

Catalogue of representative meteor spectra

6. Catalogue

7. Conclusions

6. Catalogue

測光質量 用語

- 流星の質量を間接的に求める手法の一つ。
- 流星物質の質量を流れ始めから終わりまでの測光から求める
- 光力係数というものをつかう。流星速度の一次関数になっている。
- 今回使用したのは、イニスフリーと人工ロケット流星のデータをもとに、低速で数百グラムまでの質量に対する発光効率のモデル
- 参考 <http://www5e.biglobe.ne.jp/~shibaya/fireballs/physics/mass.htm>
- 参考 <http://articles.adsabs.harvard.edu/pdf/1983BAICz..34..102P>

流星軌道の要素 用語

参考 平塚市博物館天体観察会メーリングリスト (永井さんの資料)

軌道離心率 (e)

天体の軌道の絶対的な形を決める重要なパラメータ。

$e=0$ 円、 $0 < e < 1$ 楕円、 $e=1$ 放物線、 $e > 1$ 双曲線

参考 <https://ja.m.wikipedia.org/wiki/軌道離心率>

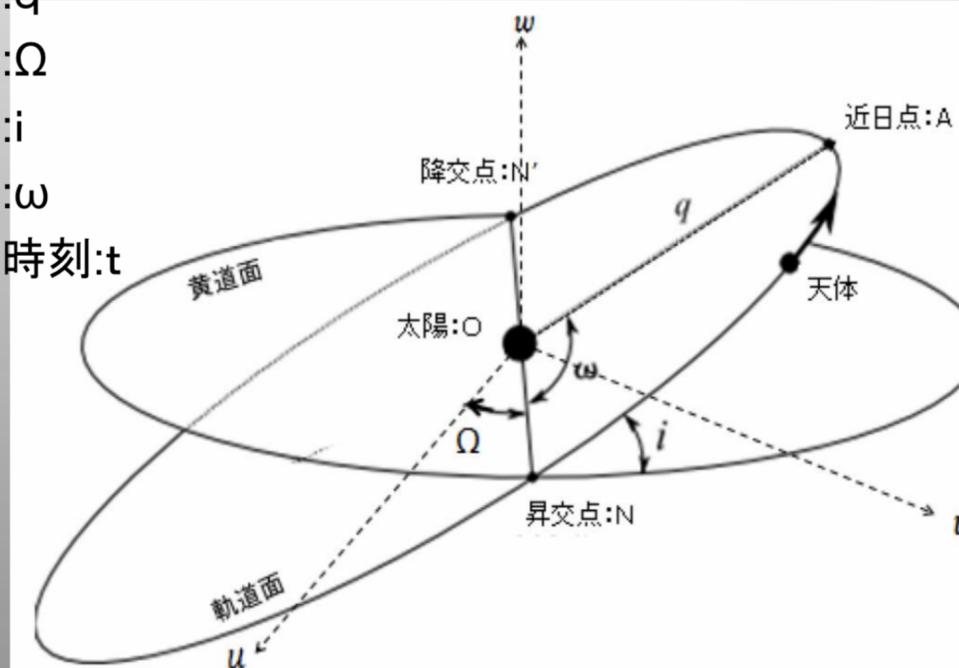
Tisserand parameter (T_j)

ティッセルランドのパラメータとは、比較的小さな物体と大きな「摂動体」のいくつかの軌道要素（半長軸、軌道偏心、軌道傾斜）から計算された値。木星を摂動体とする T_j は、木星族彗星 $2 < T_j < 3$ から小惑星 $T_j > 3$ を区別するために用いる。

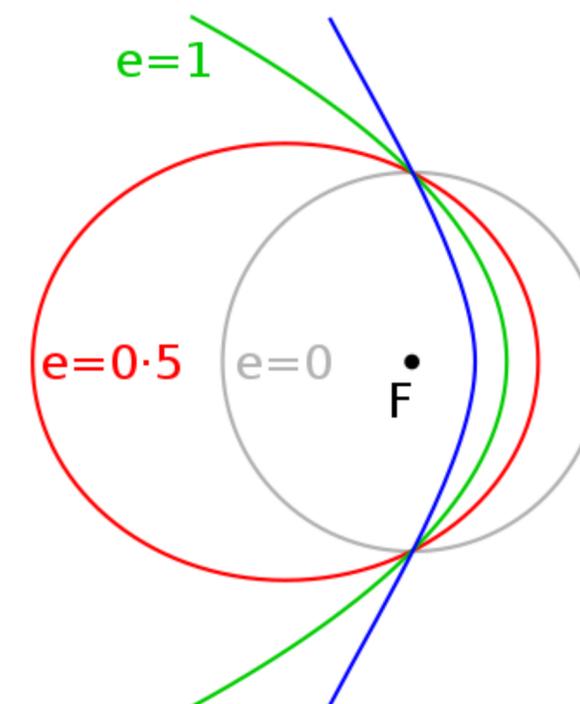
参考 https://en.m.wikipedia.org/wiki/Tisserand%27s_parameter

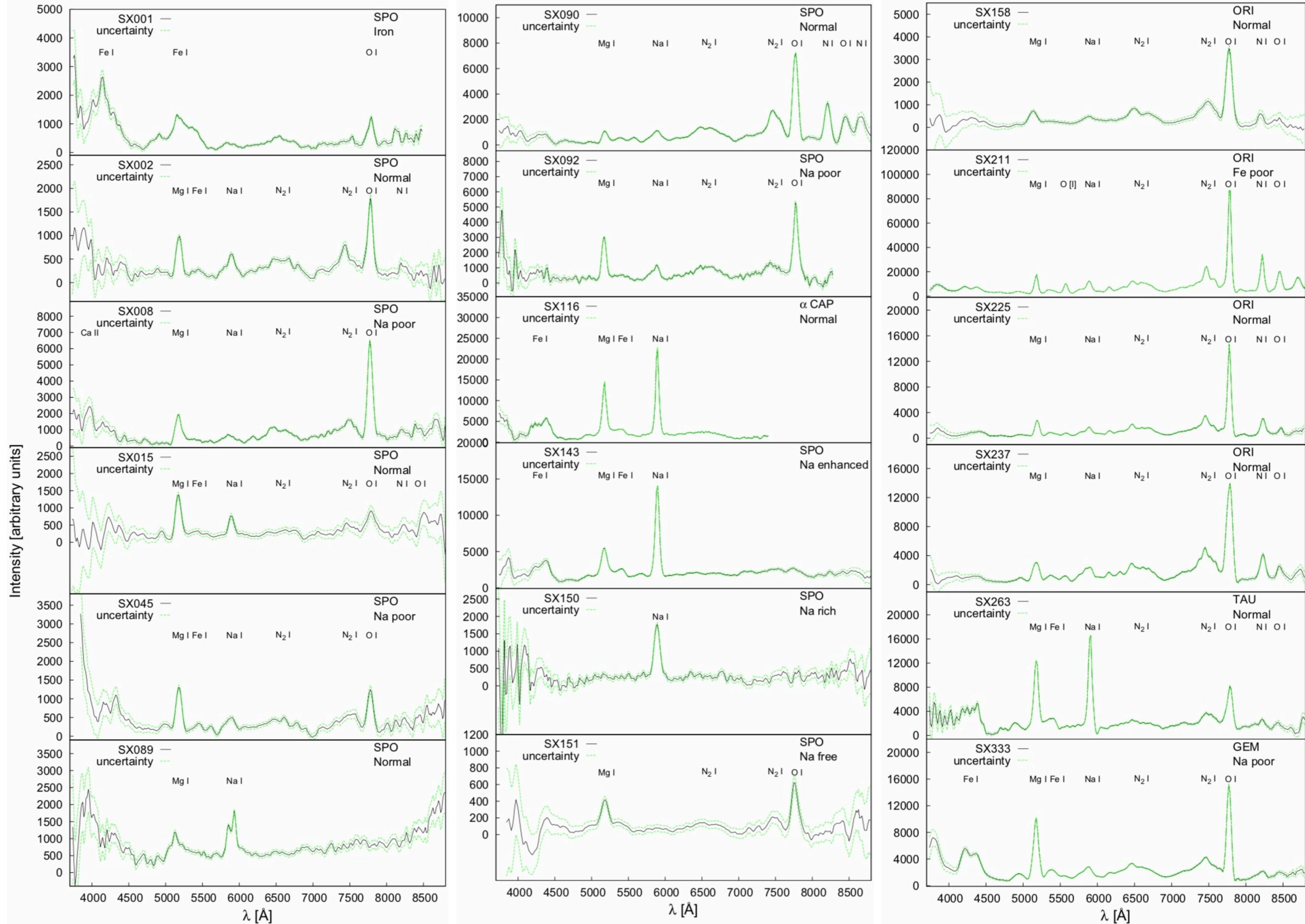
軌道の6要素

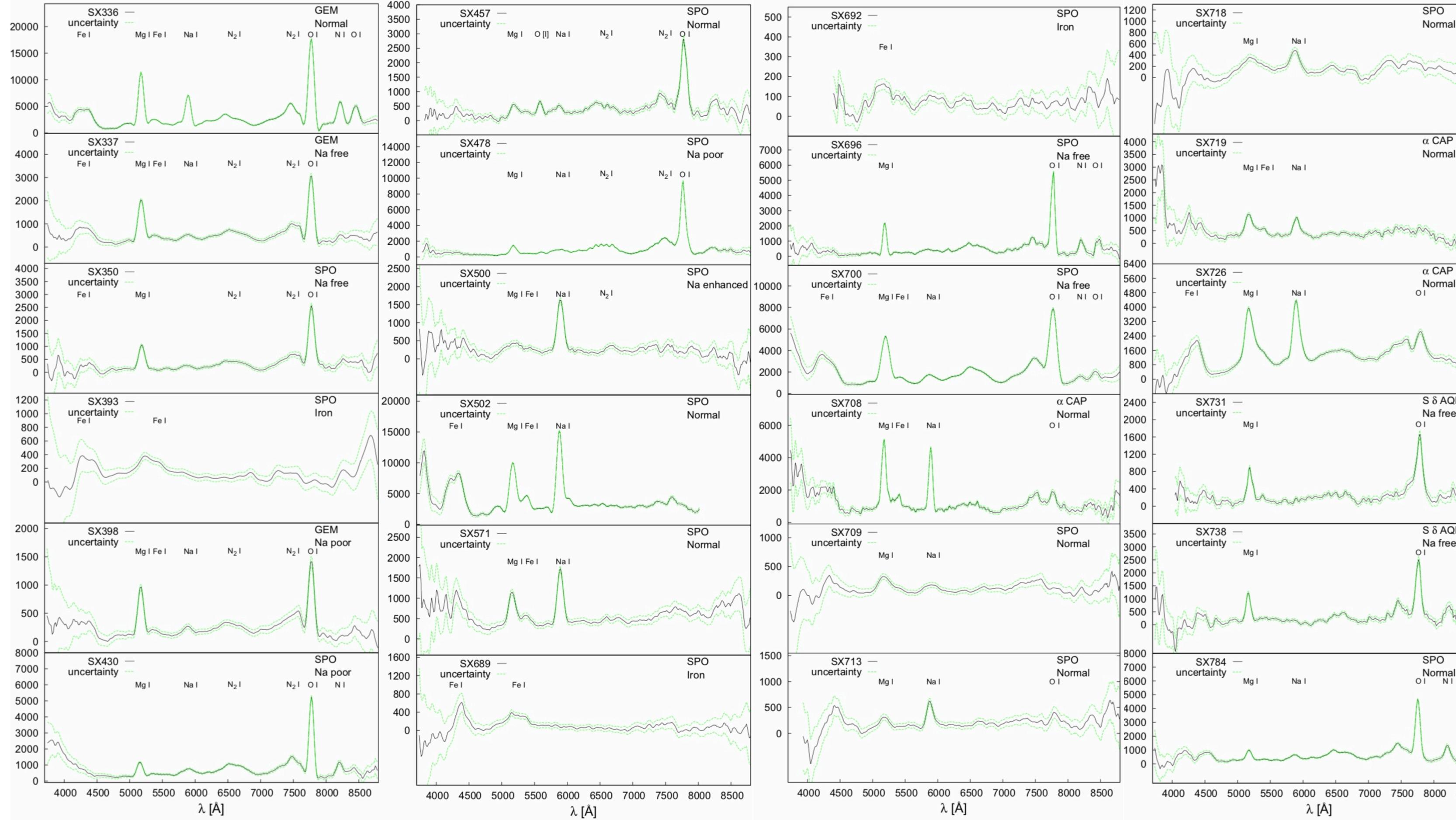
- 離心率: e
- 近日点距離: q
- 昇交点黄経: Ω
- 軌道傾斜角: i
- 近日点引数: ω
- 近日点通過時刻: t

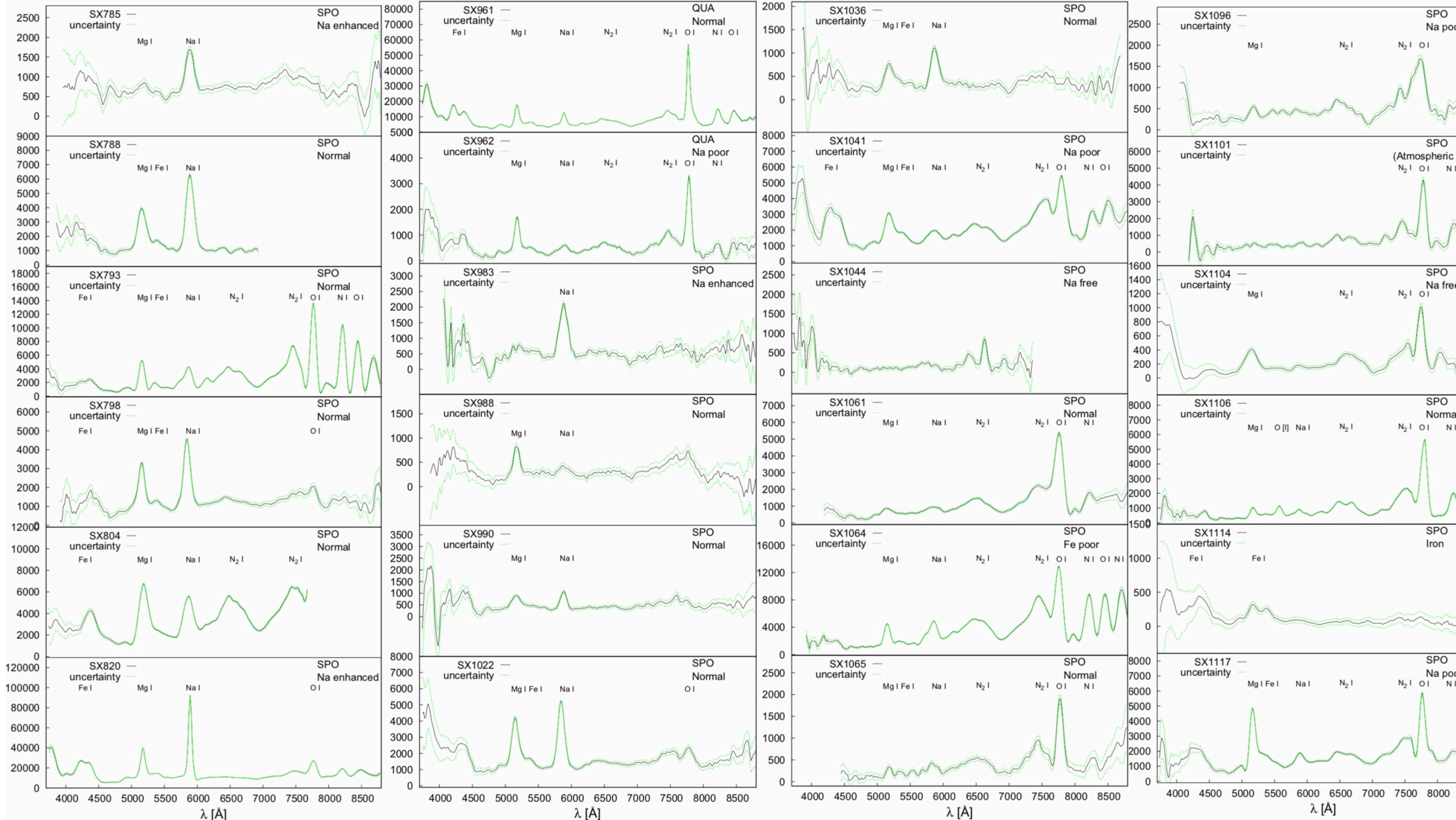


形を決める5つ
位置を決める1つ









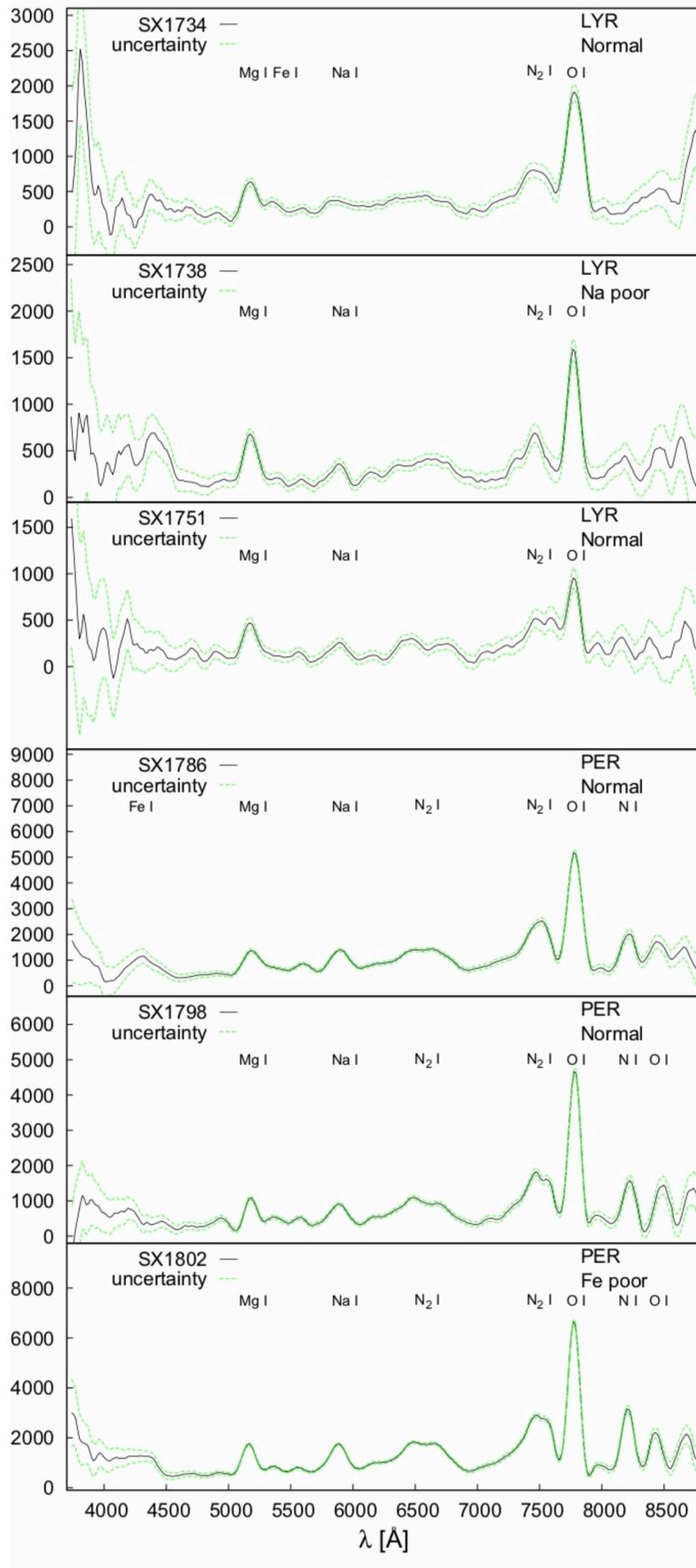
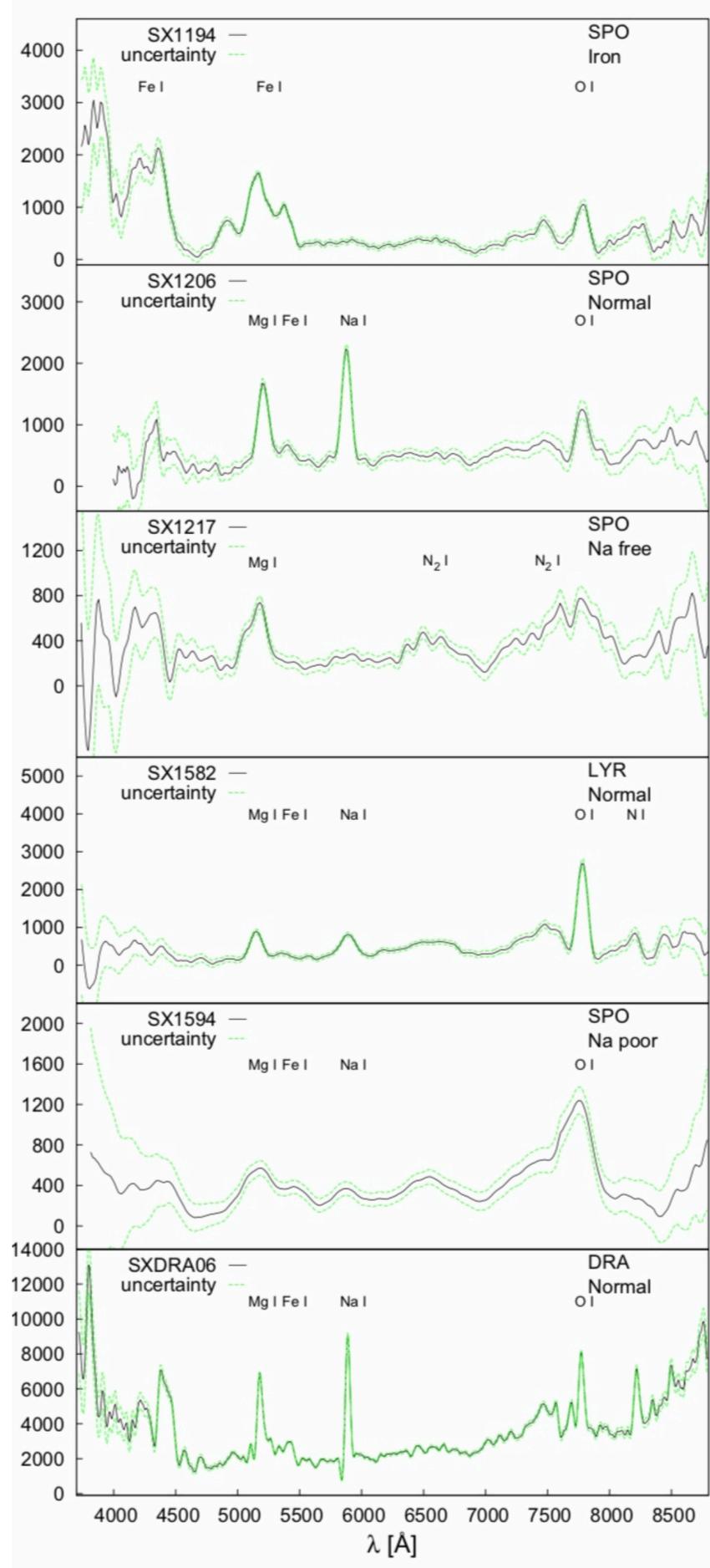
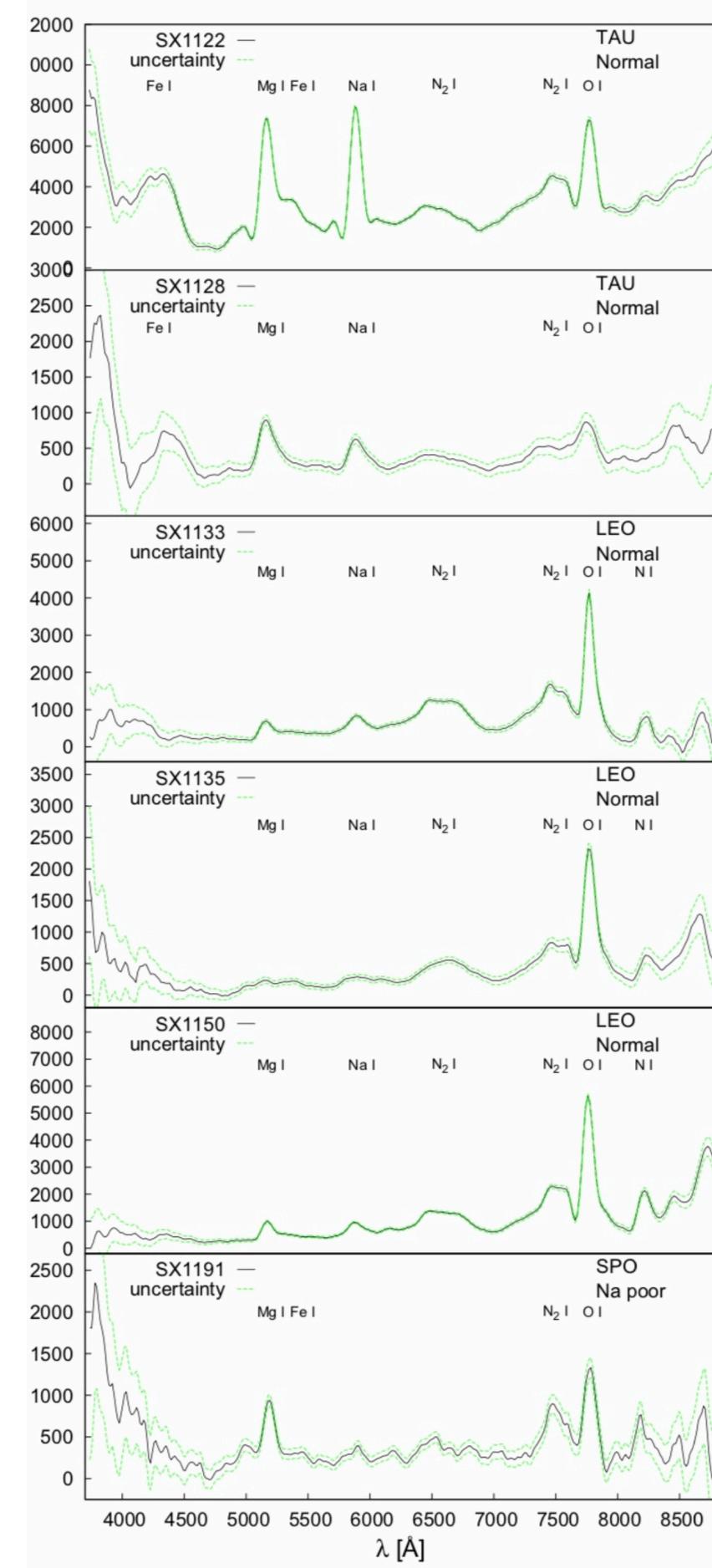


Table 4. Atmospheric trajectories of the observed meteors.

Spectrum	Meteor	Time (UT)	α_G (°)	δ_G (°)	z_R (°)	H_{beg} (km)	H_{end} (km)	M_{max} (mag)	Photo mass (g)	v (km s ⁻¹)	Spectral type
SX001	06406048	23:43:07	223.8	-6.8	57.7	98.0	84.7	0.6	2.5E-02	41.9	Iron
			0.1	0.4	0.4	-	-	-	-	0.2	
SX002	06406069	00:36:32	281.28	48.81	38.85	115.7	90.6	0.5	2.2E-02	42.2	Normal
			0.09	0.05	0.06	-	-	-	-	0.1	
SX008	06420006	20:35:16	242.09	20.52	60.80	103.8	84.0	0.0	6.6E-02	41.9	Na-poor
			0.05	0.04	0.04	-	-	-	-	0.1	
SX015	06420089	00:40:41	210.08	-17.91	67.13	99.0	80.6	0.0	2.6E-01	28.08	Normal
			0.02	0.04	0.04	-	-	-	-	0.09	
SX045	06724023	21:45:35	323.43	3.4	55.8	103.0	84.2	-0.2	7.2E-02	37.57	Na-poor
			0.03	0.3	0.2	-	-	-	-	0.09	
SX089	06727196	01:16:54	276.4	35.13	44.19	98.4	79.2	-0.9	5.4E-01	22.23	Normal
			0.07	0.08	0.06	-	-	-	-	0.07	
SX090	06727206	01:25:18	359.66	15.64	36.66	121.7	89.4	-0.8	2.2E-02	64.4	Normal
			0.09	0.07	0.07	-	-	-	-	0.1	
SX092	06727222	01:47:07	109.84	52.66	65.02	102.8	80.8	-2.1	8.5E-01	36.31	Na-poor
			0.04	0.02	0.02	-	-	-	-	0.06	
SX116	06730083	23:12:00	305.26	-9.11	55.47	95.0	80.1	-2.4	2.3E+00	23.8	Normal
			0.03	0.07	0.05	-	-	-	-	0.1	
SX143	06A20013	20:28:34	353.78	17.22	28.84	106.6	72.0	-1.4	1.2E+00	17.60	Na-enhanced
			0.05	0.06	0.03	-	-	-	-	0.08	
SX150	06A20125	22:43:42	355.2	8.3	41.8	95.2	72.6	0.7	1.5E-01	17.30	Na rich
			0.8	0.8	0.7	-	-	-	-	0.05	
SX151	06A20126	22:44:55	53.7	23.6	34.2	97.1	82.1	0.9	9.0E-03	44.4	Na-free
			0.1	0.1	0.1	-	-	-	-	0.4	
SX158	06A20149	23:01:35	94.67	15.32	62.57	118.4	94.7	2.0	2.3E-03	66.8	Normal
			0.08	0.07	0.07	-	-	-	-	0.2	
SX211	06A20437	02:10:43	95.7	15.0	38.1	135.2	90.5	-2.4	4.1E-02	67.8	Fe-poor
			0.2	0.1	0.1	-	-	-	-	0.3	
SX225	06A20527	03:01:45	95.0	15.5	34.4	120.2	87.9	1.3	3.6E-03	68.3	Normal
			0.2	0.2	0.2	-	-	-	-	0.2	
SX237	06A20632	03:57:45	96.0	14.5	35.2	125.6	94.2	1.0	0.7E-02	66.2	Normal
			0.3	0.3	0.3	-	-	-	-	0.3	
SX263	06B18075	02:18:34	62.00	24.15	40.84	104.8	72.0	-1.3	6.8E-01	28.15	Normal
			0.03	0.02	0.02	-	-	-	-	0.09	
SX333	06C13104	23:20:41	113.8	32.0	26.5	102.5	76.0	-1.2	2.1E-01	36.0	Na-poor
			0.2	0.1	0.1	-	-	-	-	0.1	
SX336	06C13136	23:34:20	113.78	32.67	23.98	104.8	67.0	-1.5	5.2E-01	35.54	Normal
			0.04	0.02	0.03	-	-	-	-	0.05	
SX337	06C13137	23:34:36	113.2	32.65	23.69	102.0	80.3	0.3	5.6E-02	37.2	Na-free
			0.1	0.07	0.09	-	-	-	-	0.2	
SX350	06C13334	01:05:55	209.80	55.04	54.20	99.9	82.1	0.3	2.3E-02	46.1	Na-free
			0.07	0.06	0.05	-	-	-	-	0.3	
SX393	06C14187	22:45:46	359.2	40.5	39.5	78.2	69.3	2.1	2.0E-01	12.70	Iron
			0.4	0.3	0.1	-	-	-	-	0.08	
SX398	06C14215	23:09:09	113.4	31.45	27.64	102.1	81.0	-0.3	3.8E-02	36.9	Na-poor
			0.1	0.04	0.06	-	-	-	-	0.2	
SX430	06C14357	01:25:38	148.59	28.28	31.55	123.6	91.2	0.5	5.2E-03	64.9	Na-poor
			0.07	0.04	0.05	-	-	-	-	0.1	
SX457	06C14515	03:19:46	129.8	2.62	48.07	114.4	93.3	-1.0	3.0E-02	59.7	Normal
			0.2	0.06	0.07	-	-	-	-	0.2	
SX478	06C14645	04:52:24	171.7	7.99	41.08	109.6	91.6	-0.6	5.0E-03	72.9	Na-poor
			0.1	0.06	0.06	-	-	-	-	0.3	
SX500	07407021	20:31:25	194.70	43.65	23.74	89.3	72.0	0.1	4.5E-01	18.2	Na-enhanced
			0.08	0.04	0.04	-	-	-	-	0.1	
SX502	07407034	21:40:46	261	85.40	36.62	86.3	67.8	0.4	2.9E-01	19.7	Normal
			1	0.06	0.08	-	-	-	-	0.1	
SX571	07812429	01:40:39	285.7	46.8	44.70	100.7	79.7	-1.5	5.8E-01	24.7	Normal
			0.1	0.1	0.08	-	-	-	-	0.1	
SX689	08505008	01:01:14	308	66.3	31.1	86.3	79.0	1.7	2.0E-02	26.6	Iron
			1	0.2	0.4	-	-	-	-	0.2	

Notes. The table includes the geocentric right ascension α_G , declination δ_G , and zenithal distance z_R of the computed radiant, meteor beginning height H_{beg} , terminal height H_{end} , absolute magnitude M_{max} , computed photometric mass, atmospheric velocity of the meteoroid v and finally the classified spectral type of given meteor.

Table 4. continued.

Spectrum	Meteor	Time (UT)	α_G (°)	δ_G (°)	z_R (°)	H_{beg} (km)	H_{end} (km)	M_{max} (mag)	Photo mass (g)	v (km s ⁻¹)	Spectral type
SX692	08505025	01:31:55	203	54	30	78.6	75.6	0.6	1.1E-01	16.1	Iron
			3	3	2	-	-	-	-	0.6	
SX696	08506016	01:08:38	279.0	7.3	45.6	103.7	86.5	-0.7	1.8E-02	57.4	Na-free
			0.1	0.1	0.1	-	-	-	-	0.4	
SX700	08507002	00:43:02	246.71	-22.8	70.7	97.9	82.8	0.4	5.0E-02	38.5	Na-free
			0.09	0.2	0.2	-	-	-	-	0.1	
SX708	08728076	22:21:19	304.82	-9.4	56.3	98.6	80.8	-0.3	3.6E-01	25.20	Normal
			0.07	0.1	0.1	-	-	-	-	0.08	
SX709	08728078	22:22:45	279.2	51.1	11.6	99.3	83.2	1.2	4.0E-02	29.4	Normal
			0.4	0.1	0.2	-	-	-	-	0.3	
SX713	08728098	22:49:51	230.0	45.8	42.7	93.6	78.3	0.8	3.2E-01	17.41	Normal
			0.3	0.2	0.2	-	-	-	-	0.04	
SX718	08728149	23:32:27	278.4	50.4	22.7	99.1	82.4	0.9	5.8E-02	28.86	Normal
			0.2	0.1	0.2	-	-	-	-	0.08	
SX719	08728151	23:33:42	304.54	-9.05	56.50	101.2	82.2	-0.1	2.3E-01	24.95	Normal
			0.05	0.09	0.08	-	-	-	-	0.09	
SX726	08728233	00:43:49	304.46	-8.67	60.30	102.3	80.4	-1.0	7.4E-01	24.80	Normal
			0.03	0.05	0.04	-	-	-	-	0.07	
SX731	08728280	01:20:07	340.1	-15.1	63.5	97.7	84.5	0.3	2.7E-02	42.3	Na-free
			0.1	0.1	0.1	-	-	-	-	0.2	
SX738	08729037	22:03:15	339.53	-16.46	75.64	103.1	85.4	0.0	4.2E-02	42.5	Na-free
			0.01	0.08	0.07	-	-	-	-	0.1	
SX784	08927015	23:59:01	82.78	13.05	61.94	123.1	96.8	0.5	6.3E-03	70.8	Normal
			0.06	0.04	0.05	-	-	-	-	0.1	
SX785	08927018	00:01:28	348.45	-20.9	68.74	99.4	83.4	0.1	7.2E-01	19.1	Na-enhanced
			0.06	0.1	0.02	-	-	-	-	0.2	
SX788	08927101	02:01:02	309.5	37.2	62.31	96.3	76.6	-0.7	1.1E+00	19.5	Normal
			0.2	0.1	0.04	-	-	-	-	0.2	
SX793	08927195	03:43:50	134.96	52.56	35.76	118.4	86.0	-2.5	9.2E-02	60.77	Normal
			0.09	0.03	0.05	-	-	-	-	0.09	
SX798	08928139	00:05:25	2.08	10.36	40.45	101.3	74.6	-0.6	7.0E-01	24.73	Normal
			0.03	0.03	0.02	-	-	-	-	0.07	
SX804	08928235	01:55:56	203.2	85.75	43.55	114.2	86.9	-1.8	1.6E-01	42.48	Normal
			0.7	0.09	0.08	-	-	-	-	0.08	
SX820	08A20002	20:05:23	23.78	5.59	51.77	90.0	55.8	-0.7	1.1E+00	23.98	Na-enhanced
			0.02	0.01	0.01	-	-	-	-	0.03	
SX961	09102507	05:28:21	229.74	52.20	19.27	103.8	79.0	-1.6	1.2E-01	41.7	Normal
			0.04	0.02	0.02	-	-	-	-	0.2	
SX962	09102515	05:31:10	231.17	49.69	20.09	103.1	81.0	-0.1	2.2E-02	42.5	Na-poor
			0.07	0.03	0.04	-	-	-	-	0.3	
SX983	09421005	20:07:24	204.4	3.28	53.25	102.9	78.2	-0.1	6.4E-01	22.40	Na-enhanced
			0.1	0.04	0.06	-	-	-	-	0.02	
SX988	09421084	00:14:38	219.5	-5.71	53.24	105.7	86.6	-1.4	3.6E-01	31.1	Normal
			0.1	0.06	0.05	-	-	-	-	0.2	
SX990	09421101	00:54:11	203.81	5.04	49.08	103.3	81.3	1.4	1.4E-01	21.9	Normal
			0.03	0.08	0.06	-	-	-	-	0.1	
SX1022	09729261	01:16:49	297.6	3.45	55.11	103.2	75.7	-1.1	1.3E+00	23.71	Normal
			0.02	0.02	0.02	-	-	-	-	0.06	
SX1036	09818045	21:18:57	289.34	21.35	27.19	94.5	80.4	0.8	1.7E-01	19.37	Normal
			0.06	0.09	0.08	-	-	-	-	0.06	
SX1041	09818120	23:23:17	352.08	3.92	47.41	104.5	82.7	-1.7	1.4E-01	40.1	Na-poor
			0.07	0.09	0.09	-	-	-	-	0.2	
SX1044	09818147	23:58:43	36.22	41.92	37.39	115.3	93.2	0.1	6.1E-03	63.7	Na-free
			0.06	0.09	0.06	-	-	-	-	0.3	
SX1061	09819134	23:19:41	66	62.3	48.1	114.1	88.6	-2.1	7.2E-02	57.33	Normal
			2	0.8	0.8	-	-	-	-	0.09	
SX1064	09819164	23:56:02	64.0	66.65	41.70	128.0	85.0	-2.8	2.0E-01	56.2	Fe-poor
			0.1	0.03	0.04						

Table 4. continued.

Spectrum	Meteor	Time (UT)	α_G ($^\circ$)	δ_G ($^\circ$)	z_R ($^\circ$)	H_{beg} (km)	H_{end} (km)	M_{max} (mag)	Photo mass (g)	v (km s^{-1})	Spectral type
SX1104	09820250	01:15:09	51.6 0.4	40.2 0.8	34.4 0.5	98.3 –	89.3 –	–0.6 –	4.8E-03 –	65 1	Na-free
SX1106	09820289	01:45:07	57.60 0.05	33.10 0.04	37.89 0.04	117.6 –	90.4 –	–0.9 –	1.4E-02 –	69.4 0.2	Normal
SX1114	09B17008	18:39:27	58.7 0.5	10.9 0.3	28.6 0.3	85.1 –	79.2 –	0.8 –	4.0E-02 –	23.8 0.2	Iron
SX1117	09B17022	19:12:24	66.38 0.09	16.81 0.04	23.64 0.05	97.0 –	76.0 –	–2.5 –	8.6E-01 –	32.0 0.2	Na-poor
SX1122	09B17055	20:39:45	63.36 0.03	14.71 0.02	23.98 0.02	107.1 –	71.7 –	–1.4 –	8.6E-01 –	27.7 0.2	Normal
SX1128	09B17084	21:23:40	62.03 0.04	25.96 0.04	22.01 0.03	100.9 –	78.5 –	–0.5 –	1.9E-01 –	29.7 0.2	Normal
SX1133	09B17115	21:52:14	154.74 0.08	21.06 0.09	55.28 0.08	117.7 –	93.0 –	1.3 –	2.5E-03 –	72.6 0.3	Normal
SX1135	09B17123	21:59:48	154.5 0.3	22.9 0.1	52.7 0.2	121.8 –	94.5 –	1.8 –	1.3E-03 –	72.0 0.3	Normal
SX1150	09B17192	23:03:06	153.9 0.1	22.23 0.08	40.0 0.1	123.6 –	92.1 –	0.9 –	2.2E-03 –	71.1 0.3	Normal
SX1191	10406022	21:07:08	212.99 0.05	–2.98 0.03	64.67 0.04	105.6 –	84.8 –	0.0 –	9.6E-02 –	34.91 0.03	Na-poor
SX1194	10406060	23:12:11	207.5 0.2	–8.8 0.2	57.0 0.2	92.1 –	80.4 –	0.5 –	4.4E-02 –	32.6 0.1	Iron
SX1206	10407030	21:46:02	196.02 0.06	4.52 0.03	45.18 0.03	107.4 –	79.5 –	0.3 –	3.7E-01 –	24.47 0.06	Normal
SX1217	10408088	02:45:40	225.3 0.3	–9.9 0.4	62.5 0.4	100.2 –	85.6 –	–0.1 –	3.8E-02 –	40.6 0.3	Na-free
SX1582	11422209	02:18:47	272.7 0.2	32.90 0.05	19.17 0.08	115.3 –	86.4 –	–3.1 –	2.7E-01 –	48.5 0.2	Normal
SX1594	11505072	01:05:40	245.08 0.03	–16.62 0.09	65.25 0.09	109.0 –	89.7 –	–1.2 –	1.6E-01 –	42.5 0.1	Na-poor
SXDRA06	DRA06	20:28:21	262.77 0.06	55.82 0.07	39.92 0.02	105.5 –	76.7 –	–3.1 –	1.0E+00 –	23.3 0.1	Normal
SX1734	12421024	20:41:33	271.85 0.02	33.61 0.02	68.74 0.01	114.6 –	93.5 –	–0.7 –	8.0E-02 –	48.51 0.03	Normal
SX1738	12421069	22:47:04	271.68 0.04	32.68 0.03	50.27 0.03	124.7 –	89.4 –	–0.7 –	4.4E-02 –	48.9 0.1	Na-poor
SX1751	12422070	00:23:19	271.68 0.05	33.48 0.02	33.69 0.04	122.5 –	85.9 –	0.6 –	1.4E-02 –	48.32 0.06	Normal
SX1786	12811093	22:27:52	46.82 0.07	57.77 0.04	52.61 0.04	131.3 –	87.2 –	–2.0 –	8.3E-02 –	60.87 0.06	Normal
SX1798	12811305	00:29:01	48.29 0.09	56.91 0.04	38.93 0.05	129.7 –	90.6 –	–0.2 –	2.0E-02 –	61.59 0.08	Normal
SX1802	12811384	01:07:25	46.09 0.09	56.74 0.02	32.89 0.05	136.7 –	87.7 –	–1.6 –	4.3E-02 –	61.1 0.2	Fe-poor

Table 5. Orbital parameters of observed meteors.

Spectrum	$1/a$ (1/AU)	e	i (°)	q (AU)	Q (AU)	ω (°)	Ω	T_j (°)	v_g (km s ⁻¹)	Shower
SX001	0.395	0.957	28.9	0.110	5.0	325.1	16.95	2.4	40.3	SPO
	0.016	0.002	0.9	0.004	0.2	0.7	–	0.3	0.2	
SX002	0.013	0.99	66.3	0.999	160	174.5	16.98	0.6	40.5	SPO
	0.010	0.01	0.1	0.001	130	0.1	–	0.3	0.1	
SX008	0.047	0.974	56.7	0.563	42	263.7	30.54	0.7	40.2	SPO
	0.010	0.005	0.2	0.001	9	0.2	–	0.1	0.1	
SX015	0.377	0.812	4.88	0.498	4.81	97.21	210.70	2.79	25.9	SPO
	0.005	0.003	0.03	0.001	0.08	0.04	–	0.03	0.1	
SX045	0.512	0.898	35.0	0.200	3.71	314.2	121.76	3.1	35.7	SPO
	0.006	0.002	0.5	0.002	0.05	0.2	–	0.2	0.1	
SX089	0.283	0.733	26.3	0.943	6.1	213.73	124.77	2.48	19.50	SPO
	0.005	0.004	0.1	0.001	0.1	0.09	–	0.06	0.09	

Notes. Second row for each meteor contains corresponding errors. The standard error for the ascending node Ω is of order 10^{-3} for all mete

Table 5. continued.

Spectrum	$1/a$ (1/AU)	e	i (°)	q (AU)	Q (AU)	ω (°)	Ω	T_j (°)	v_g (km s ⁻¹)	Shower
SX090	0.023	0.989	147.1	0.495	86	271.8	124.78	-0.6	63.3	SPO
	0.013	0.006	0.2	0.003	50	0.5	–	0.3	0.2	
SX092	0.383	0.844	42.80	0.408	4.82	72.13	124.79	2.55	34.40	SPO
	0.003	0.001	0.09	0.001	0.05	0.08	–	0.05	0.06	
SX116	0.436	0.730	7.00	0.619	3.97	265.72	127.56	3.17	21.1	α CAP
	0.007	0.005	0.08	0.002	0.07	0.06	–	0.04	0.1	
SX143	0.396	0.657	6.84	0.865	4.19	227.95	207.21	3.10	13.6	SPO
	0.006	0.005	0.06	0.001	0.07	0.06	–	0.04	0.1	
SX150	0.358	0.69	3.5	0.872	4.7	225.9	207.30	2.92	13.43	SPO
	0.012	0.01	0.3	0.004	0.2	0.9	–	0.08	0.06	
SX151	0.316	0.985	19.9	0.048	6.3	336.6	207.31	1.9	42.9	SPO
	0.028	0.002	0.8	0.002	0.6	0.4	–	0.2	0.4	
SX158	0.161	0.908	163.0	0.576	12	83.5	27.32	0.0	65.6	ORI
	0.015	0.008	0.1	0.004	1	0.7	–	0.1	0.2	
SX211	0.083	0.95	162.8	0.619	23	77	27.45	-0.5	66.8	ORI
	0.024	0.02	0.3	0.006	7	1	–	0.3	0.3	
SX225	0.015	0.99	163.9	0.610	130	77.2	27.49	-1	67.3	ORI
	0.022	0.01	0.4	0.005	200	0.9	–	1	0.2	
SX237	0.211	0.87	161.7	0.598	9	82	27.53	0.2	65.3	ORI
	0.023	0.01	0.5	0.008	1	1	–	0.2	0.3	
SX263	0.461	0.802	3.09	0.430	3.91	285.67	236.50	3.17	26.1	TAU
	0.005	0.003	0.03	0.001	0.05	0.06	–	0.02	0.1	
SX333	0.773	0.894	23.1	0.137	2.46	325.4	261.72	4.43	34.1	GEM
	0.009	0.002	0.3	0.002	0.03	0.2	–	0.07	0.2	
SX336	0.751	0.895	24.8	0.139	2.52	324.62	261.73	4.51	34.5	GEM
	0.006	0.001	0.2	0.001	0.02	0.06	–	0.02	0.1	
SX337	0.691	0.906	25.4	0.136	2.76	324.4	261.73	4.00	35.4	GEM
	0.009	0.002	0.3	0.001	0.04	0.2	–	0.07	0.2	
SX350	0.289	0.72	78.4	0.984	5.9	179.5	261.79	1.7	44.5	SPO
	0.019	0.02	0.3	0.001	0.5	0.2	–	0.3	0.3	
SX393	0.631	0.384	6.4	0.976	2.19	194.1	262.71	4.3	6.5	SPO
	0.009	0.009	0.2	0.001	0.05	0.3	–	0.2	0.2	
SX398	0.688	0.905	22.1	0.139	2.77	324.0	262.73	4.00	35.0	GEM
	0.013	0.003	0.3	0.002	0.06	0.2	–	0.08	0.3	
SX430	0.017	0.993	144.7	0.425	120	278.1	278.1	-0.6	63.8	SPO
	0.013	0.006	0.1	0.003	100	0.5	–	0.4	0.2	
SX457	0.042	0.991	129.7	0.222	50	123.8	81.89	-0.1	58.7	SPO
	0.021	0.005	0.4	0.003	20	0.7	–	0.3	0.2	
SX478	0.049	0.95	173.0	0.977	40	190.2	261.96	-1.0	72.0	SPO
	0.025	0.02	0.1	0.001	20	0.4	–	0.6	0.3	
SX500	0.484	0.553	16.4	0.924	3.21	218.42	17.55	3.52	14.3	SPO
	0.008	0.008	0.1	0.001	0.07	0.09	–	0.09	0.1	
SX502	0.360	0.641	23.8	0.998	4.6	172.7	17.59	2.90	16.3	SPO
	0.008	0.008	0.2	0.001	0.1	0.1	–	0.09	0.1	
SX571	0.256	0.753	32.9	0.964	6.8	207.6	139.86	2.3	22.3	SPO
	0.007	0.007	0.2	0.001	0.2	0.1	–	0.1	0.1	
SX689	0.542	0.48	41.3	0.966	2.72	150	45.77	3.6	24.1	SPO
	0.011	0.01	0.3	0.002	0.08	1	–	0.2	0.2	
SX692	0.477	0.52	16	0.999	3.2	194	45.80	3.5	11.8	SPO
	0.044	0.05	1	0.004	0.4	3	–	0.6	0.8	
SX696	0.066	0.97	108.4	0.524	30	269	46.75	0.1	56.2	SPO
	0.033	0.02	0.4	0.006	20	1	–	0.4	0.4	
SX700	0.374	0.941	2.4	0.159	5.2	137.7	227.68	2.43	36.9	SPO
	0.007	0.001	0.4	0.001	0.1	0.2	–	0.03	0.1	
SX708	0.385	0.772	7.48	0.592	4.60	267.5	126.08	2.89	22.58	α CAP
	0.005	0.003	0.09	0.001	0.07	0.1	–	0.03	0.09	
SX709	0.026	0.97	40.0	0.982	70	201.2	126.07	1.1	27.3	SPO
	0.023	0.02	0.3	0.001	70	0.3	–	0.6	0.3	
SX713	0.355	0.640	18.30	1.014	4.63	175.5	126.09	2.92	13.65	SPO
	0.004	0.004	0.08	0.001	0.06	0.2	–	0.04	0.05	
SX718	0.038	0.96	39.0	0.981	50	201.3	126.12	1.1	26.76	SPO
	0.007	0.07	0.1	0.001	10	0.2	–	0.1	0.08	
SX719	0.388	0.768	7.65	0.598	4.56	266.9	126.12	2.91	22.4	α CAP
	0.005	0.003	0.08	0.001	0.07	0.1	–	0.03	0.1	

Table 5. continued.

Spectrum	$1/a$ (1/AU)	e	i ($^{\circ}$)	q (AU)	Q (AU)	ω ($^{\circ}$)	Ω	T_j ($^{\circ}$)	v_g (km s^{-1})	Shower
SX726	0.391	0.766	7.91	0.600	4.52	266.78	126.17	2.93	22.33	α CAP
	0.004	0.003	0.05	0.001	0.05	0.07	–	0.02	0.08	
SX731	0.439	0.973	25.7	0.061	4.5	154.9	306.19	2.56	40.8	S δ AQR
	0.012	0.001	0.6	0.001	0.1	0.3	–	0.09	0.2	
SX738	0.363	0.971	26.3	0.080	5.4	150.5	307.01	2.20	40.8	S δ AQR
	0.009	0.001	0.3	0.001	0.1	0.1	–	0.06	0.1	
SX784	0.018	0.98	161.78	0.891	110	39.1	4.14	–1.0	69.7	SPO
	0.011	0.01	0.08	0.001	70	0.3	–	0.5	0.1	
SX785	0.276	0.766	6.26	0.848	6.4	49.8	6.10	2.50	15.7	SPO
	0.010	0.009	0.02	0.002	0.3	0.2	–	0.06	0.2	
SX788	0.290	0.73	20.0	0.949	5.9	209.1	185.20	2.6	16.3	SPO
	0.011	0.01	0.2	0.001	0.3	0.1	–	0.1	0.2	
SX793	0.005	0.997	113.99	0.749	430	119.6	185.27	–0.4	59.59	SPO
	0.008	0.006	0.09	0.001	770	0.2	–	0.5	0.09	
SX798	0.417	0.760	6.43	0.577	4.22	269.04	186.10	3.04	22.22	SPO
	0.004	0.003	0.04	0.001	0.05	0.05	–	0.02	0.08	
SX804	0.137	0.863	69.28	1.001	13.6	178.0	186.18	1.1	40.99	SPO
	0.006	0.006	0.09	0.001	0.6	0.2	–	0.1	0.08	
SX820	0.390	0.758	2.71	0.621	4.51	82.63	27.69	2.94	21.04	SPO
	0.002	0.001	0.01	0.001	0.03	0.03	–	0.01	0.04	
SX961	0.315	0.69	69.3	0.983	5.4	176.60	282.85	2.0	40.1	QUA
	0.010	0.01	0.2	0.001	0.2	0.06	–	0.2	0.2	
SX962	0.318	0.69	71.0	0.978	5.3	170.5	282.85	2.0	40.9	QUA
	0.017	0.02	0.3	0.001	0.3	0.2	–	0.3	0.3	
SX983	0.375	0.726	7.18	0.731	4.60	249.4	31.72	2.93	19.24	SPO
	0.003	0.002	0.03	0.001	0.04	0.2	–	0.02	0.03	
SX988	0.308	0.868	10.1	0.430	6.1	283.4	31.89	2.37	29.1	SPO
	0.015	0.007	0.2	0.003	0.3	0.3	–	0.07	0.2	
SX990	0.357	0.733	7.81	0.748	4.9	246.78	31.92	2.85	19.1	SPO
	0.006	0.005	0.08	0.001	0.1	0.07	–	0.04	0.1	
SX1022	0.341	0.760	15.30	0.705	5.17	253.02	126.91	2.71	21.18	SPO
	0.004	0.003	0.06	0.001	0.06	0.03	–	0.03	0.07	
SX1036	0.309	0.714	17.10	0.925	5.55	217.59	145.92	2.66	15.93	SPO
	0.004	0.004	0.08	0.001	0.09	0.07	–	0.04	0.07	
SX1041	0.509	0.955	21.7	0.088	3.84	330.3	146.01	2.99	38.4	SPO
	0.010	0.001	0.4	0.001	0.08	0.2	–	0.07	0.2	
SX1044	0.281	0.73	133.8	0.960	6.2	208.6	146.03	0.7	62.5	SPO
	0.029	0.03	0.2	0.002	0.7	0.8	–	0.3	0.4	
SX1061	0.160	0.86	107	0.89	12	137.0	146.96	0	56.1	SPO
	0.037	0.03	1	0.01	3	2.6	–	1	0.1	
SX1064	0.068	0.94	101.2	0.918	28	143.8	146.99	0.1	54.9	SPO
	0.013	0.01	0.1	0.001	5	0.3	–	0.2	0.2	
SX1065	0.035	0.97	141.2	0.751	60	241	146.99	–0.6	65.0	SPO
	0.042	0.03	0.3	0.006	70	1	–	0.9	0.5	
SX1096	0.370	0.823	139.0	0.479	4.9	279.6	147.93	1.3	59.1	SPO
	0.016	0.006	0.3	0.005	0.2	0.9	–	0.2	0.2	
SX1101	0.049	0.954	129.17	0.946	40	29.9	327.97	–0.5	63.71	SPO
	0.007	0.006	0.08	0.001	5	0.1	–	0.1	0.07	
SX1104	0.372	0.6	143	1.010	4	175	148.00	1	64	SPO
	0.103	0.1	1	0.001	1	2	–	1	1	
SX1106	0.153	0.85	157.9	0.995	12	164.5	148.02	–0.3	68.3	SPO
	0.016	0.02	0.08	0.001	1	0.2	–	0.2	0.2	
SX1114	0.575	0.681	6.7	0.554	2.92	94.9	55.43	3.83	20.9	SPO
	0.015	0.008	0.2	0.006	0.09	0.9	–	0.08	0.2	
SX1117	0.386	0.868	5.95	0.343	4.8	113.9	55.45	2.70	29.9	SPO
	0.009	0.004	0.07	0.002	0.1	0.2	–	0.04	0.2	
SX1122	0.506	0.780	6.11	0.434	3.52	106.21	55.51	3.40	25.5	TAU
	0.008	0.004	0.04	0.002	0.06	0.07	–	0.04	0.2	
SX1128	0.421	0.832	5.28	0.398	4.3	288.37	235.52	2.94	27.7	TAU
	0.012	0.006	0.07	0.003	0.1	0.08	–	0.06	0.2	
SX1133	0.020	0.98	163.0	0.980	100	169.6	235.56	–1	71.5	LEO
	0.032	0.03	0.2	0.001	170	0.3	–	2	0.3	
SX1135	0.053	0.95	160.3	0.985	37	172.6	235.56	–0.9	70.9	LEO
	0.027	0.03	0.3	0.001	20	0.9	–	0.6	0.3	
SX1150	0.146	0.86	161.5	0.985	12.7	173.3	235.61	–0.4	70.0	LEO
	0.028	0.03	0.2	0.001	2.7	0.5	–	0.3	0.3	

Table 5. continued.

Spectrum	$1/a$ (1/AU)	e	i ($^{\circ}$)	q (AU)	Q (AU)	ω ($^{\circ}$)	Ω	T_j ($^{\circ}$)	v_g (km s^{-1})	Shower
SX1191	0.381	0.889	14.53	0.291	4.96	300.4	16.81	2.61	32.87	SPO
	0.003	0.001	0.06	0.001	0.03	0.1	–	0.02	0.03	
SX1194	0.395	0.867	3.1	0.335	4.7	295.6	16.91	2.75	30.6	SPO
	0.011	0.003	0.2	0.003	0.1	0.4	–	0.05	0.2	
SX1206	0.373	0.758	7.12	0.650	4.71	259.3	17.83	2.87	21.69	SPO
	0.004	0.003	0.04	0.001	0.06	0.1	–	0.02	0.07	
SX1217	0.482	0.952	21	0.099	4.1	327.9	19.01	2.9	39.2	SPO
	0.023	0.003	1	0.004	0.2	0.8	–	0.2	0.3	
SX1582	0.087	0.92	80.7	0.922	40	209.6	32.45	0.4	46.9	LYR
	0.012	0.01	0.2	0.001	20	0.3	–	0.3	0.2	
SX1594	0.113	0.985	13.0	0.134	17	318.4	45.04	1.03	41.1	SPO
	0.010	0.001	0.3	0.001	2	0.1	–	0.04	0.2	
SXDRA06	0.304	0.697	31.5	0.996	5.6	173.23	195.05	2.6	20.6	DRA
	0.007	0.007	0.1	0.001	0.2	0.05	–	0.1	0.1	
SX1734	0.018	0.983	79.48	0.923	110	213.57	31.97	0.31	46.96	LYR
	0.003	0.003	0.03	0.001	20	0.05	–	0.04	0.04	
SX1738	0.023	0.979	80.4	0.914	90	215.3	32.05	0.3	47.3	LYR
	0.008	0.007	0.1	0.001	30	0.2	–	0.1	0.1	
SX1751	0.010	0.991	79.06	0.915	200	215.0	33.09	0.28	46.86	LYR
	0.005	0.004	0.06	0.001	100	0.1	–	0.09	0.06	
SX1786	0.013	0.988	113.6	0.954	157	151.9	139.46	–0.4	59.96	PER
	0.005	0.005	0.1	0.001	70	0.1	–	0.2	0.06	
SX1798	–0.011	1.01	115.4	0.947	–200	150.5	139.54	–0.6	60.43	PER
	0.007	0.01	0.1	0.001	100	0.2	–	0.3	0.08	
SX1802	0.039	0.96	115.1	0.960	50	153.3	139.56	–0.3	59.9	PER
	0.016	0.02	0.1	0.001	20	0.3	–	0.3	0.2	

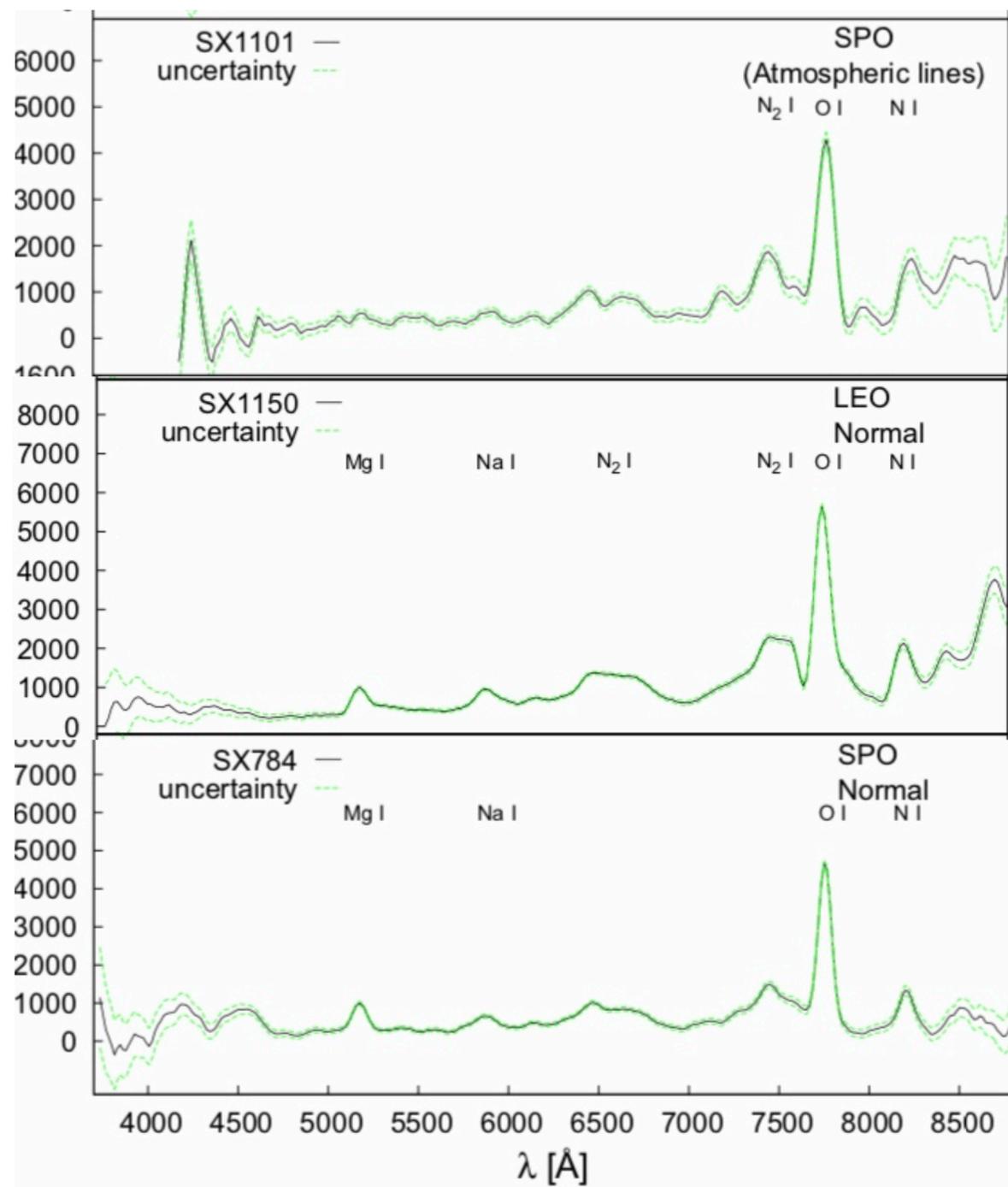
Table 6. Total intensities of lines Mg -2, Na -1 and Fe -15.

Spectrum	Mg -2 (J/sr)	Na -1 (J/sr)	Fe -15 (J/sr)	spectrum	Mg -2 (J/sr)	Na -1 (J/sr)	Fe -15 (J/sr)
SX001	5.06×10^{-1}	1.56×10^{-1}	2.61×10^0	SX785	7.36×10^{-1}	1.49×10^0	5.21×10^{-1}
SX002	1.72×10^0	1.09×10^0	9.57×10^{-1}	SX788	2.08×10^0	4.25×10^0	1.78×10^0
SX008	2.34×10^0	3.86×10^{-1}	7.89×10^{-1}	SX793	1.06×10^1	6.15×10^0	5.15×10^0
SX015	2.90×10^0	1.67×10^0	1.56×10^0	SX798	2.96×10^0	5.09×10^0	2.12×10^0
SX045	1.80×10^0	6.43×10^{-1}	7.09×10^{-1}	SX804	6.35×10^0	3.37×10^0	3.44×10^0
SX089	3.75×10^0	7.80×10^0	2.19×10^0	SX820	3.54×10^1	9.76×10^1	2.22×10^1
SX090	2.62×10^0	2.59×10^0	1.64×10^0	SX961	1.02×10^1	6.42×10^0	4.93×10^0
SX092	1.35×10^1	3.78×10^0	4.12×10^0	SX962	2.05×10^0	6.39×10^{-1}	1.49×10^0
SX116	2.32×10^1	3.55×10^1	9.45×10^0	SX983	7.51×10^0	1.72×10^1	3.24×10^0
SX143	6.02×10^0	1.97×10^1	5.45×10^0	SX988	2.92×10^0	1.37×10^0	1.89×10^0
SX150	4.40×10^{-1}	3.36×10^0	3.79×10^{-1}	SX990	1.26×10^0	1.37×10^0	1.40×10^0
SX151	2.97×10^0	1.99×10^{-1}	1.94×10^0	SX1022	5.28×10^0	8.38×10^0	3.99×10^0
SX158	1.06×10^0	4.85×10^{-1}	7.40×10^{-1}	SX1036	6.03×10^{-1}	9.26×10^{-1}	5.40×10^{-1}
SX211	3.57×10^1	2.05×10^1	1.05×10^1	SX1041	4.36×10^0	1.67×10^0	4.70×10^0
SX225	4.72×10^0	2.26×10^0	1.71×10^0	SX1044	2.88×10^{-1}	2.10×10^{-2}	6.00×10^{-2}
SX237	4.26×10^0	2.88×10^0	1.87×10^0	SX1061	3.31×10^0	1.76×10^0	1.81×10^0
SX263	2.32×10^1	3.38×10^1	9.32×10^0	SX1064	5.83×10^0	4.48×10^0	2.07×10^0
SX333	1.50×10^1	2.55×10^0	7.03×10^0	SX1065	3.67×10^{-1}	2.21×10^{-1}	2.13×10^{-1}
SX336	2.91×10^1	1.58×10^1	1.09×10^1	SX1096	2.85×10^{-1}	7.10×10^{-2}	1.40×10^{-1}
SX337	5.20×10^0	5.76×10^{-1}	2.42×10^0	SX1101	1.19×10^0	1.50×10^0	7.56×10^{-1}
SX350	4.04×10^0	4.31×10^{-1}	6.40×10^{-1}	SX1104	4.55×10^{-1}	1.80×10^{-2}	1.14×10^{-1}
SX393	3.10×10^{-2}	2.00×10^{-3}	3.86×10^{-1}	SX1106	7.81×10^{-1}	3.31×10^{-1}	5.07×10^{-1}
SX398	2.08×10^0	3.95×10^{-1}	1.07×10^0	SX1114	1.39×10^{-1}	9.50×10^{-2}	1.20×10^0
SX430	1.87×10^0	4.89×10^{-1}	6.58×10^{-1}	SX1117	3.41×10^0	7.07×10^{-1}	2.35×10^0
SX457	1.12×10^0	6.89×10^{-1}	6.23×10^{-1}	SX1122	8.07×10^0	1.05×10^1	8.46×10^0
SX478	1.55×10^0	4.68×10^{-1}	4.55×10^{-1}	SX1128	6.75×10^{-1}	5.08×10^{-1}	5.86×10^{-1}
SX500	3.50×10^{-1}	1.75×10^0	4.30×10^{-1}	SX1133	1.47×10^0	1.02×10^0	1.30×10^0
SX502	3.92×10^0	6.77×10^0	3.11×10^0	SX1135	4.35×10^{-1}	2.10×10^{-1}	4.43×10^{-1}
SX571	5.22×10^0	8.39×10^0	3.86×10^0	SX1150	1.46×10^0	9.12×10^{-1}	1.93×10^0
SX689	1.13×10^{-1}	1.00×10^{-2}	8.78×10^{-1}	SX1191	1.69×10^0	6.04×10^{-1}	6.24×10^{-1}
SX692	4.00×10^{-2}	6.00×10^{-3}	3.89×10^{-1}	SX1194	3.55×10^{-1}	5.00×10^{-2}	3.33×10^0
SX696	7.31×10^0	4.54×10^{-1}	7.46×10^{-1}	SX1206	3.51×10^0	4.68×10^0	2.82×10^0

Table 6. continued.

Spectrum	Mg -2 (J/sr)	Na -1 (J/sr)	Fe -15 (J/sr)	spectrum	Mg -2 (J/sr)	Na -1 (J/sr)	Fe -15 (J/sr)
SX700	5.40×10^0	6.42×10^{-1}	2.27×10^0	SX1217	9.40×10^{-1}	2.90×10^{-2}	3.46×10^{-1}
SX708	6.97×10^0	6.43×10^0	4.27×10^0	SX1582	6.75×10^0	5.07×10^0	3.30×10^0
SX709	3.21×10^{-1}	2.43×10^{-1}	2.57×10^{-1}	SX1594	1.24×10^0	3.53×10^{-1}	1.11×10^0
SX713	3.29×10^{-1}	9.54×10^{-1}	3.68×10^{-1}	SXDRA06	2.54×10^0	4.72×10^0	3.28×10^0
SX718	4.35×10^{-1}	5.64×10^{-1}	4.04×10^{-1}	SX1734	1.16×10^0	6.88×10^{-1}	1.03×10^0
SX719	7.15×10^{-1}	7.68×10^{-1}	6.77×10^{-1}	SX1738	1.54×10^0	5.46×10^{-1}	7.71×10^{-1}
SX726	3.21×10^0	3.83×10^0	3.16×10^0	SX1751	1.41×10^0	5.58×10^{-1}	4.56×10^{-1}
SX731	1.37×10^0	1.38×10^{-1}	4.67×10^{-1}	SX1786	3.28×10^0	2.33×10^0	2.72×10^0
SX738	3.15×10^0	2.89×10^{-1}	1.49×10^0	SX1798	3.80×10^0	2.28×10^0	1.74×10^0
SX784	1.92×10^0	7.61×10^{-1}	6.38×10^{-1}	SX1802	6.60×10^0	5.11×10^0	2.84×10^0

速度が速すぎて大気の影響が大きすぎた カタログを見てみよう！

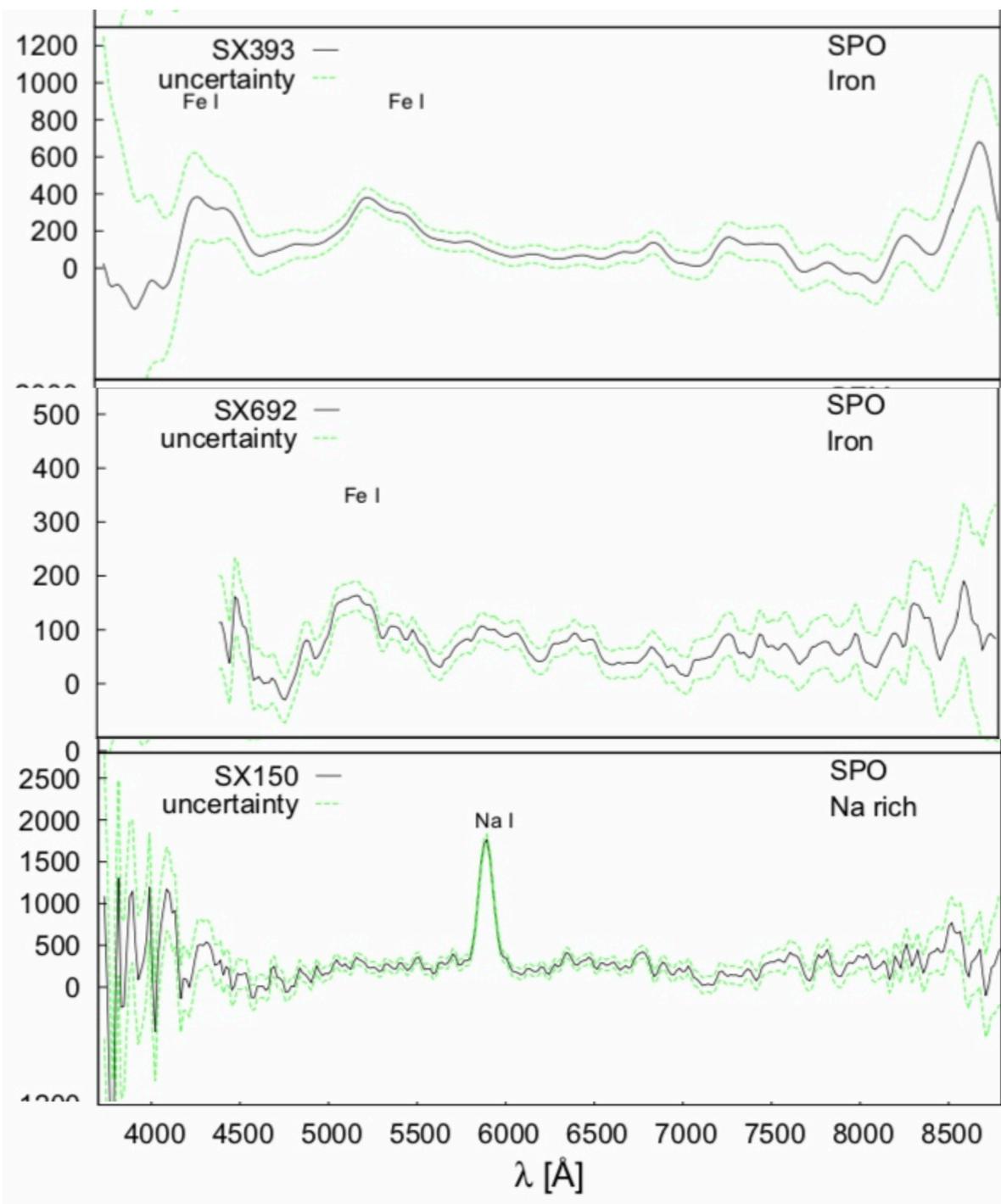


Spectrum	Meteor	Time (UT)	α_G (°)	δ_G (°)	z_R (°)	H_{beg} (km)	H_{end} (km)	M_{max} (mag)	Photo mass (g)	v (km s ⁻¹)	Spectral type
SX1101	09820190	00:17:12	53.08 0.01	-10.98 0.05	81.72 0.04	119.3 -	99.8 -	-0.5 -	4.9E-02 -	64.94 0.07	(Atmospheric lines)
SX1150	09B17192	23:03:06	153.9 0.1	22.23 0.08	40.0 0.1	123.6 -	92.1 -	0.9 -	2.2E-03 -	71.1 0.3	Normal
SX784	08927015	23:59:01	82.78 0.06	13.05 0.04	61.94 0.05	123.1 -	96.8 -	0.5 -	6.3E-03 -	70.8 0.1	Normal

Spectrum	$1/a$ (1/AU)	e	i (°)	q (AU)	Q (AU)	ω (°)	Ω	T_j (°)	v_g (km s ⁻¹)	Shower
SX1101	0.049	0.954	129.17	0.946	40	29.9	327.97	-0.5	63.71	SPO
SX1150	0.007	0.006	0.08	0.001	5	0.1	-	0.1	0.07	LEO
SX784	0.028	0.03	0.2	0.001	2.7	0.5	-	0.3	0.3	SPO
SX785	0.011	0.01	0.08	0.001	70	0.3	-	0.5	0.1	SPO

遅い流星Top3

カタログを見てみよう！

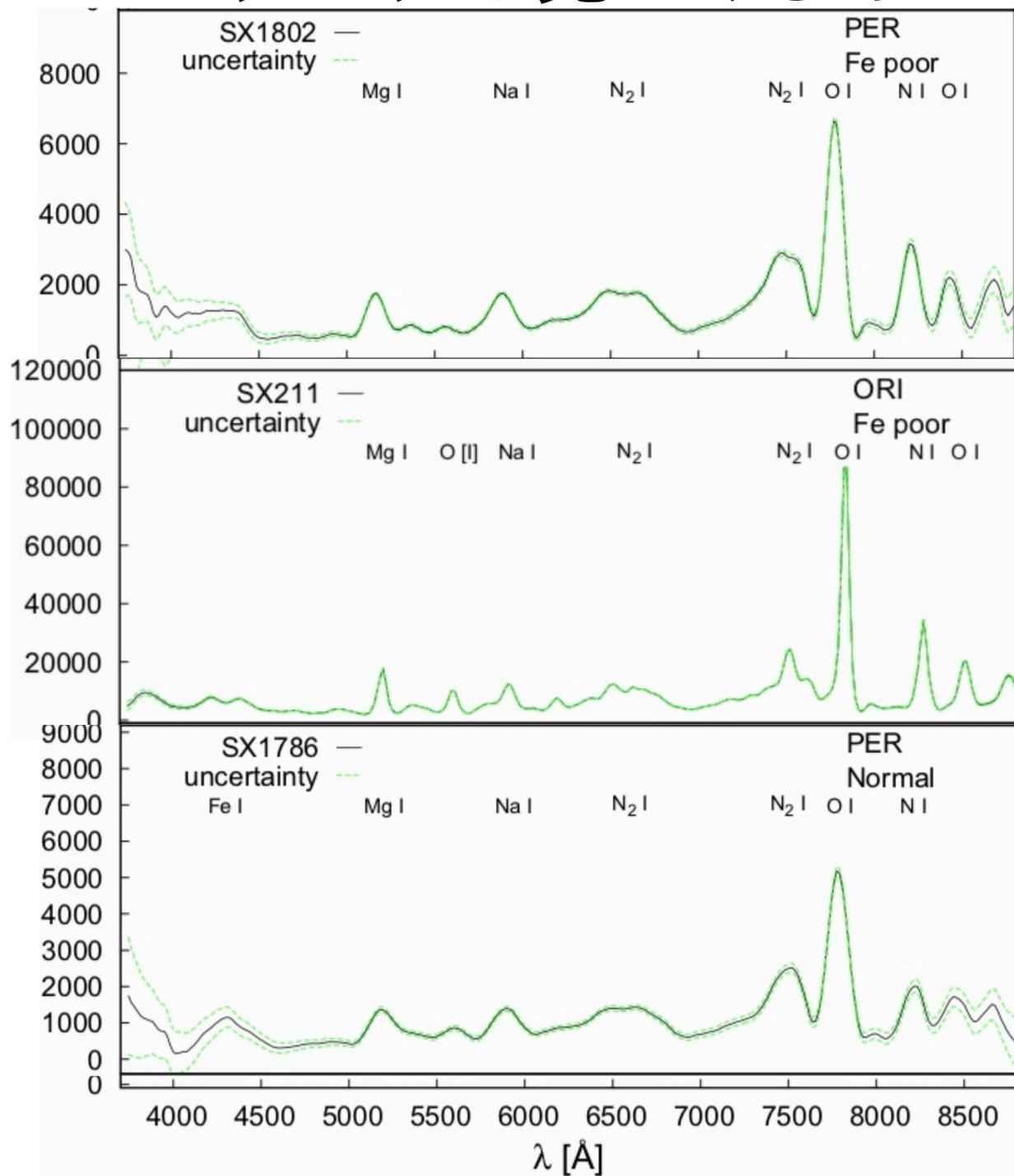


Spectrum	Meteor	Time (UT)	α_G (°)	δ_G (°)	z_R (°)	H_{beg} (km)	H_{end} (km)	M_{max} (mag)	Photo mass (g)	v (km s ⁻¹)	Spectral type
SX393	06C14187	22:45:46	359.2	40.5	39.5	78.2	69.3	2.1	2.0E-01	12.70	Iron
SX692	08505025	01:31:55	203	54	30	78.6	75.6	0.6	1.1E-01	16.1	Iron
SX150	06A20125	22:43:42	355.2	8.3	41.8	95.2	72.6	0.7	1.5E-01	17.30	Na rich

Spectrum	$1/a$ (1/AU)	e	i (°)	q (AU)	Q (AU)	ω (°)	Ω	T_j (°)	v_g (km s ⁻¹)	Shower
SX393	0.631	0.384	6.4	0.976	2.19	194.1	262.71	4.3	6.5	SPO
SX692	0.477	0.52	16	0.999	3.2	194	45.80	3.5	11.8	SPO
SX150	0.358	0.69	3.5	0.872	4.7	225.9	207.30	2.92	13.43	SPO

発光高度が高いTop3

カタログを見てみよう！

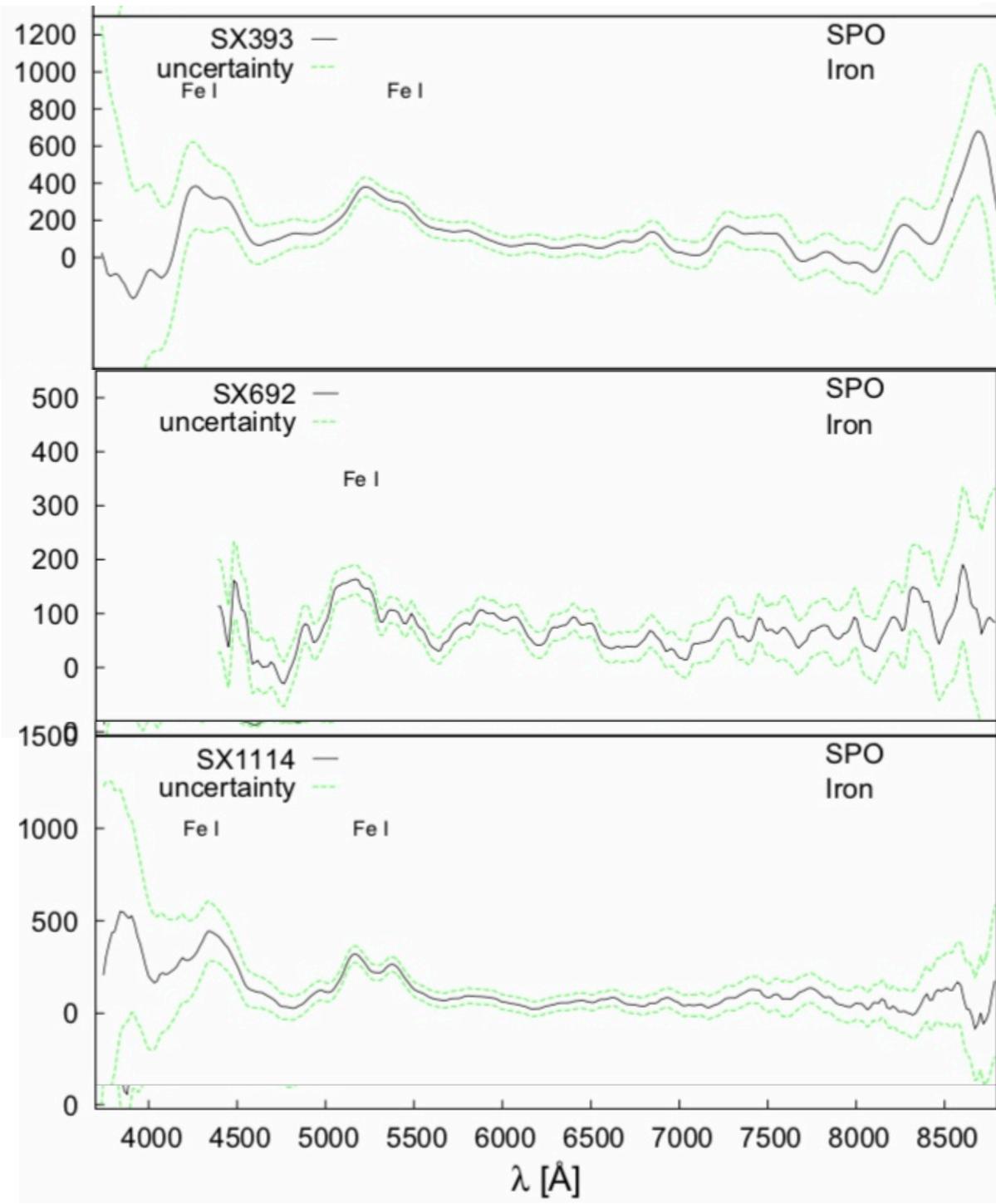


Spectrum	Meteor	Time (UT)	α_G (°)	δ_G (°)	z_R (°)	H_{beg} (km)	H_{end} (km)	M_{max} (mag)	Photo mass (g)	v (km s ⁻¹)	Spectral type
SX1802	12811384	01:07:25	46.09 0.09	56.74 0.02	32.89 0.05	136.7 -	87.7 -	-1.6 -	4.3E-02 -	61.1 0.2	Fe-poor
SX211	06A20437	02:10:43	95.7 0.2	15.0 0.1	38.1 0.1	135.2 -	90.5 -	-2.4 -	4.1E-02 -	67.8 0.3	Fe-poor
SX1786	12811093	22:27:52	46.82 0.07	57.77 0.04	52.61 0.04	131.3 -	87.2 -	-2.0 -	8.3E-02 -	60.87 0.06	Normal

Spectrum	$1/a$ (1/AU)	e	i (°)	q (AU)	Q (AU)	ω (°)	Ω	T_j (°)	v_g (km s ⁻¹)	Shower
SX1802	0.039 0.016	0.96 0.02	115.1 0.1	0.960 0.001	50 20	153.3 0.3	139.56 -	-0.3 0.3	59.9 0.2	PER
SX211	0.083 0.024	0.95 0.02	162.8 0.3	0.619 0.006	23 7	77 1	27.45 -	-0.5 0.3	66.8 0.3	ORI
SX1786	0.013 0.005	0.988 0.005	113.6 0.1	0.954 0.001	157 70	151.9 0.1	139.46 -	-0.4 0.2	59.96 0.06	PER

発光高度が低いTop3

カタログを見てみよう！

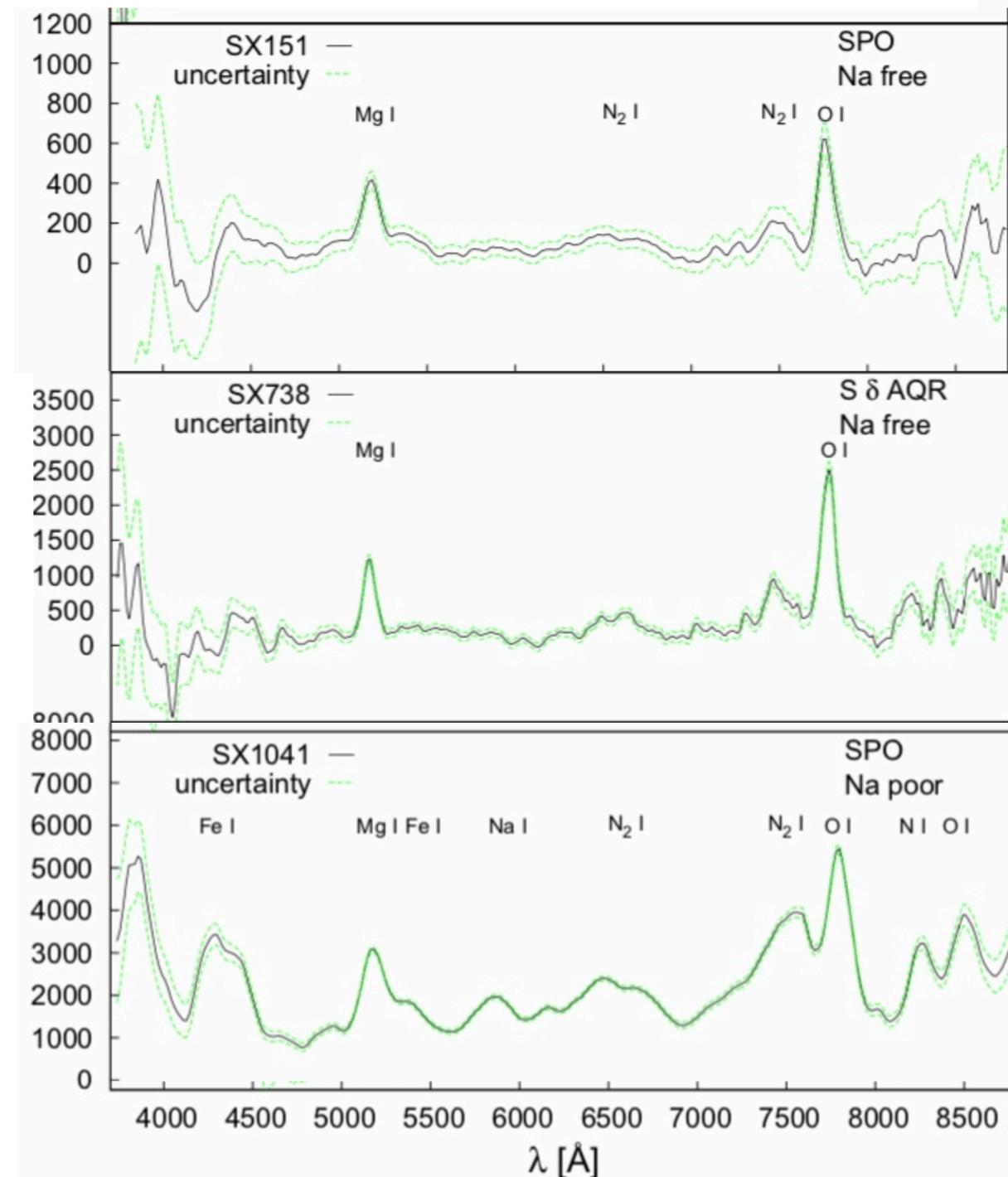


Spectrum	Meteor	Time (UT)	α_G (°)	δ_G (°)	z_R (°)	H_{beg} (km)	H_{end} (km)	M_{max} (mag)	Photo mass (g)	v (km s ⁻¹)	Spectral type
SX393	06C14187	22:45:46	359.2	40.5	39.5	78.2	69.3	2.1	2.0E-01	12.70	Iron
			0.4	0.3	0.1	—	—	—	—	0.08	
SX692	08505025	01:31:55	203	54	30	78.6	75.6	0.6	1.1E-01	16.1	Iron
			3	3	2	—	—	—	—	0.6	
SX1114	09B17008	18:39:27	58.7	10.9	28.6	85.1	79.2	0.8	4.0E-02	23.8	Iron
			0.5	0.3	0.3	—	—	—	—	0.2	

Spectrum	$1/a$ (1/AU)	e	i (°)	q (AU)	Q (AU)	ω (°)	Ω	T_j (°)	v_g (km s ⁻¹)	Shower
SX393	0.631	0.384	6.4	0.976	2.19	194.1	262.71	4.3	6.5	SPO
	0.009	0.009	0.2	0.001	0.05	0.3	—	0.2	0.2	
SX692	0.477	0.52	16	0.999	3.2	194	45.80	3.5	11.8	SPO
	0.044	0.05	1	0.004	0.4	3	—	0.6	0.8	
SX1114	0.575	0.681	6.7	0.554	2.92	94.9	55.43	3.83	20.9	SPO
	0.015	0.008	0.2	0.006	0.09	0.9	—	0.08	0.2	

近日点に近い順Top3

カタログを見てみよう！



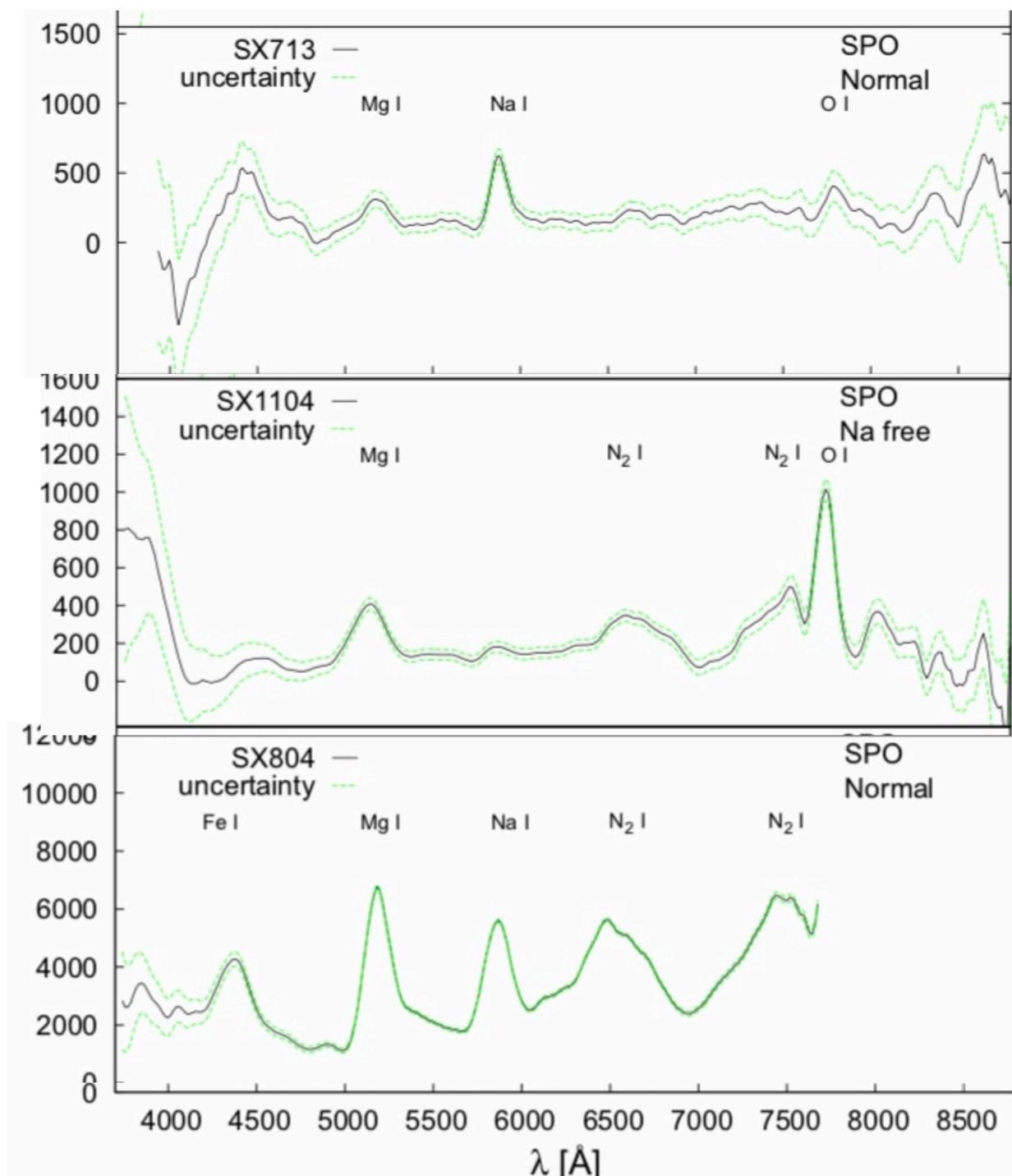
Spectrum	Meteor	Time (UT)	α_G (°)	δ_G (°)	z_R (°)	H_{beg} (km)	H_{end} (km)	M_{max} (mag)	Photo mass (g)	v (km s ⁻¹)	Spectral type
SX151	06A20126	22:44:55	53.7 0.1	23.6 0.1	34.2 0.1	97.1 -	82.1 -	0.9 -	9.0E-03 -	44.4 0.4	Na-free
SX738	08729037	22:03:15	339.53 0.01	-16.46 0.08	75.64 0.07	103.1 -	85.4 -	0.0 -	4.2E-02 -	42.5 0.1	Na-free

SX1041	09818120	23:23:17	352.08 0.07	3.92 0.09	47.41 0.09	104.5 -	82.7 -	-1.7 -	1.4E-01 -	40.1 0.2	Na-poor
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Spectrum	$1/a$ (1/AU)	e	i (°)	q (AU)	Q (AU)	ω (°)	Ω	T_j (°)	v_g (km s ⁻¹)	Shower
SX151	0.316 0.028	0.985 0.002	19.9 0.8	0.048 0.002	6.3 0.6	336.6 0.4	207.31 -	1.9 0.2	42.9 0.4	SPO
SX738	0.363 0.009	0.971 0.001	26.3 0.3	0.080 0.001	5.4 0.1	150.5 0.1	307.01 -	2.20 0.06	40.8 0.1	S δ AQR
SX1041	0.509 0.010	0.955 0.001	21.7 0.4	0.088 0.001	3.84 0.08	330.3 0.2	146.01 -	2.99 0.07	38.4 0.2	SPO

近日点が遠いTop3

カタログを見てみよう！

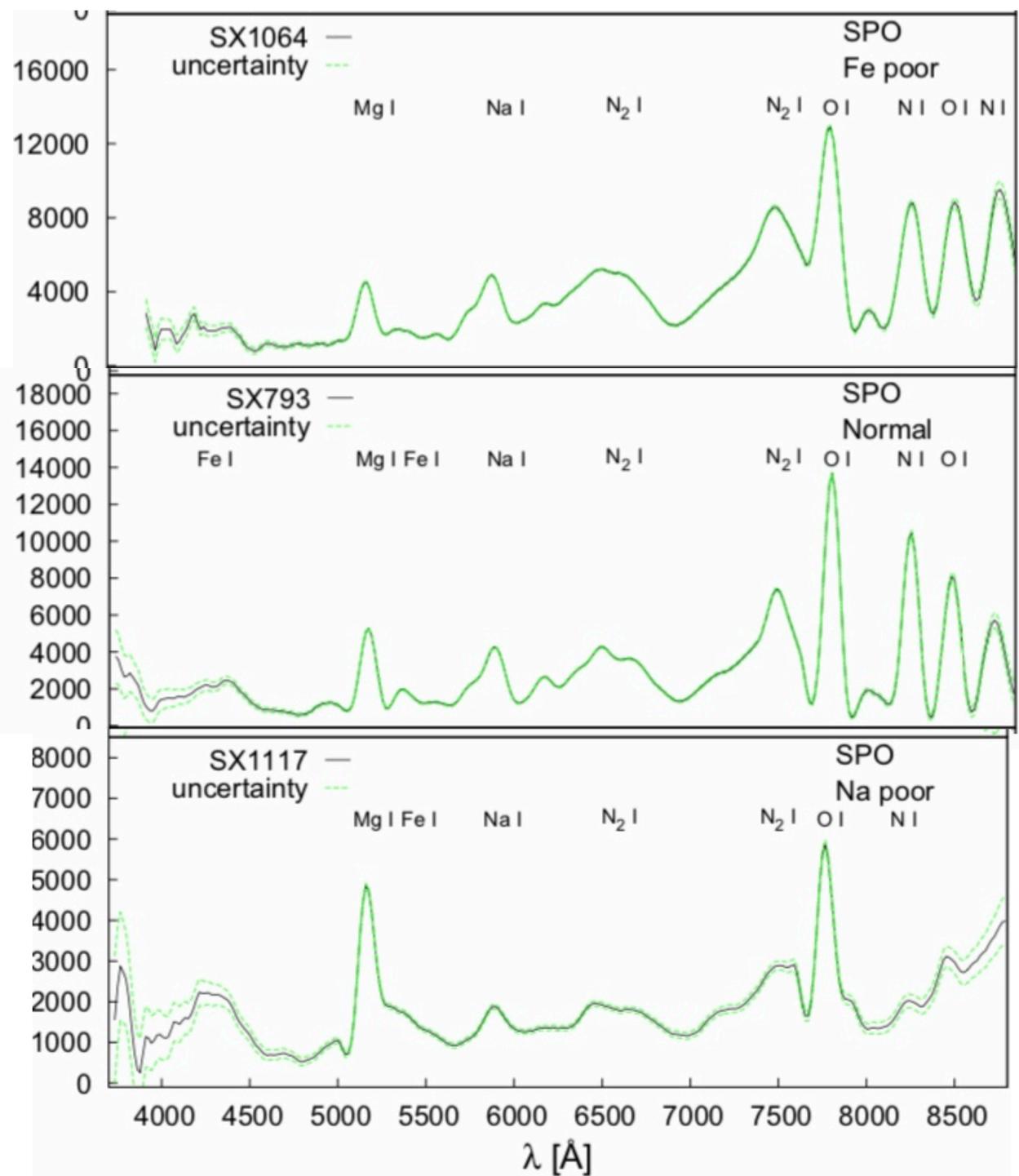


Spectrum	Meteor	Time (UT)	α_G (°)	δ_G (°)	z_R (°)	H_{beg} (km)	H_{end} (km)	M_{max} (mag)	Photo mass (g)	v (km s ⁻¹)	Spectral type
SX713	08728098	22:49:51	230.0	45.8	42.7	93.6	78.3	0.8	3.2E-01	17.41	Normal
SX713	08728098	22:49:51	0.3	0.2	0.2	-	-	-	-	0.04	
SX1104	09820250	01:15:09	51.6	40.2	34.4	98.3	89.3	-0.6	4.8E-03	65	Na-free
SX1104	09820250	01:15:09	0.4	0.8	0.5	-	-	-	-	1	
SX804	08928235	01:55:56	203.2	85.75	43.55	114.2	86.9	-1.8	1.6E-01	42.48	Normal
SX804	08928235	01:55:56	0.7	0.09	0.08	-	-	-	-	0.08	

Spectrum	$1/a$ (1/AU)	e	i (°)	q (AU)	Q (AU)	ω (°)	Ω	T_j (°)	v_g (km s ⁻¹)	Shower
SX713	0.355	0.640	18.30	1.014	4.63	175.5	126.09	2.92	13.65	SPO
SX713	0.004	0.004	0.08	0.001	0.06	0.2	-	0.04	0.05	
SX1104	0.372	0.6	143	1.010	4	175	148.00	1	64	SPO
SX1104	0.007	0.005	0.07	0.001	0.03	0.03	=	0.02	0.03	
SX804	0.137	0.863	69.28	1.001	13.6	178.0	186.18	1.1	40.99	SPO
SX804	0.006	0.006	0.09	0.001	0.6	0.2	-	0.1	0.08	

明るい流星Top3

カタログを見てみよう！

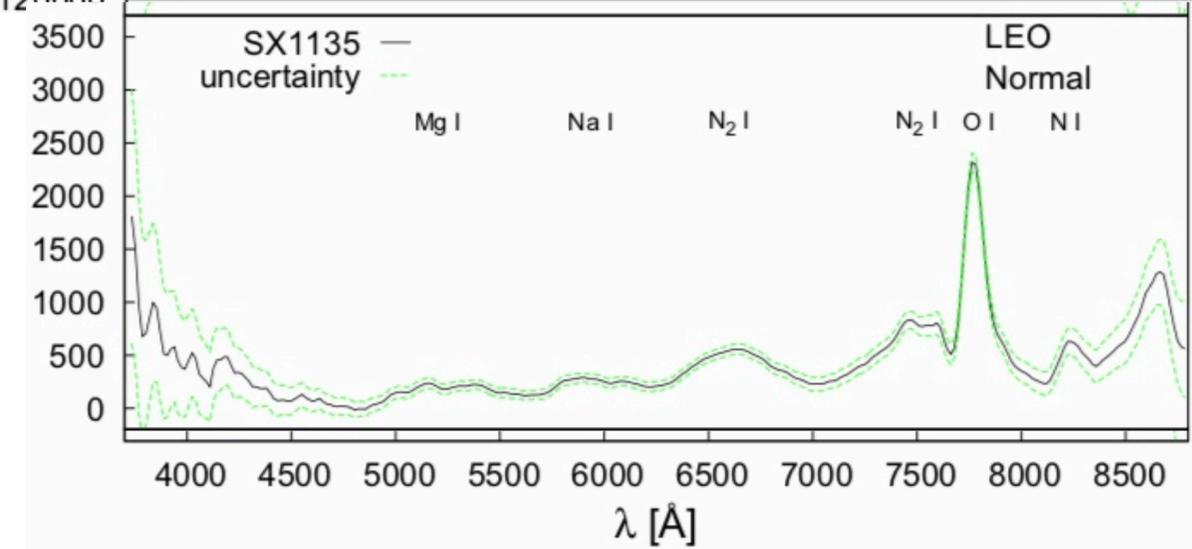
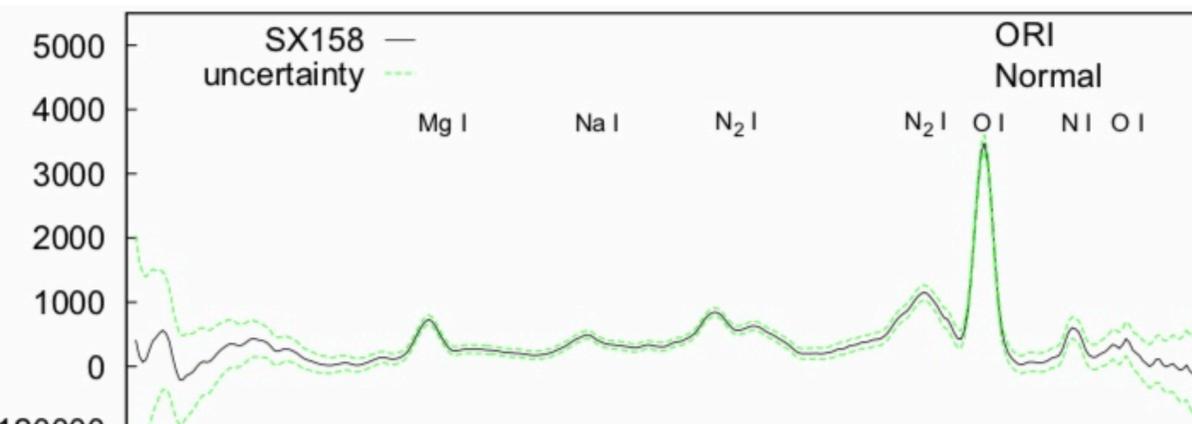
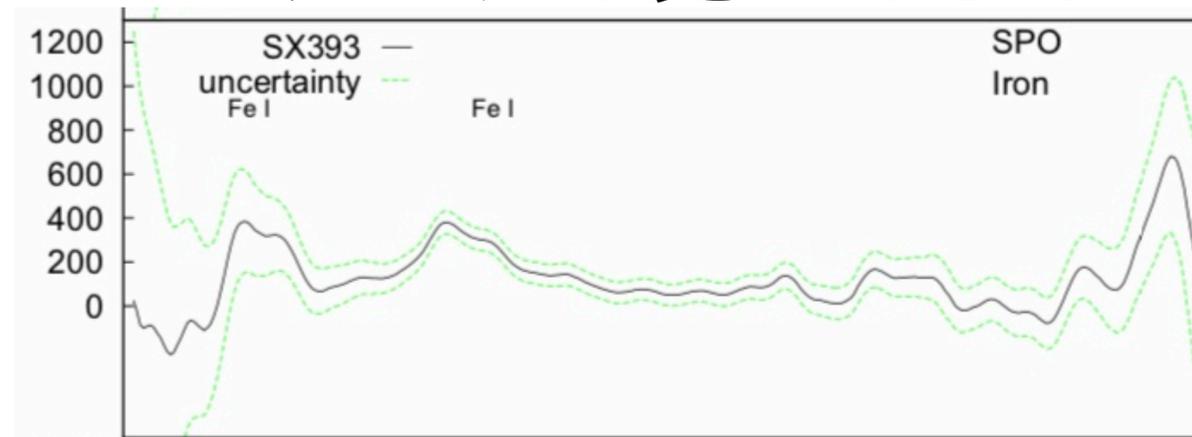


Spectrum	Meteor	Time (UT)	α_G (°)	δ_G (°)	z_R (°)	H_{beg} (km)	H_{end} (km)	M_{max} (mag)	Photo mass (g)	v (km s ⁻¹)	Spectral type
SX1064	09819164	23:56:02	64.0	66.65	41.70	128.0	85.0	-2.8	2.0E-01	56.2	Fe-poor
SX793	08927195	03:43:50	134.96	52.56	35.76	118.4	86.0	-2.5	9.2E-02	60.77	Normal
SX1117	09B17022	19:12:24	66.38	16.81	23.64	97.0	76.0	-2.5	8.6E-01	32.0	Na-poor

Spectrum	$1/a$ (1/AU)	e	i (°)	q (AU)	Q (AU)	ω (°)	Ω	T_j (°)	v_g (km s ⁻¹)	Shower
SX1064	0.068	0.94	101.2	0.918	28	143.8	146.99	0.1	54.9	SPO
SX793	0.005	0.997	113.99	0.749	430	119.6	185.27	-0.4	59.59	SPO
SX1117	0.386	0.868	5.95	0.343	4.8	113.9	55.45	2.70	29.9	SPO

暗い流星Top3

カタログを見てみよう！

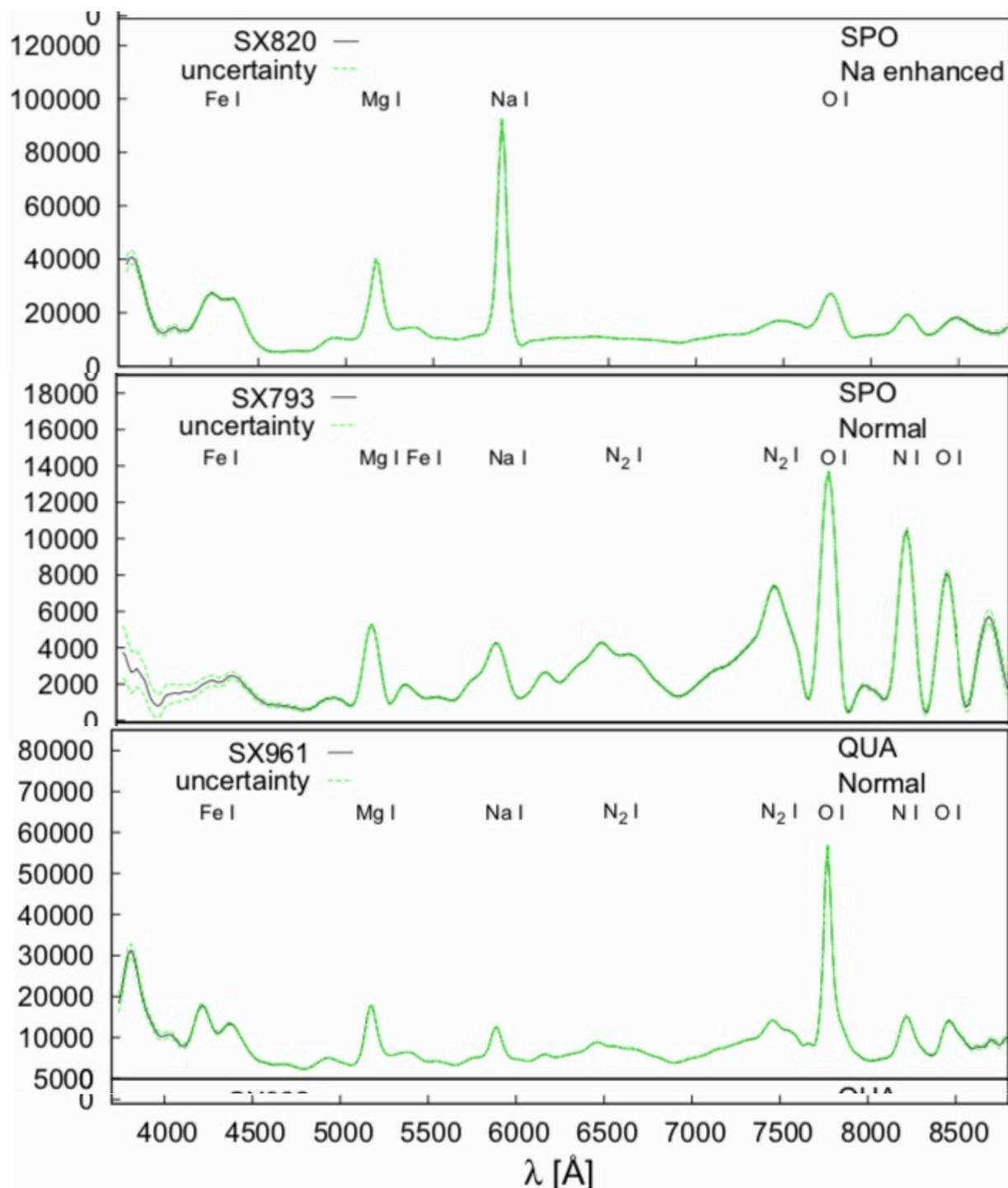


Spectrum	Meteor	Time (UT)	α_G (°)	δ_G (°)	z_R (°)	H_{beg} (km)	H_{end} (km)	M_{max} (mag)	Photo mass (g)	v (km s ⁻¹)	Spectral type
SX393	06C14187	22:45:46	359.2	40.5	39.5	78.2	69.3	2.1	2.0E-01	12.70	Iron
SX158	06A20149	23:01:35	94.67	15.32	62.57	118.4	94.7	2.0	2.3E-03	66.8	Normal
SX1135	09B17123	21:59:48	154.5	22.9	52.7	121.8	94.5	1.8	1.3E-03	72.0	Normal

Spectrum	1/a (1/AU)	e	i (°)	q (AU)	Q (AU)	ω (°)	Ω	T_j (°)	v_g (km s ⁻¹)	Shower
SX393	0.631	0.384	6.4	0.976	2.19	194.1	262.71	4.3	6.5	SPO
SX158	0.161	0.908	163.0	0.576	12	83.5	27.32	0.0	65.6	ORI
SX1135	0.053	0.95	160.3	0.985	37	172.6	235.56	-0.9	70.9	LEO

Mg強度の強いTop3

カタログを見てみよう！



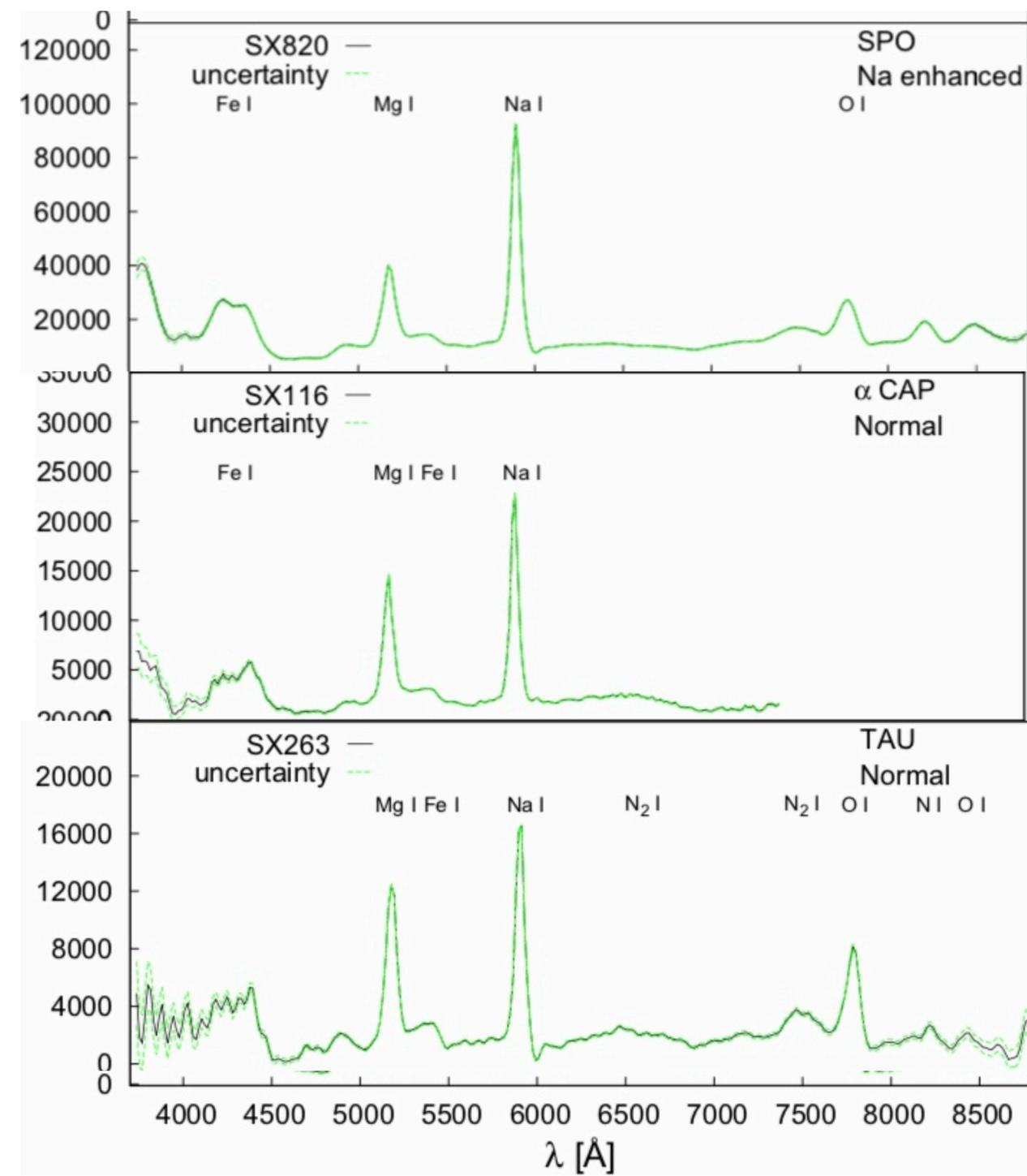
Spectrum	Meteor	Time (UT)	α_G (°)	δ_G (°)	z_R (°)	H_{beg} (km)	H_{end} (km)	M_{max} (mag)	Photo mass (g)	v (km s ⁻¹)	Spectral type
SX820	08A20002	20:05:23	23.78 0.02	5.59 0.01	51.77 0.01	90.0 -	55.8 -	-0.7 -	1.1E+00 -	23.98 0.03	Na-enhanced
SX793	08927195	03:43:50	134.96 0.09	52.56 0.03	35.76 0.05	118.4 -	86.0 -	-2.5 -	9.2E-02 -	60.77 0.09	Normal
SX961	09102507	05:28:21	229.74 0.04	52.20 0.02	19.27 0.02	103.8 -	79.0 -	-1.6 -	1.2E-01 -	41.7 0.2	Normal

Spectrum	$1/a$ (1/AU)	e	i (°)	q (AU)	Q (AU)	ω (°)	Ω	T_j (°)	v_g (km s ⁻¹)	Shower
SX820	0.390 0.002	0.758 0.001	2.71 0.01	0.621 0.001	4.51 0.03	82.63 0.03	27.69 -	2.94 0.01	21.04 0.04	SPO
SX793	0.005 0.008	0.997 0.006	113.99 0.09	0.749 0.001	430 770	119.6 0.2	185.27 -	-0.4 0.5	59.59 0.09	SPO
SX961	0.315 0.010	0.69 0.01	69.3 0.2	0.983 0.001	5.4 0.2	176.60 0.06	282.85 -	2.0 0.2	40.1 0.2	QUA

spectrum	Mg -2 (J/sr)	Na -1 (J/sr)	Fe -15 (J/sr)
SX820	3.54×10^1	9.76×10^1	2.22×10^1
SX793	1.06×10^1	6.15×10^0	5.15×10^0
SX961	1.02×10^1	6.42×10^0	4.93×10^0

Na強度の強いTop3

カタログを見てみよう！



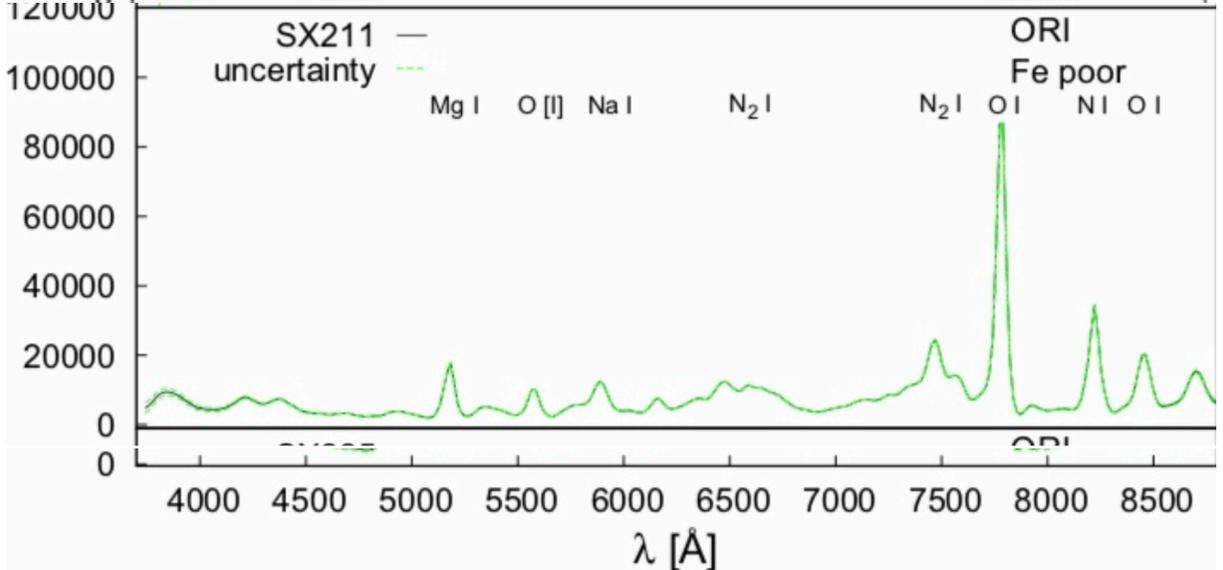
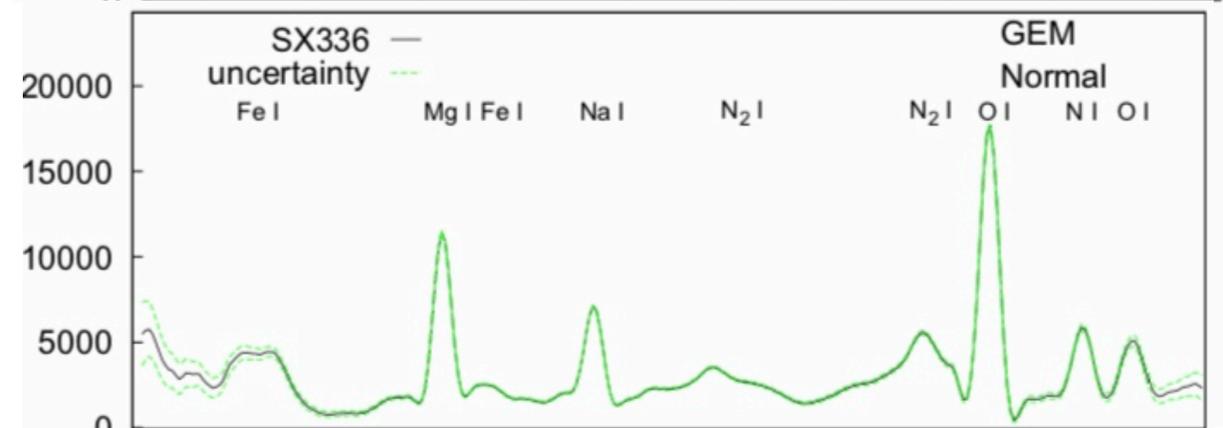
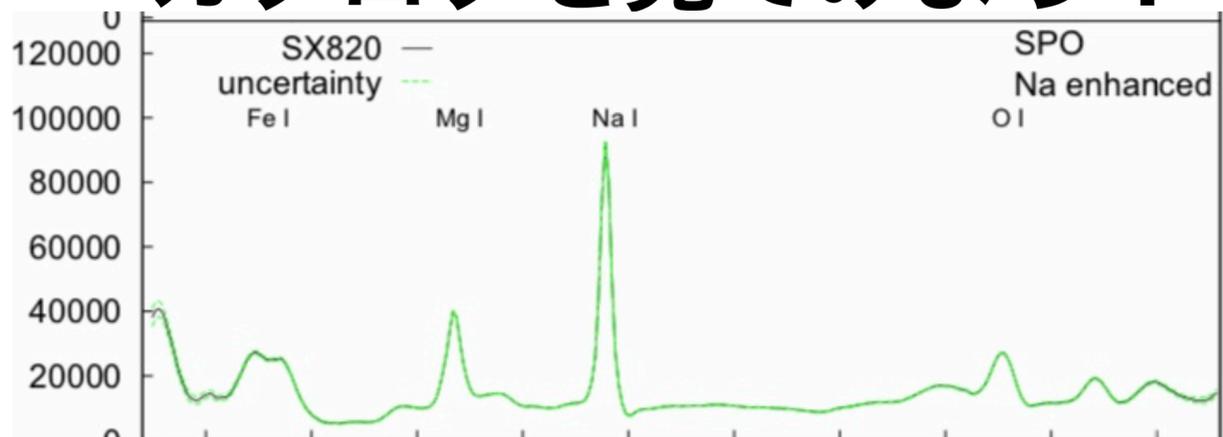
Spectrum	Meteor	Time (UT)	α_G (°)	δ_G (°)	z_R (°)	H_{beg} (km)	H_{end} (km)	M_{max} (mag)	Photo mass (g)	v (km s ⁻¹)	Spectral type
SX820	08A20002	20:05:23	23.78 0.02	5.59 0.01	51.77 0.01	90.0 -	55.8 -	-0.7 -	1.1E+00 -	23.98 0.03	Na-enhanced
SX116	06730083	23:12:00	305.26 0.03	-9.11 0.07	55.47 0.05	95.0 -	80.1 -	-2.4 -	2.3E+00 -	23.8 0.1	Normal
SX263	06B18075	02:18:34	62.00 0.03	24.15 0.02	40.84 0.02	104.8 -	72.0 -	-1.3 -	6.8E-01 -	28.15 0.09	Normal

Spectrum	$1/a$ (1/AU)	e	i (°)	q (AU)	Q (AU)	ω (°)	Ω	T_j (°)	v_g (km s ⁻¹)	Shower
SX820	0.390 0.002	0.758 0.001	2.71 0.01	0.621 0.001	4.51 0.03	82.63 0.03	27.69 -	2.94 0.01	21.04 0.04	SPO
SX116	0.436 0.007	0.730 0.005	7.00 0.08	0.619 0.002	3.97 0.07	265.72 0.06	127.56 -	3.17 0.04	21.1 0.1	α CAP
SX263	0.461 0.005	0.802 0.003	3.09 0.03	0.430 0.001	3.91 0.05	285.67 0.06	236.50 -	3.17 0.02	26.1 0.1	TAU

spectrum	Mg -2 (J/sr)	Na -1 (J/sr)	Fe -15 (J/sr)
SX820	3.54×10^1	9.76×10^1	2.22×10^1
SX116	2.32×10^1	3.55×10^1	9.45×10^0
SX263	2.32×10^1	3.38×10^1	9.32×10^0

Fe強度の強いTop3

カタログを見てみよう！



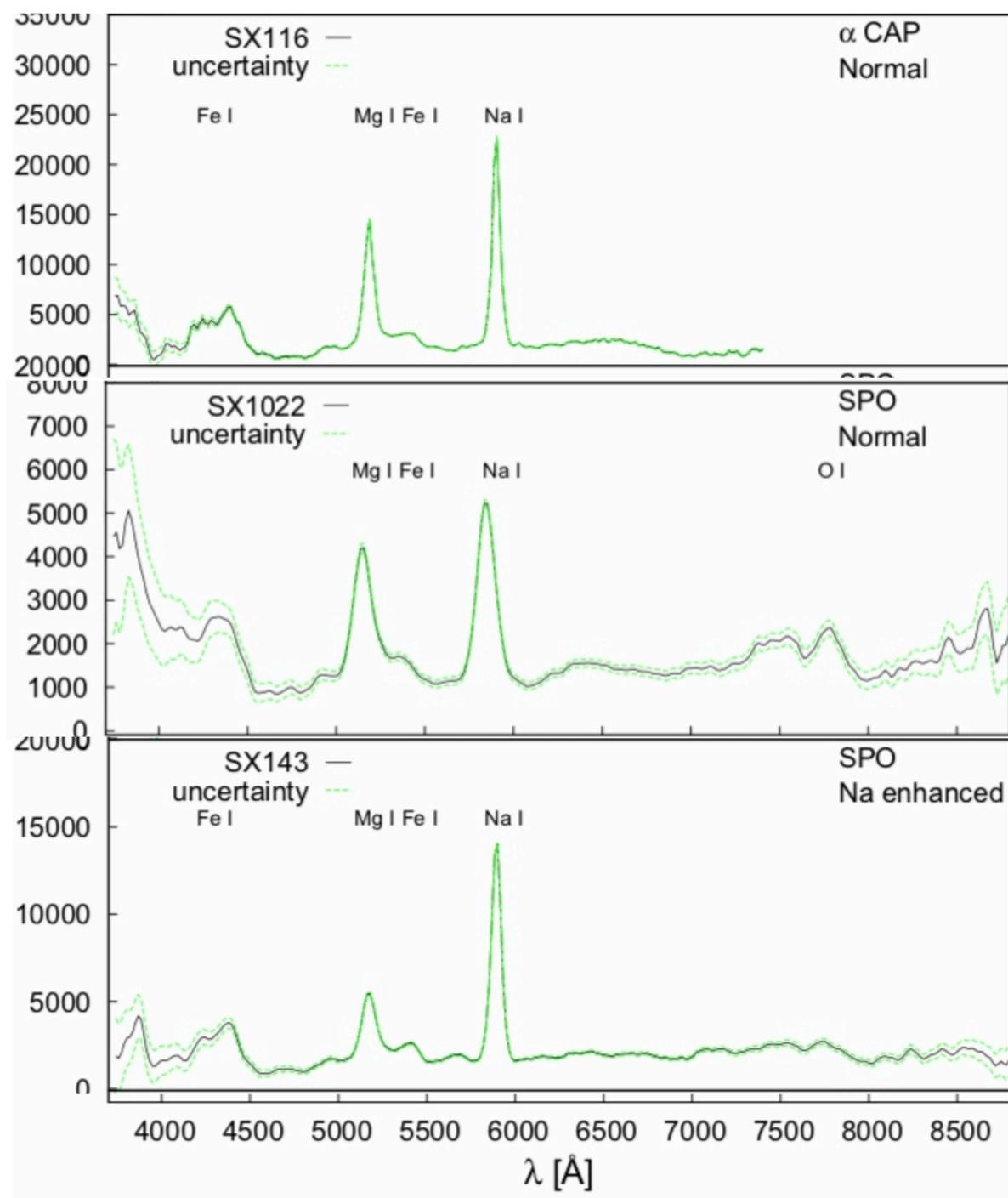
Spectrum	Meteor	Time (UT)	α_G (°)	δ_G (°)	z_R (°)	H_{beg} (km)	H_{end} (km)	M_{max} (mag)	Photo mass (g)	v (km s ⁻¹)	Spectral type
SX820	08A20002	20:05:23	23.78 0.02	5.59 0.01	51.77 0.01	90.0	55.8	-0.7	1.1E+00	23.98 0.03	Na-enhanced
SX336	06C13136	23:34:20	113.78 0.04	32.67 0.02	23.98 0.03	104.8	67.0	-1.5	5.2E-01	35.54 0.05	Normal
SX211	06A20437	02:10:43	95.7 0.2	15.0 0.1	38.1 0.1	135.2	90.5	-2.4	4.1E-02	67.8 0.3	Fe-poor

Spectrum	$1/a$ (1/AU)	e	i (°)	q (AU)	Q (AU)	ω (°)	Ω	T_j (°)	v_g (km s ⁻¹)	Shower
SX820	0.390 0.002	0.758 0.001	2.71 0.01	0.621 0.001	4.51 0.03	82.63 0.03	27.69	2.94 0.01	21.04 0.04	SPO
SX336	0.751 0.006	0.895 0.001	24.8 0.2	0.139 0.001	2.52 0.02	324.62 0.06	261.73	4.51 0.02	34.5 0.1	GEM
SX211	0.083 0.024	0.95 0.02	162.8 0.3	0.619 0.006	23 7	77 1	27.45	-0.5 0.3	66.8 0.3	ORI

spectrum	Mg -2 (J/sr)	Na -1 (J/sr)	Fe -15 (J/sr)
SX820	3.54×10^1	9.76×10^1	2.22×10^1
SX336	2.91×10^1	1.58×10^1	1.09×10^1
SX211	3.57×10^1	2.05×10^1	1.05×10^1

測光質量が大きいTop3

カタログを見てみよう！

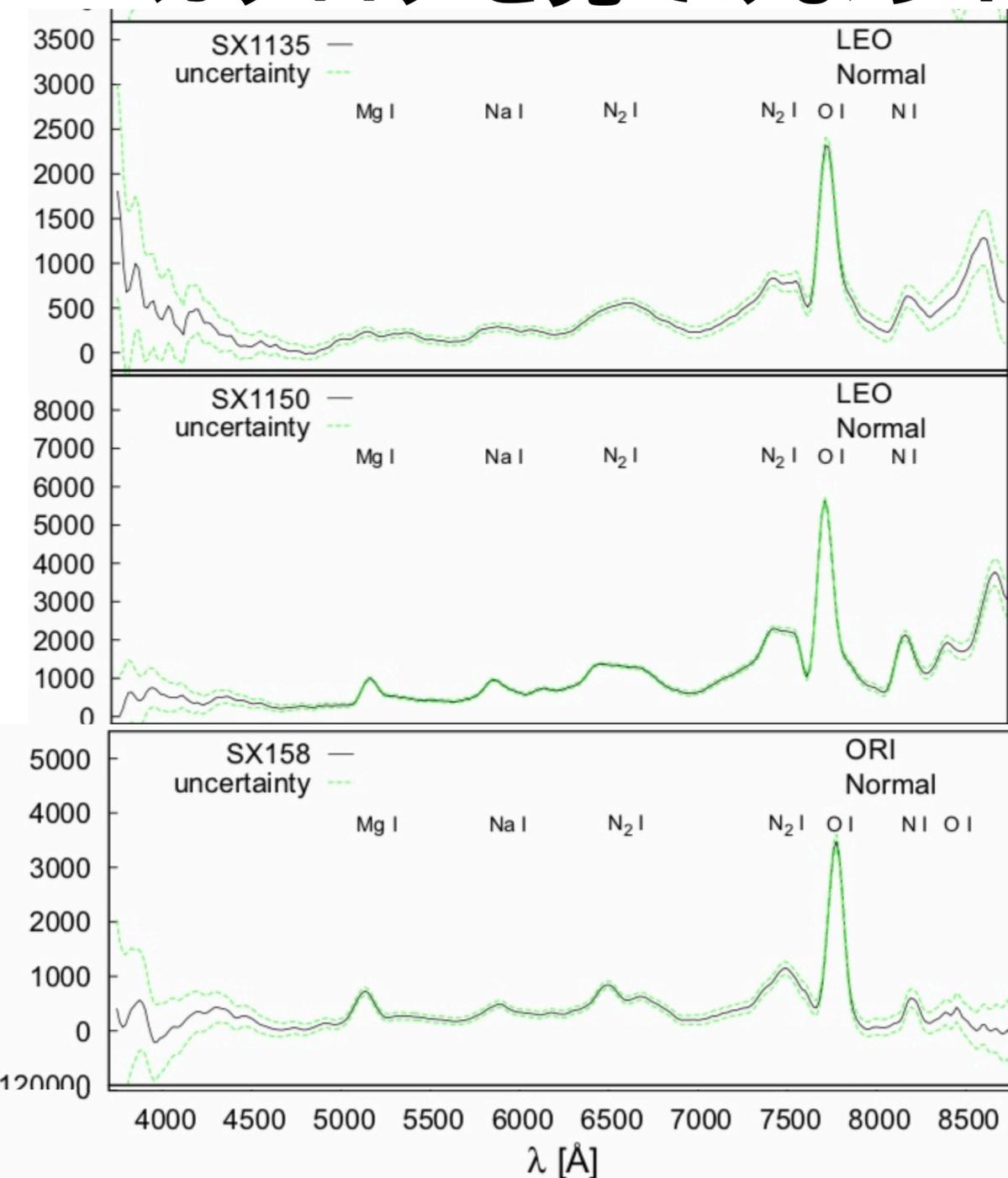


Spectrum	Meteor	Time (UT)	α_G ($^\circ$)	δ_G ($^\circ$)	z_R ($^\circ$)	H_{beg} (km)	H_{end} (km)	M_{max} (mag)	Photo mass (g)	v (km s^{-1})	Spectral type
SX116	06730083	23:12:00	305.26 0.03	-9.11 0.07	55.47 0.05	95.0 -	80.1 -	-2.4 -	2.3E+00 -	23.8 0.1	Normal
SX1022	09729261	01:16:49	297.6 0.02	3.45 0.02	55.11 0.02	103.2 -	75.7 -	-1.1 -	1.3E+00 -	23.71 0.06	Normal
SX143	06A20013	20:28:34	353.78 0.05	17.22 0.06	28.84 0.03	106.6 -	72.0 -	-1.4 -	1.2E+00 -	17.60 0.08	Na-enhanced

Spectrum	$1/a$ (1/AU)	e	i ($^\circ$)	q (AU)	Q (AU)	ω ($^\circ$)	Ω	T_j ($^\circ$)	v_g (km s^{-1})	Shower
SX116	0.436 0.007	0.730 0.005	7.00 0.08	0.619 0.002	3.97 0.07	265.72 0.06	127.56 -	3.17 0.04	21.1 0.1	α CAP
SX1022	0.341 0.004	0.760 0.003	15.30 0.06	0.705 0.001	5.17 0.06	253.02 0.03	126.91 -	2.71 0.03	21.18 0.07	SPO
SX143	0.396 0.006	0.657 0.005	6.84 0.06	0.865 0.001	4.19 0.07	227.95 0.06	207.21 -	3.10 0.04	13.6 0.1	SPO

測光質量が小さいTop3

カタログを見てみよう！



Spectrum	Meteor	Time (UT)	α_G (°)	δ_G (°)	z_R (°)	H_{beg} (km)	H_{end} (km)	M_{max} (mag)	Photo mass (g)	v (km s ⁻¹)	Spectral type
SX1135	09B17123	21:59:48	154.5 0.3	22.9 0.1	52.7 0.2	121.8 -	94.5 -	1.8 -	1.3E-03 -	72.0 0.3	Normal
SX1150	09B17192	23:03:06	153.9 0.1	22.23 0.08	40.0 0.1	123.6 -	92.1 -	0.9 -	2.2E-03 -	71.1 0.3	Normal
SX158	06A20149	23:01:35	94.67 0.08	15.32 0.07	62.57 0.07	118.4 -	94.7 -	2.0 -	2.3E-03 -	66.8 0.2	Normal

Spectrum	$1/a$ (1/AU)	e	i (°)	q (AU)	Q (AU)	ω (°)	Ω	T_j (°)	v_g (km s ⁻¹)	Shower
SX1135	0.053	0.95	160.3	0.985	37	172.6	235.56	-0.9	70.9	LEO
SX1150	0.146	0.86	161.5	0.985	12.7	173.3	235.61	-0.4	70.0	LEO
SX158	0.161	0.908	163.0	0.576	12	83.5	27.32	0.0	65.6	ORI

誤差だと信じてる、離心率が1以上の流星

カタログを見てみよう！

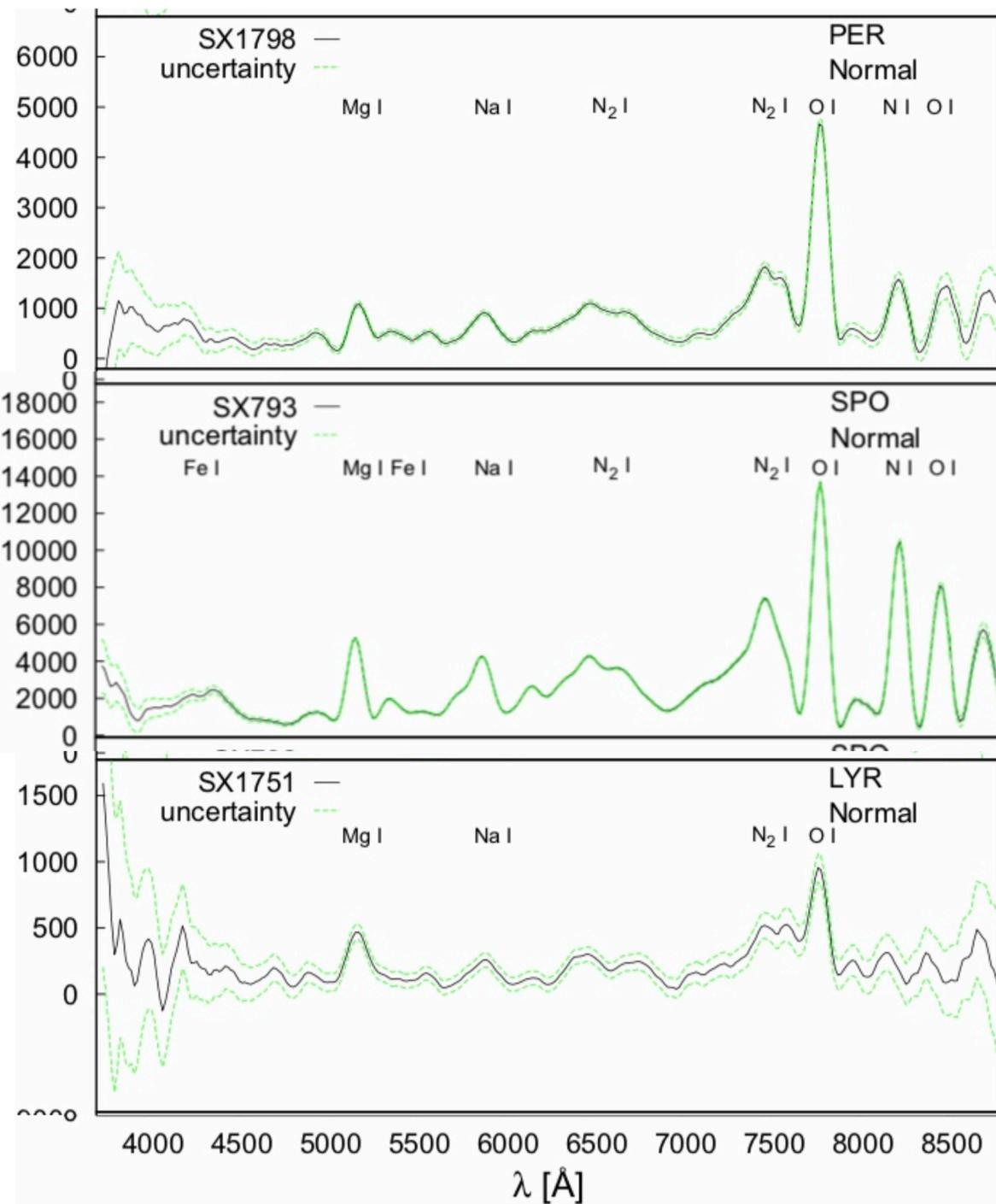


Table 4. continued.

Spectrum	Meteor	Time (UT)	α_G (°)	δ_G (°)	z_R (°)	H_{beg} (km)	H_{end} (km)	M_{max} (mag)	Photo mass (g)	v (km s ⁻¹)	Spectral type
SX1798	12811305	00:29:01	48.29 0.09	56.91 0.04	38.93 0.05	129.7 -	90.6 -	-0.2 -	2.0E-02 -	61.59 0.08	Normal
SX793	08927195	03:43:50	134.96 0.09	52.56 0.03	35.76 0.05	118.4 -	86.0 -	-2.5 -	9.2E-02 -	60.77 0.09	Normal
SX1751	12422070	00:23:19	271.68 0.05	33.48 0.02	33.69 0.04	122.5 -	85.9 -	0.6 -	1.4E-02 -	48.32 0.06	Normal

Spectrum	$1/a$ (1/AU)	e	i (°)	q (AU)	Q (AU)	ω (°)	Ω	T_j (°)	v_g (km s ⁻¹)	Shower
SX1798	-0.011 0.007	1.01 0.01	115.4 0.1	0.947 0.001	-200 100	150.5 0.2	139.54 -	-0.6 0.3	60.43 0.08	PER
SX793	0.005 0.008	0.997 0.006	113.99 0.09	0.749 0.001	430 770	119.6 0.2	185.27 -	-0.4 0.5	59.59 0.09	SPO
SX1751	0.010 0.005	0.991 0.004	79.06 0.06	0.915 0.001	200 100	215.0 0.1	33.09 -	0.28 0.09	46.86 0.06	LYR

7. Conclusions

気孔率

用語

- かさ密度と鉱物学的密度の関係を利用して、流星の気孔率を推定する
- ふたご座流星群の気孔率が最も低く、しし座流星群とりゅう座流星群の気孔率が最も高い。
- 隕石の母天体である彗星や小惑星の多孔質構造を裏付ける。
- 参考 Densities and porosities of meteoroids
- https://www.aanda.org/articles/aa/full_html/2009/07/aa10460-08/aa10460-08.html

Iron meteoroids		典型的な太陽近接軌道 (1スペクトル)	小惑星コンドライト軌道にあるほとんどの流星		
Na-free meteoroids →全体の20%		小惑星起源の鉄流星 太陽近接型 ← 彗星型	ふたご座流星群の一部とみずがめ座デルタ流星群（南流星群）の一部	ふたご座流星群	ハレータイプ彗星起源
Na-rich meteoroids					木星族彗星起源
Mainstream meteoroids					
	Normal meteoroids	彗星軌道、小惑星軌道	一部はコンドライト 組成	ふたご座流星群	
	Na-poor meteoroids			ふたご座流星群	ハレータイプ彗星起源
	Na-enhanced meteoroids				木星族彗星起源
	Fe-poor meteoroids				ハレー型彗星起源