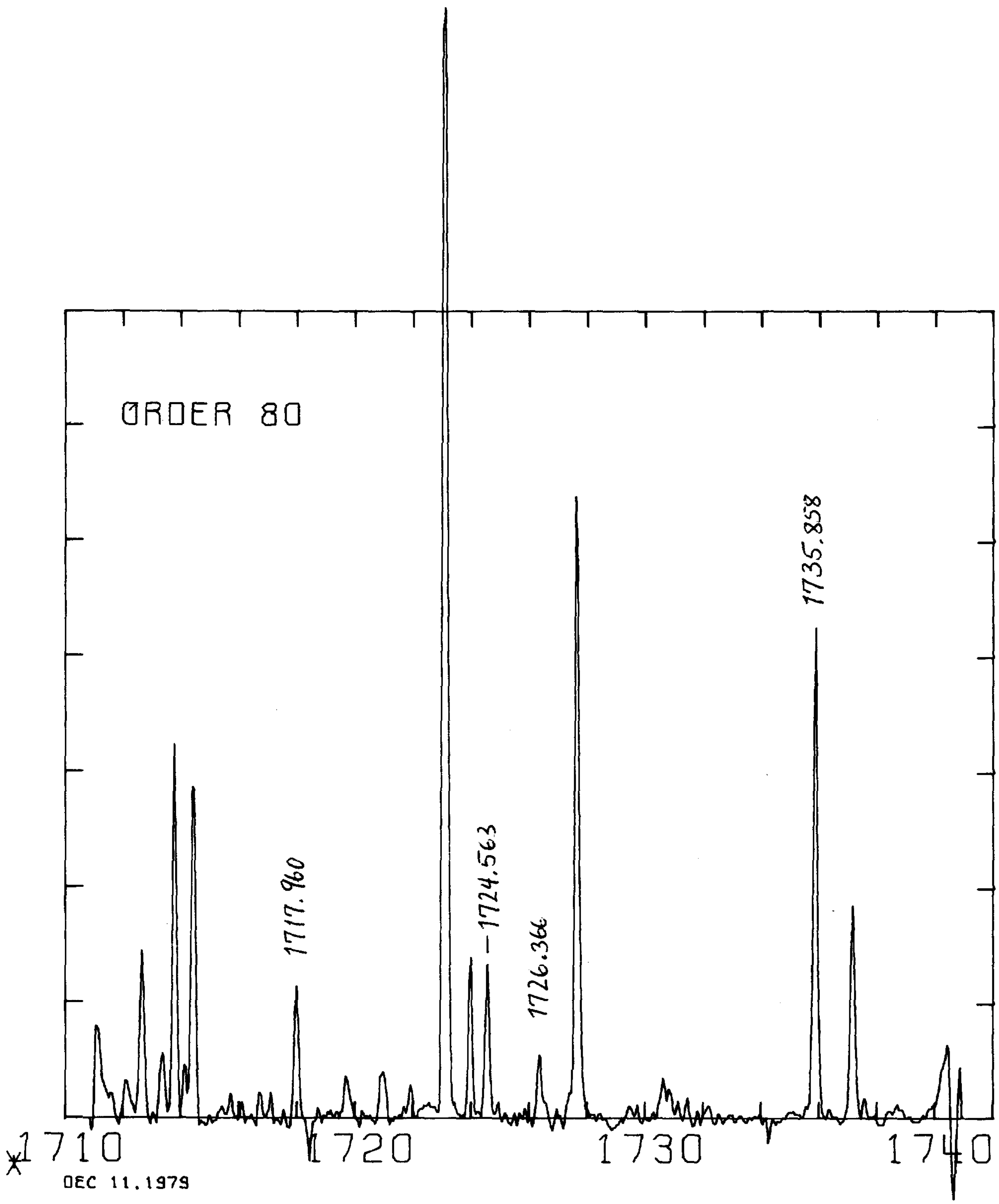
1650
1660
1670
1680
DEC 11,1979



ORDER 82
1686.246
1696.278
1670
1680
1690
1700
*
DEC 11,1979


ORDER 81
1696.278
1704.765
1705.914
1710.852
1690
1700
1710
1720
DEC 11.1979


ORDER 80
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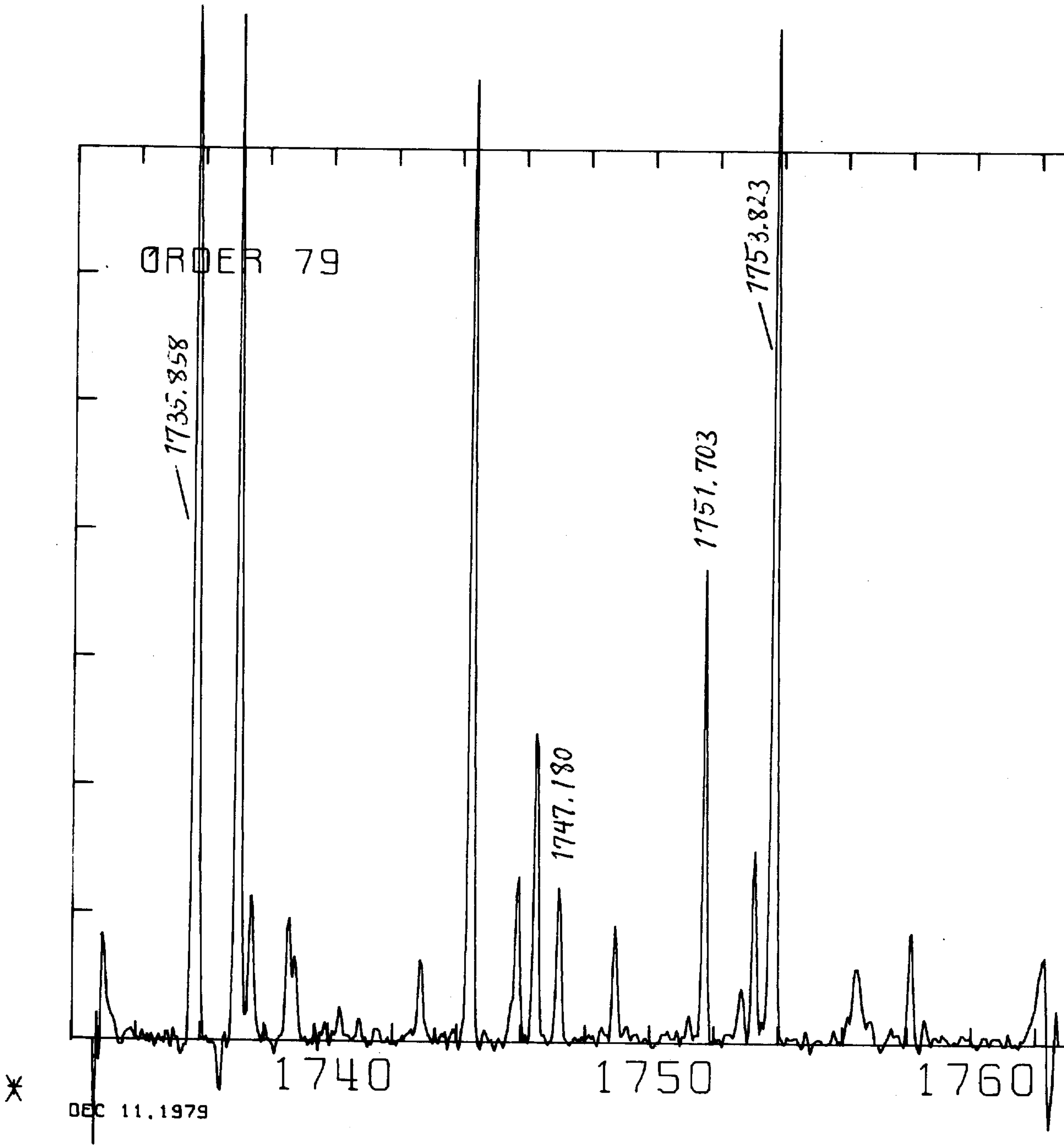
1724.563
1726.366
1735.858
1710
1720
1730
1740
DEC 11.1979


ORDER 79
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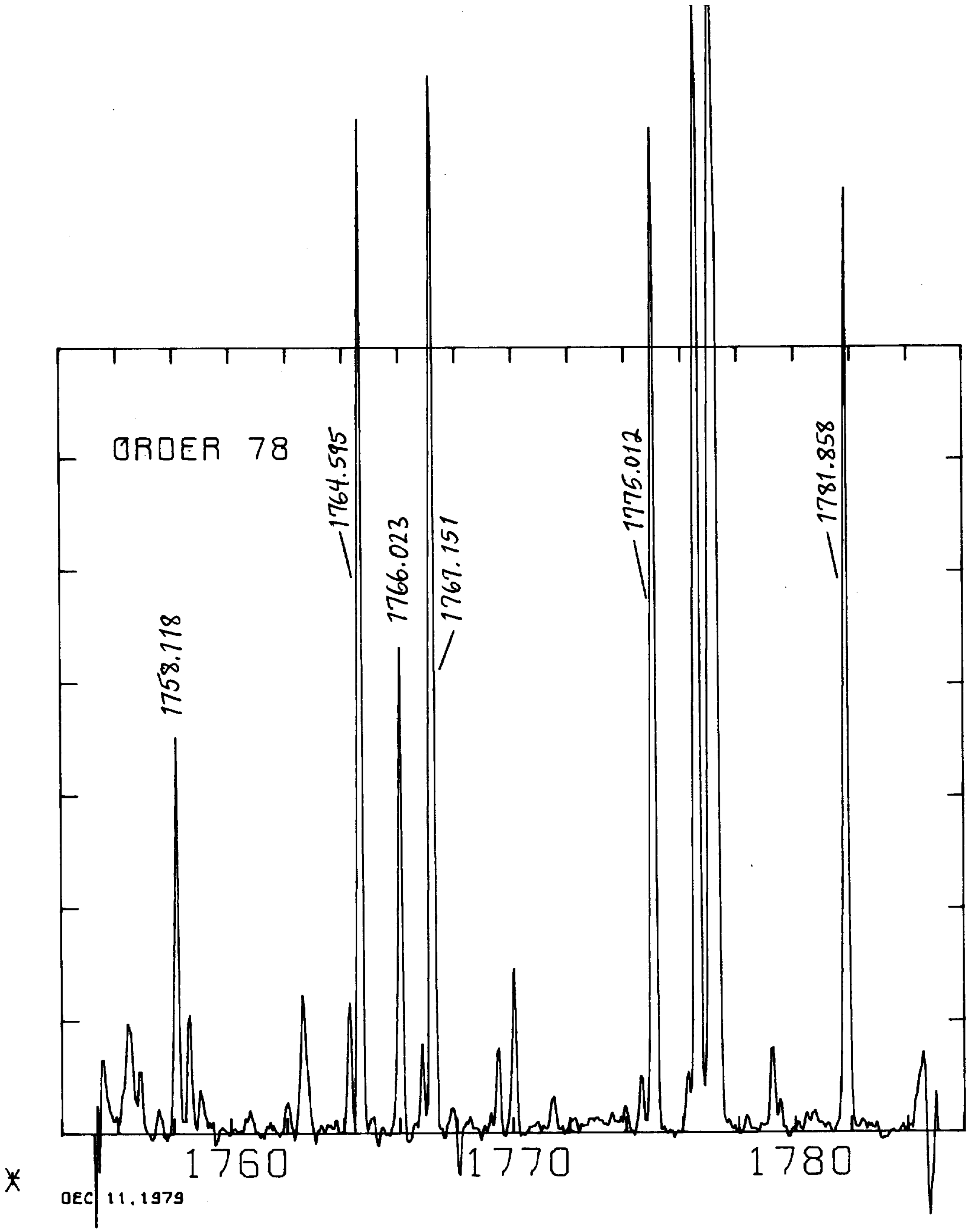
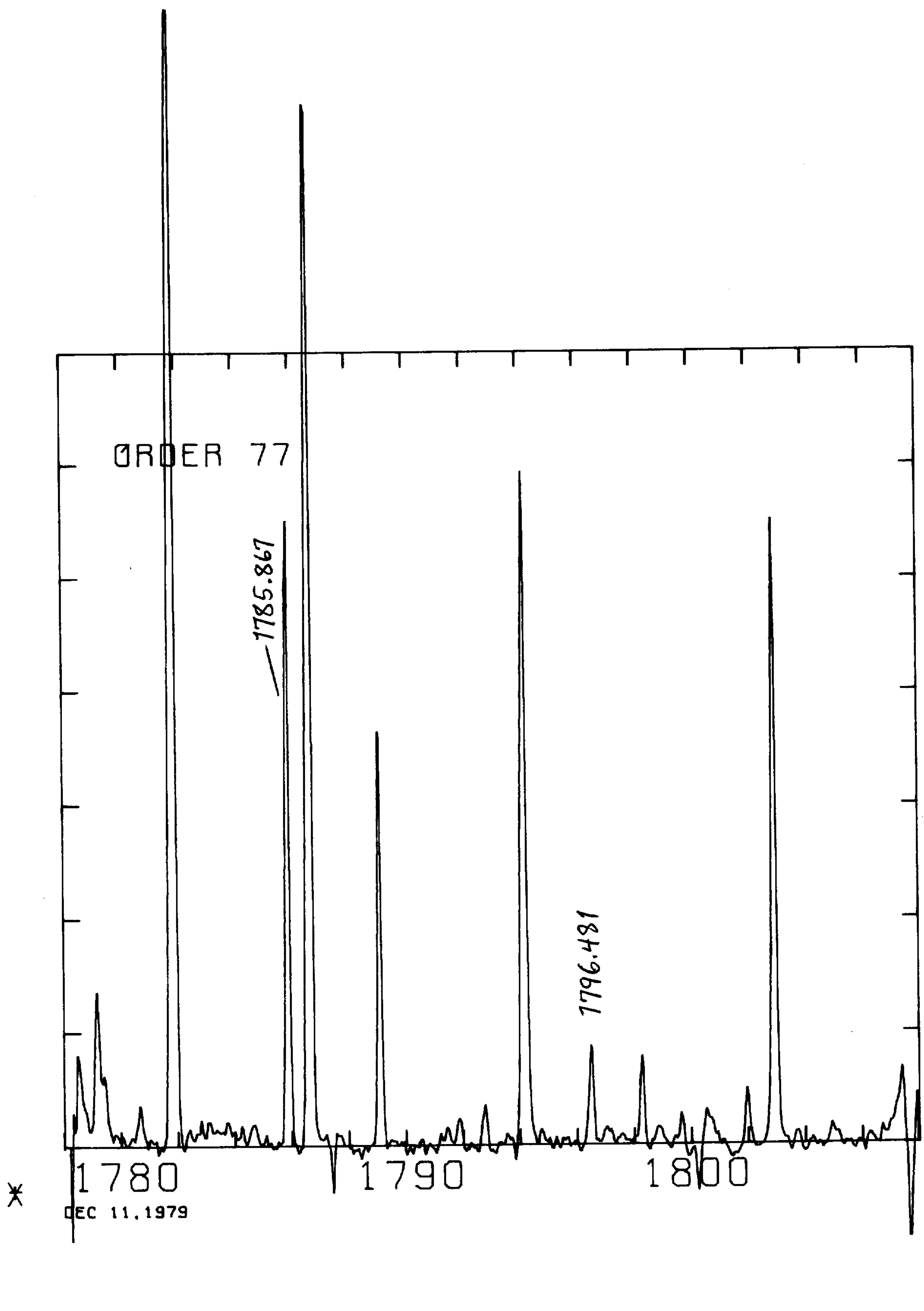
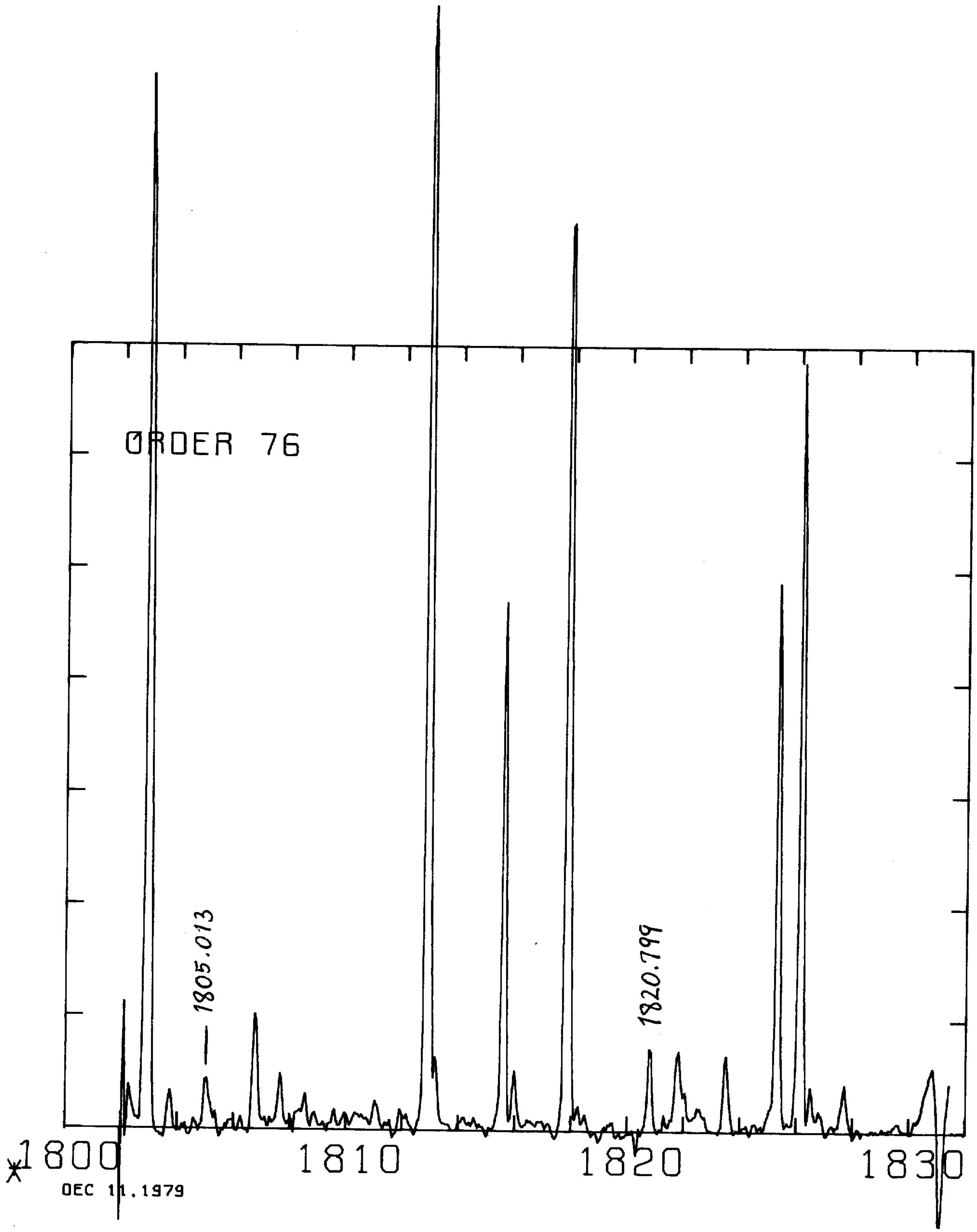
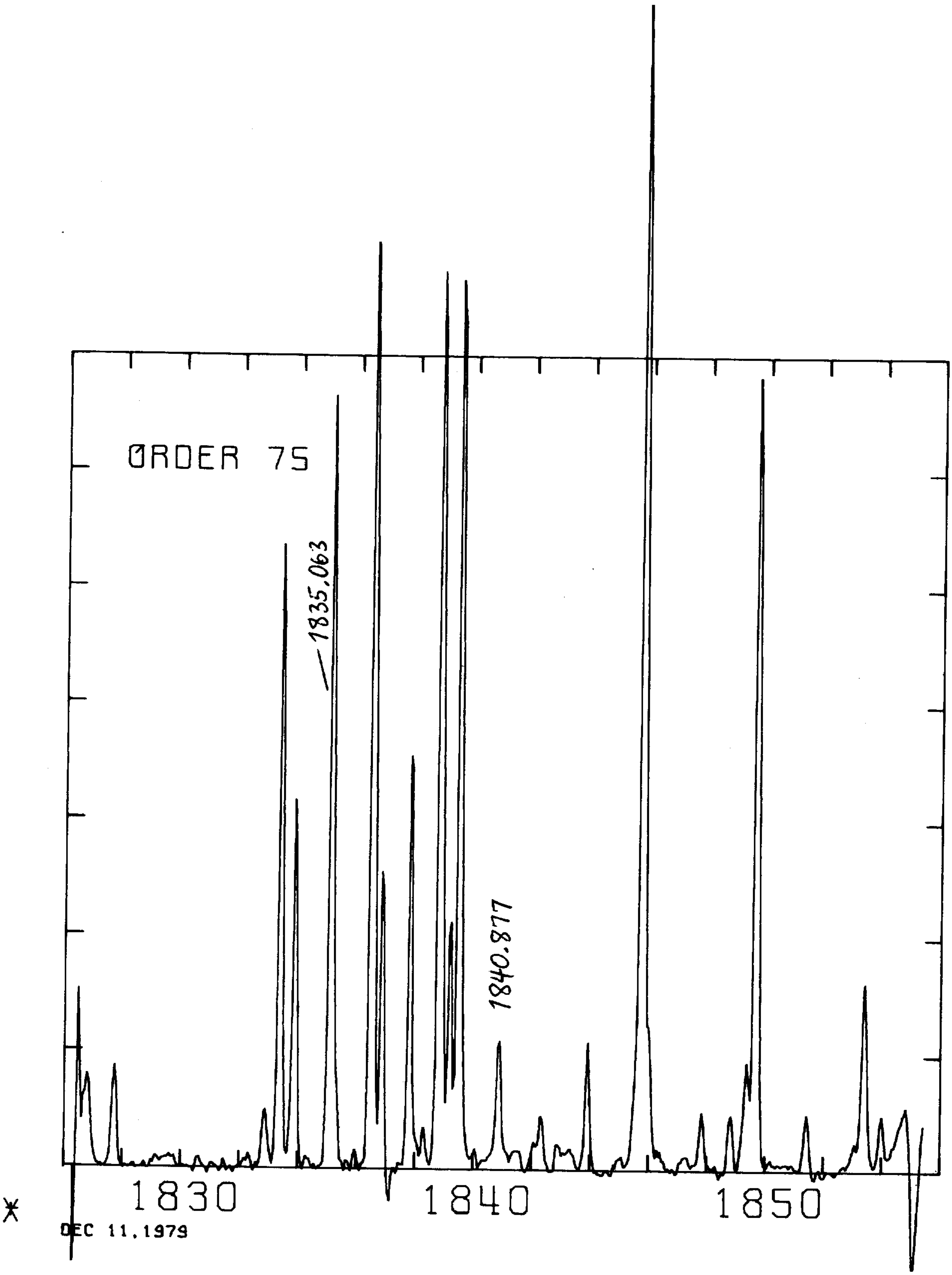
1747.180
1751.703
1753.823
1740
1750
1760
DEC 11,1979

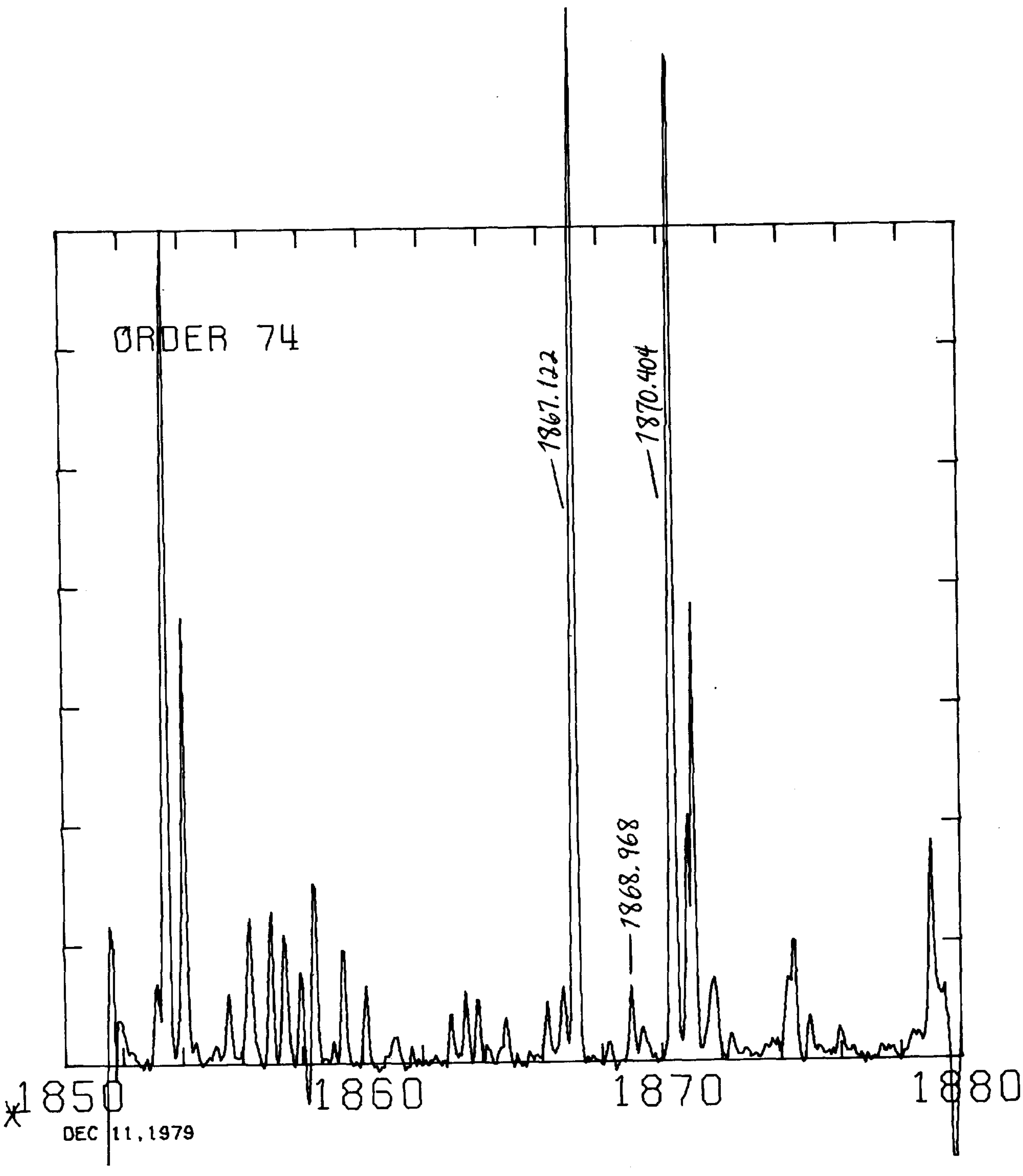


ORDER 78
1758.118
1764.595
1766.023
1767.151
1775.012
1781.858
1760
1770
1780
DEC 11, 1979

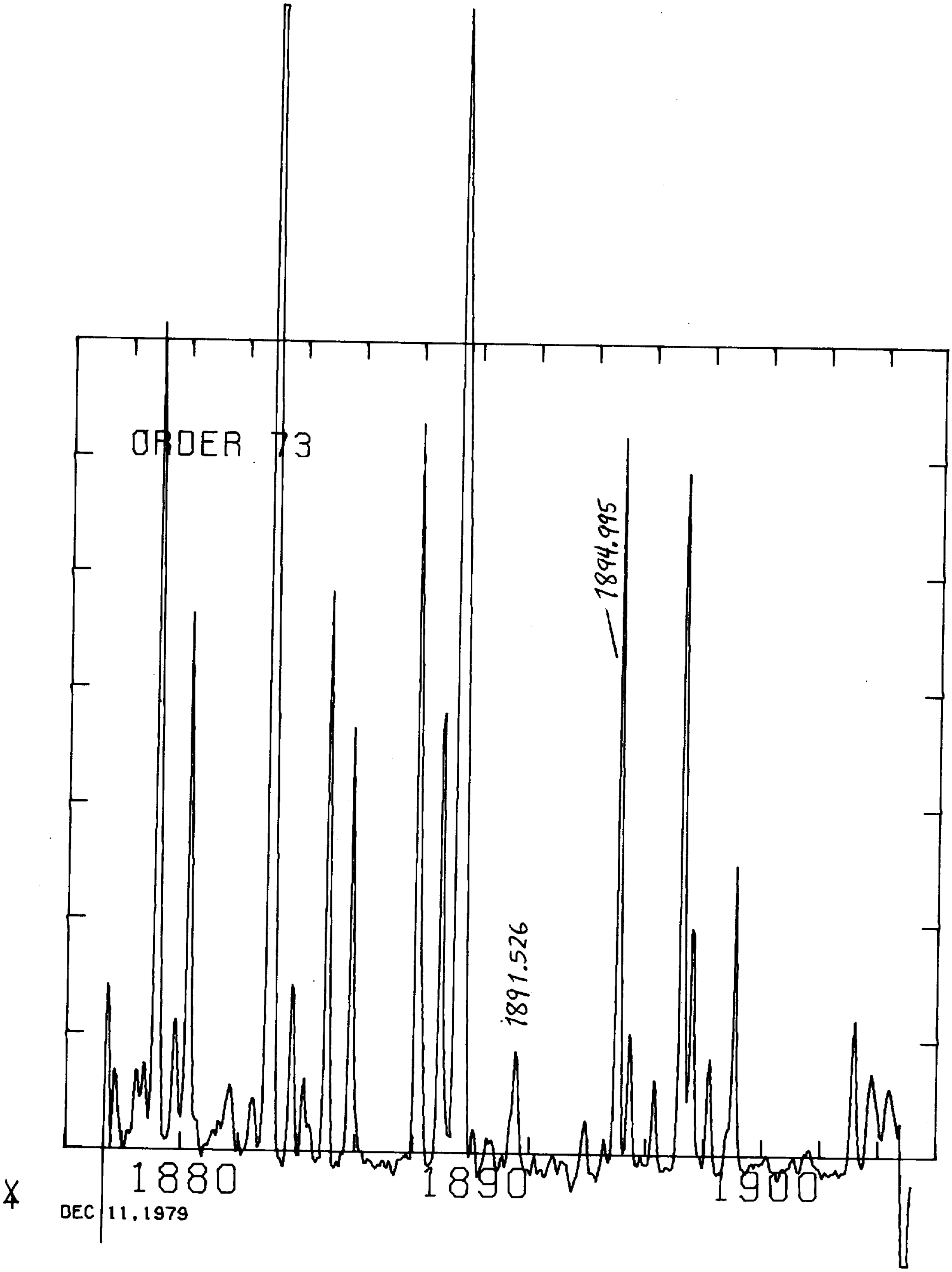

ORDER 77
1785.867
1796.481
1780
1790
1800
DEC 11,1979


ØRDER 76
1805.013
1820.799
1800
1810
1820
1830
DEC 11,1979

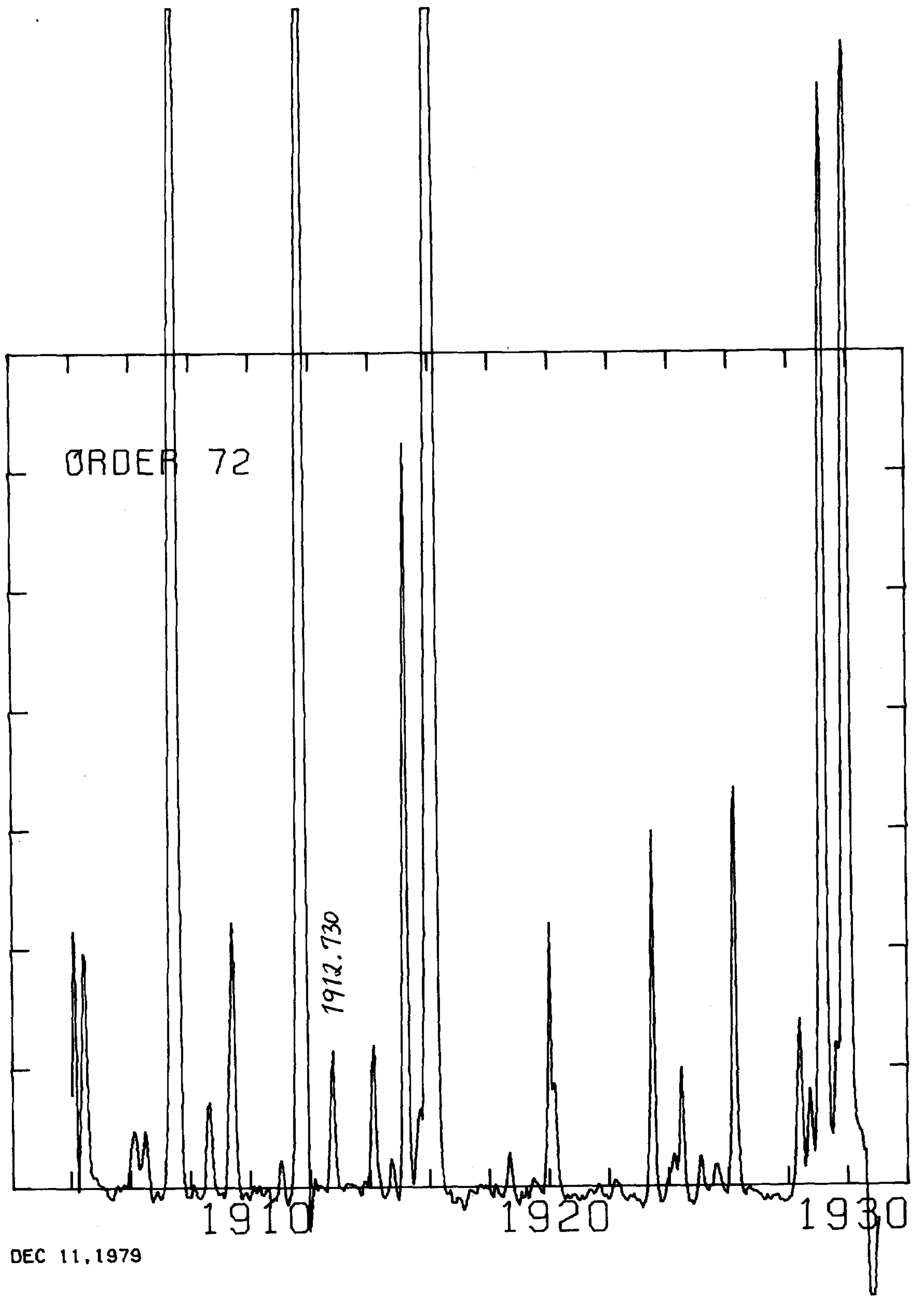

ORDER 75
1835.063
1840.877
1830
1840
1850
DEC 11,1979



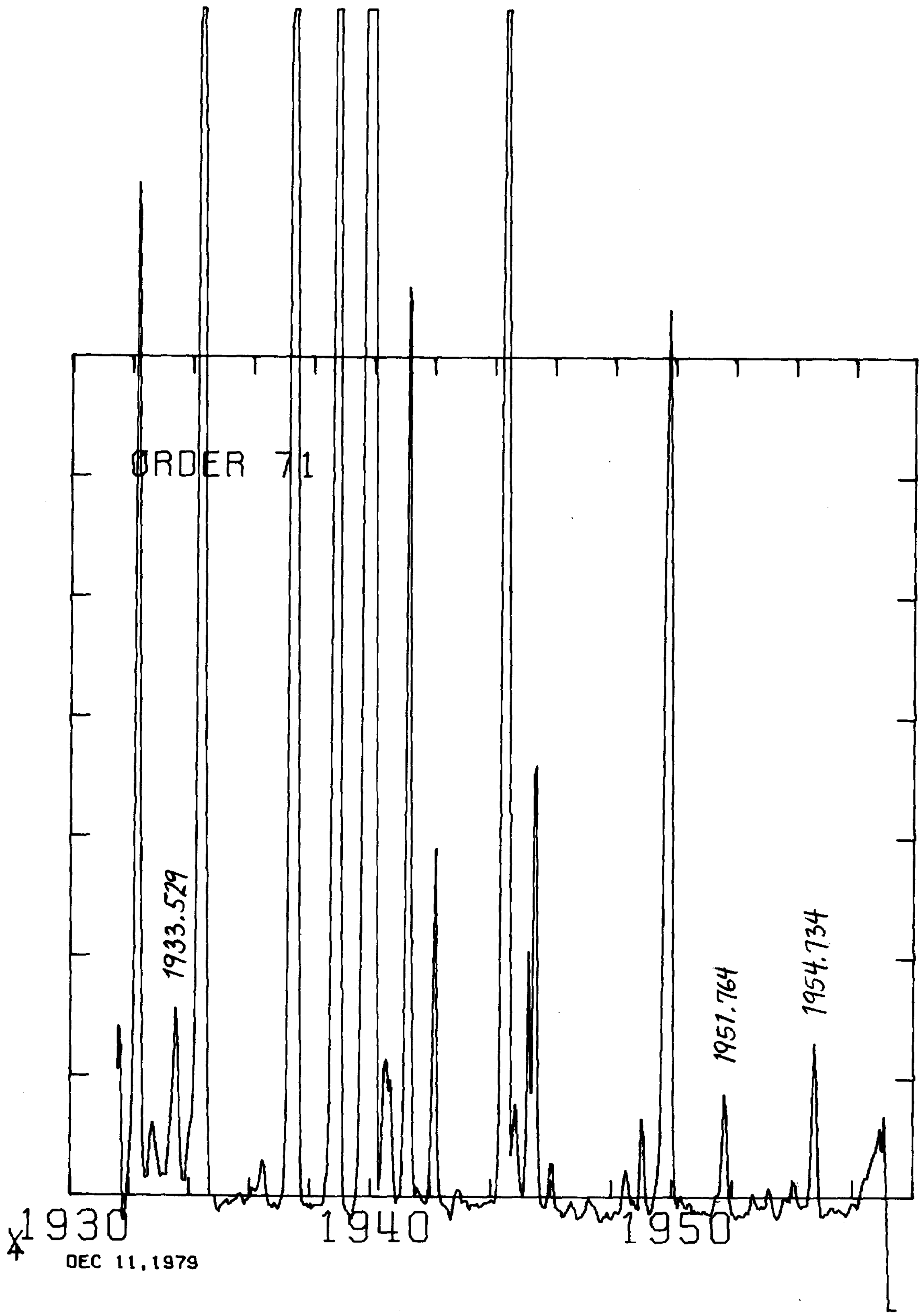
ØRDER 74
1867.122
1870.404
1868.968
1850
1860
1870
1880
DEC 11,1979

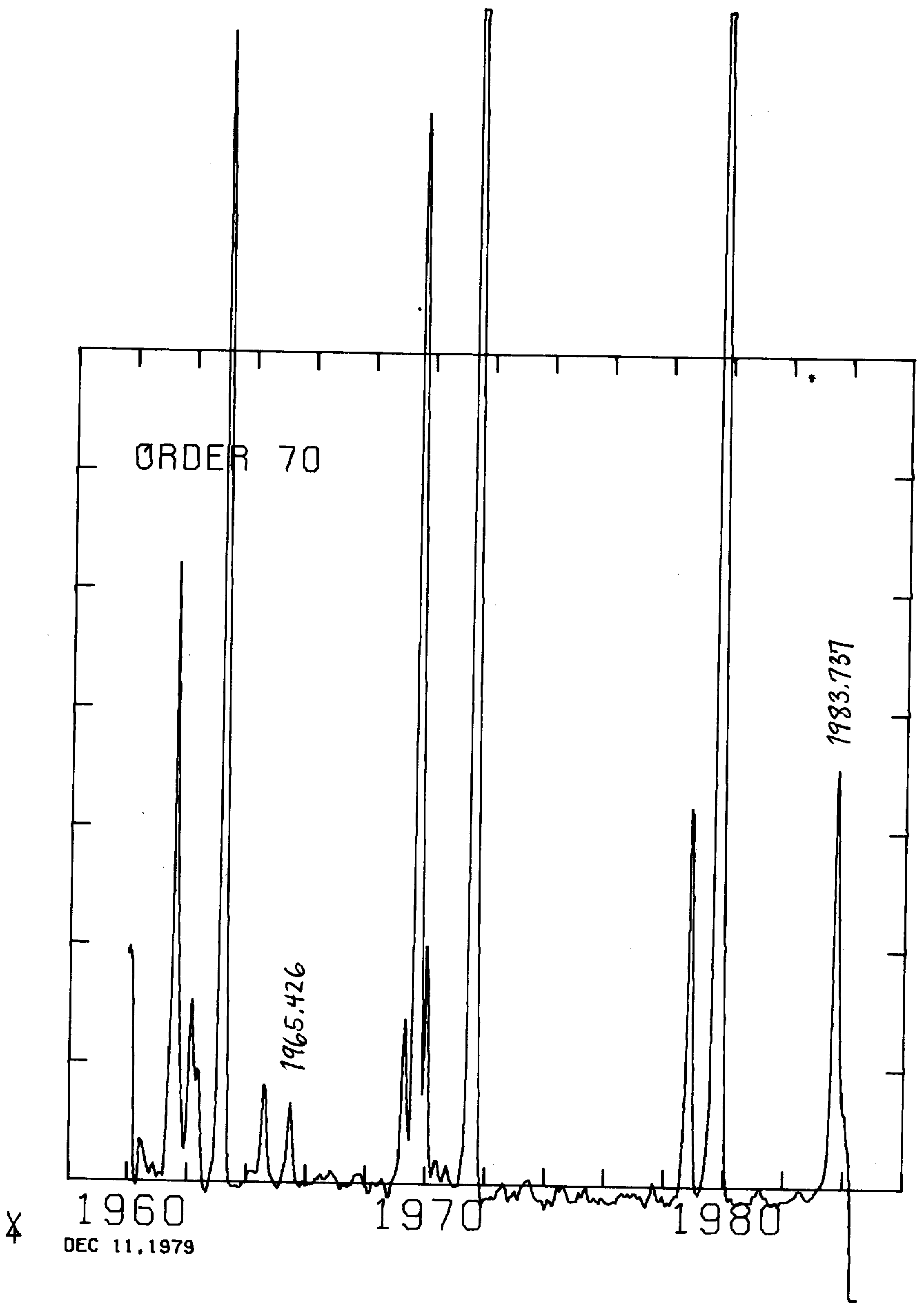


ORDER 73
1894.995
1891.526
1880
1890
1900
DEC 11, 1979

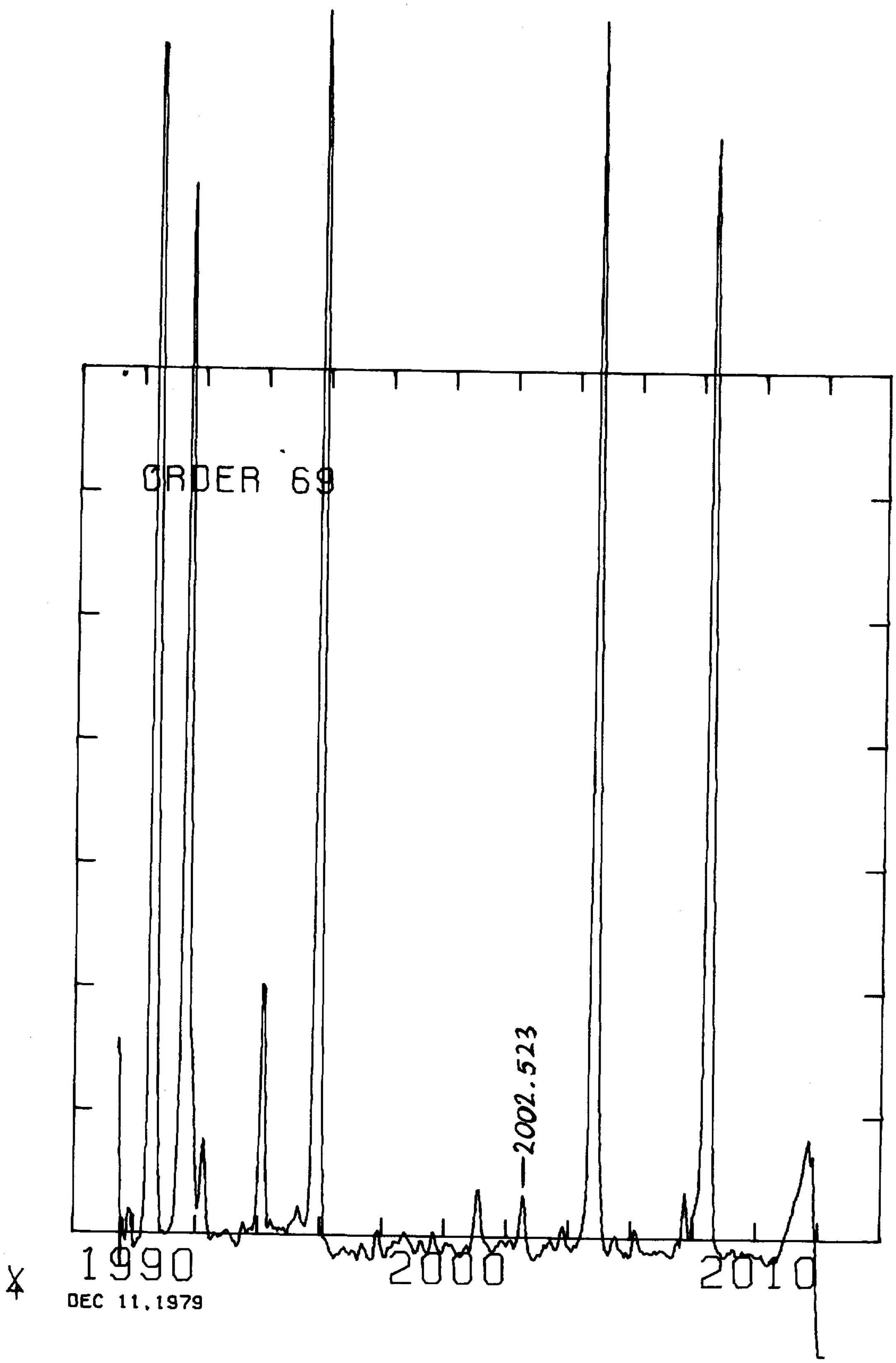


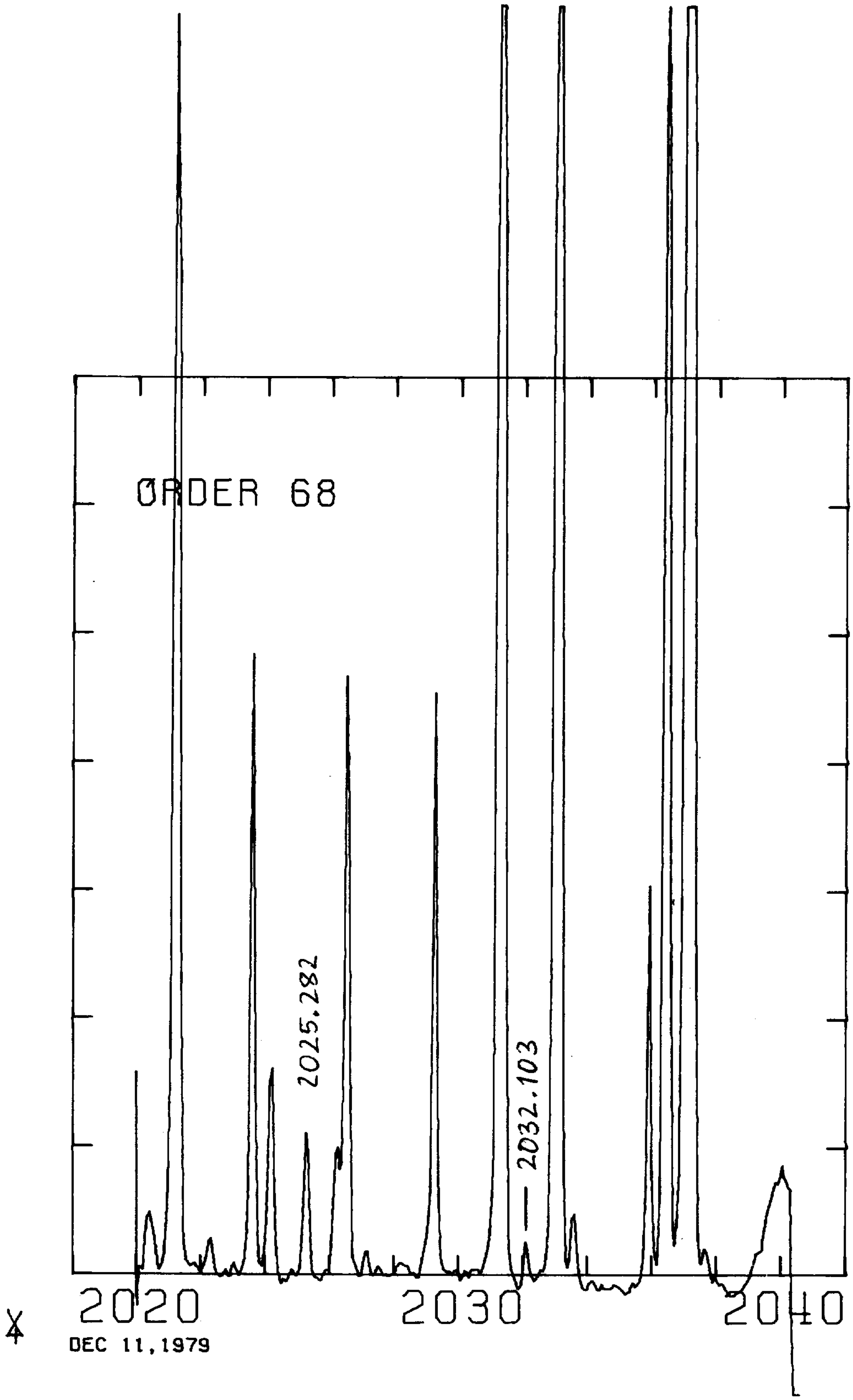
DEC 11,1979


ORDER 71
1933.529
1951.764
1954.734
1930
1940
1950
DEC 11,1979

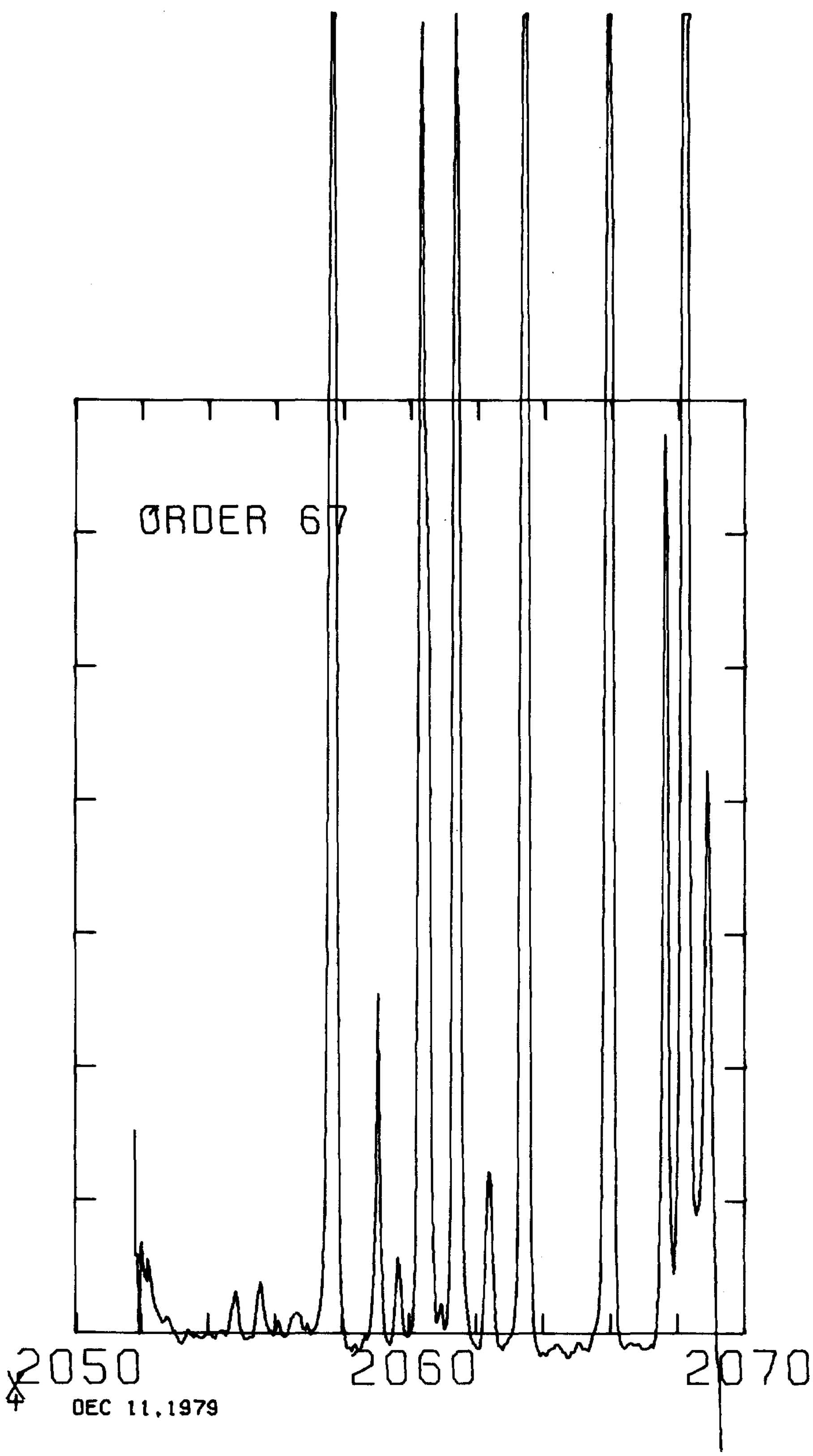


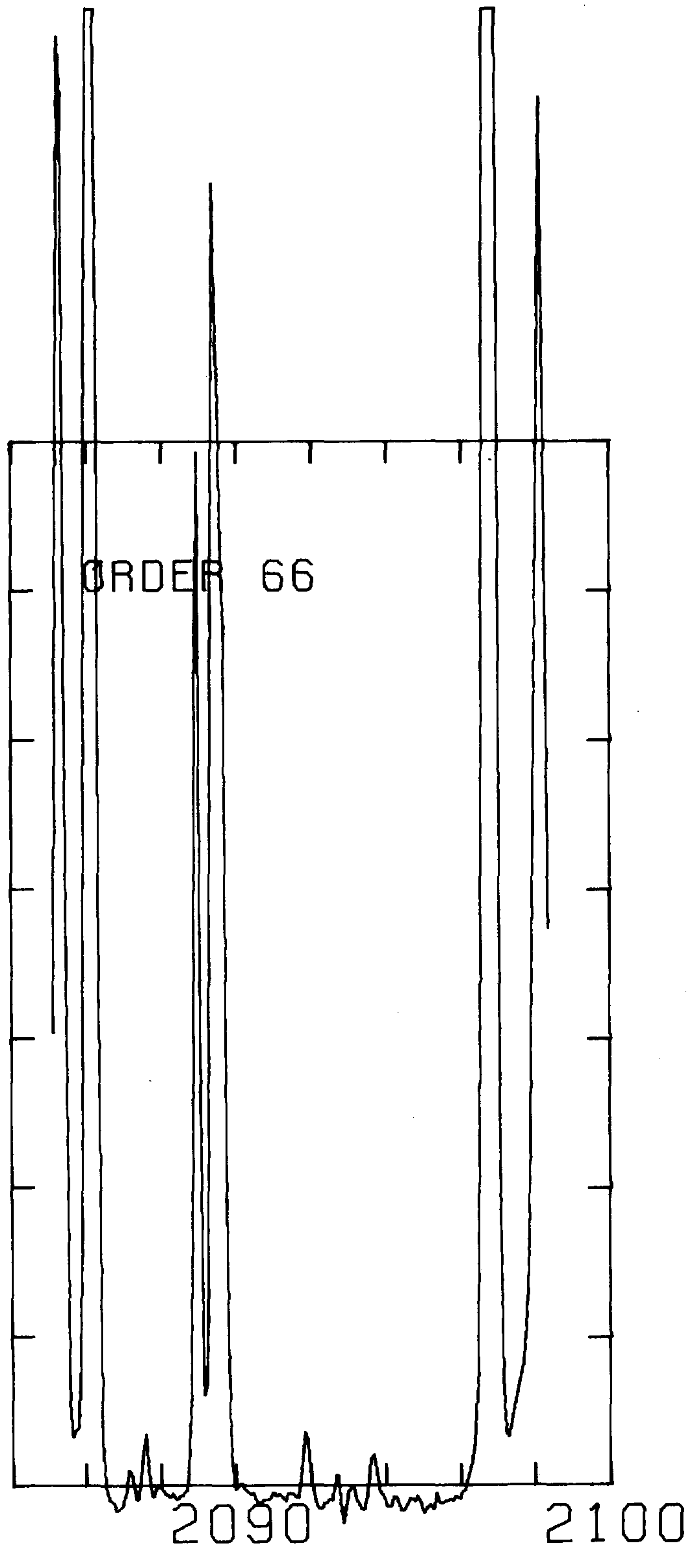
ØRDER 70
1965.426
1983.737
1960
1970
1980
DEC 11,1979


ORDER 69
2002.523
1990
2000
2010
X
DEC 11,1979



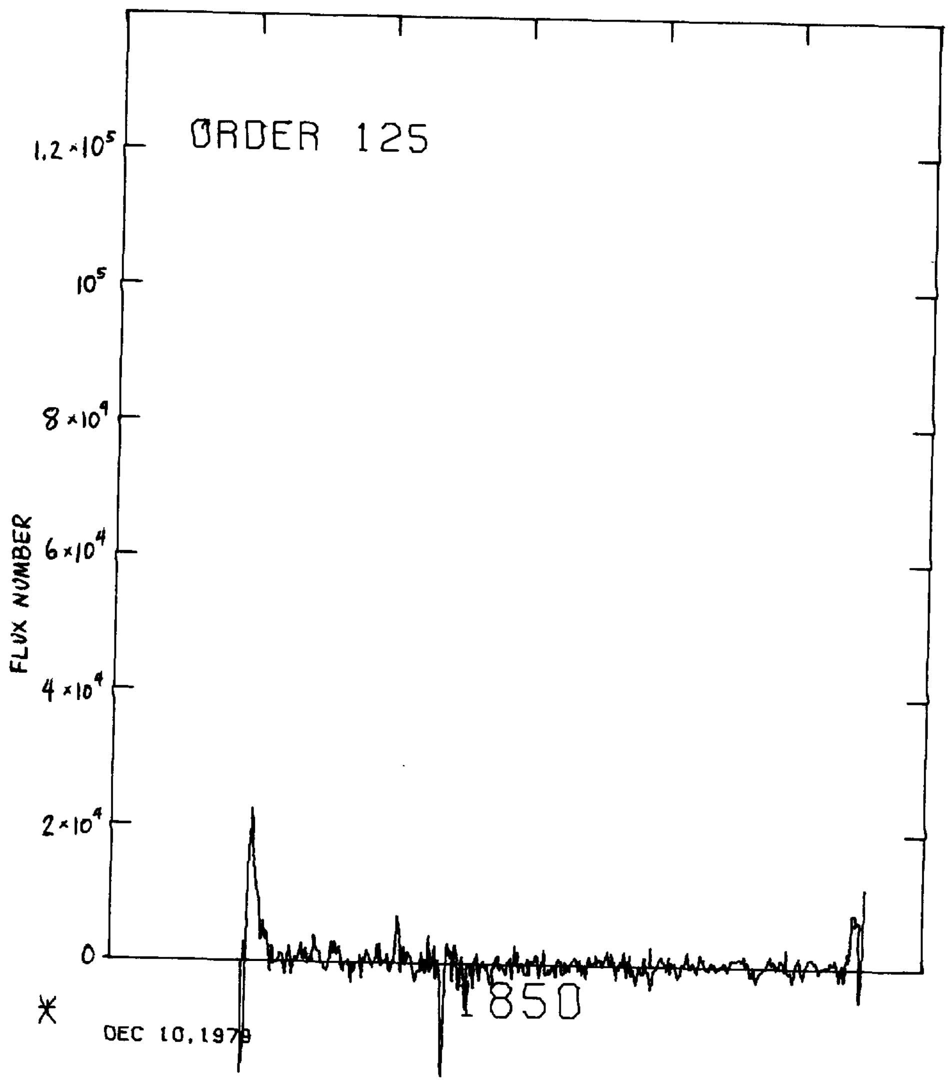
ØRDER 68
2025.282
2032.103
2020
2030
2040
DEC 11,1979


ØRDER 67
2050
2060
2070
DEC 11,1979

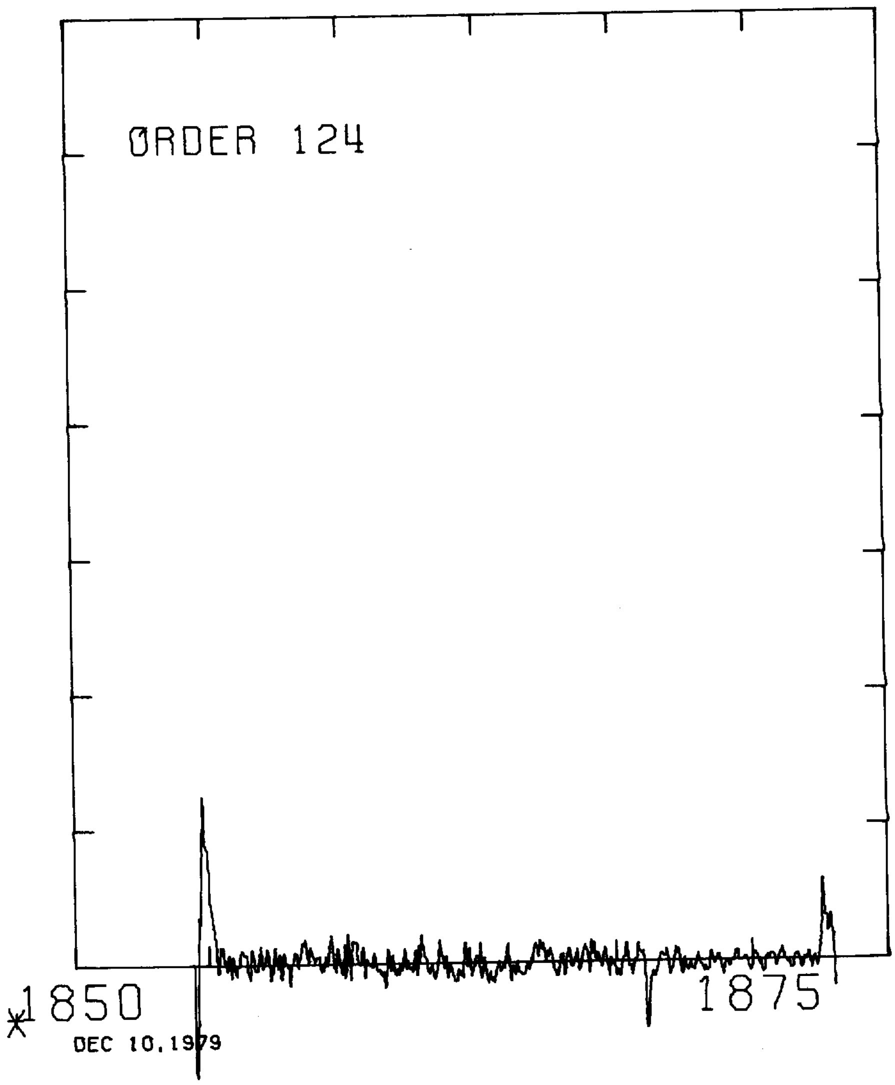


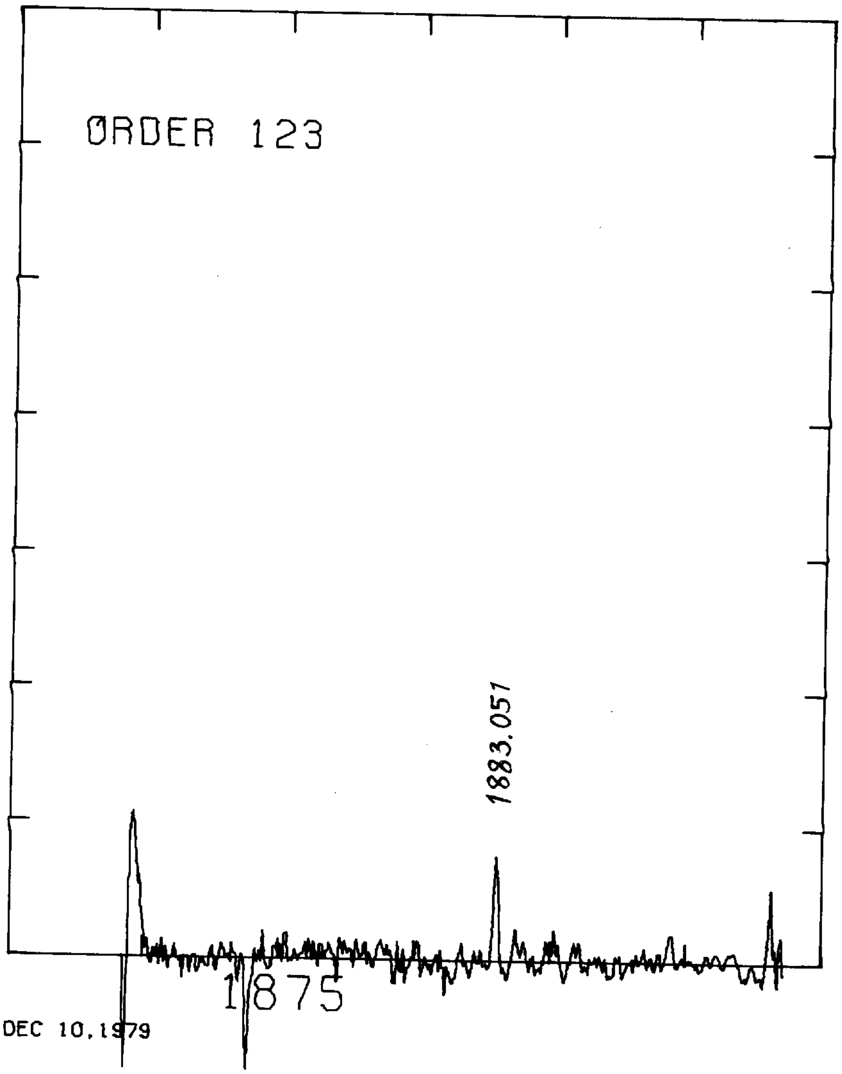
X
DEC 11,1979

FIGURE 4



ØRDER 125
1.2×10⁵
10⁵
8×10⁴
6×10⁴
4×10⁴
2×10⁴
0
FLUX NUMBER
1850
DEC 10, 1979


ØRDER 124
1850
1875
DEC 10,1979



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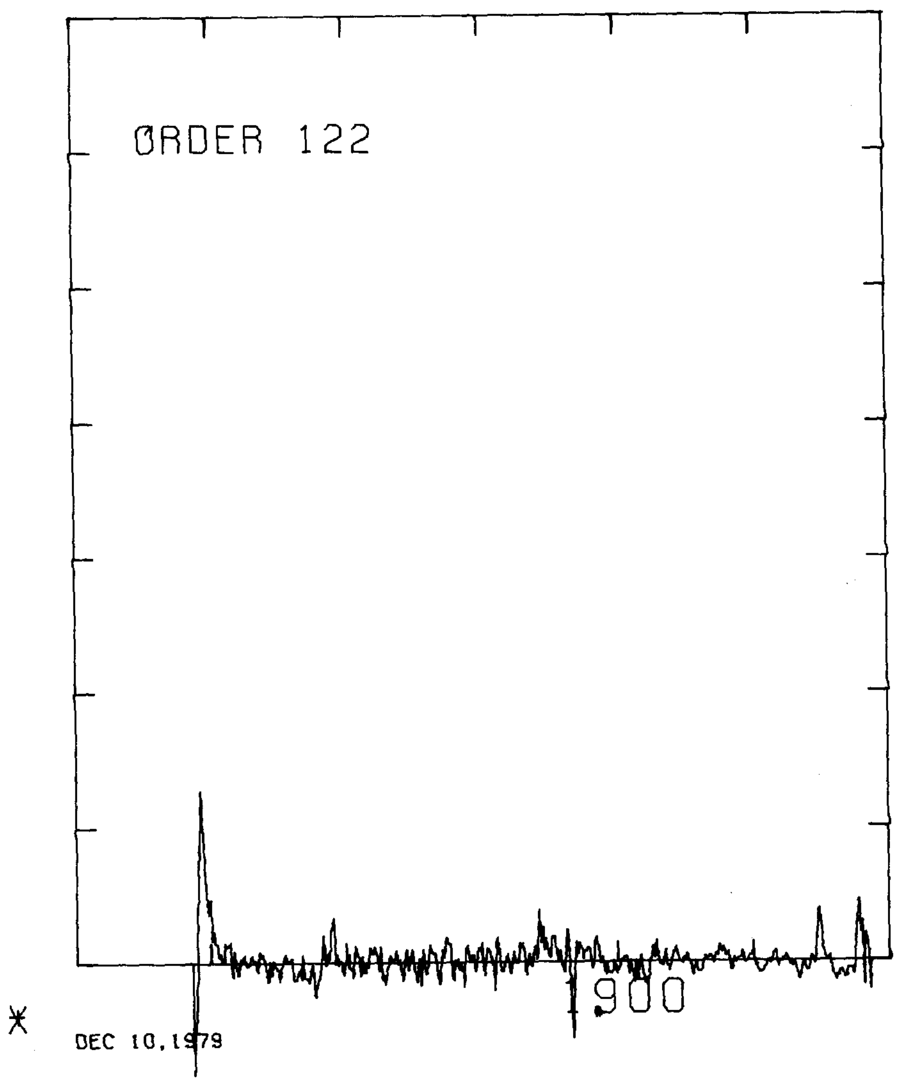
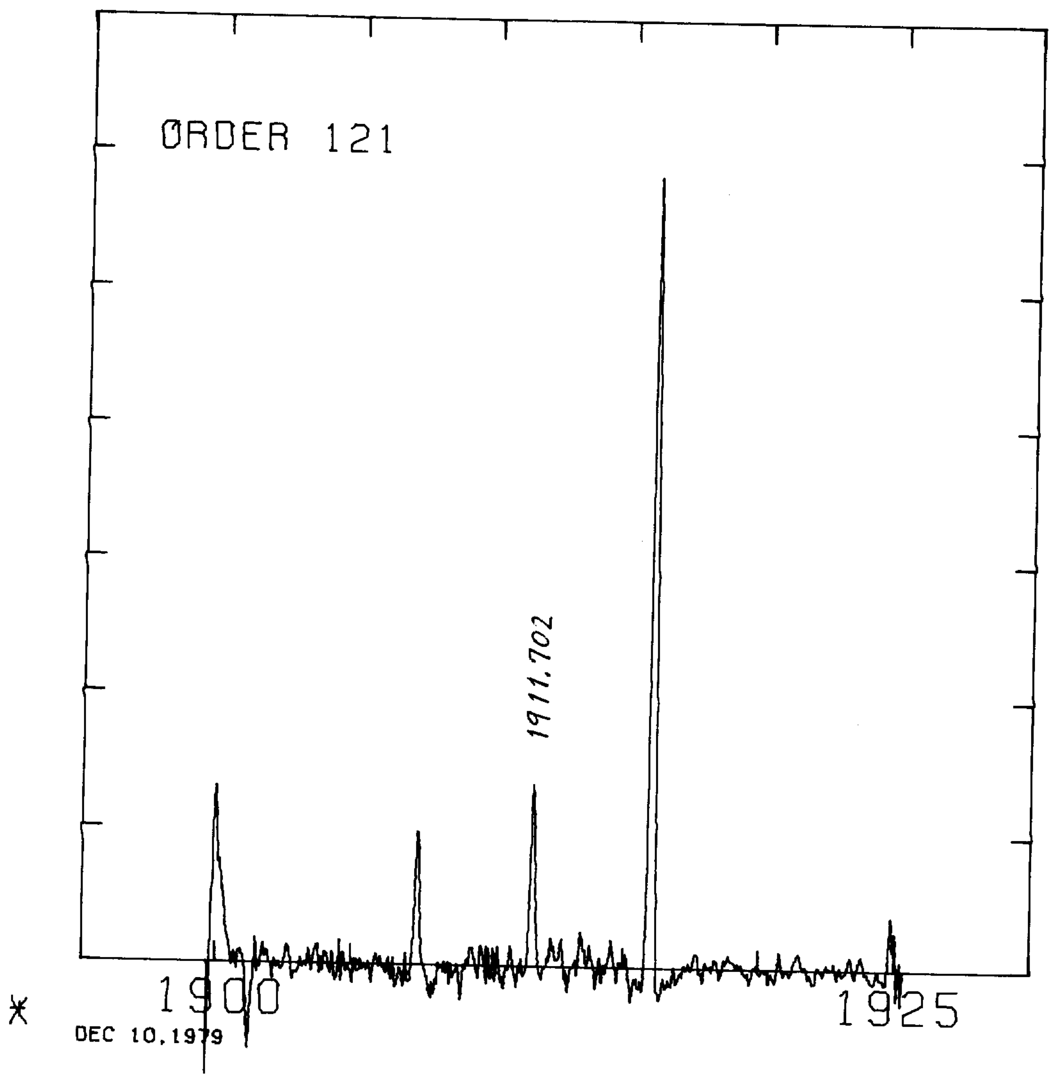
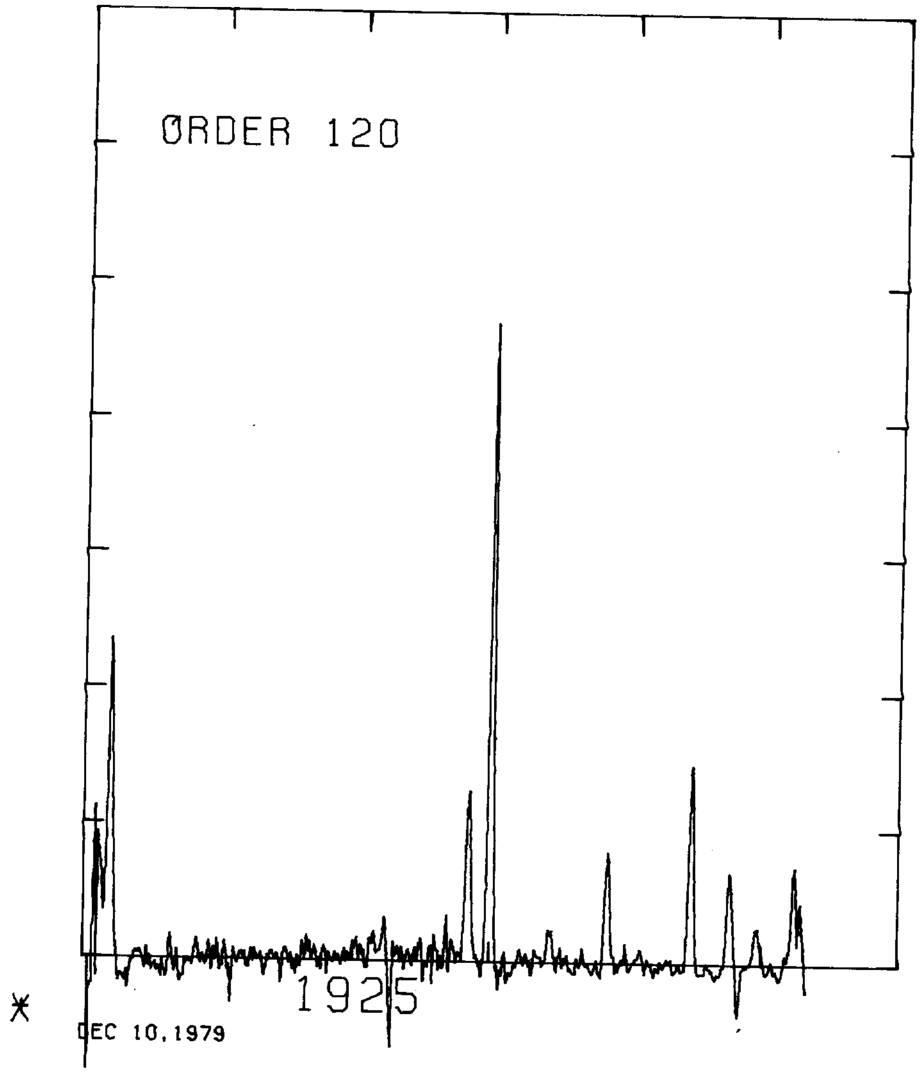
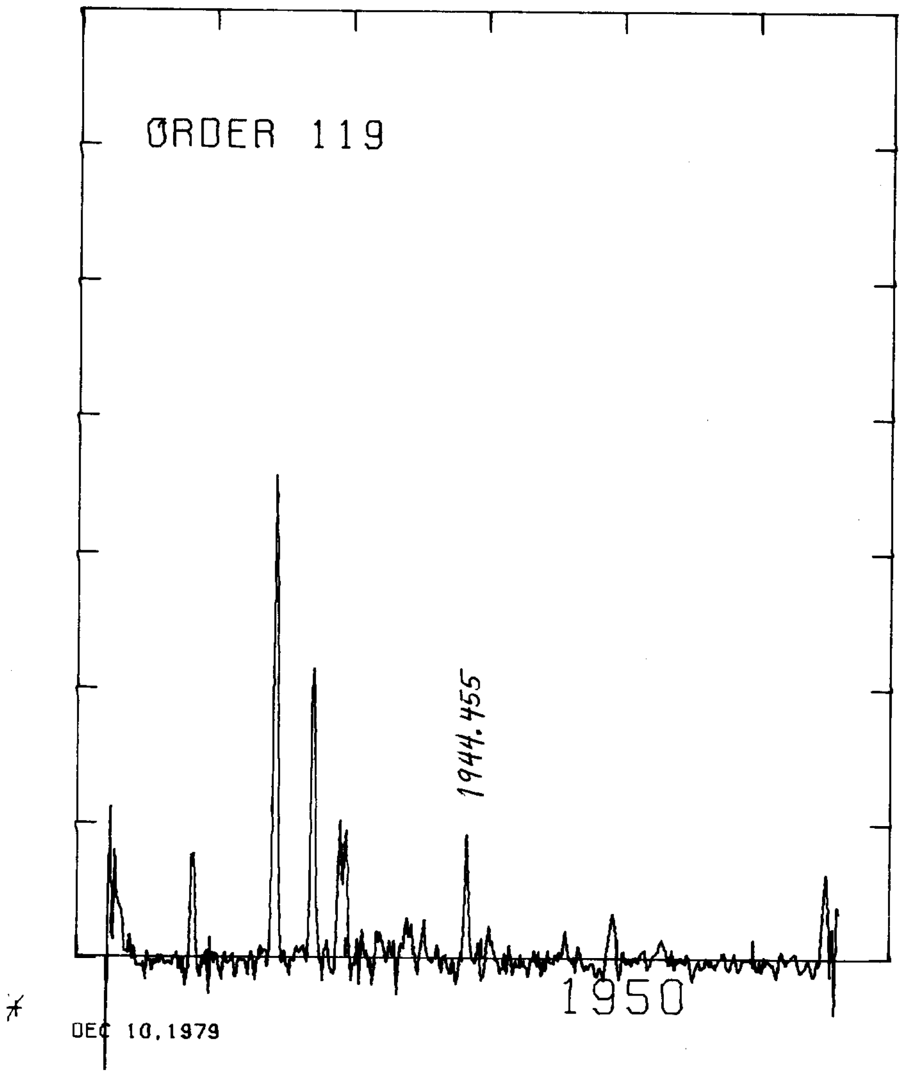
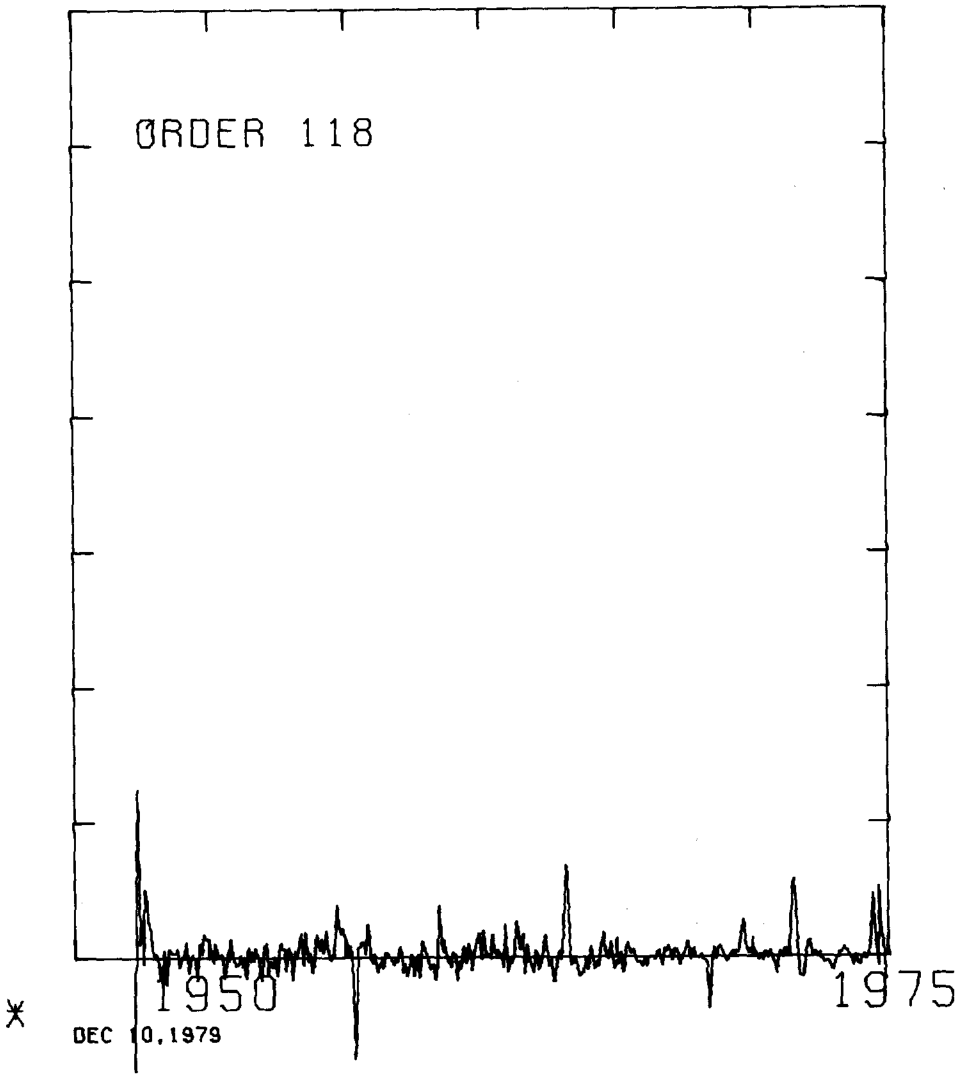
DEC 10,1979

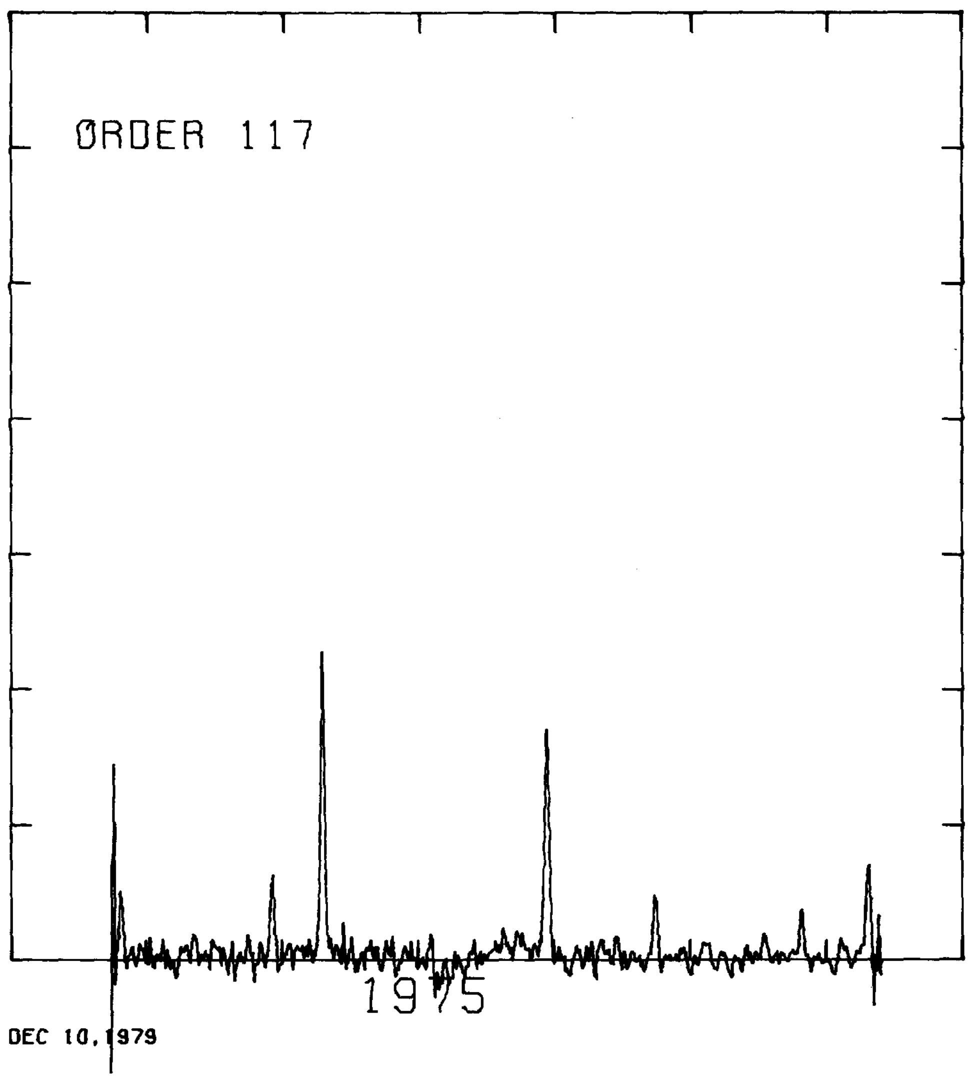

ØRDER 122
1900
DEC 10,1979


ORDER 121
1911.702
1900
1925
DEC 10,1979


ØRDER 120
1925
DEC 10, 1979


ORDER 119
1944.455
1950
DEC 10,1979


ØRDER 118
1950
1975
DEC 10,1979



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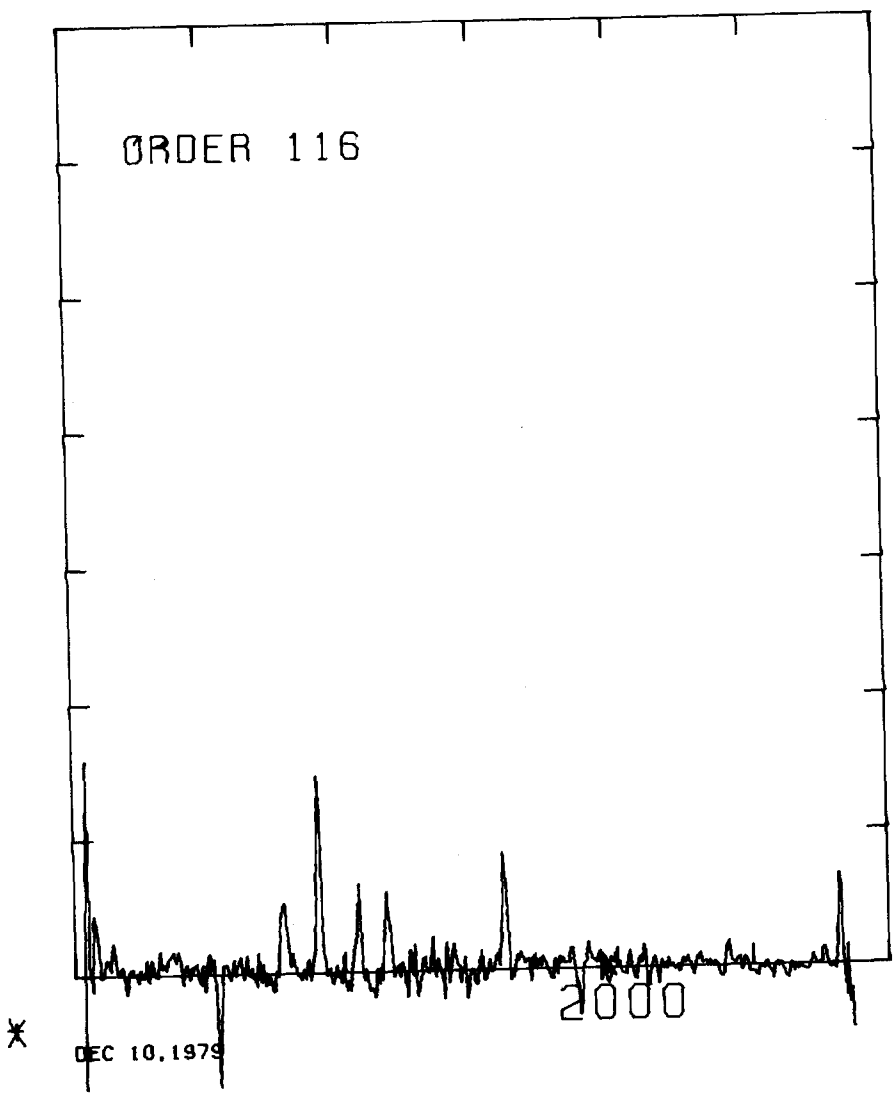
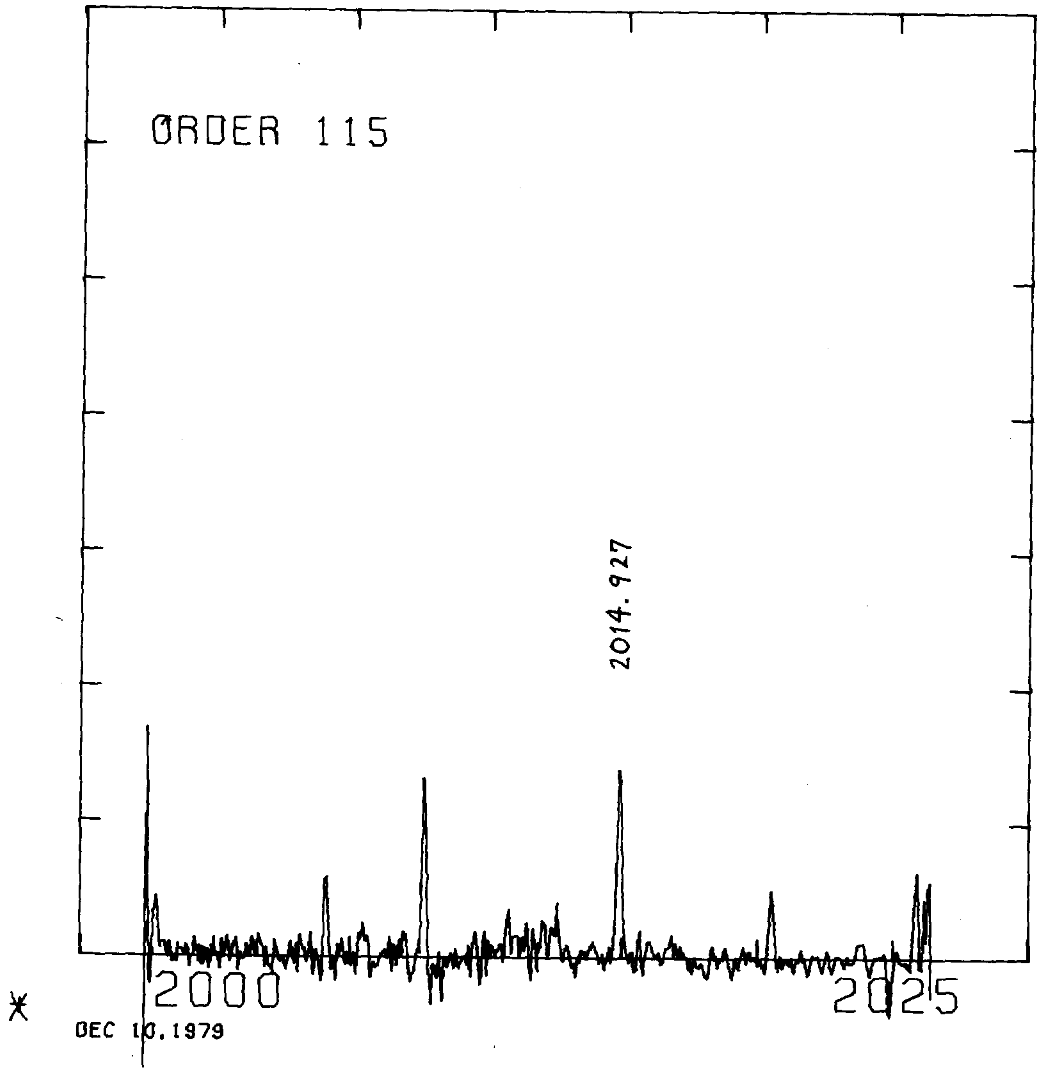
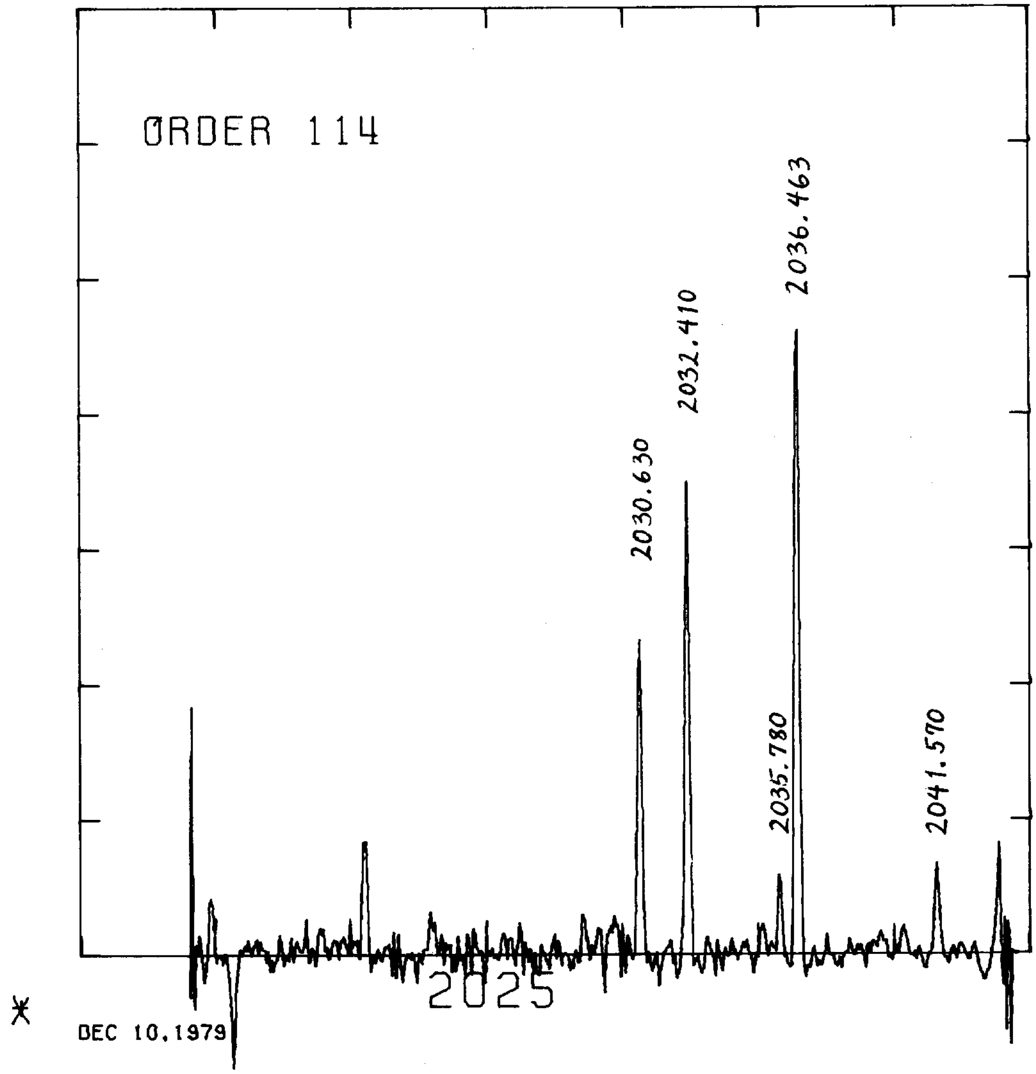
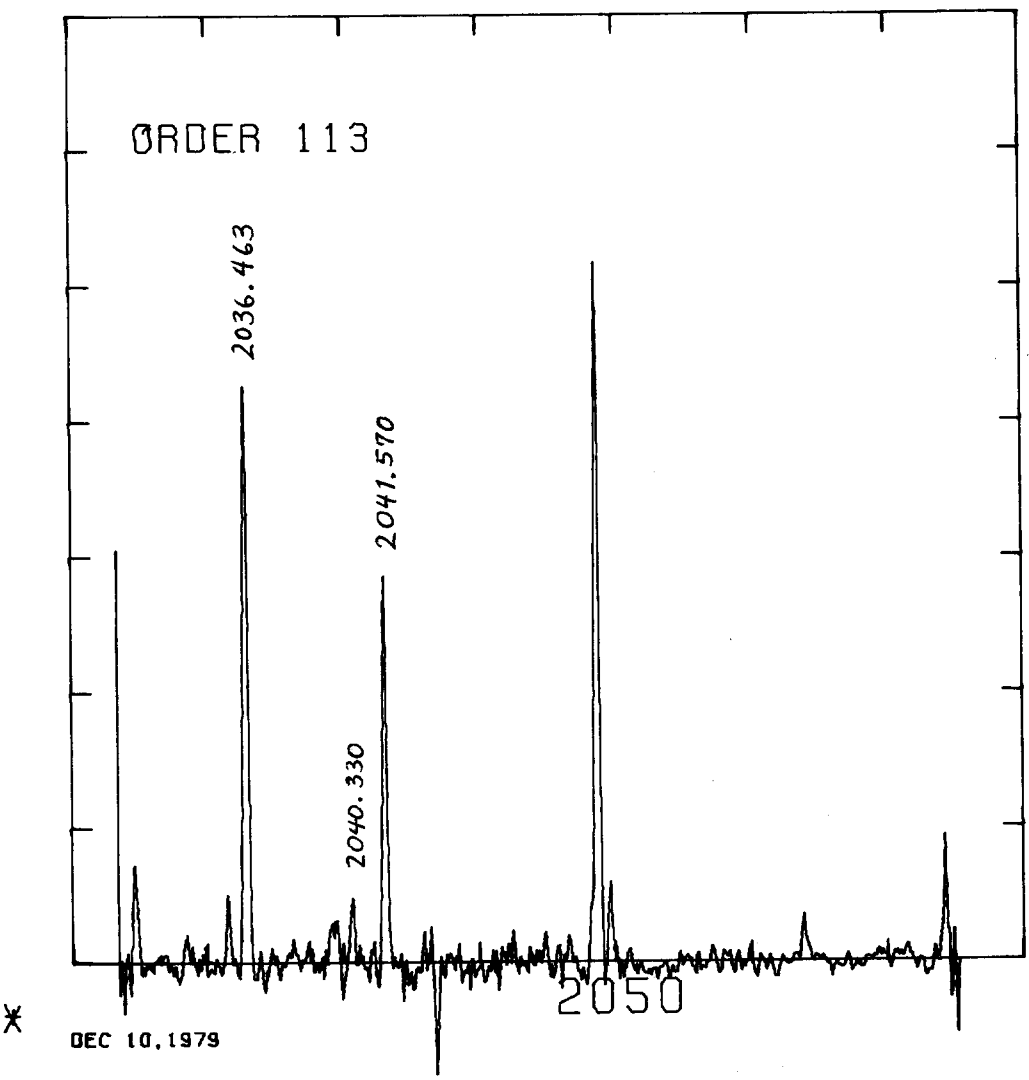
DEC 10,1979

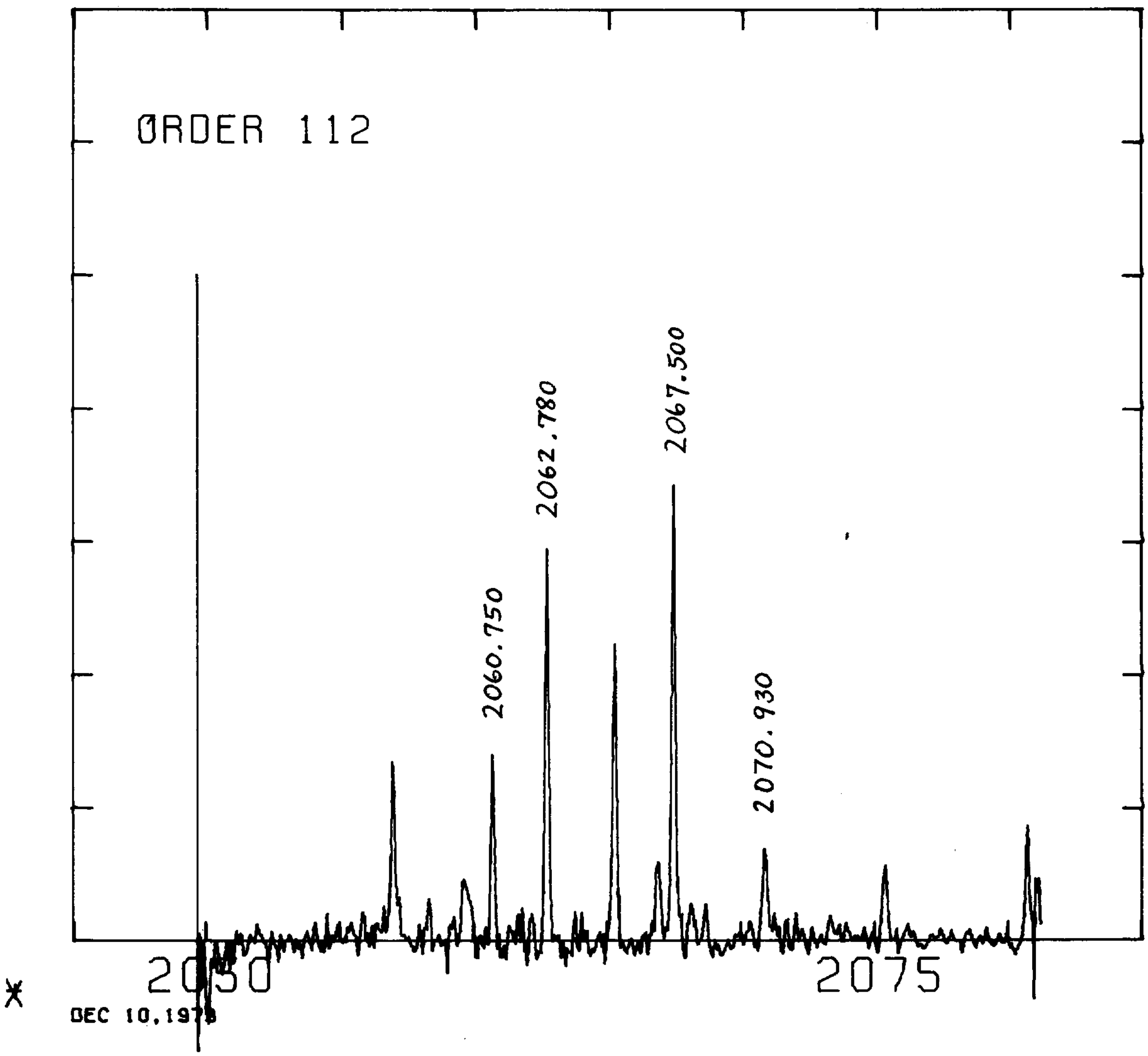

ØRDER 116
2000
DEC 10,1979


ØRDER 115
2014.927
2000
2025
DEC 10,1979

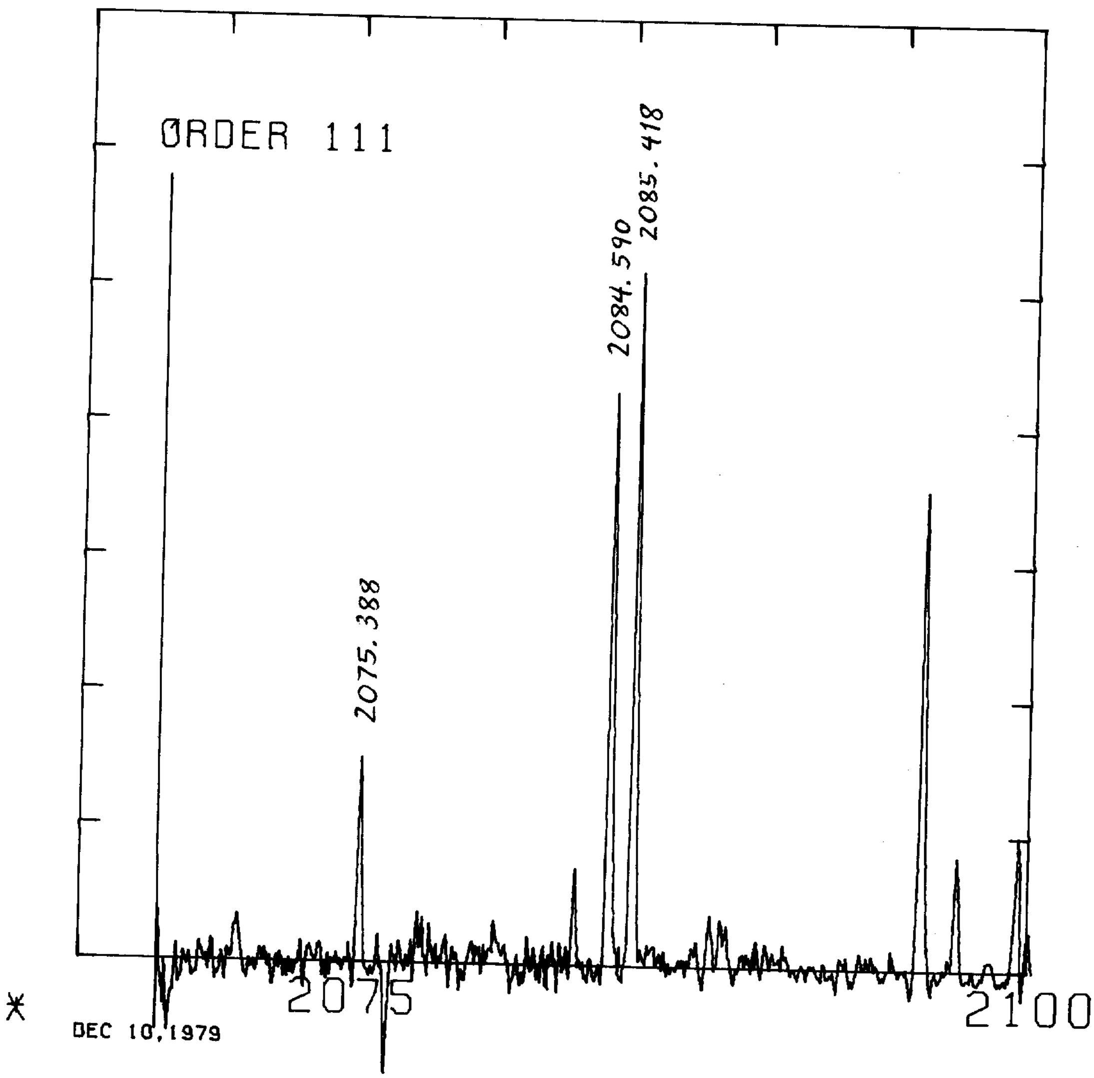


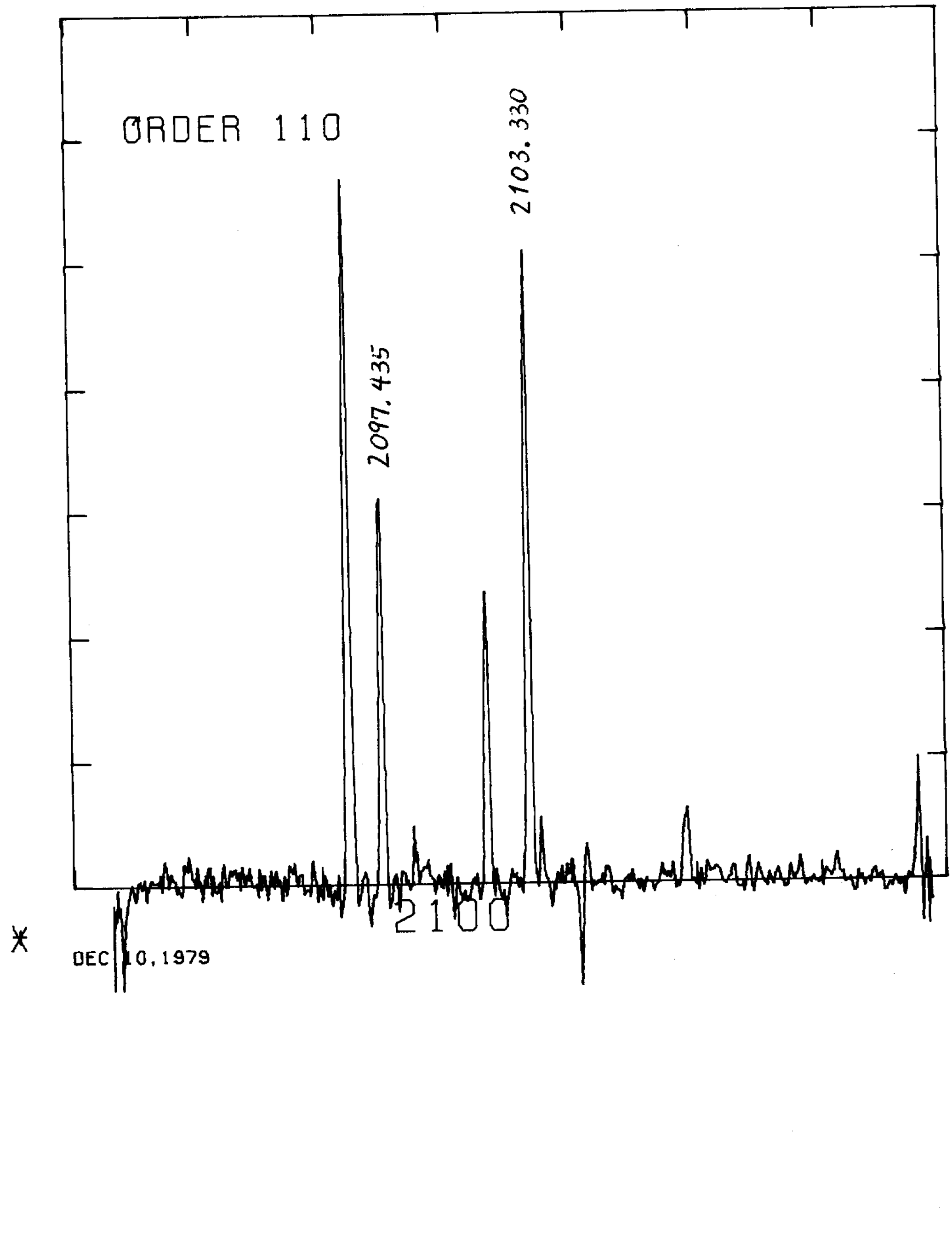
ØRDER 114
2036.463
2032.410
2030.630
2035.780
2041.590
2025
DEC 10,1979

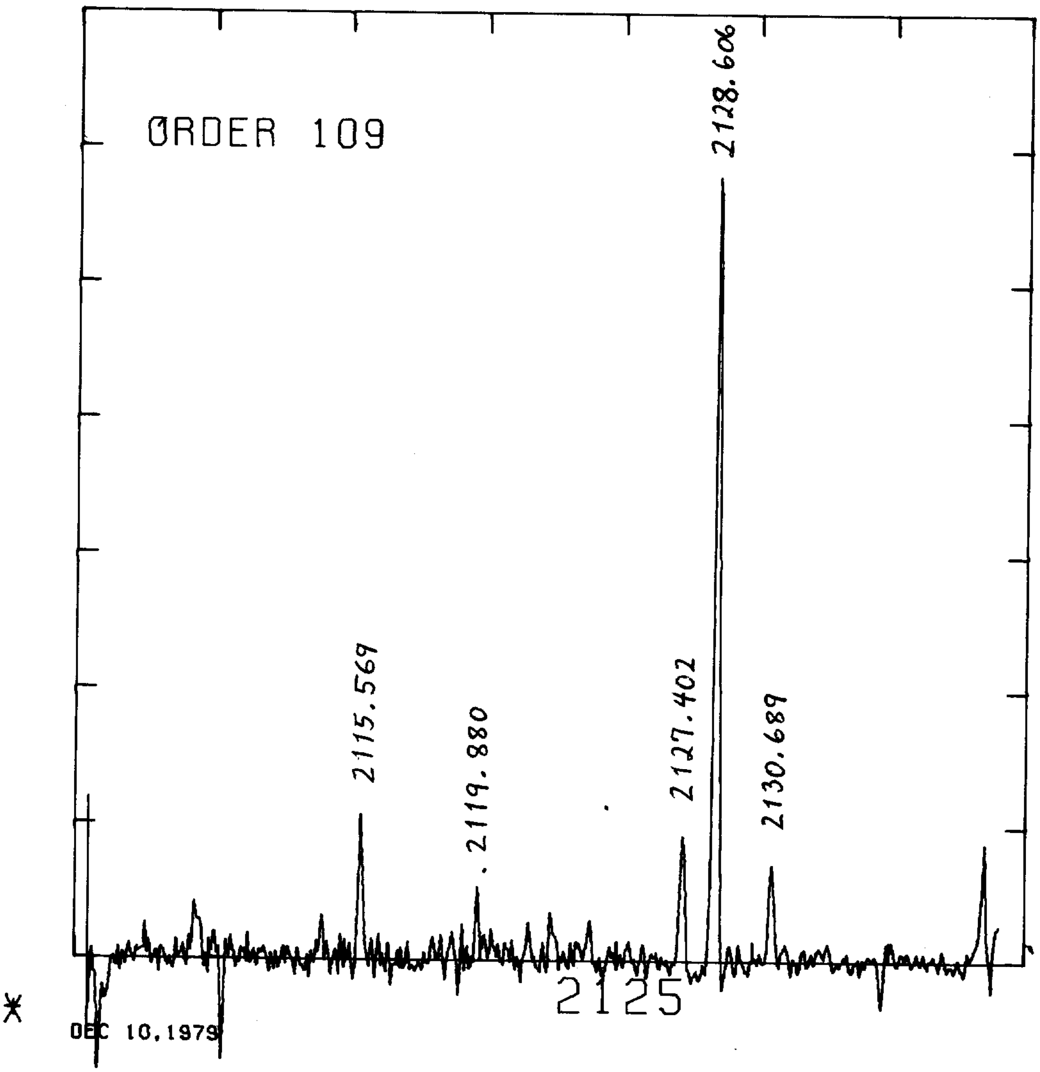

ØRDER 113
2036.463
2041.570
2040.330
2050
DEC 10,1979

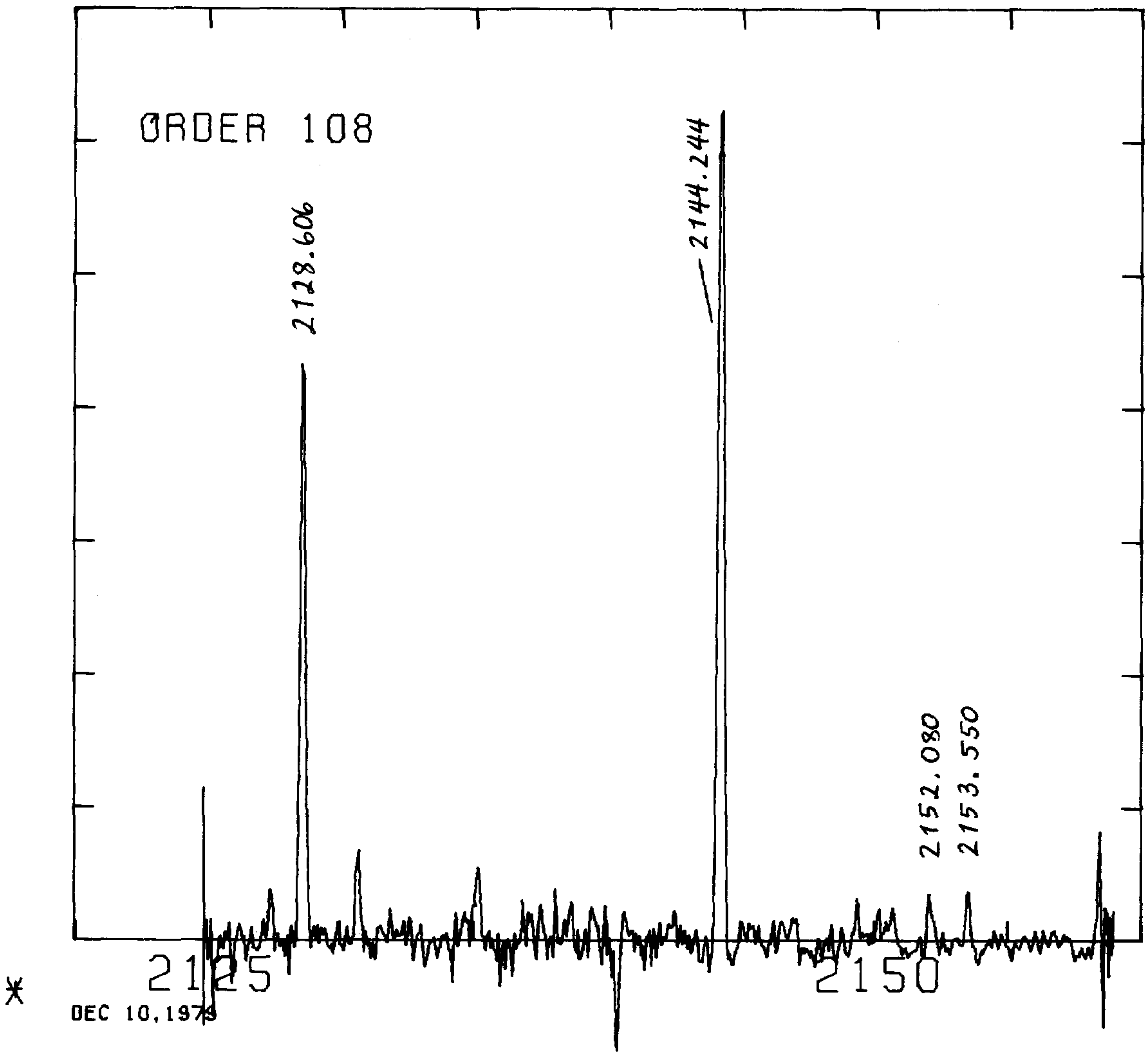


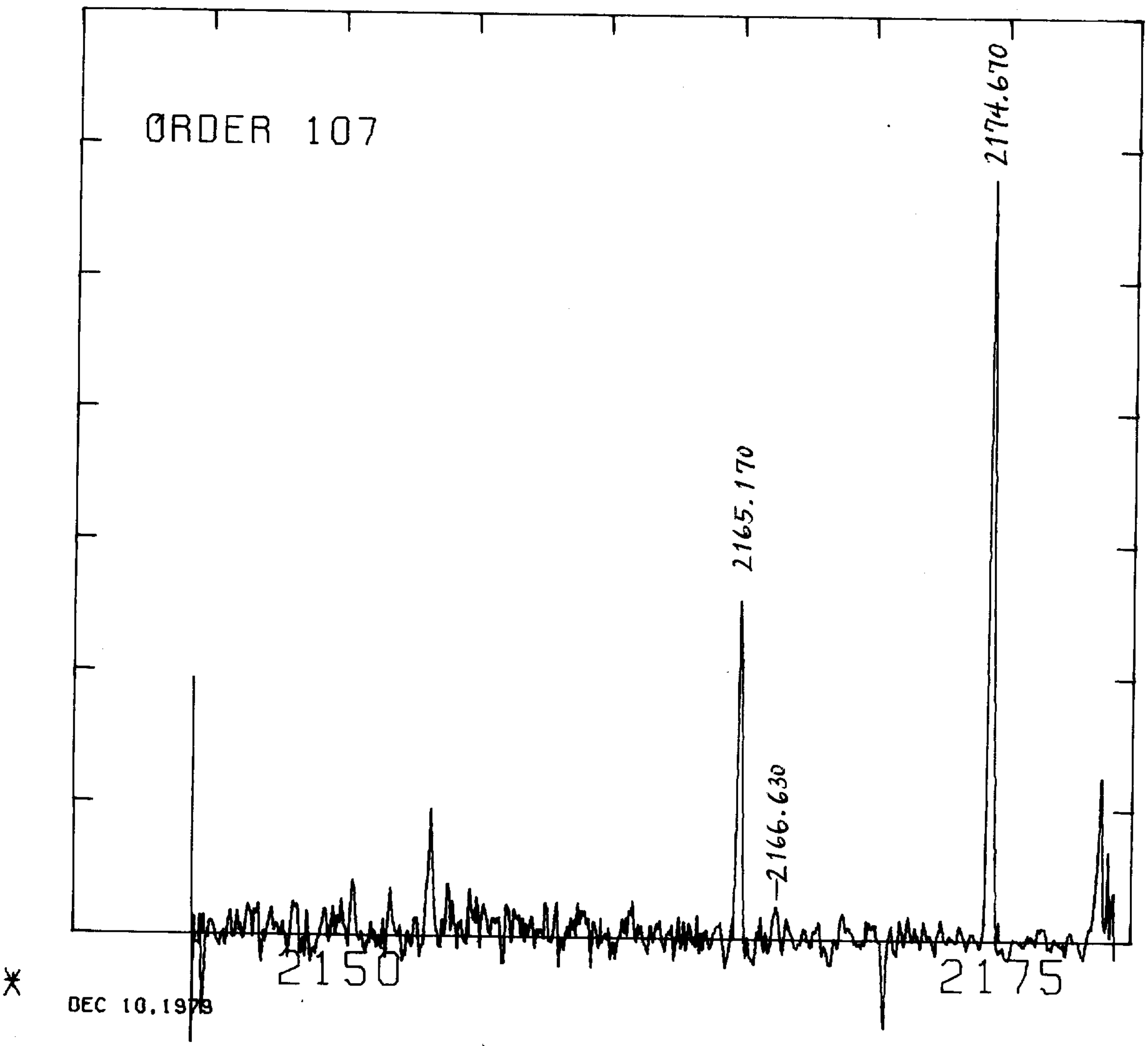
ØRDER 112
2060.750
2062.780
2067.500
2070.930
2050
2075
DEC 10,1979

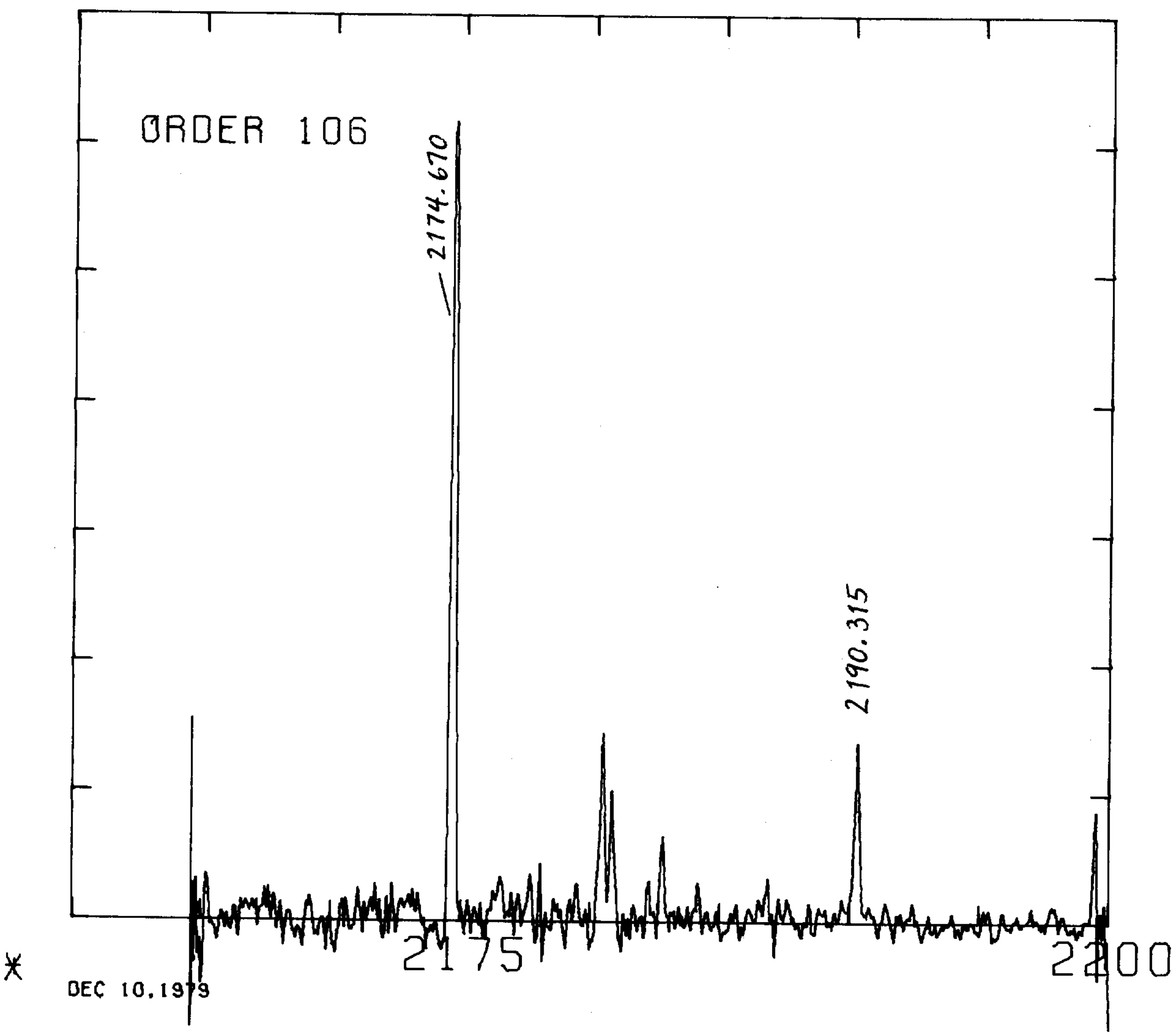

ØRDER 111
2075.388
2084.590
2085.418
2075
2100
DEC 10,1979

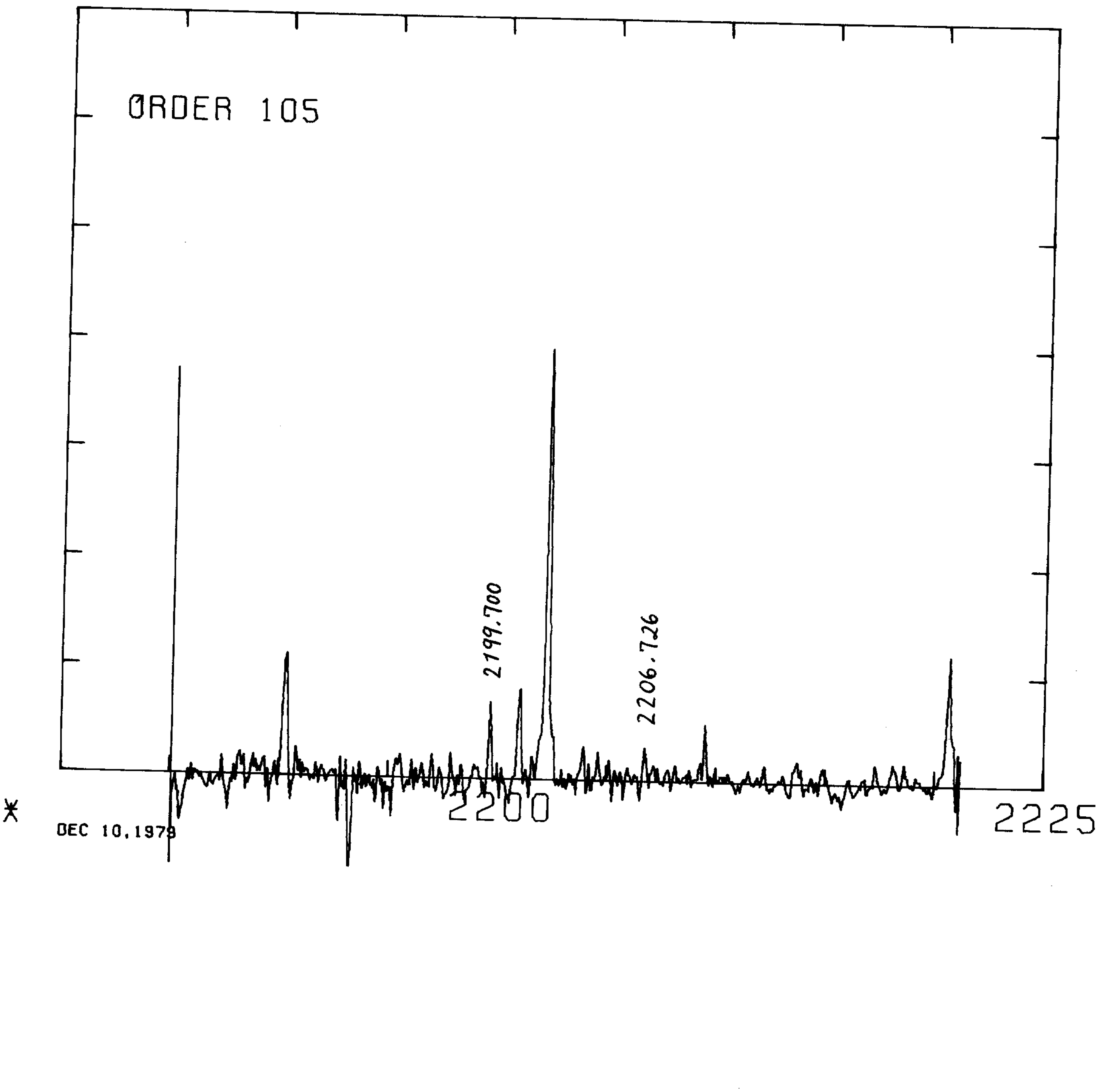

ØRDER 110
2097.435
2103.330
2100
DEC 10,1979

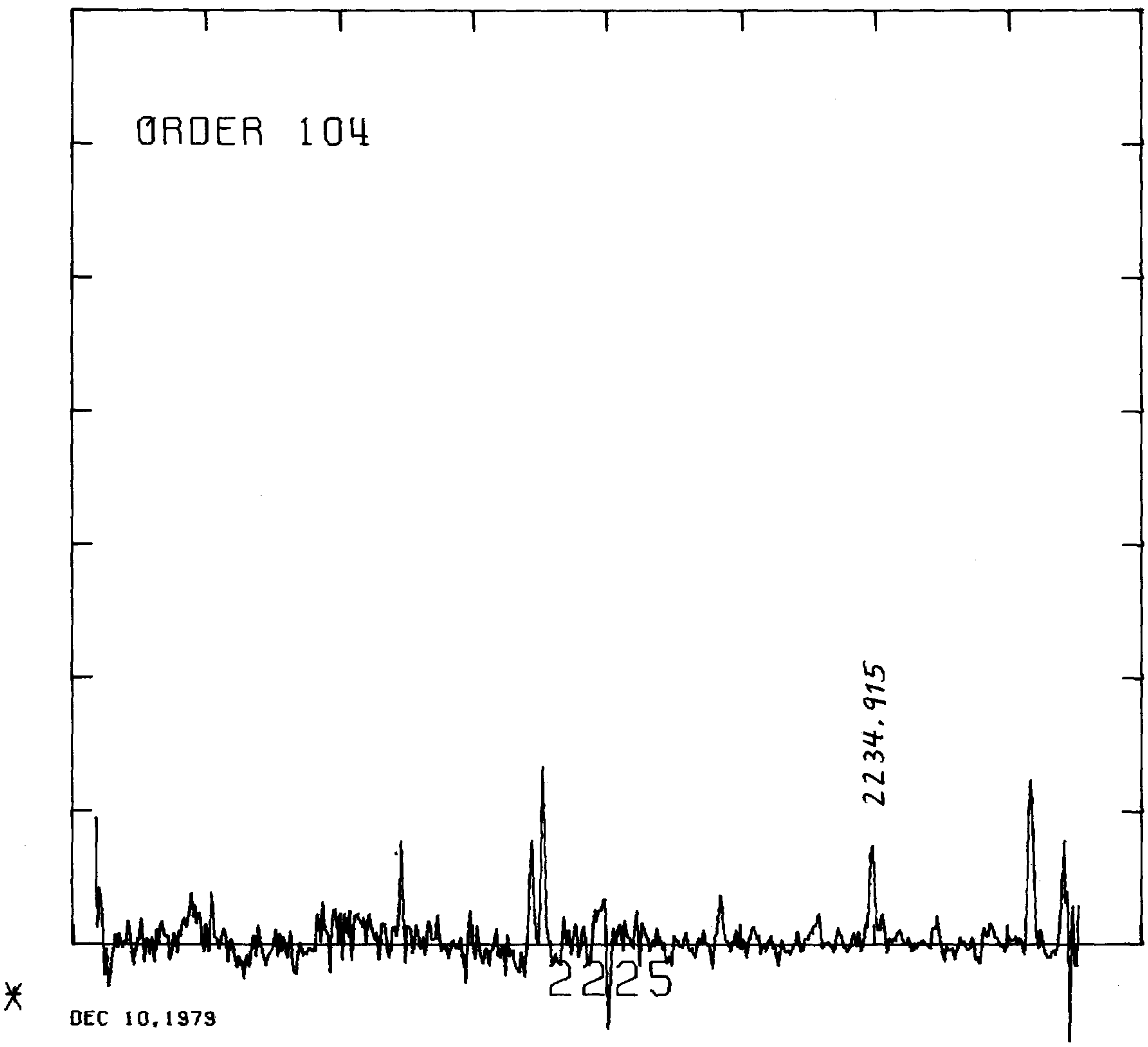

ORDER 109
2128.606
2115.569
2119.880
2127.402
2130.689
2125
DEC 10,1979

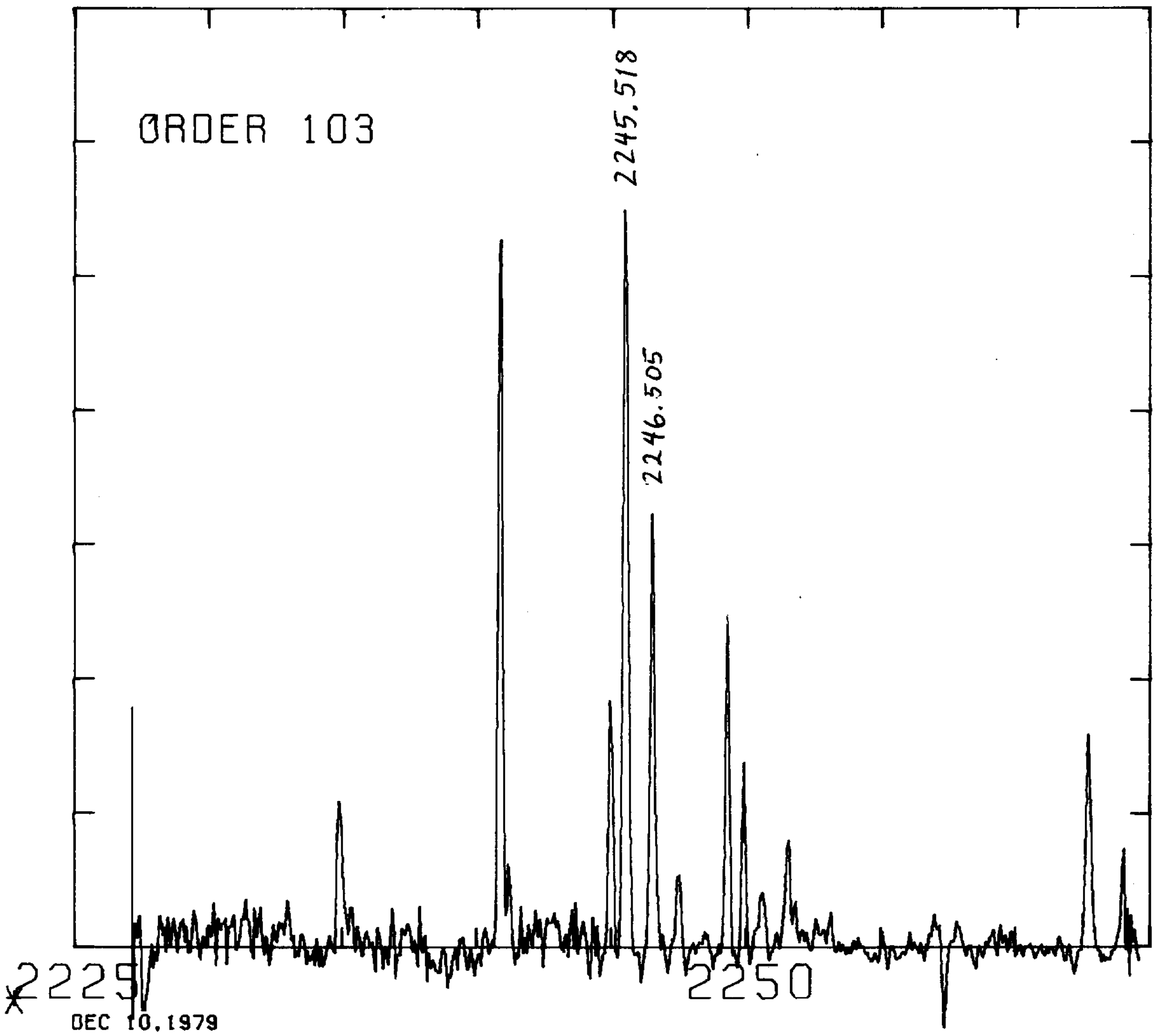

ORDER 108
2128.606
2144.244
2152.080
2153.550
2125
2150
DEC 10,1979

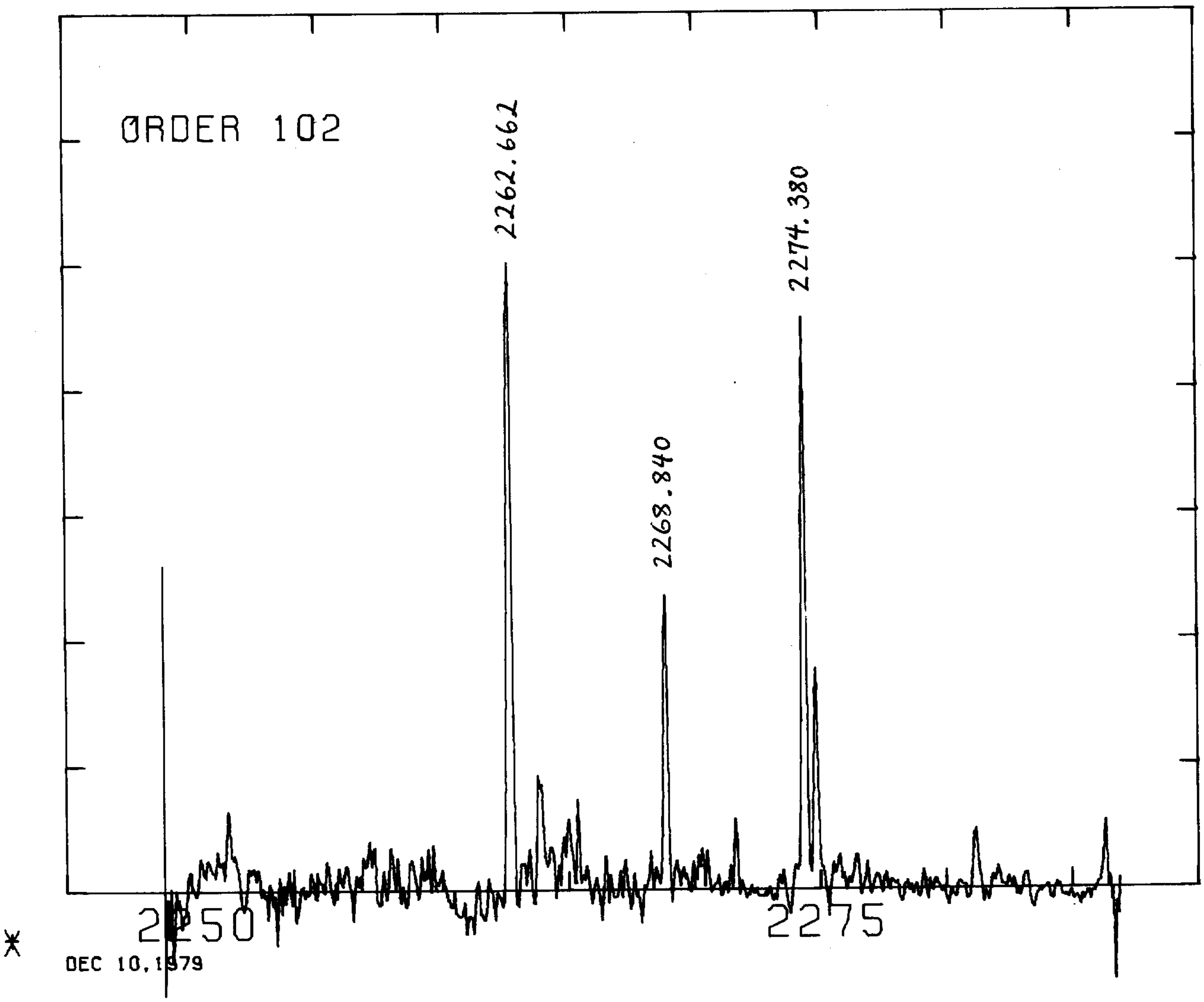

ØRDER 107
2174.670
2165.170
2166.630
2150
2175
DEC 10,1979

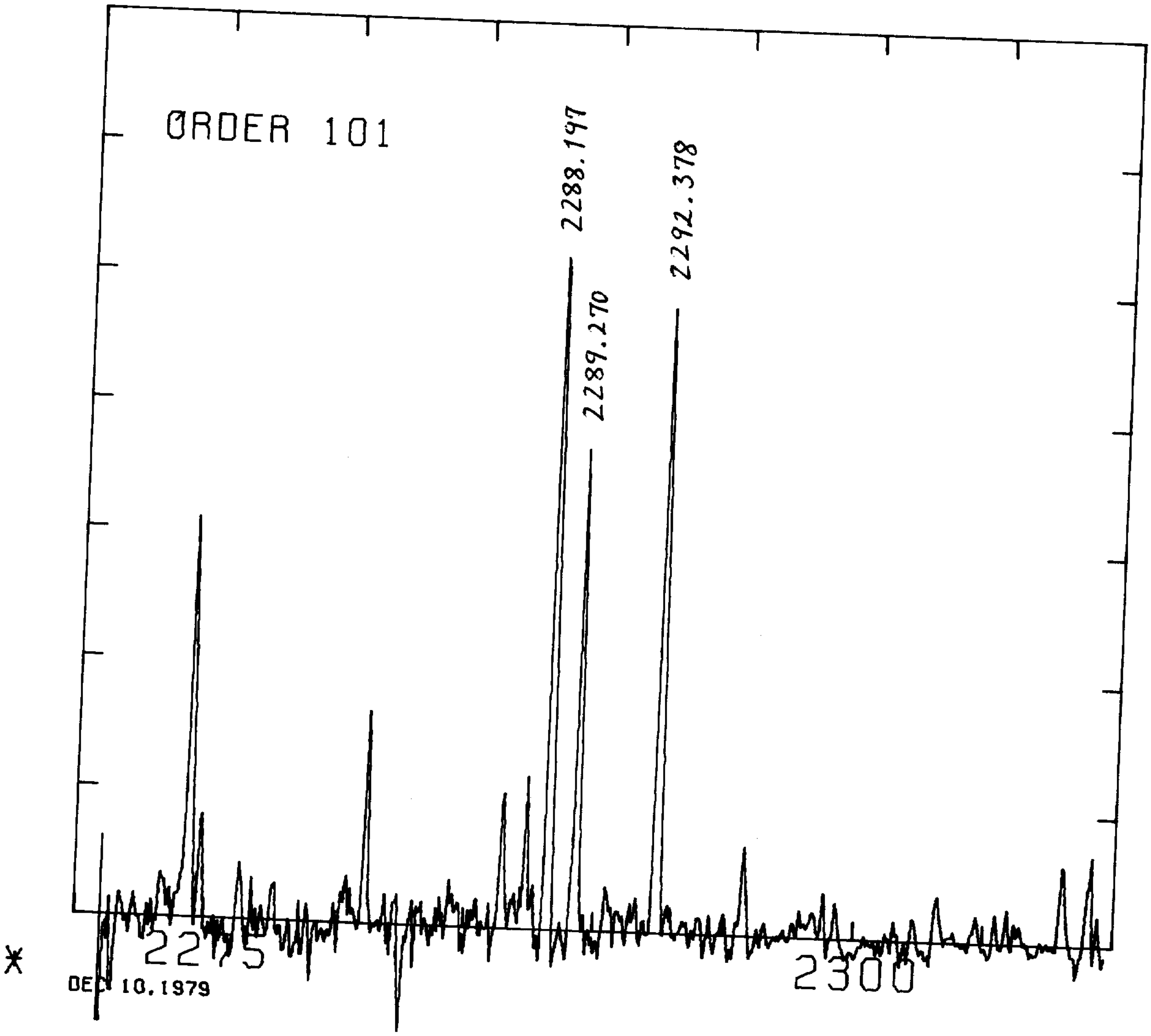

ØRDER 106
2174.670
2190.315
2175
2200
DEC 10,1979


ORDER 105
2199.700
2206.726
2200
2225
DEC 10,1979

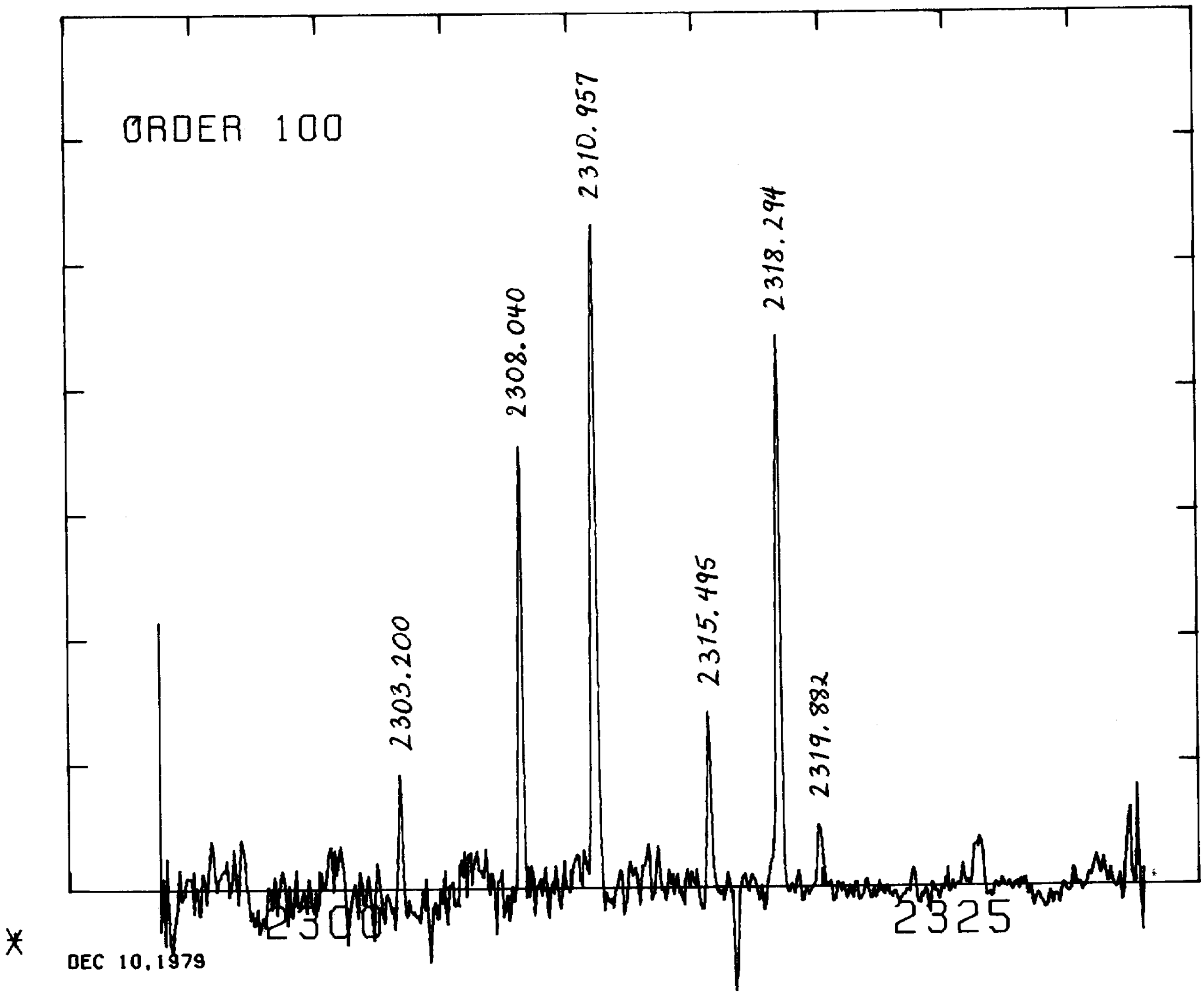

ORDER 104
2234.915
2225
DEC 10,1979


ORDER 103
2245.518
2246.505
2225
2250
DEC 10,1979

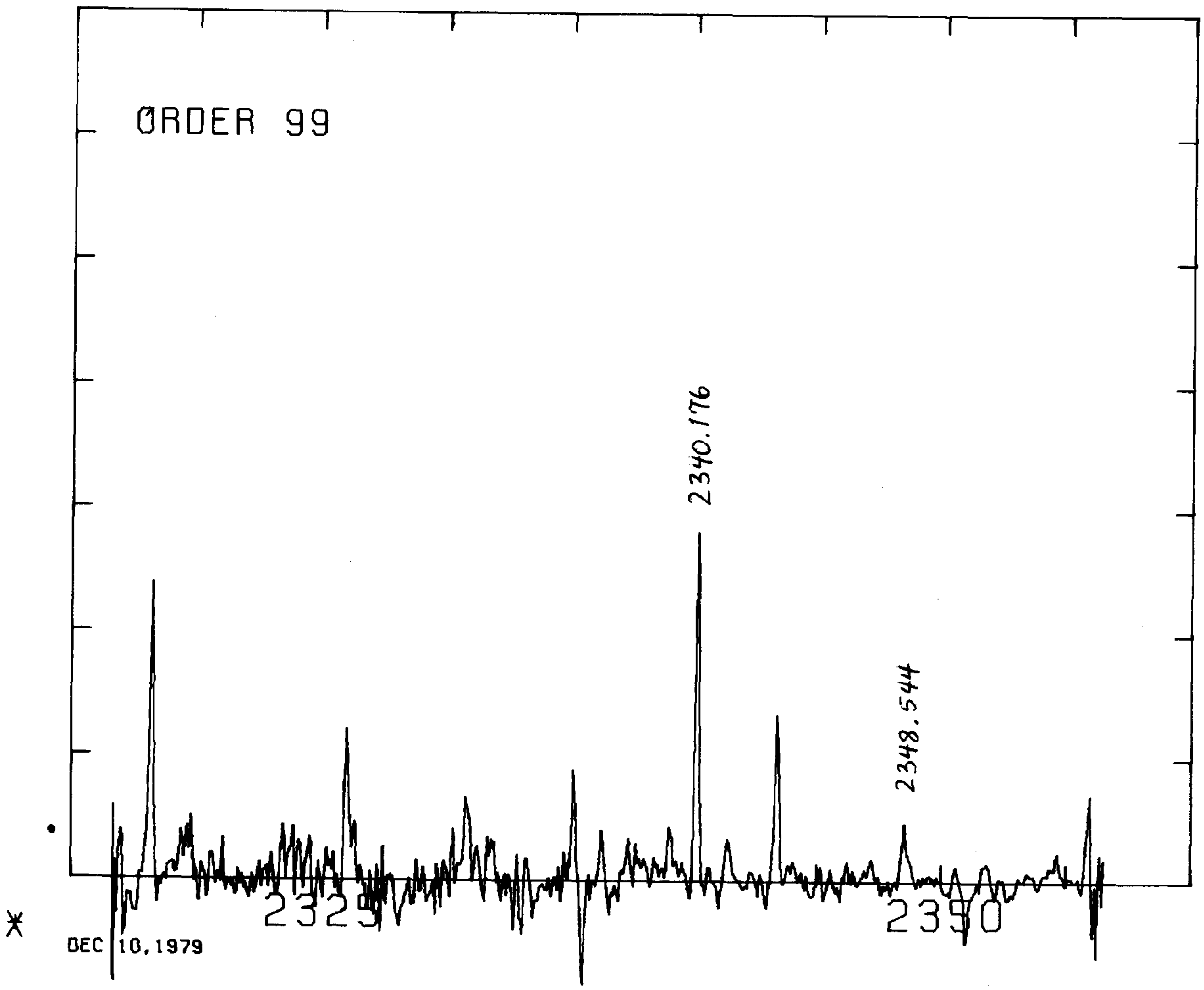

ØRDER 102
2262.662
2268.840
2274.380
2250
2275
DEC 10,1979

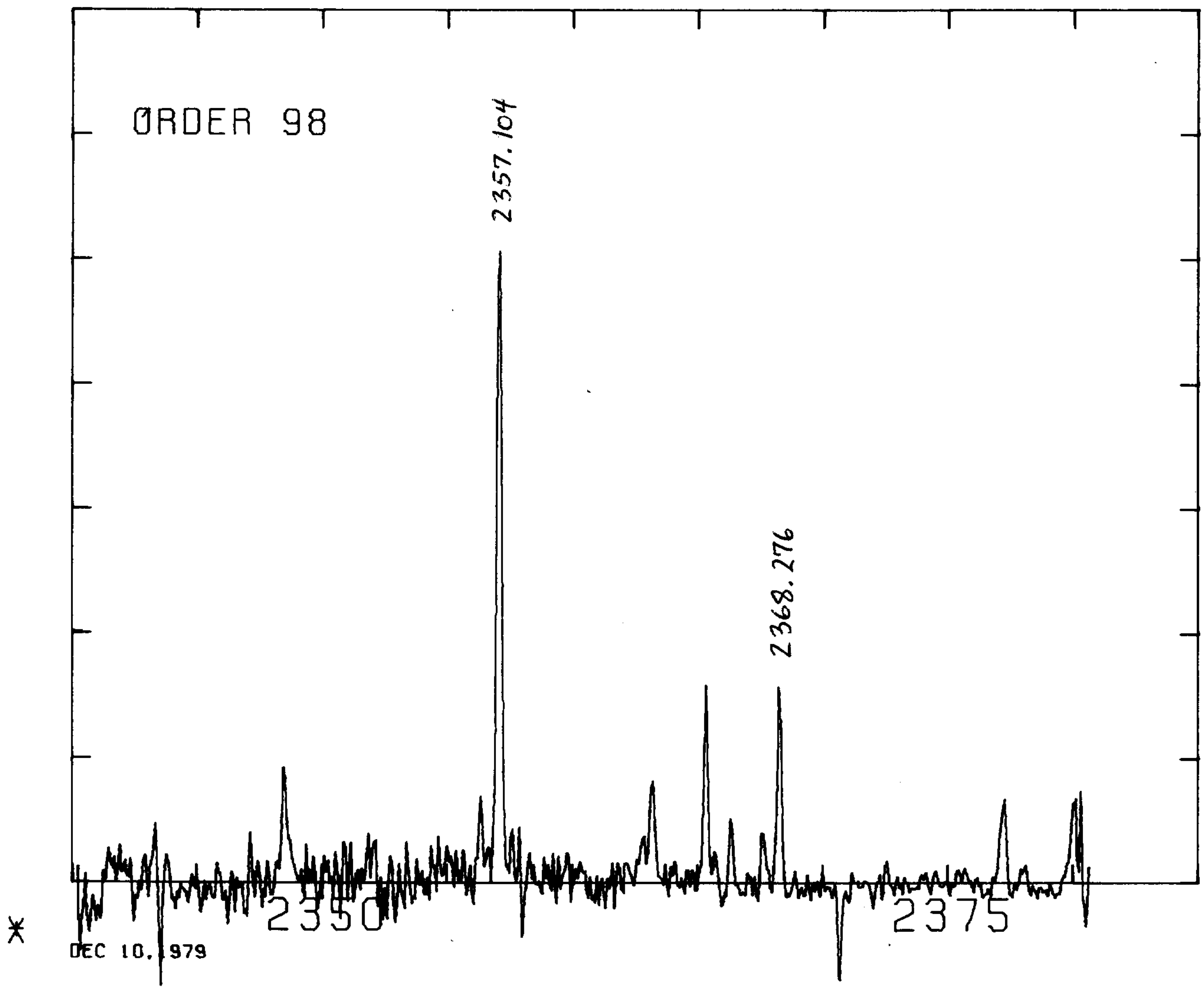


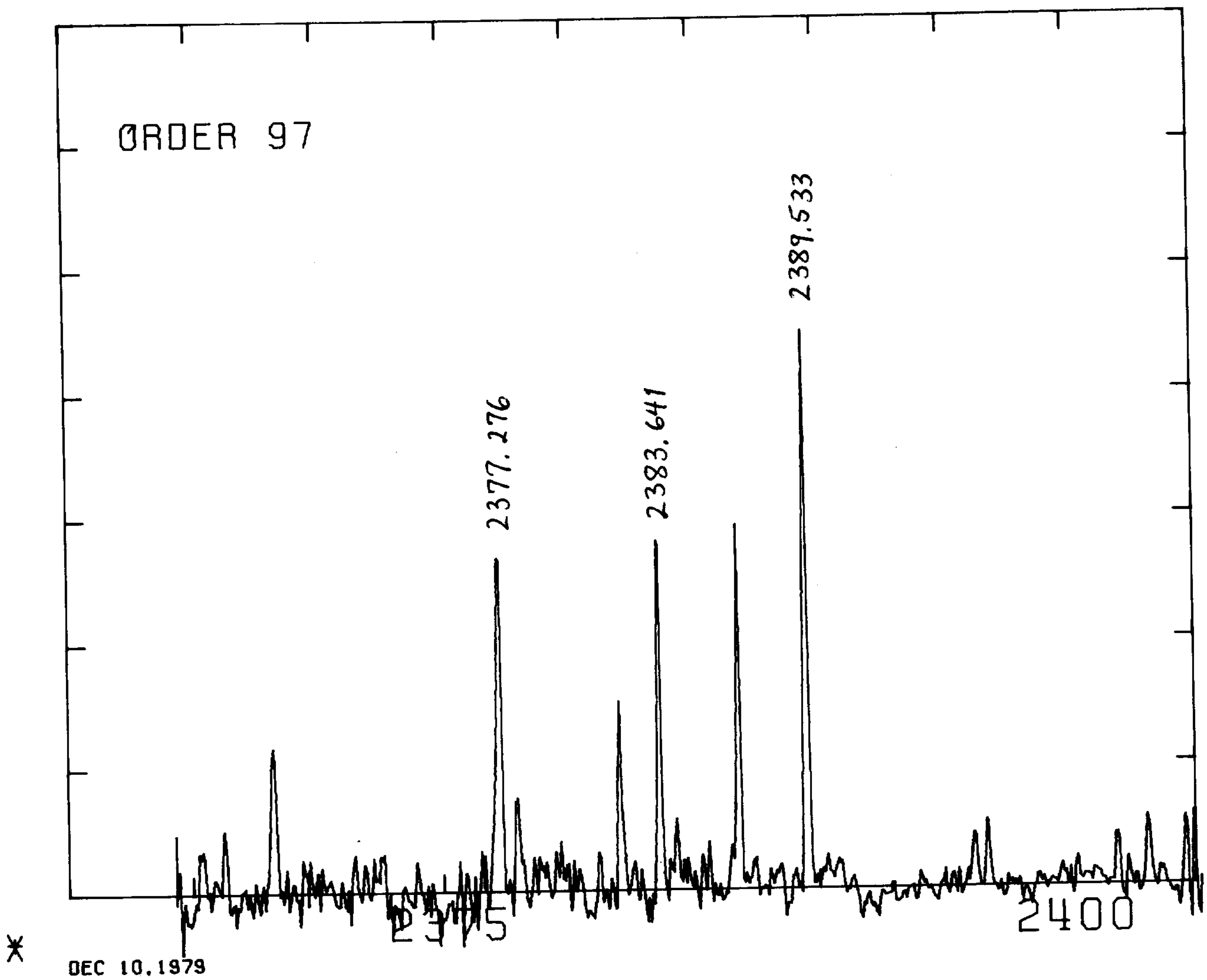
ORDER 101
2288.197
2289.270
2292.378
2275
2300
DEC 10,1979

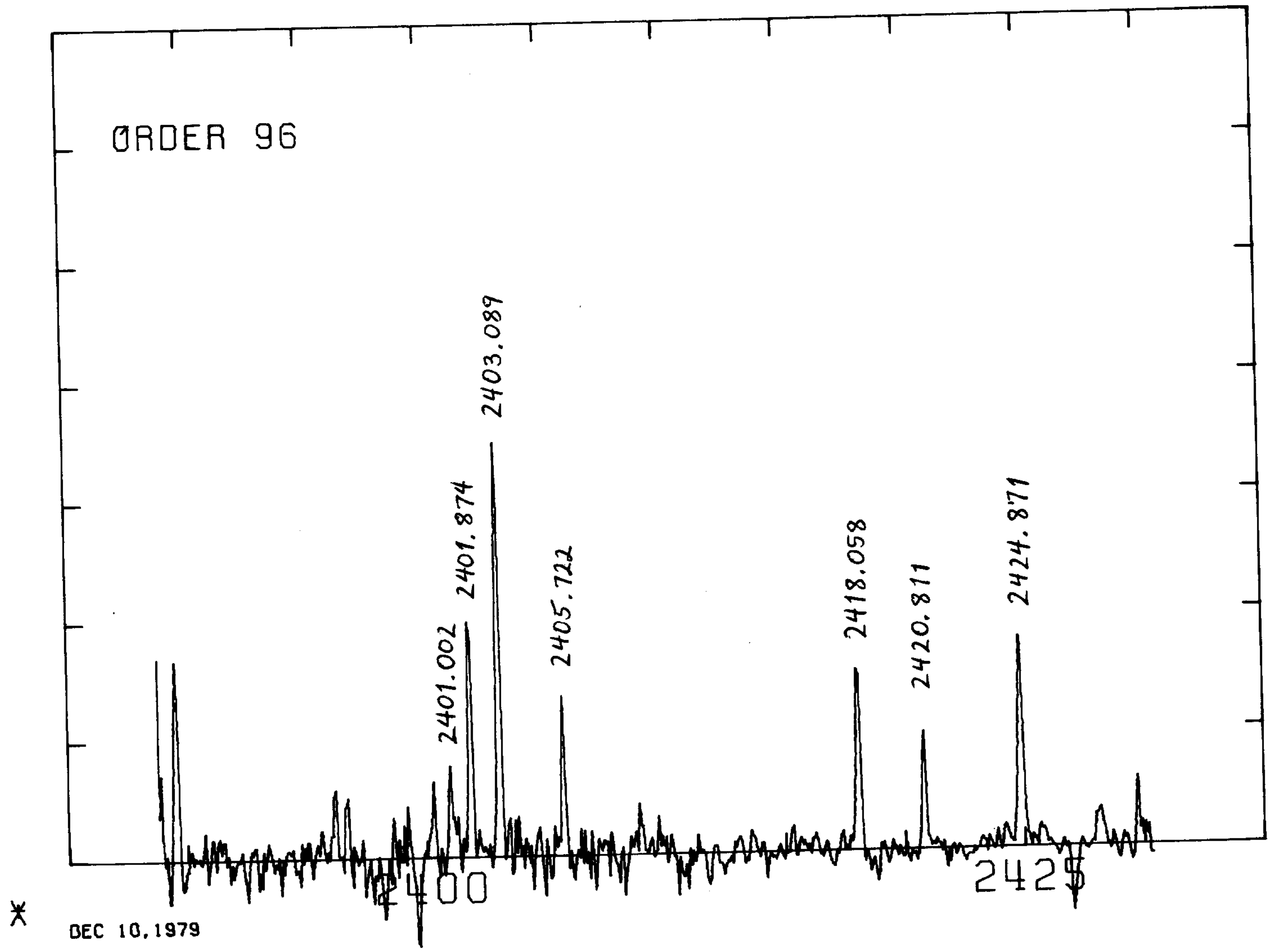


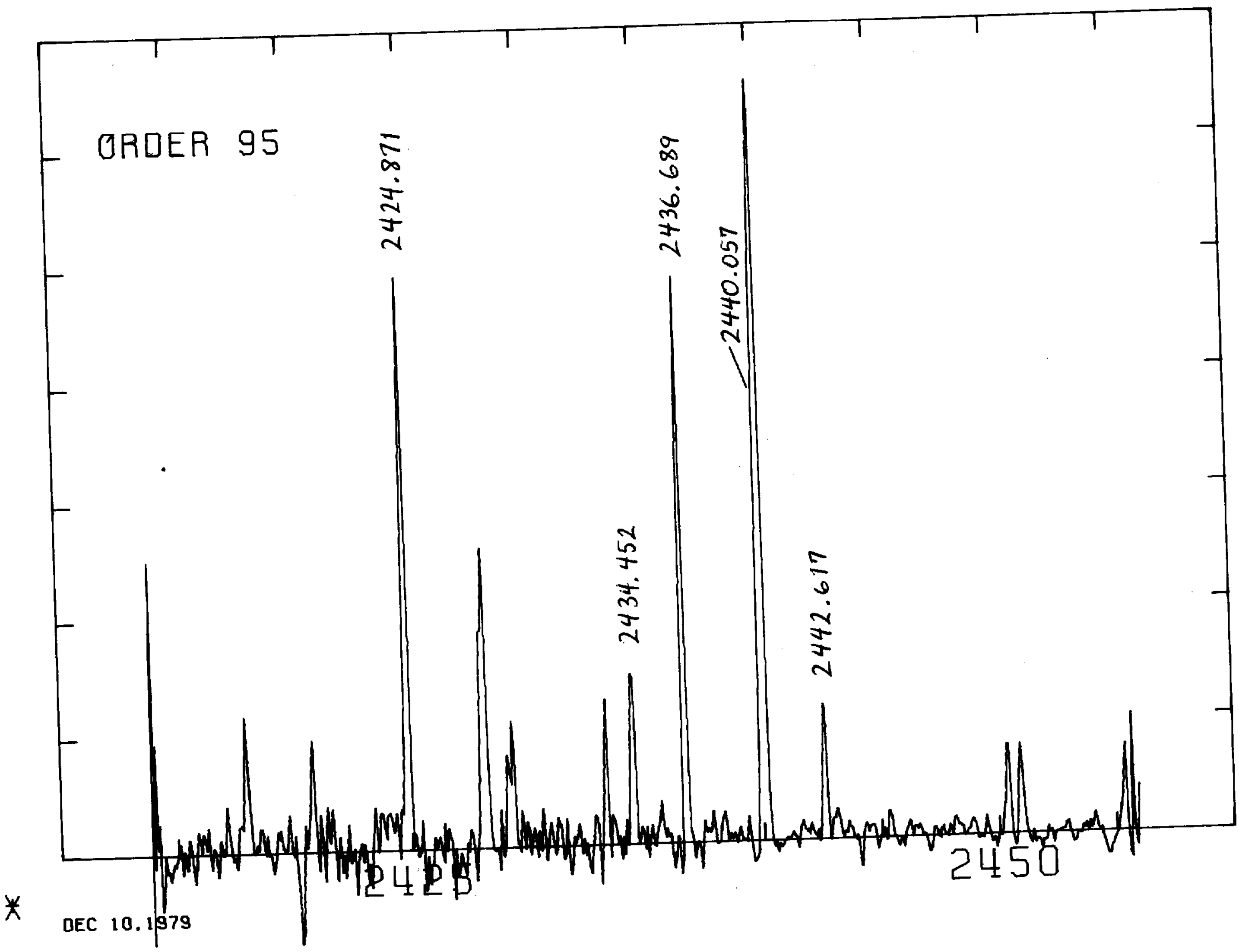
ØRDER 100
2303.200
2308.040
2310.957
2315.495
2318.294
2319.882
2300
2325
DEC 10,1979

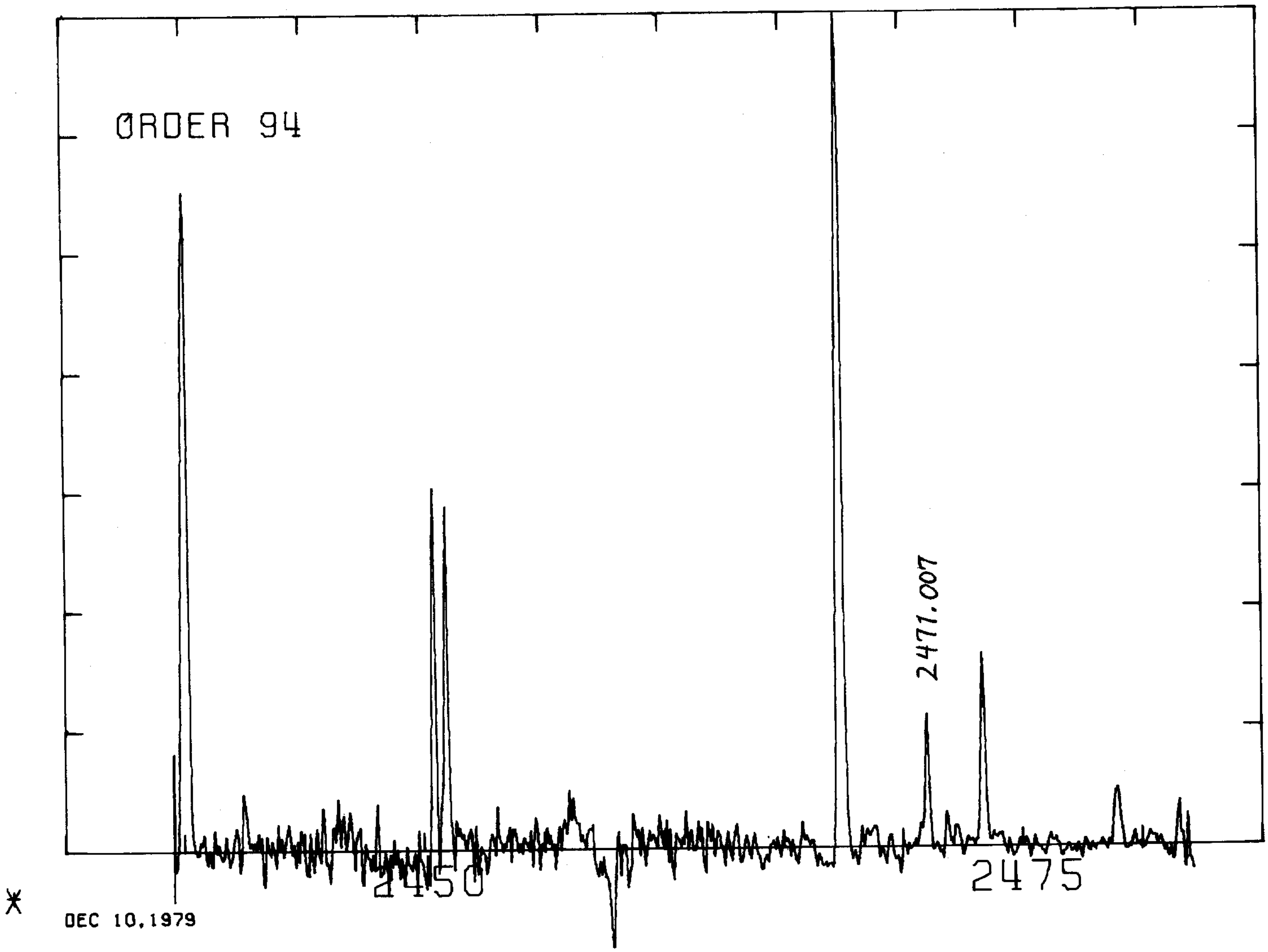

ØRDER 99
2340.176
2348.544
2325
2350
DEC 10,1979


ØRDER 98
2357.104
2368.276
2350
2375
DEC 10, 1979

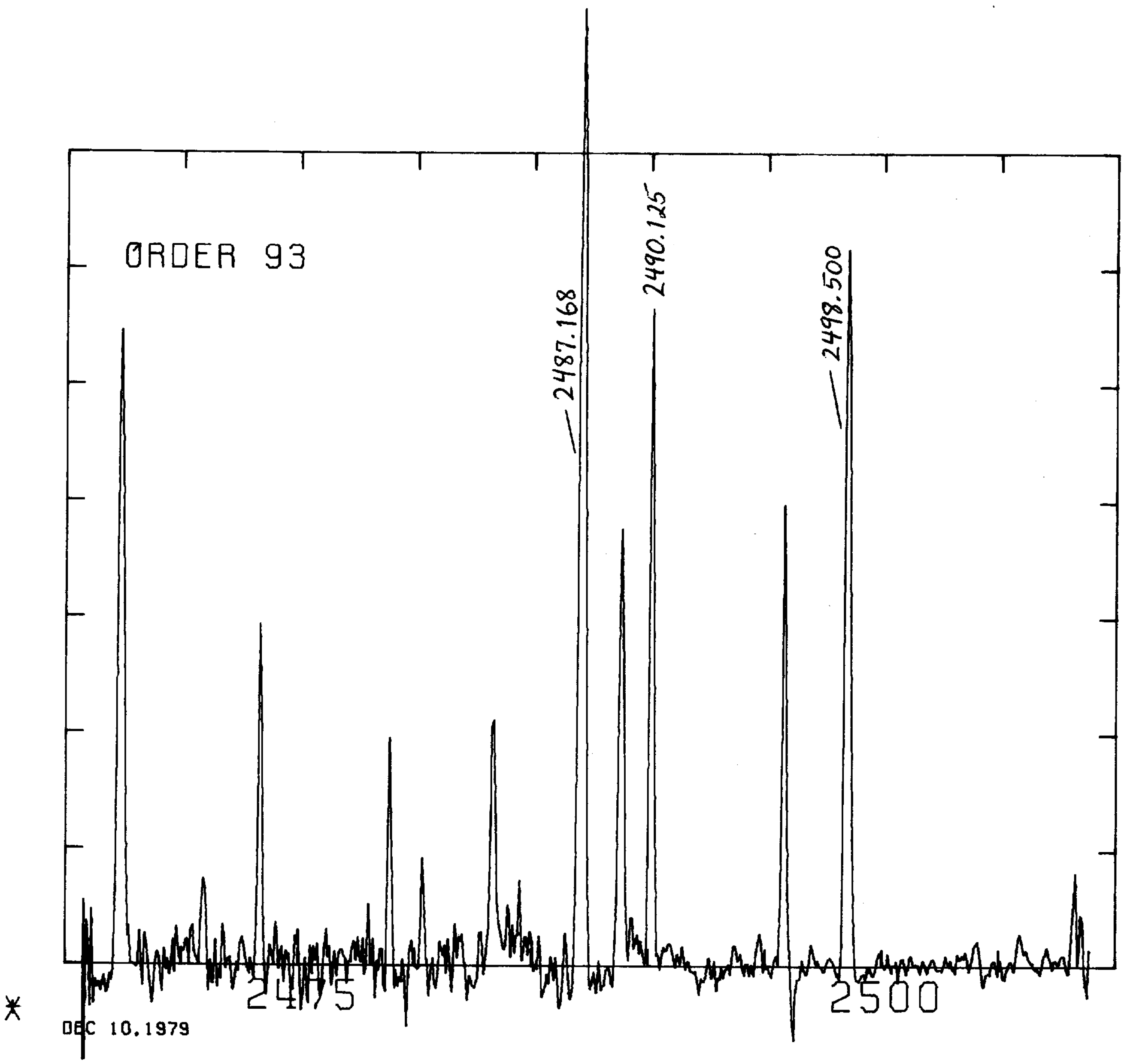

ORDER 97
2377.276
2383.641
2389.533
2375
2400
DEC 10,1979

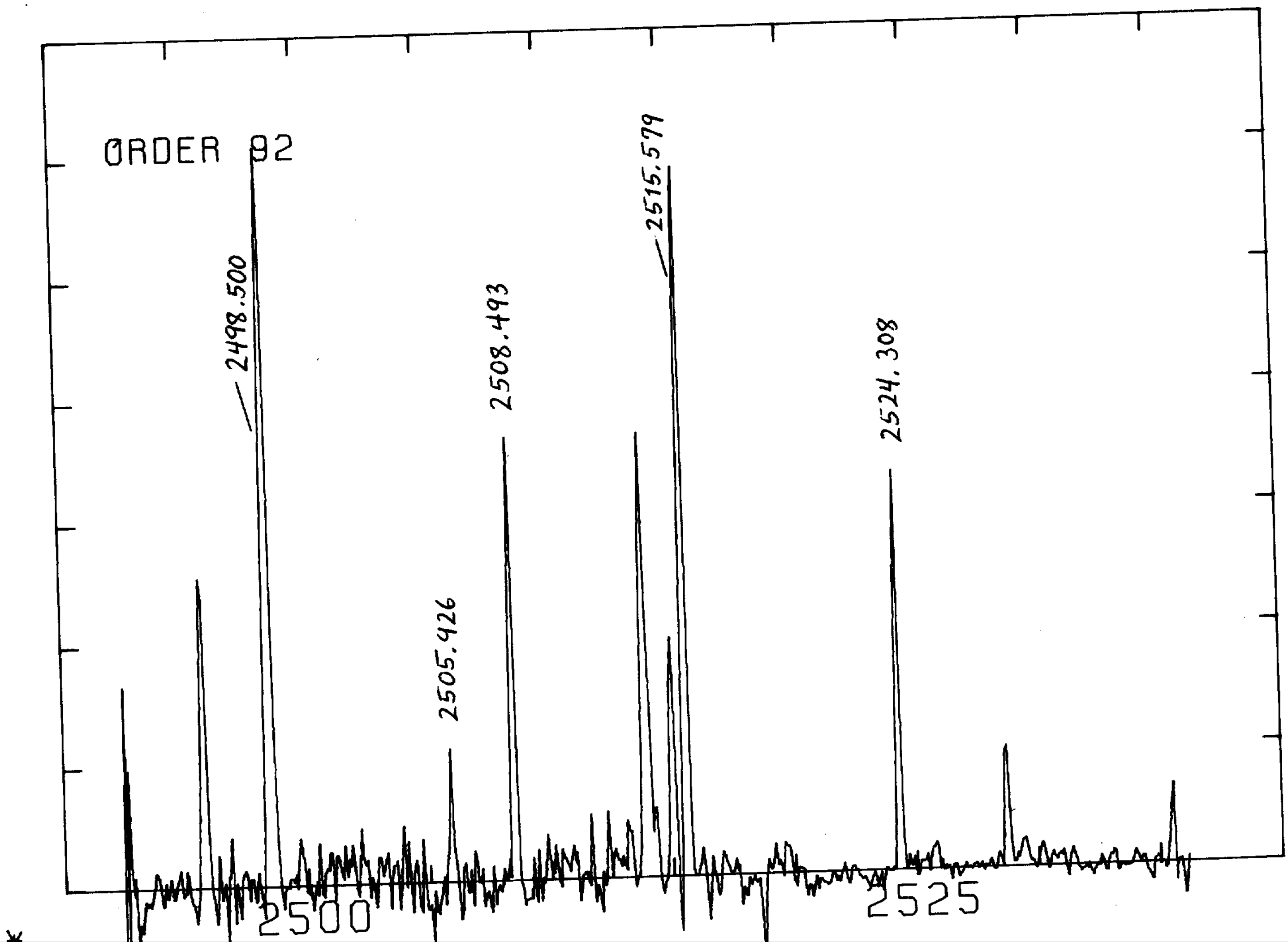

ØRDER 96
2401.002
2401.874
2403.089
2405.722
2418.058
2420.811
2424.871
2400
2425
DEC 10,1979

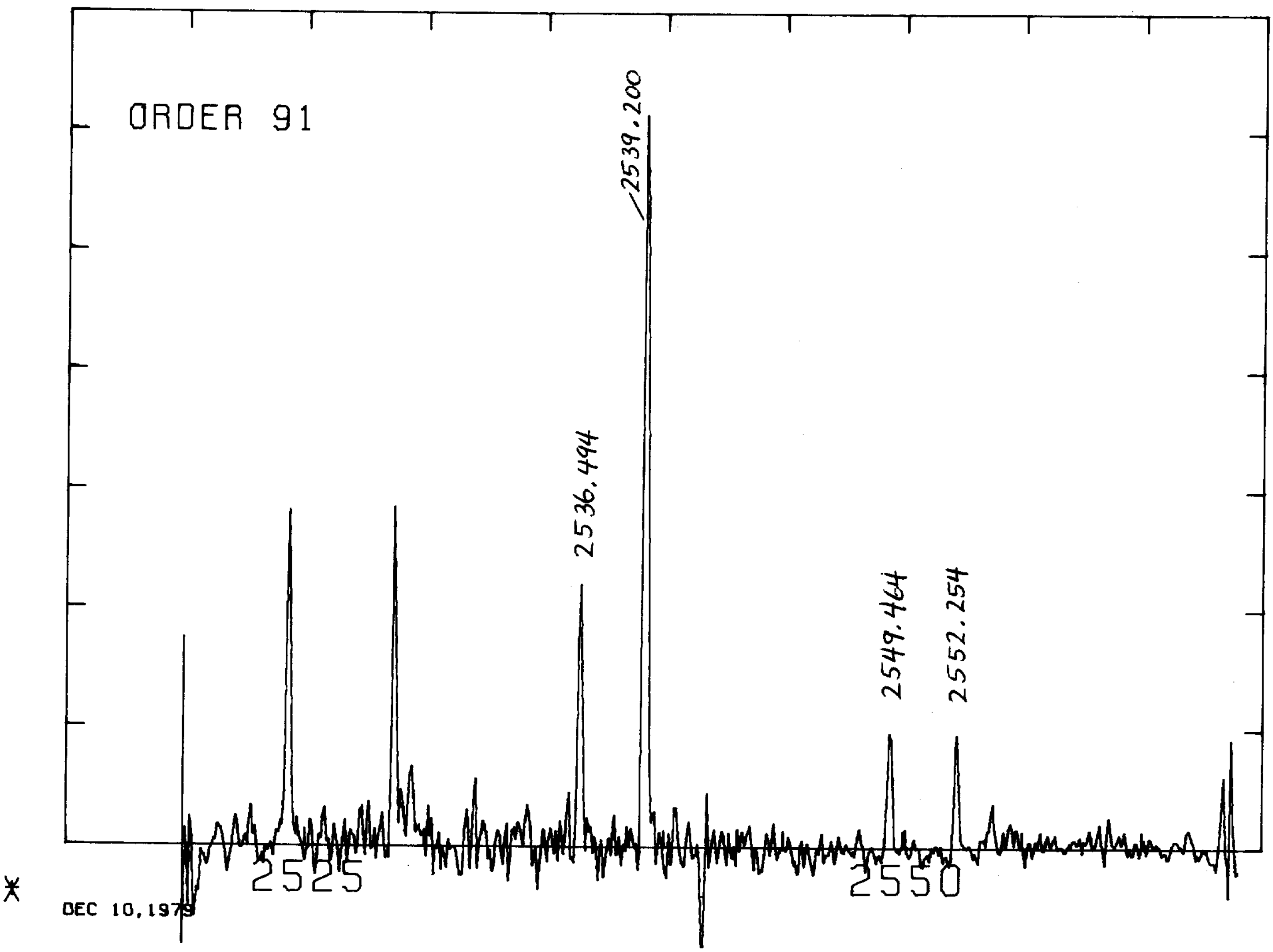

ORDER 95
2424.871
2434.452
2436.689
2440.057
2442.617
2450
DEC 10, 1979

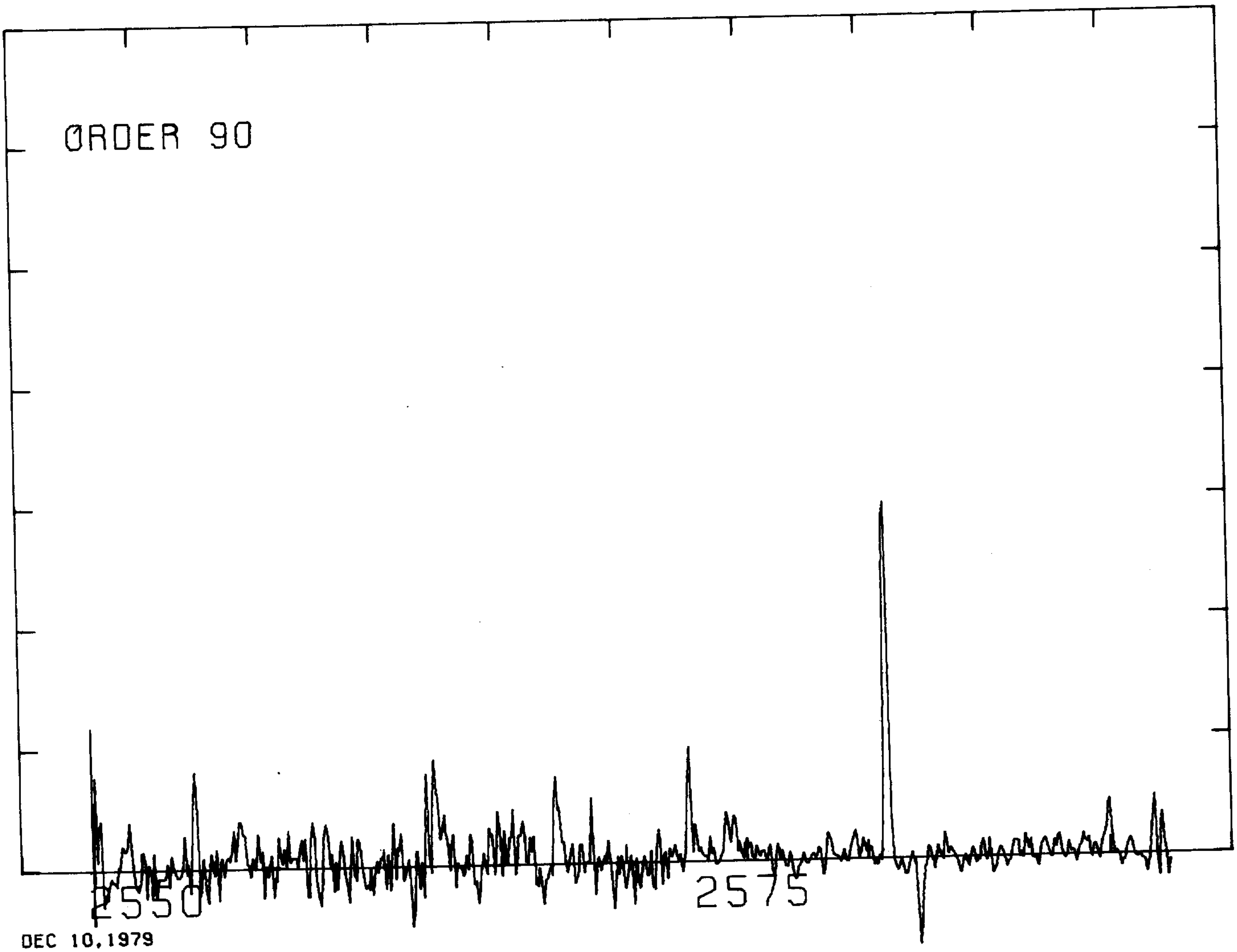


ØRDER 94
2471.007
2450
2475
DEC 10,1979


ØRDER 93
2487.168
2490.125
2498.500
2475
2500
DEC 10,1979


ORDER 92
2498.500
2505.426
2508.493
2515.579
2524.308
2500
2525


ORDER 91
2539.200
2536.494
2549.464
2552.254
2525
2550
DEC 10,1979



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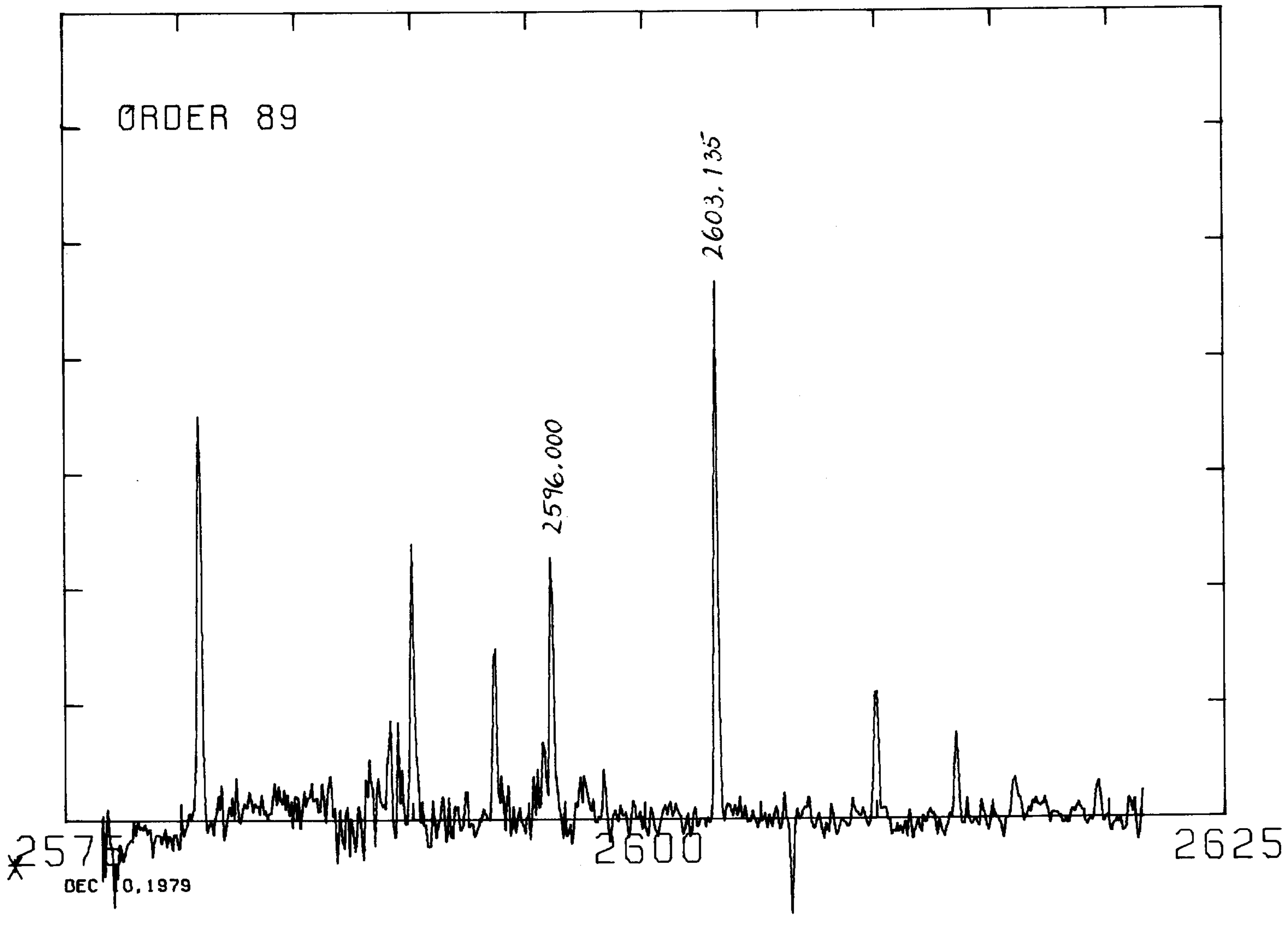
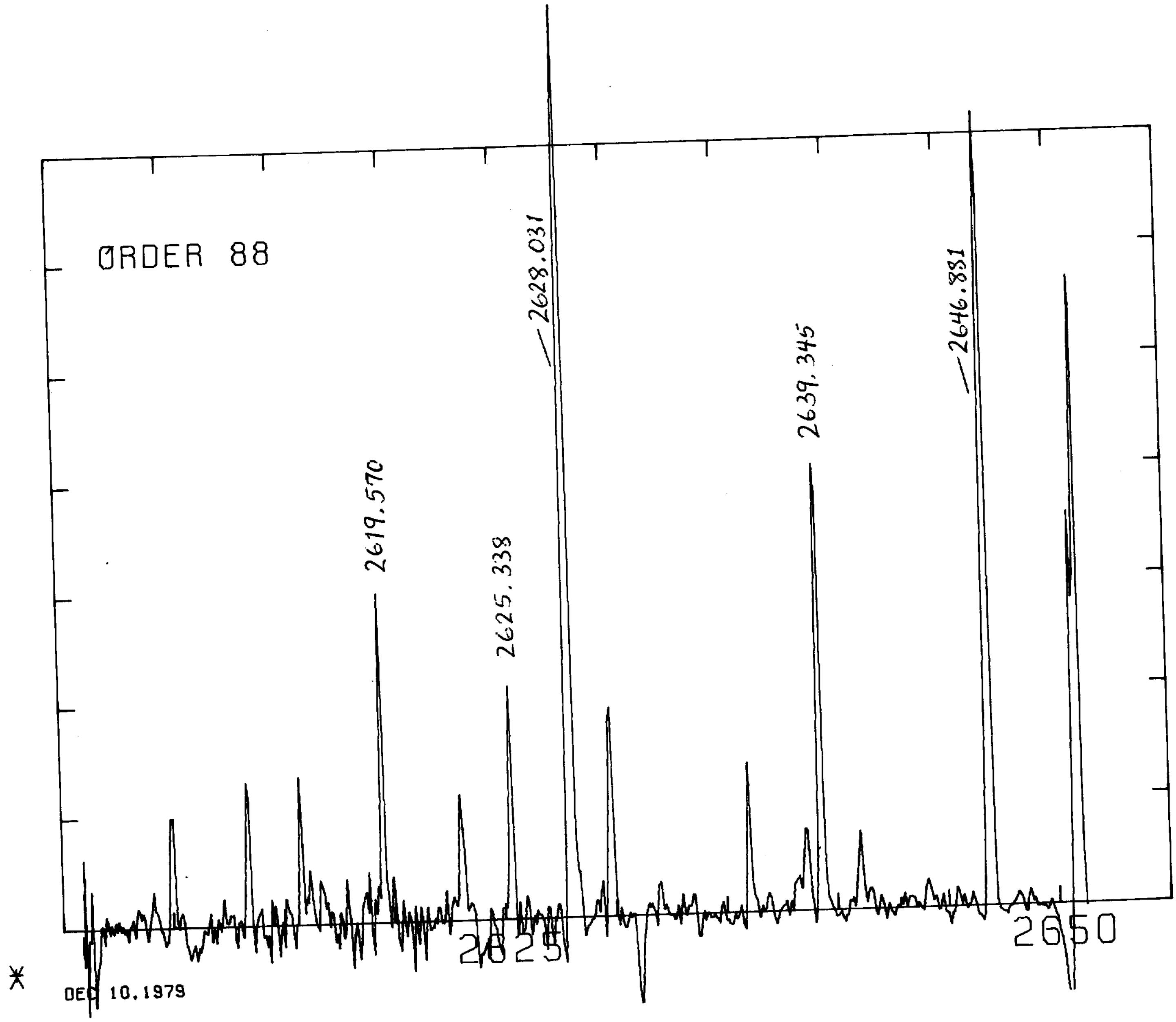
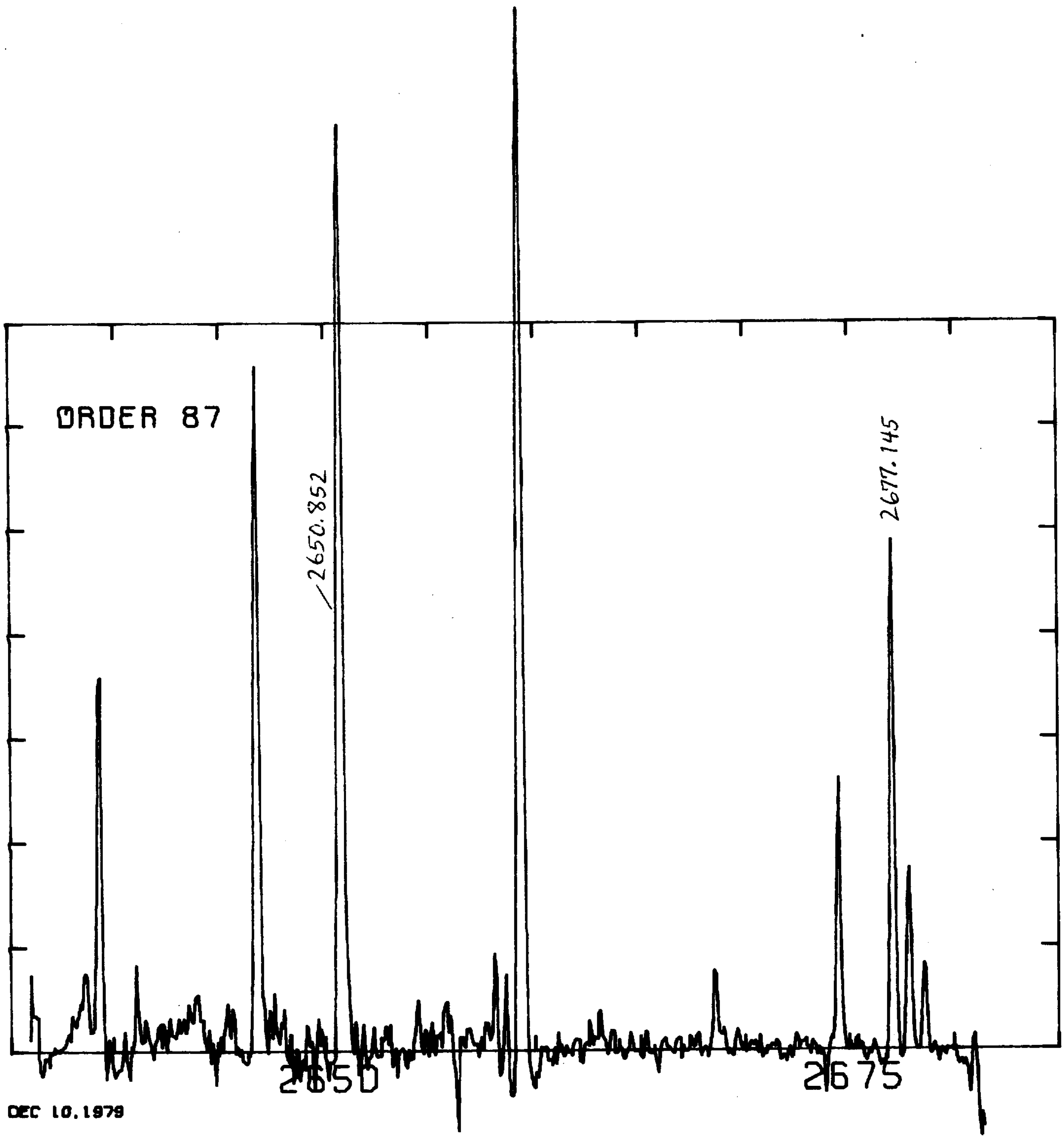
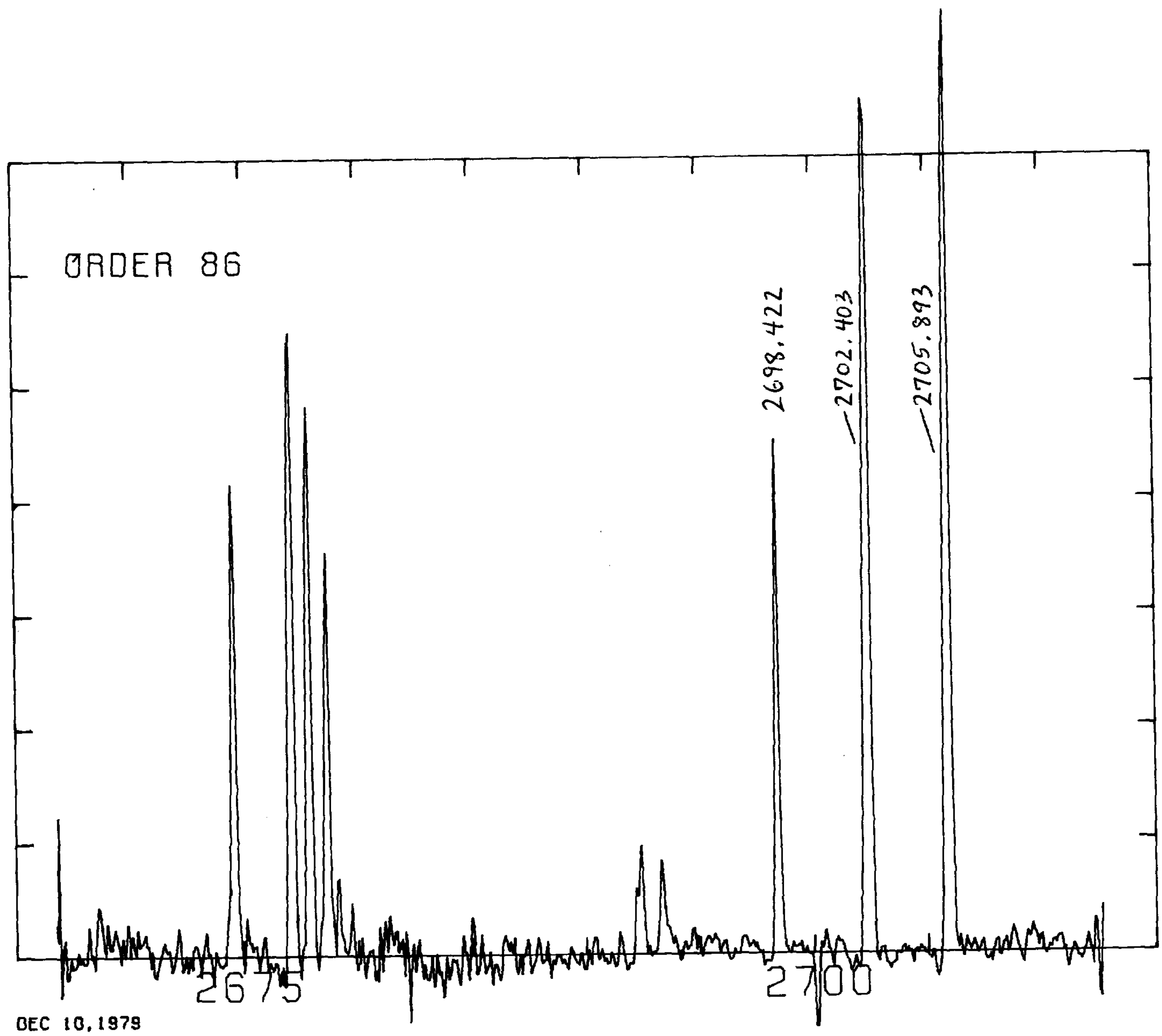
DEC 10,1979


ØRDER 89
2603.135
2596.000
2575
2600
2625
DEC 10,1979

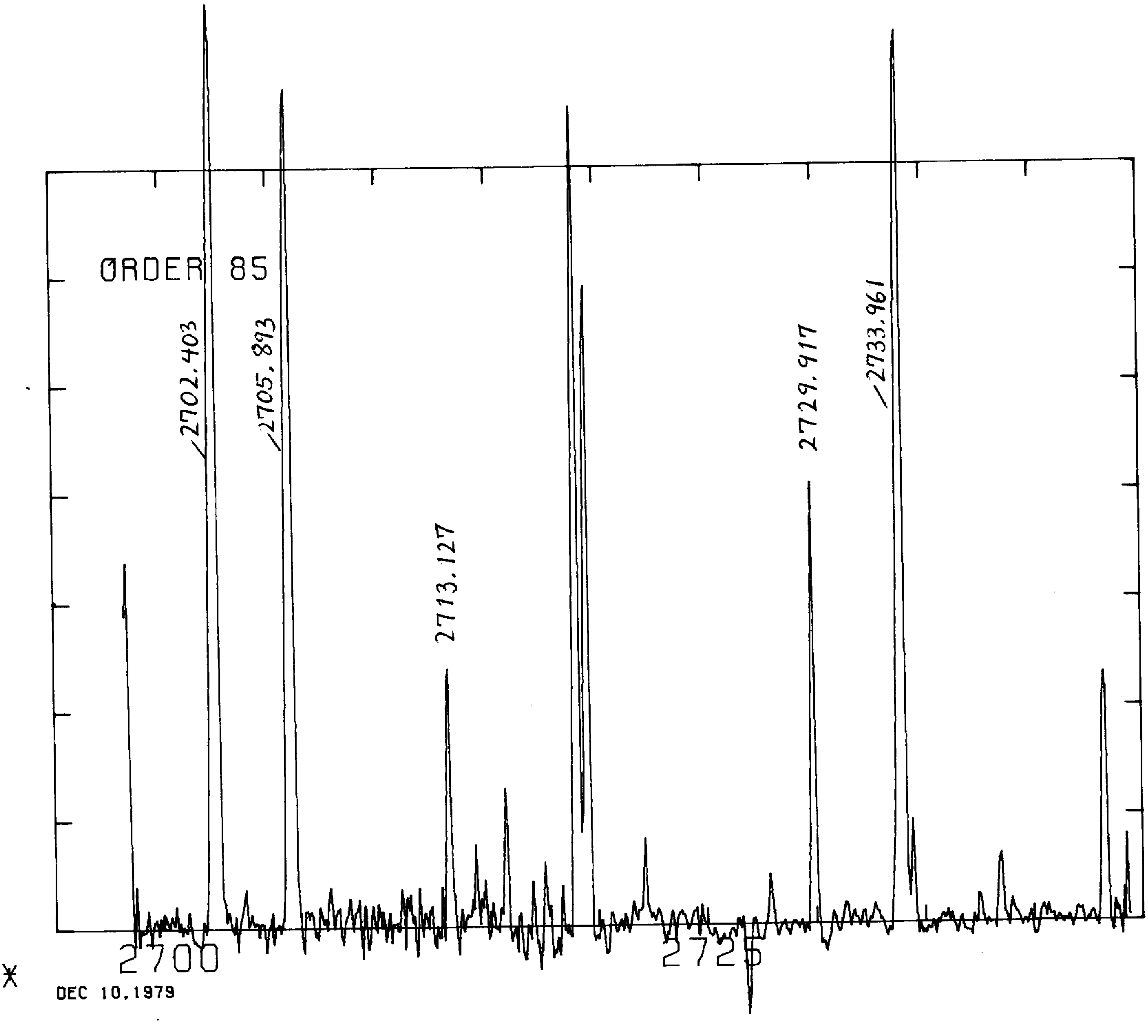

ORDER 88
2619.570
2625.338
2628.031
2639.345
2646.881
2625
2650
DEC 10,1979



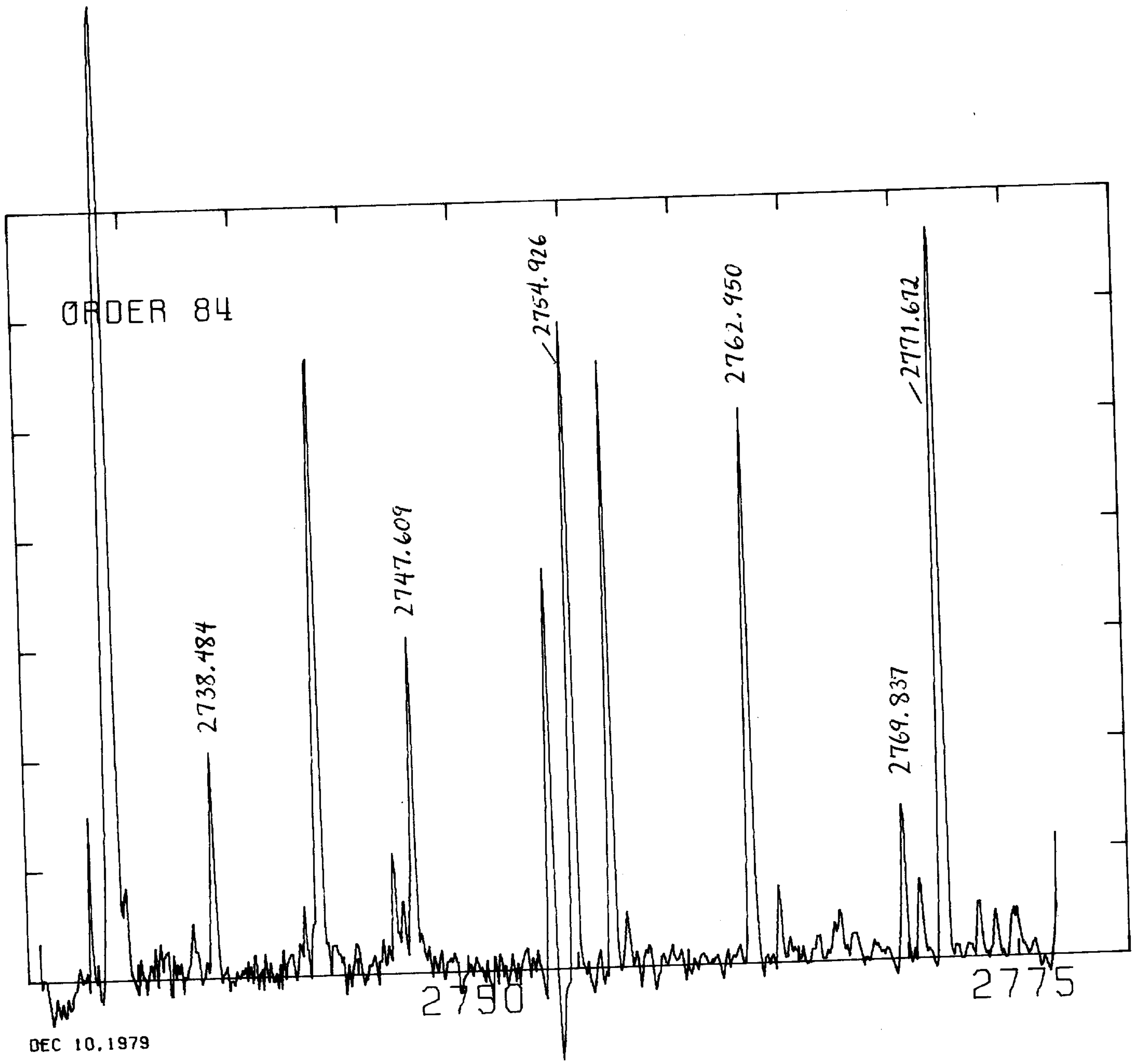
✳ DEC 10, 1979



DEC 10, 1979


ØRDER 85
2702.403
2705.893
2713.127
2729.917
2733.961
2700
2725

DEC 10,1979


ORDER 84
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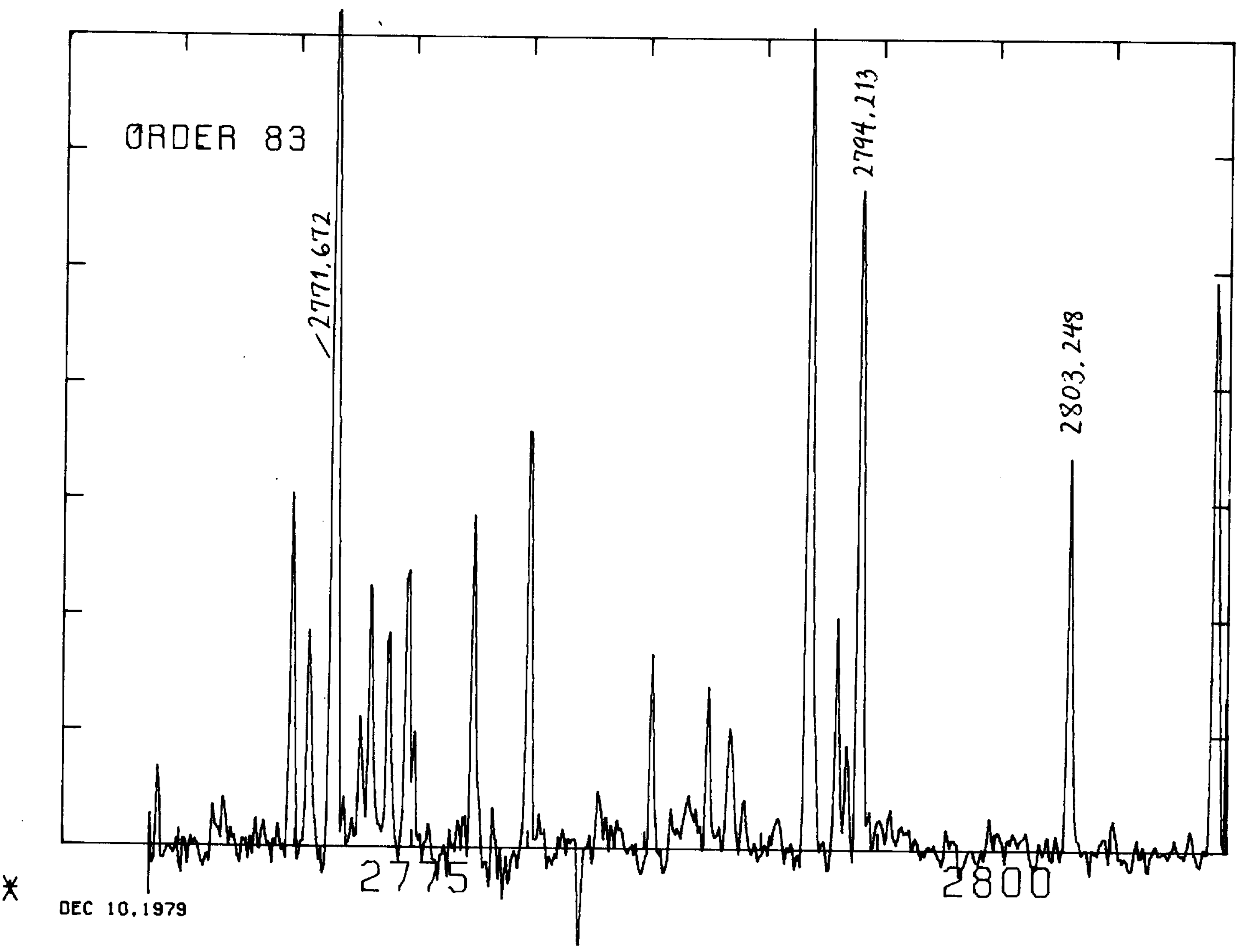
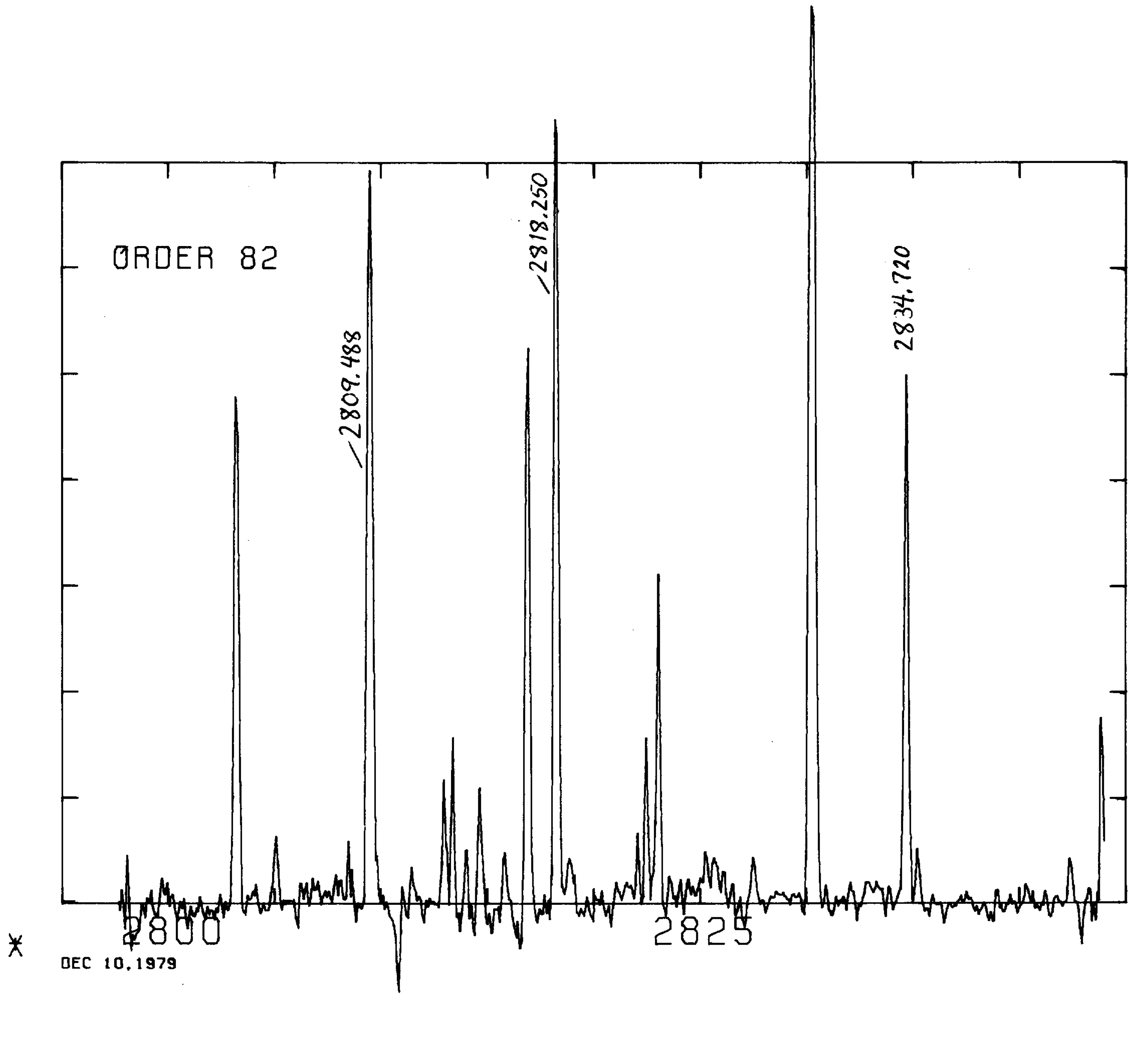
2747.609
2754.926
2762.950
2769.837
2771.672
2750
2775

DEC 10,1979


ORDER 83
2771.672
2794.113
2803.248
2775
2800
DEC 10,1979


ORDER 82
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2818.250
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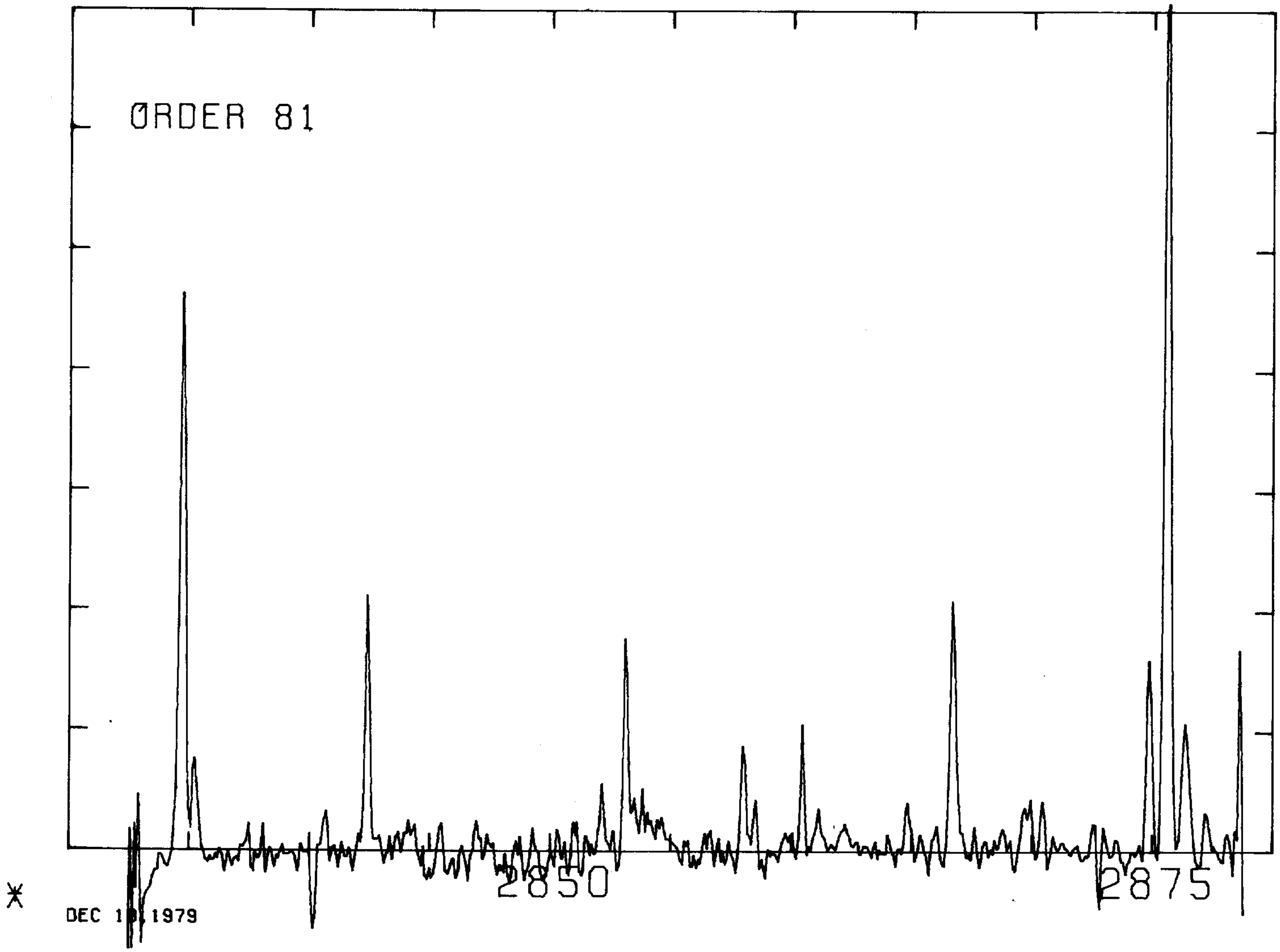
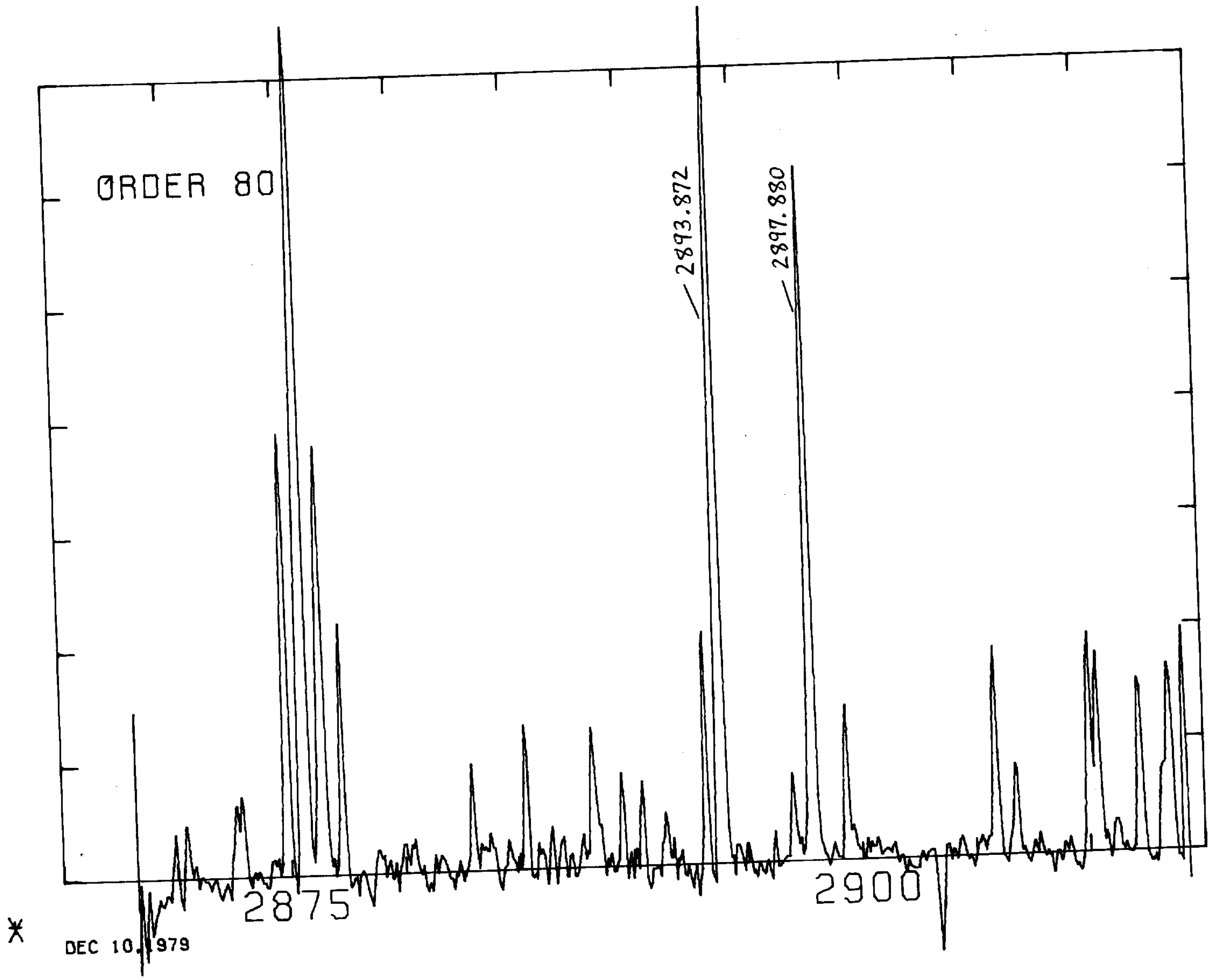
2800
2825
DEC 10,1979


ØRDER 81
2850
2875


ORDER 80
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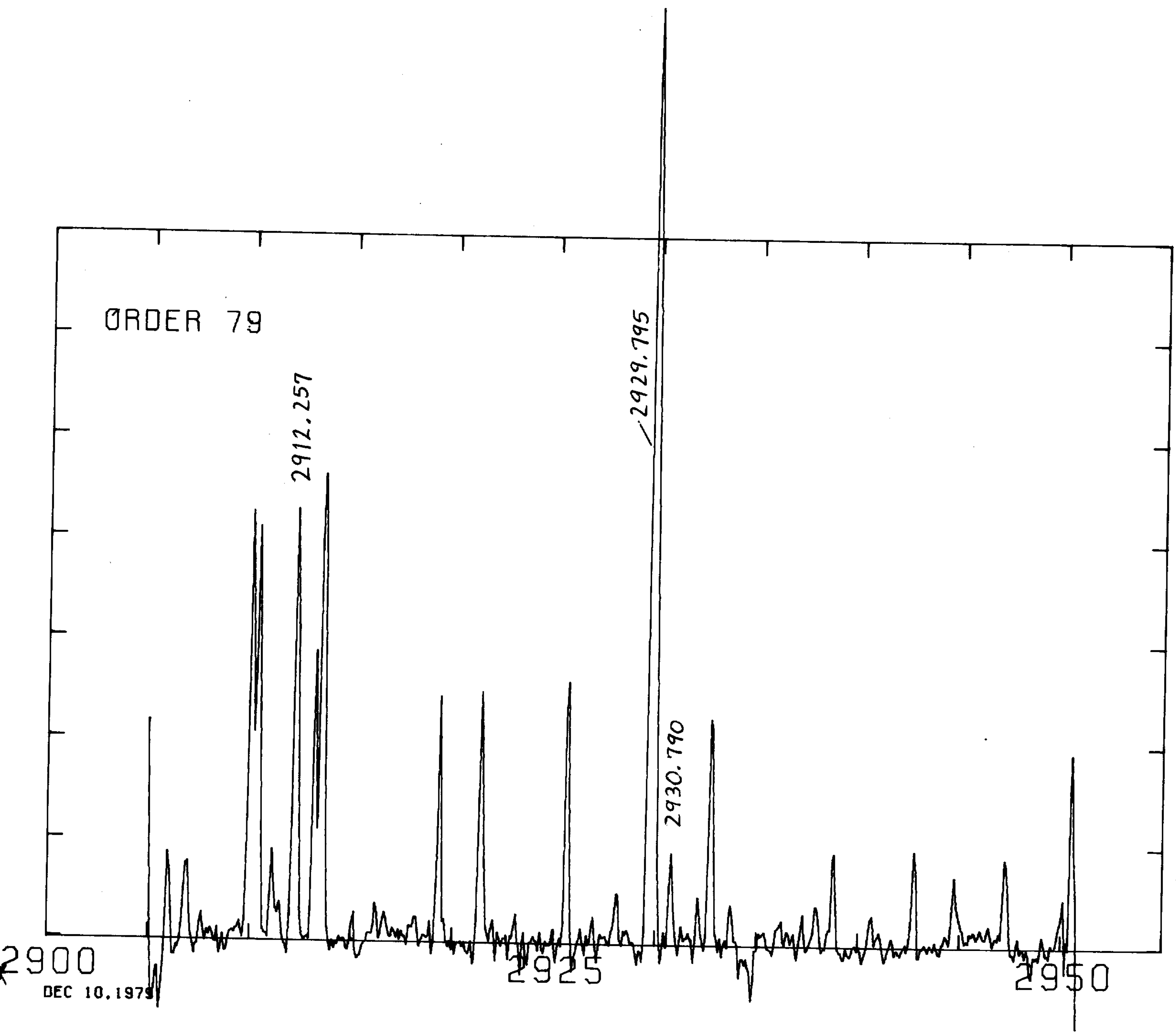
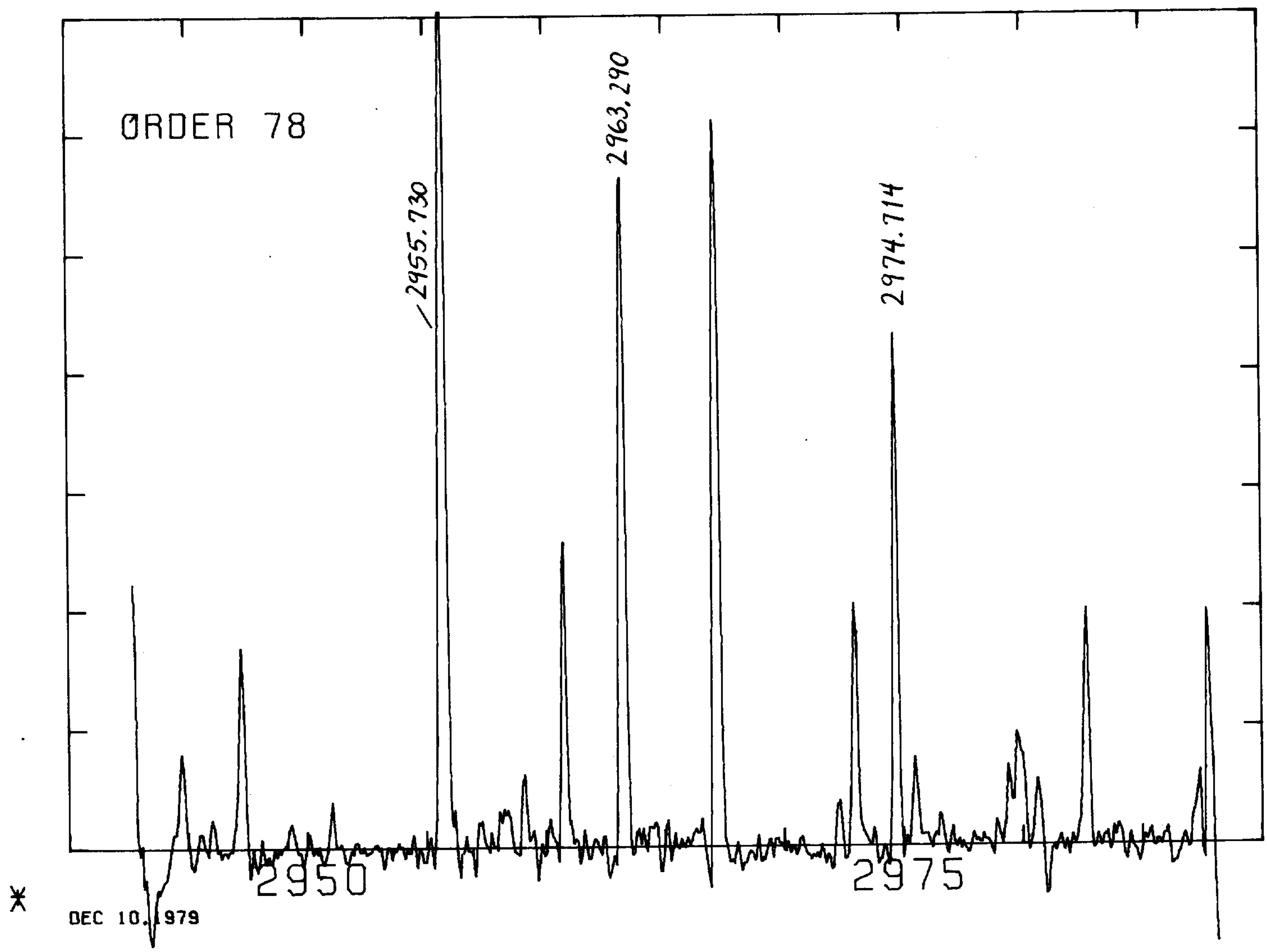
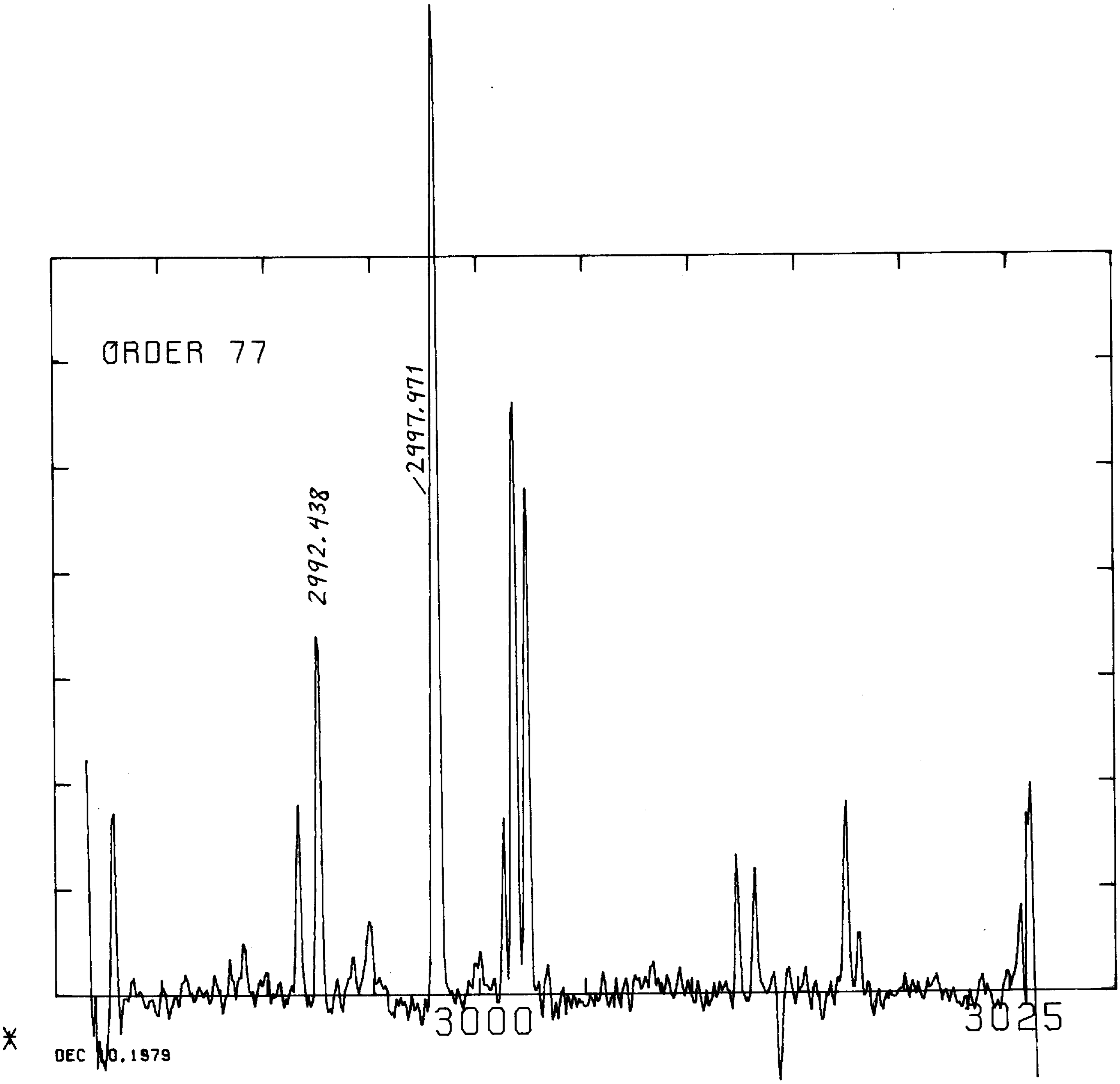
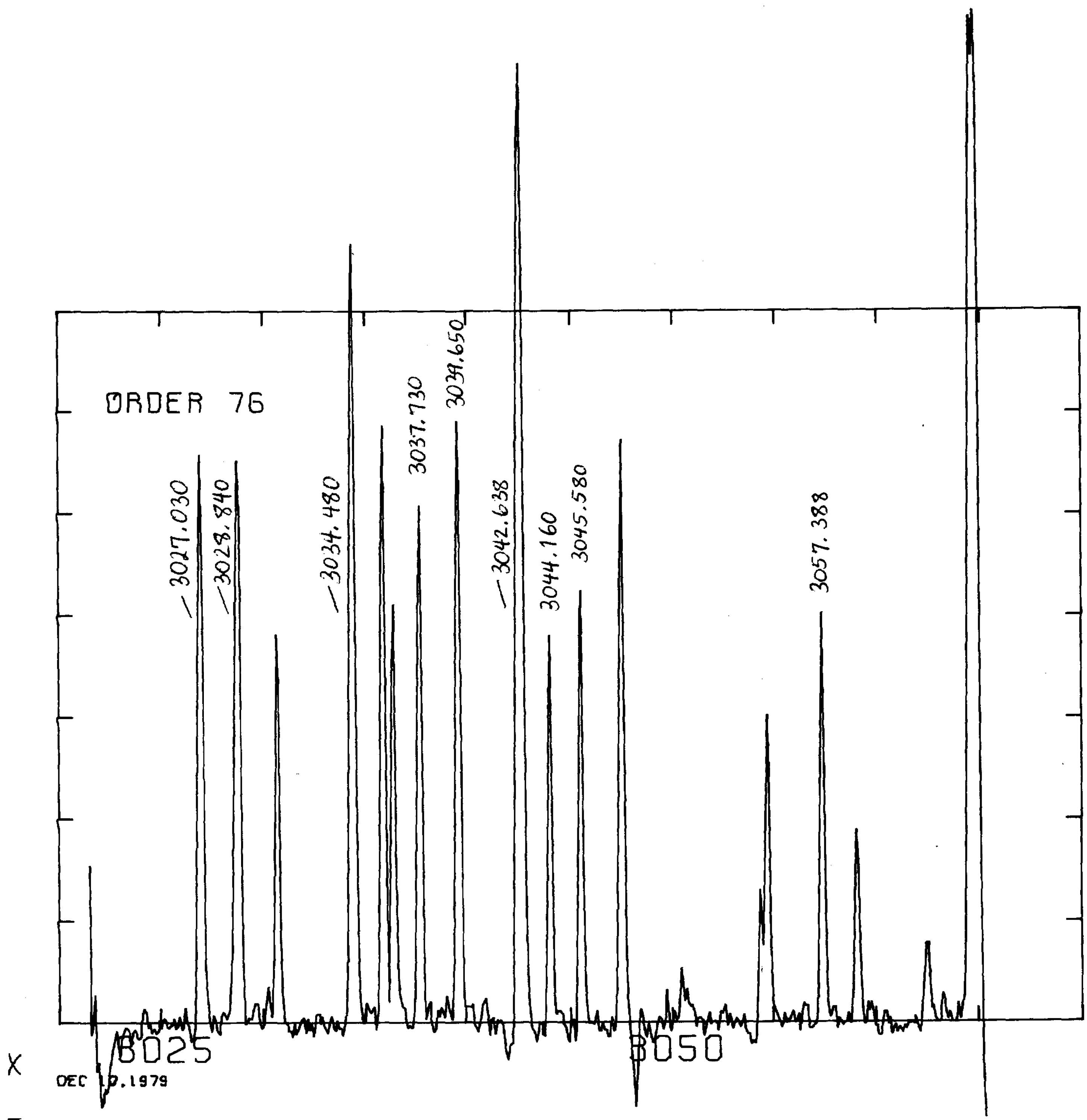
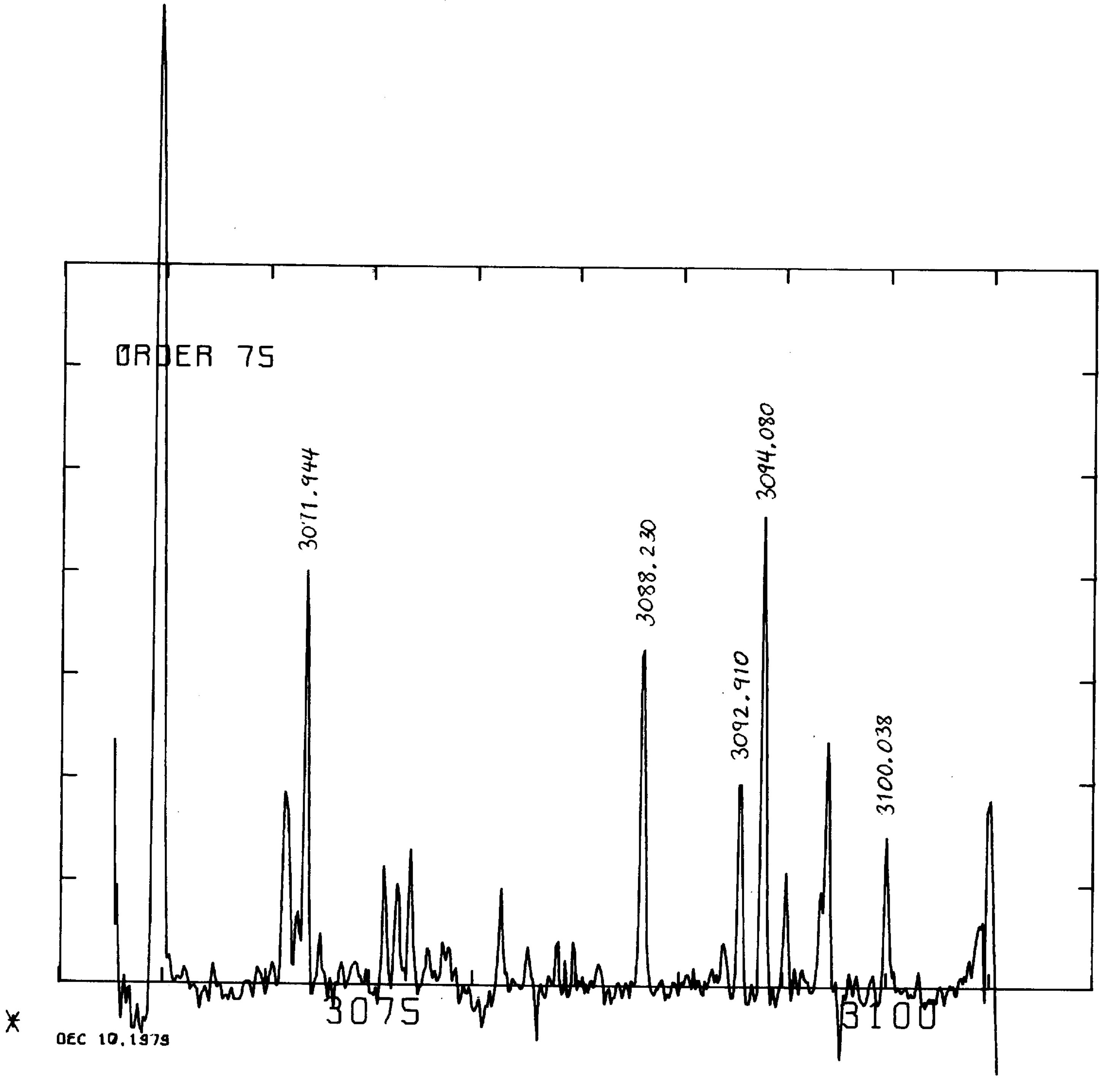
2897.880
2875
2900
DEC 10, 1979

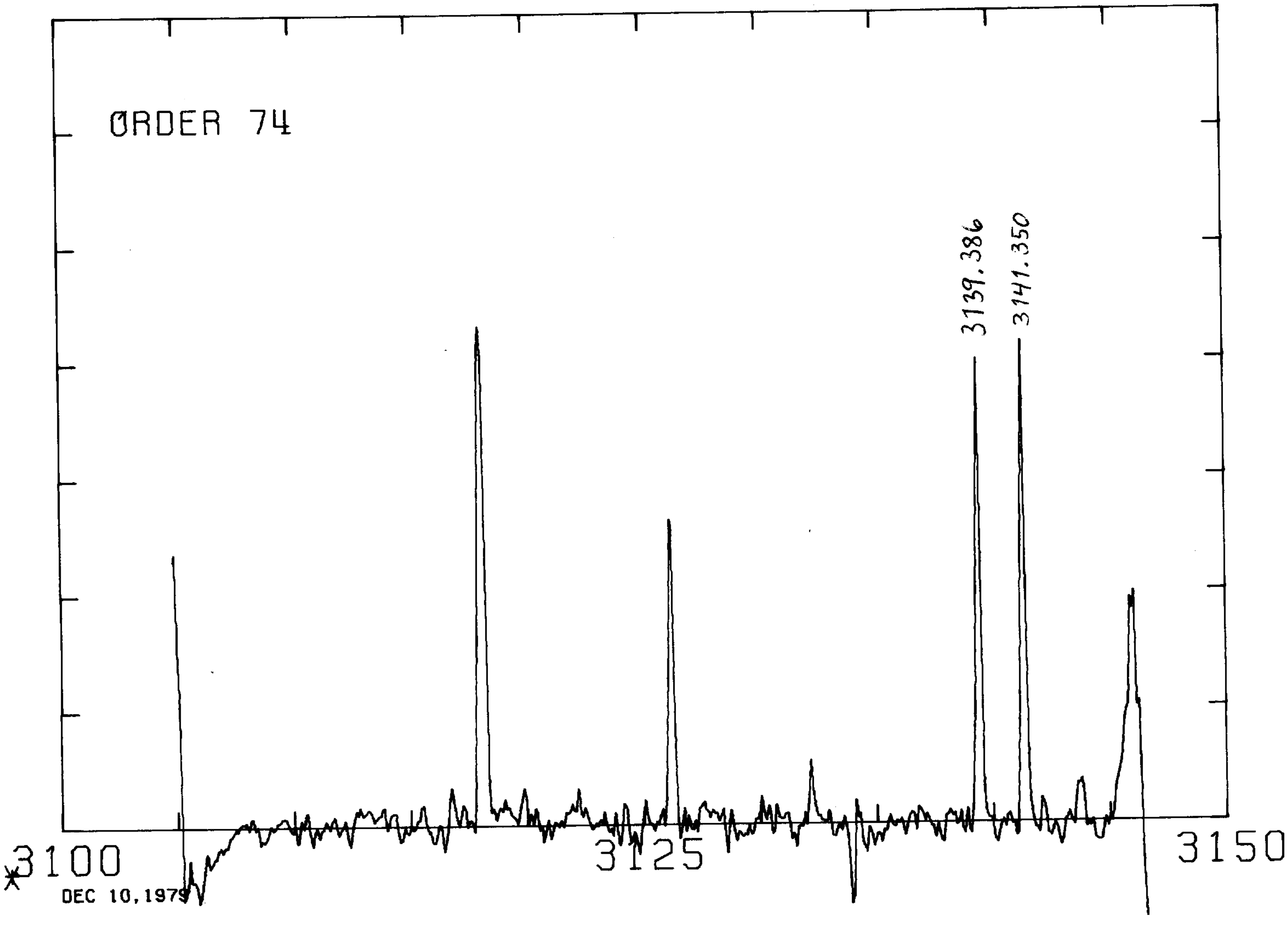

ORDER 79
2912.257
2929.795
2930.790
2900
2925
2950
DEC 10,1979

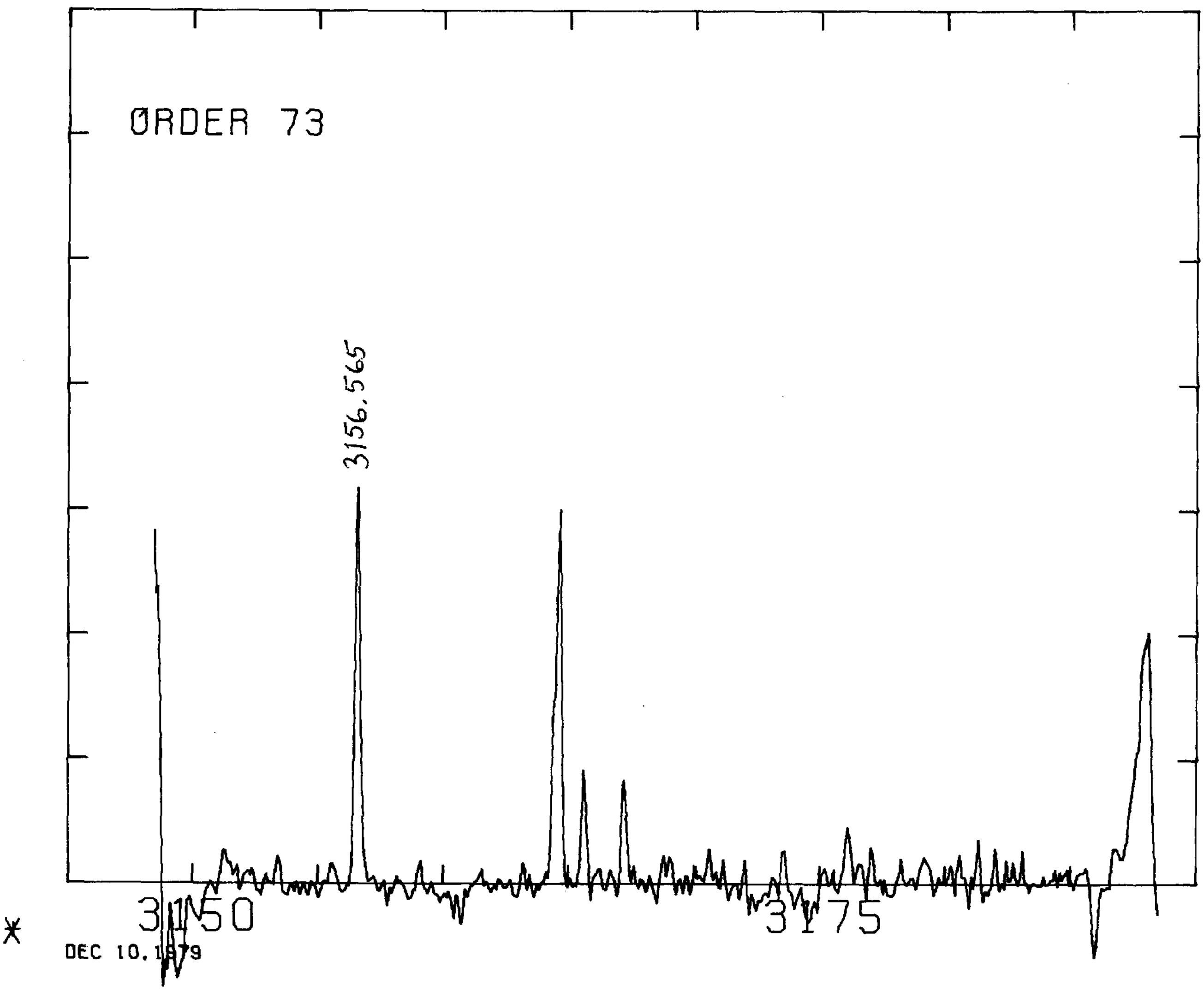

ØRDER 78
2955.730
2963.290
2974.714
2950
2975
DEC 10, 1979

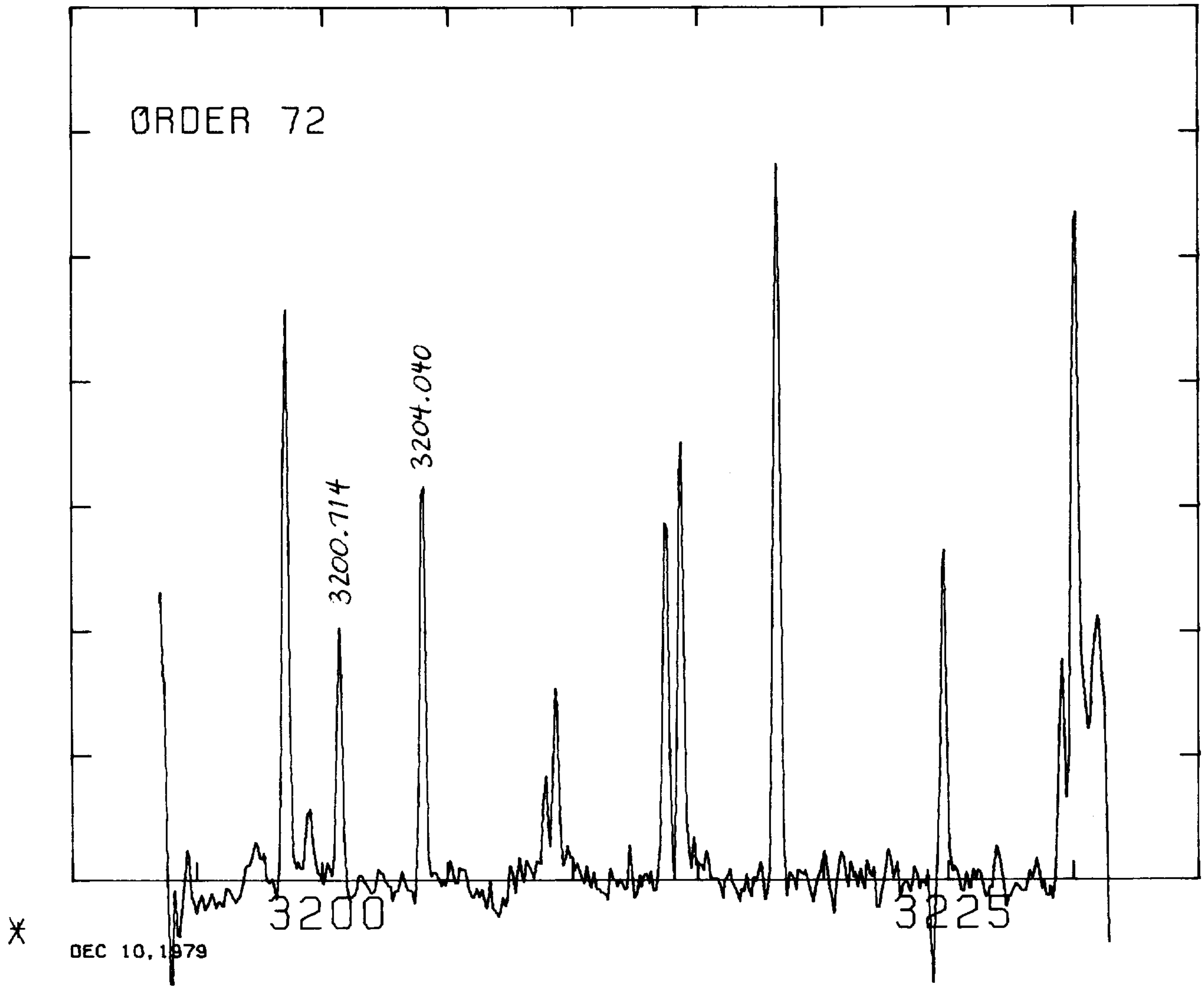

ØRDER 77
2992.438
2997.971
3000
3025
DEC 10.1979


ORDER 76
3027.030
3028.840
3034.480
3037.730
3039.650
3042.638
3044.160
3045.580
3057.388
3025
3050
X


ORDER 75
3071.944
3088.230
3092.910
3094.080
3100.038
3075
3100
DEC 10,1979


ØRDER 74
3139.386
3141.350
3100
3125
3150
DEC 10,1979


ØRDER 73
3156.565
3150
3175
DEC 10,1979


ØRDER 72
3200.714
3204.040
3200
3225
DEC 10,1979