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Preliminary report

THE BELGRADE OBSERVATIONS OF JUPITER DURING THE PERIOD OF ITS COLLIDING WITH SL-9 COMET

L. Č. Popović, A. Kubičela, J. Arsenijević, D. Jevremović and I. Vince

Astronomical Observatory, Volgina 7, 11050 Belgrade, Yugoslavia

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SUMMARY: In this paper we present the results of CCD observations of the perturbations in Jupiter's atmosphere caused by the impact of fragments of the comet SL9 on this planet. The appearance and evolution of "dark spots" in Jupiter's atmosphere were recorded in V and R spectral region.

1. INTRODUCTION

The comet Shoemaker–Levy 9 1993e (SL-9) was discovered by C. S. Shoemaker, E. M. Shoemaker and D. H. Levy on 24 March 1993 (Marsden 1993a). Later the comet was observed by Scotti, who described the nuclear region as "a long narrow train $\sim 47''$ in length and $\sim 11''$ in width", located about 4° from Jupiter (Scotti 1993).

Orbit calculation by Marsden (1993b) suggested that the comet was a temporary satellite of Jupiter and had passed within the Roche limit in July 1992. Yeomans and Chodes (1993) predicted that the center of the nuclear train would collide with Jupiter in late July 1994. Later, the calculation by Chodes *et al.* (1994) has shown that the collision will occur from 16 to 22 July 1994.

Generally, there were three possibilities to observe the consequences of SL-9 comet crash into Jupiter. Namely, direct observations (photograph) of Jupiter's disc, spectral observations of the Jupiter's light and the photometry of the impact flashes reflected from the Jupiter's satellites. Two facts were important for the selection of our observing program. First during the impact period Jupiter was not more than about 32° above the horizon and second we have just prepared a CCD camera for the first use at the 65 cm refractor. So, we decided to observe Jupiter's disc with CCD camera in V and R spectral regions. We are now presenting the first results of our successful observations.

2. OBSERVATIONS

The observations were carried out at the Belgrade Observatory from 17th July till 8th August covering the impact period and 17 days after it – until the visibility of Jupiter became poor.

Santa Barbara Instrument Group model ST–6 professional CCD imaging camera was attached to the Zeiss 65/1055 cm refractor. The refractor aperture was reduced to 40 cm. Two glass filters were used: VG–14 for the visual (V) region and RG–8 for the red (R) region.

Using the spectral response data of the camera given by the manufacturer and the spectral transition curves of the glass filters, it was estimated that the camera plus VG–14 filter yields an overall spectral response having the maximum (normalized to 100%) at 530 nm, full width (FW) at 50% from 500 nm to 560 nm and FW at 5% from 475 nm to 590 nm – which is close to V spectral region of Johnson and Morgan (1951). However, the camera plus RG–8 combination yields a less symmetric overall spectral response with the maximum (normalized to 100%) at 730 nm, FW at 50% from 700 nm to 920 nm and FW at 5% from 680 nm to 1000 nm. The maximum itself is close to Stebbins and Whitford's R region in their six–color system (Stebbins and Whitford, 1945), but because of the very extended red wing of the camera plus RG–8 spectral response curve, we only conditionally refer to it as "R".

We also estimated that the effective sensitivity in our R region is about 15 times higher than in the V one.

Our observations of comet impact sites in Jupiter's atmosphere started in V and R regions on July 17th. It could be readily noticed that, even with the optimal exposures, in the obtained R-images not all impact traces were visible, while in V-images all impact structures were light or dark gray. Namely, only two (E and A) out of three impact traces could be hardly recognized in the R-images obtained this night. One of the most prominent impact traces, G on July 18th, having a complex structure was clearly seen in R-images but as a quite dark small area corresponding to the very center of the large impact trace seen in V-spectral region.

It seems that, in general, the contrast of the impact structures with respect to the undisturbed Juptier's atmosphere changes continuously with the wavelength but also depends on the extent and violence of the impact event. The medium-size impact traces are dark against the light background in visual wavelengths reversing to the bright spots surrounded by dark background in the IR (West, 1994). Some other examples one can find in O'Meara (1994, sequence of three Figures at the top of page 35) and in images of the K impact site taken with IAC80 telescope of Instituto de Astrofisica de Canarias on July 19 at the wavelengths 750 nm and 892 nm (Instituto de Astrofisica de Canarias, 1994). It is seen that the impact traces at 740 nm or 750 nm are slighly darker and the corresponding images around 890 nm are slightly lighter than the Jupiter's undisturbed atmosphere. The red - IR reversal, as far as the average-size impact traces are concerned, seems to take place just within our R region. Soon we gave up the observations with the R-filter.

Table 1.1 List of images obtained on July 17th, 1994. The columns contain: the image number, time, duration of exposure (in seconds), name of fragments whose traces were seen on the image and quality of the image.

No.	UT	exp.	Fragments	Quality
1	18:34:45	1.00	E A C	II
2	18:55:55	.50	E A C	I
3	19:00:36	.80	E A C	I
4	19:04:21	.80	E A C	III
5	19:05:53	.80	E A C	II
6	19:07:59	.80	E A C	II
7	19:09:13	.80	E A C	II
8	19:11:34	.80	E A C	III
9	19:12:45	.80	E A C	III
10	19:13:42	.80	E A C	III
11	19:16:09	.80	E A C	III
12	19:21:34	3.00	E A C	II
13	19:29:15	3.00	E A C	II
14	19:35:42	1.00	E A*	III
15	19:38:12	.50	E A*	III
16	19:45:05	2.00	A C	III
17	19:46:32	2.00	A C	III
18	19:49:14	1.50	A C	III
19	19:52:24	1.80	A C	III
20	19:59:39	.80	A C	III
21	20:03:25	1.00	A C	III
22	20:13:45	1.00	A C	III

*These two images were obtained through the R filter. The impact traces are hardly recognized.

Table 1.2 Same as Table 1.1, for July 18 1994

No.	UT	exp.	Fragments	Quality
1	18:30:21	.50	G	III
2	18:33:16	.50	G	III
3	18:34:43	.50	G	III
4	18:37:19	.50	G	III
5	18:40:08	.50	G	III
6	18:43:17	.50	G	III
7	18:45:14	.50	G	III
8	18:46:44	.50	G	III
9	18:49:05	.70	G	III
10	18:53:02	.80	G	II
11	18:54:57	.80	G	III
12	19:01:15	.90	G	I
13	19:06:07	.30	G*	III
14	19:08:12	.20	G*	III
15	19:10:43	.10	G*	III

* These three images were obtained through R filter.

Table 1.2 continued

No.	UT	exp.	Fragments	Quality
16	19:13:52	1.00	G	II
17	19:16:28	1.00	G	II
18	19:19:17	1.00	G	I
19	19:22:18	1.00	G	II
20	19:24:47	1.00	G	II
21	19:27:43	1.00	G	II
22	19:30:47	1.00	G	II
23	19:34:27	1.00	G	II
24	19:37:34	1.00	G	II
25	19:39:17	1.00	G	II
26	19:41:16	1.00	G	II
27	19:43:43	1.00	G	III
28	19:47:06	1.00	G	II
29	19:48:14	1.00	G	II
30	19:49:46	1.00	G	II
31	19:51:18	1.00	G	I
32	19:52:54	1.00	G	III
33	19:54:20	1.00	G	III
34	19:56:05	.70	G	II
35	19:58:27	.70	G	III
36	19:59:35	.70	G	III
37	20:01:24	.70	G	III
38	20:03:32	.70	G	II
39	20:05:36	.70	G	I
40	20:07:23	.70	G	II
41	20:09:20	.70	G	II
42	20:11:24	.70	G	III
43	20:14:08	.60	G	III
44	20:16:02	.60	G	II
45	20:18:03	.60	G	II
46	20:19:49	.60	G	III
47	20:21:31	.60	G	III
48	20:23:11	.60	G	III
49	20:24:25	.60	G	III
50	20:28:19	.50	G	III
51	20:32:26	.50	G	III
52	20:35:30	.50	G	III
53	20:39:18	1.00	G H	III
54	20:41:26	.80	G H	III
55	20:43:38	1.00	G H	III
56	20:45:35	.50	G H	III
57	20:47:44	2.00	G H	III
58	20:50:32	2.00	G H	III
59	20:56:38	3.00	G H	III
60	20:59:23	3.00	G H	III

Table 1.2 continued

No.	UT	exp.	Fragments	Quality
61	21:03:30	3.00	G H	III
62	21:05:29	3.00	G H	III
63	21:08:12	4.00	G H	III
64	21:13:43	5.00	G H	III
65	21:16:44	5.00	G H	III

Table 1.3 Same as Table 1.1, for July 20, 1994

No.	UT	exp.	Fragments	Quality
1	18:42:00	.80	C K	III
2	18:44:05	.50	C K	III
3	18:51:42	1.00	C K L	III
4	18:58:58	1.00	K L	III
5	19:06:08	1.00	K L	III
6	19:08:34	1.00	K L	III
7	19:13:39	2.00	K L	III
8	19:18:09	2.00	K L	III
9	19:20:15	2.00	K L	III
10	19:24:34	2.00	K L	III
11	19:28:25	2.00	K L	III
12	19:44:26	2.00	K L	III

Table 1.4 Same as Table 1.1, for July 23, 1994

No.	UT	exp.	Fragments	Quality
1	18:09:47	1.00	K L GR	III
2	18:12:49	1.00	K L GR	III
3	18:15:08	1.00	K L GR	III
4	18:17:10	1.00	K L GR	II
5	18:23:46	.50	K L GR	III
6	18:27:30	1.00	K L GR	III
7	18:30:09	1.00	K L GR	II
8	18:31:59	1.00	L GR	II
9	18:33:53	1.00	L GR	II
10	18:37:44	1.00	L GR	III
11	18:39:31	1.00	L GR	III
12	18:41:22	1.00	L GR	III
13	18:43:27	1.00	L GR	III
14	18:46:22	1.00	L GR	III
15	18:48:43	1.00	L GR	III
16	18:50:35	1.00	L GR	III
17	18:52:28	1.00	L GR Q1	II
18	18:55:02	1.00	L GR Q1	III
19	18:56:57	1.00	L GR Q1	III
20	18:59:24	1.00	L GR Q1	III

Table 1.4 continued

No.	UT	exp.	Fragments	Quality
21	19:08:50	1.00	L GR Q1	III
22	19:11:31	1.00	L GR Q1	II
23	19:17:07	2.00	L GR Q1	III
24	19:18:59	2.00	L GR Q1	III
25	19:21:13	1.00	L GR Q1	III
26	19:22:52	1.00	L GR Q1	III
27	19:26:29	1.00	L GR Q1	III
28.	19:32:48	.80	L GR Q1	III
29	19:34:57	1.50	L GR Q1	III
30	19:37:07	1.20	L GR Q1	III
31	19:39:16	3.00	L GR Q1	III
32	19:42:31	3.00	L GR Q1	III
33	19:44:36	3.00	L GR Q1	III
34	19:46:46	3.00	L GR Q1	III
35	19:51:18	2.00	L GR Q1	III
36	19:57:39	2.00	L GR Q1 H	III

Table 1.5 Same as Table 1.1, for July 24, 1994

No.	UT	exp.	Fragments	Quality
1	18:27:07	.80	H E A	III
2	19:03:18	1.00	H E A C	III
3	19:22:01	1.50	E A C	III
4	19:42:20	.50	E A C	III

Table 1.6 Same as Table 1.1, for July 25, 1994

No.	UT	exp.	Fragments	Quality
1	18:36:58	1.00	UWK L	III
2	18:39:18	1.00	UWK L	III
3	18:48:22	.80	UWK L	II
4	18:50:18	.80	UWK L	II
5	18:52:10	.80	UWK L	III
6	18:53:40	1.00	UWK L	III
7	19:01:01	1.00	UWK L G	III
8	19:05:25	1.00	UWK L G	III
9	19:12:03	1.00	UWK L G	II
10	19:13:38	1.00	UWK L G	III
11	19:15:02	1.00	UWK L G	III
12	19:25:09	1.00	UWK L G	III

Table 1.7 Same as Table 1.1, for July 26, 1994

No.	UT	exp.	Fragments	Quality
1	19:56:47	1.00	H E	III

Table 1.8 Same as Table 1.1, for July 29, 1994

No.	UT	exp.	Fragments	Quality
1	18:27:11	.80	E C	III
2	18:29:23	.50	E C	II
3	18:33:21	.50	E C	II
4	18:35:30	.50	E C	II
5	18:37:17	.80	E C	II
6	18:39:35	.80	E C	II
7	18:43:12	.80	E C	III
8	18:45:13	1.00	E C	III
9	18:47:27	.80	E C P2	II
10	18:51:24	.80	E C P2	III
11	18:55:03	.80	E C P2	III
12	18:57:34	.80	E C P2	III
13	18:59:28	.80	E C P2	III
14	19:01:33	1.00	E C P2	III
15	19:10:58	1.00	E C P2 UWK	III
16	19:12:45	1.00	E C P2 UWK	III
17	19:15:04	1.00	E C P2 UWK	II
18	19:19:08	1.00	E C P2 UWK	II
19	19:22:39	1.00	E C P2 UWK	III
20	19:24:38	1.00	E C P2 UWK	III
21	19:33:26	1.00	E C P2 UWK	III
22	19:35:42	1.00	E C P2 UWK	III
23	19:39:29	1.00	E C P2 UWK	III

Table 1.9 Same as Table 1.1, for July 30, 1994

No.	UT	exp.	Fragments	Quality
1	19:14:30	.50	K L GRQ1	III
2	19:16:45	1.00	K L GRQ1	III
3	19:21:25	1.50	K L GRQ1	III
4	19:23:16	1.50	K L GRQ1	III

Table 1.10 Same as Table 1.1, for July 31, 1994 31.

No.	UT	exp.	Fragments	Quality
1	18:31:36	.80	GRQ1 H E	III
2	18:34:16	.80	GRQ1 H E	III
3	18:38:06	.80	GRQ1 H E	III
4	18:40:02	.80	GRQ1 H E	III
5	18:42:12	1.00	GRQ1 H E	III
6	18:44:17	1.00	GRQ1 H E	III
7	18:47:00	1.00	GRQ1 H E	III
8	18:50:06	1.00	GRQ1 H E	III
9	18:54:24	1.00	GRQ1 H E	III
10	18:57:40	1.00	GRQ1 H E	III

Table 1.10 continued

No.	UT	exp.	Fragments	Quality
11	18:59:24	1.00	GRQ1 H E	III
12	19:01:06	1.00	GRQ1 H E	III
13	19:02:42	1.00	GRQ1 H E	III
14	19:04:38	1.00	GRQ1 H E	III
15	19:06:30	1.00	GRQ1 H E	III
16	19:08:53	1.00	GRQ1 H E	III
17	19:10:26	1.00	GRQ1 H E	III
18	19:12:34	1.00	GRQ1 H E	III
19	19:22:59	1.00	H E	III
20	19:25:07	1.00	H E	III
21	19:27:47	1.50	H E	III
22	19:29:31	1.50	H E	III
23	19:31:42	1.50	H E	III
24	19:33:35	1.50	H E	III
25	19:35:36	1.50	H E	III
26	19:37:58	1.50	H E	III
27	19:44:27	3.00	H E	III
28	19:49:20	1.50	H E	III
29	19:53:54	1.50	H E	III
30	19:58:45	1.50	H E	III
31	20:01:19	1.50	H E	III

Table 1.11 Same as Table 1.1, for August 5, 1994

No.	UT	exp.	Fragments	Quality
1	18:55:14	1.00	H TV E	III
2	18:57:15	1.00	H TV E	III

Table 1.12 Same as Table 1.1, for August 6, 1994

No.	UT	exp.	Fragments	Quality
1	18:30:26	1.00	UWK LG	III
2	18:35:00	1.00	UWK LG	III
3	18:44:24	2.00	UWK LG	III
4	18:46:44	2.00	UWK LG	III
5	18:50:25	2.00	UWK LG	III
6	18:52:02	2.00	UWK LG	III
7	18:53:27	2.00	UWK LG	III
8	18:55:45	2.00	UWK LG	III
9	18:58:17	2.00	UWK LG	III
10	19:01:19	1.00	UWK LG	III
11	19:04:27	2.00	UWK LG	II
12	19:06:08	2.00	UWK LG	III
13	19:08:30	2.00	UWK LG	III
14	19:13:21	2.00	UWK LG	III
15	19:16:15	2.00	UWK LG	III

Table 1.13 Same as Table 1.1, for August 8, 1994

No.	UT	exp.	Fragments	Quality
1	18:31:32	2.00	UWK	III
2	18:36:10	2.00	UWK	III
3	18:38:10	2.00	UWK	III
4	18:44:27	2.00	UWK	III
5	18:49:06	2.00	UWK	III
6	18:58:20	2.00	UWK	III

3. ANALYSIS OF OBSERVATIONS

During and after the impact period we made 233 images of Jupiter. On the basis of quality, we divided images into three classes (see Tables 1.1 – 1.13), where images marked by I are the best ones. In the Tables we give a list of obtained images with imaging time, quality, exposure time and name of fragments whose traces are seen in the images.

Some obtained images are presented in Figs. 1–13. By analyzing the images we noted the following:

17. 7. 94.

The image taken at 18:56 UT (Fig. 1) shows, from the west to the east, the impact sites of fragments E, A and C. The darkest and most complex feature corresponds to the fragment E which is the youngest being old only 3.8 hours. The other two, A and C, are less intense and the largest of all is the later one. Their age is 22.8 and 11.7 hours, respectively. In several successive images a disturbance resembling a dark arc roughly centered around C impact site and passing close to the trace A could be noticed. It also looked like a curved part of Jupiter's South Temperate Belt. Disappearing behind the planet's west limb the impact site E became invisible at 19:45 UT.

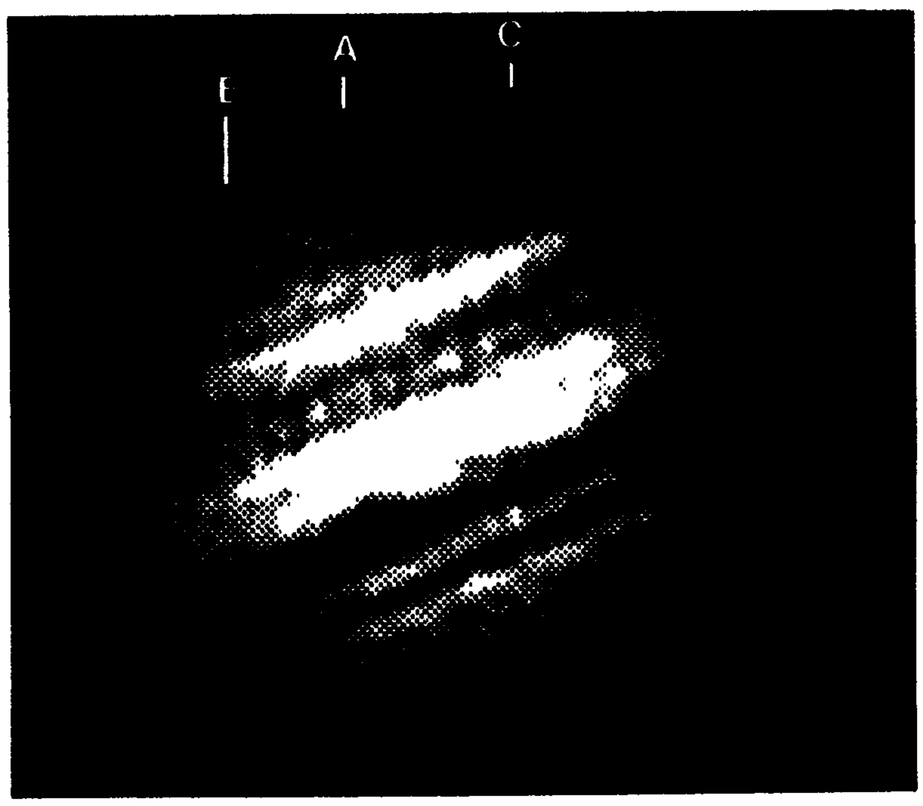

Fig. 1. Jupiter on 17. 7. 94. at 18:55:55 UT. south is up and west is to the left. V filter. The orientation and filter are the same in all the following Figures.

Fig. 2. 18. 7. 94. at 19:01:15 UT.

18. 7. 94.

In Fig. 2, obtained at 19:01 UT, a huge dark eliptic spot with a darker core at its north–east is seen around the impact site of the fragment G just 11.5 hours after the impact. About one hour later, at 20:06 UT, Fig. 3, the impact structure G was close to the central meridian. Here and also in five following images (not shown) the dark spot G seemed to be surrounded by a bright area, being the most intensive at its north side. However, the trace of the fragment D, a couple of degrees in longitude east from G and clearly seen in a picture obtained by Hubble Space Telescope (Macchetto, 1994) on 18. 7. 94 at 9:17 UT, in our images has not been noticed. It is possible that the small spot at the impact site D about 10 hours after the Hubble's observation, at its age of about 31.1 hours weakened, disappeared or merged into the growing G structure. Later, at 20:39 UT it was possible to notice the appearance of the 1.1 hours old impact spot H at the planet's east limb.

Fig. 3. 18. 7. 94. at 20:05:36 UT.

20. 7. 94

The site of the impact C is seen on the first 3 exposures until 18:52 UT, while the trace of the impact K is present during the whole observational evening. The K and L sites (the last appeared at 18:52 UT) are large dark spots showing no detailed structure. Trace L is somewhat darker and larger which is nicely seen at 19:44 UT, Fig. 4, where the ages of K and L rises to 33.4 and 21.5 hours, respectively. The observational conditions were poor during the whole night.

Fig. 4. 20. 7. 94. at 19:44:26 UT.

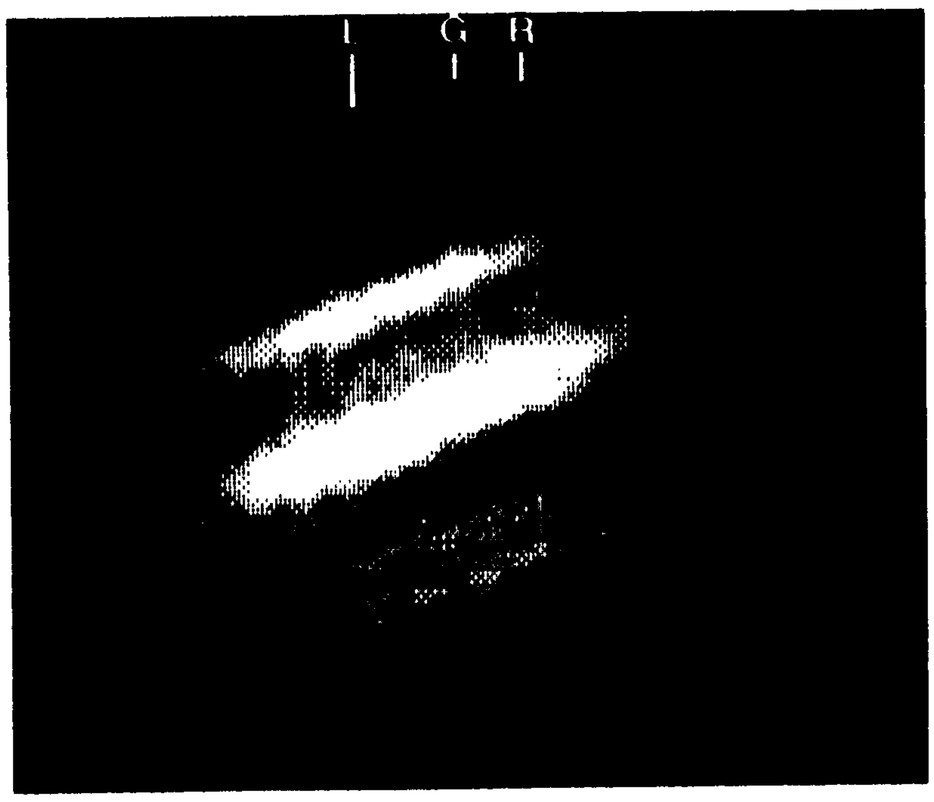

Fig. 5. 23. 7. 94. at 18:30:09 UT.

23. 7. 94.

The first images show K impact site disappearing at the Jupiter's west limb. Its age at 18:30 UT is 104.0 hours, Fig. 5. At the same time the trace L, being 92.2 hours old, is approximately at the central meridian. It is an irregular structure slightly elongated in the East–West direction and darker at its east side. The observed complex around the impact spot G, merging with the impact spot R, ex-

tends about 20° in longitude. The age of G and R is 131.0 and 60.9 hours, respectively. Within this complex structure G impact spot is still the darkest feature followed by R spot at the east end of the complex. Later, at 18:52 UT the impact site Q1, being old 70.7 hours, appeared at the planet's east limb. It was followed by the rise of the spot H which was 120.4 hours old at 19:09 UT. The quality of the later images was poor.

24. 7. 94.

In spite of bad observational conditions during this night, the obtained Jupiter's images exhibit the impact site H setting at the west limb as well as the sites E, A and C east from the central meridian. Actually, it is possible that what we call E site contains also the F impact spot. At 19:03 UT, Fig. 6, the age of E spot is 171.9 hours and that of F is 162.5 hours. The age of the other impact sites H, A and C, rises to 143.5, 190.9 and 179.9 hours, respectively.

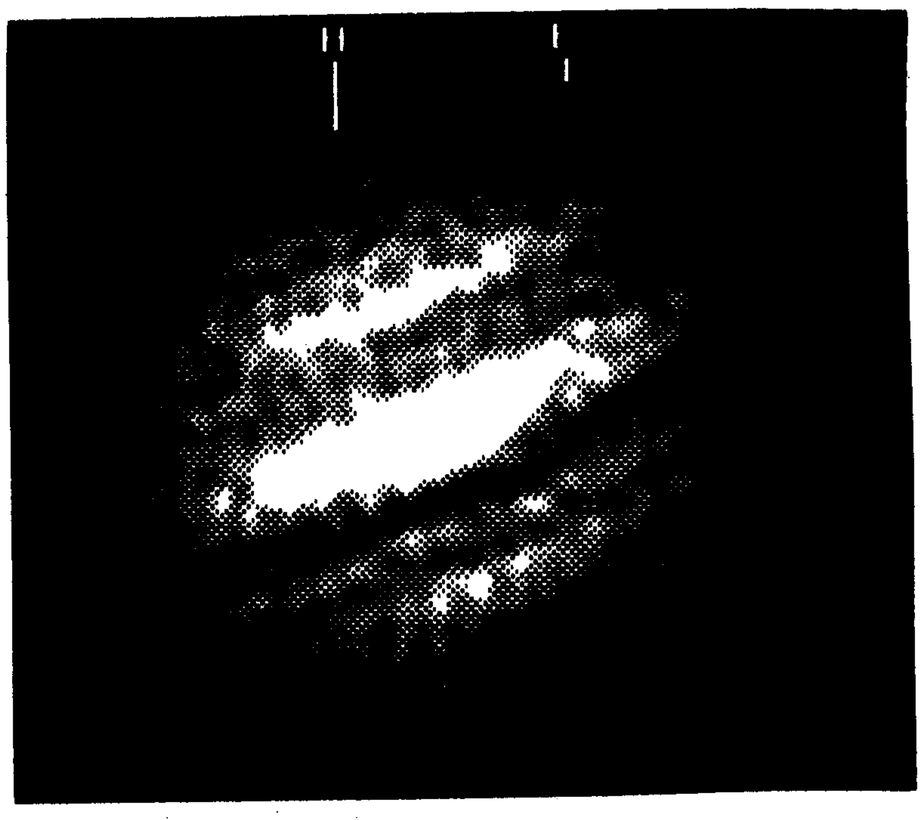

Fig. 6. 24. 7. 94. at 19:03:18 UT.

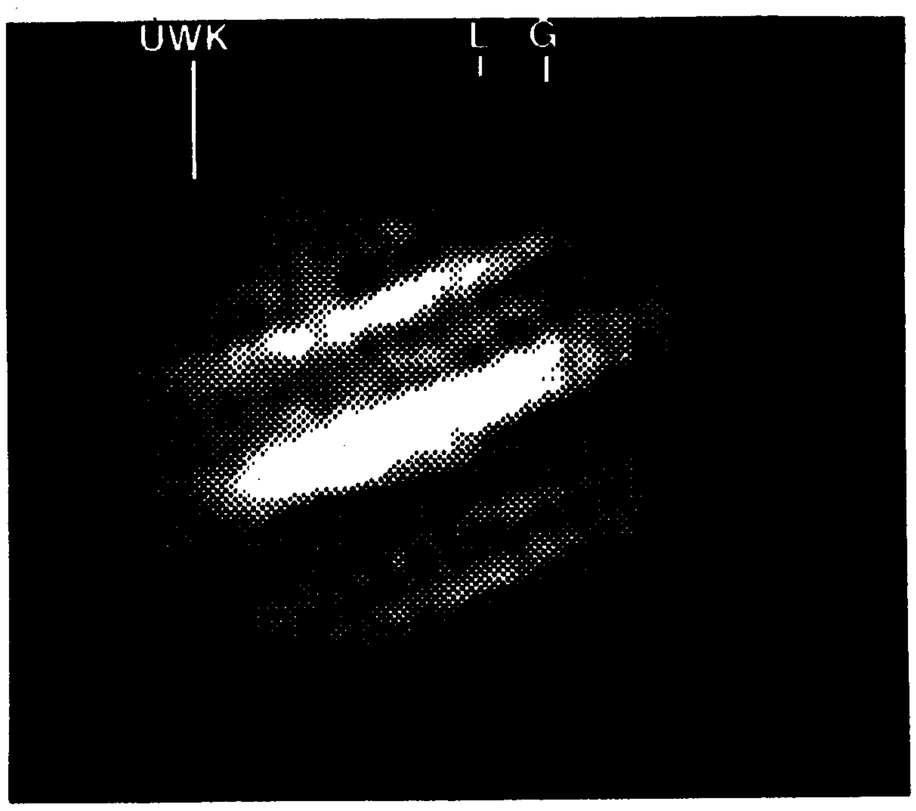

Fig. 7. 25. 7. 94. at 19:12:03 UT.

25. 7. 94.

The image taken at 19:12 UT (Fig. 7) shows, west from the central meridian, an east–west elongated, not very dark trace exhibiting no fine structure. It corresponds to the position of UWK complex where the respective ages are: 93.3, 83.1 and 152.9 hours. The impact site L (140.9 hours old) is a darker large and irregular area. At the planet's extreme east limb starts appearing the dark and great, 179.7 hours old, G impact site.

26. 7. 94.

Very bad observing conditions. Only one image of Jupiter was obtained. The identification of the impact sites is uncertain.

29. 7. 94.

A quite dark and almost circular spot west from the central meridian corresponds to the impact site of the fragment E. At 19:19 UT, Fig. 8, its age is 292.1 hours. C impact site, 300.1 hours old, is weak irregular and elongated in east–west direction. It possibly comprises the trace of fragment P2. At the same time, the large and very dark UWK structure appears at the planet's east limb.

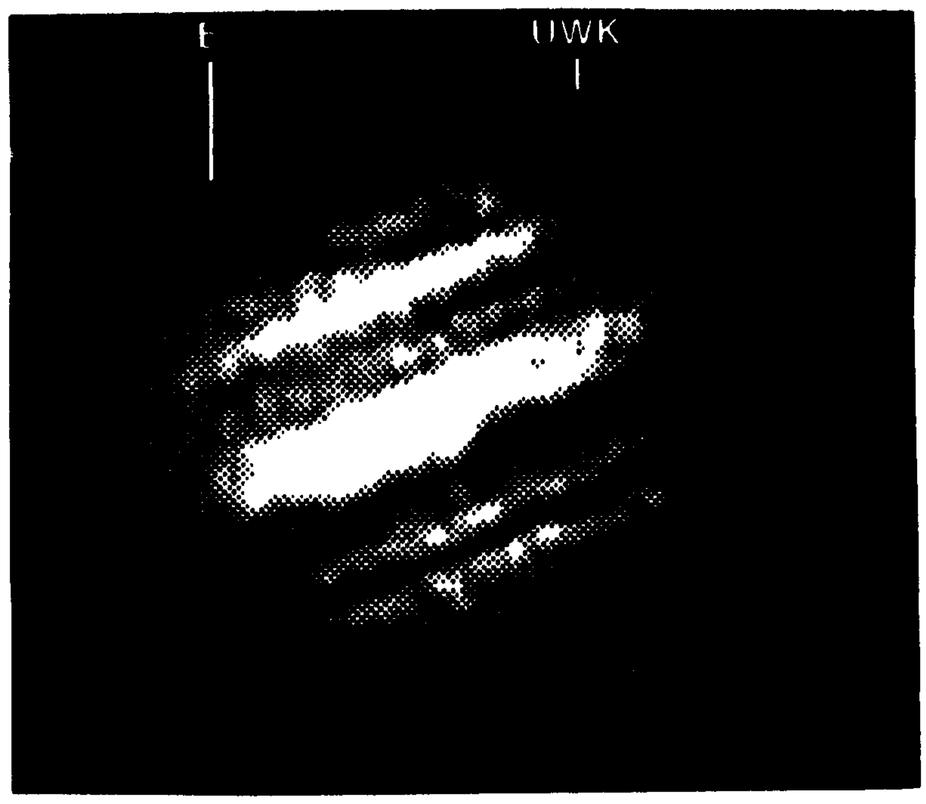

Fig. 8. 29. 7. 94. at 19:19:08 UT.

30. 7. 94.

The best Jupiter's image in poor observational conditions was obtained at 19:17 UT, Fig. 9. Here the impact site K, being old 296.9 hours, sets at the west limb. L impact site is seen near the central meridian as a large but weak and irregular spot. Its age is 261.0 hours. Further east one can find a dark complex extended in longitude. It corresponds to the impact site G, R and Q1 that cannot be separated one from another.

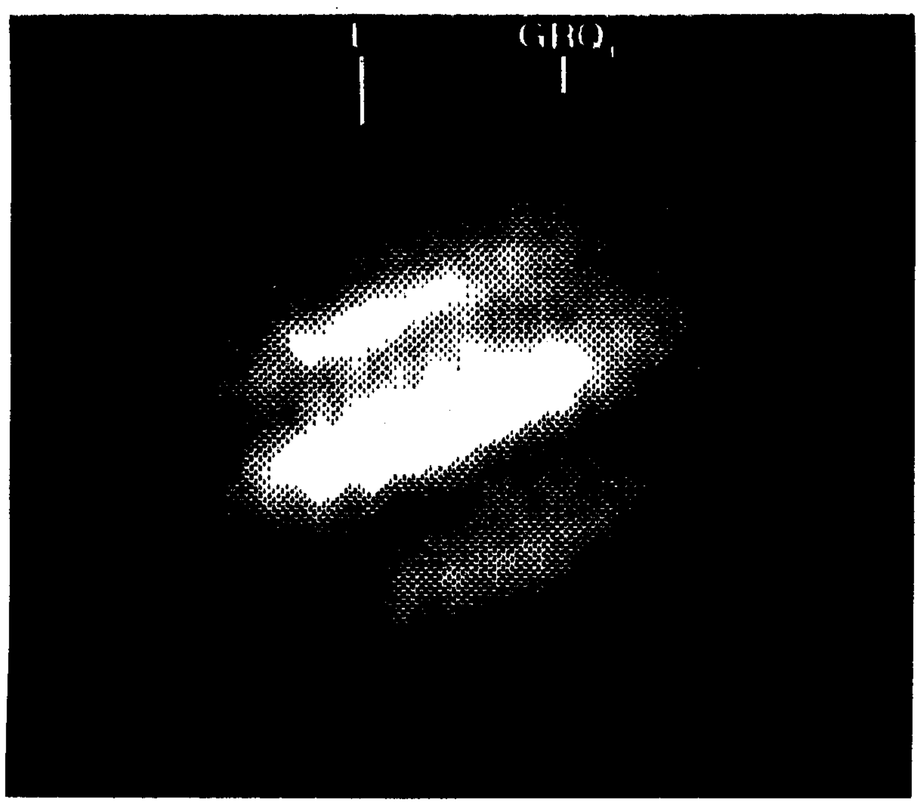

Fig. 9. 30. 7. 94. at 19:16:45 UT.

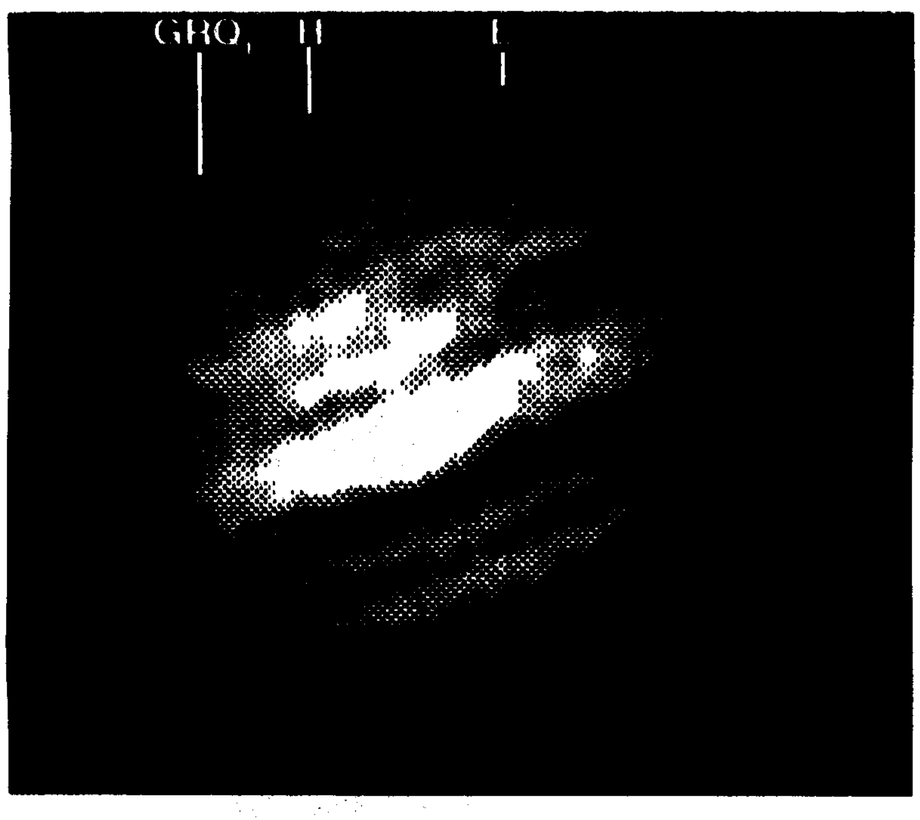

Fig. 10. 31. 7. 94. at 18:34:16 UT.

31. 7. 94.

In the image taken at 18:34 UT, Fig. 10, at the planet's west limb one can see only a part of the huge complex originating from the impact sites G, R and Q1. The impact site H, being 311.0 hours old, is an elliptic dark spot extended in east–west direction. At the East a large but not very dark E impact spot is seen. It probably comprises the impact site F too.

5. 8. 94.

Both images on this night were obtained under very bad conditions. We do not comment on the identified impact traces.

6. 8. 94.

The configuration of the UWK impact sites, dark and elongated in east–west direction sets behind the planet's west limb at 19:04 UT, Fig. 11. This

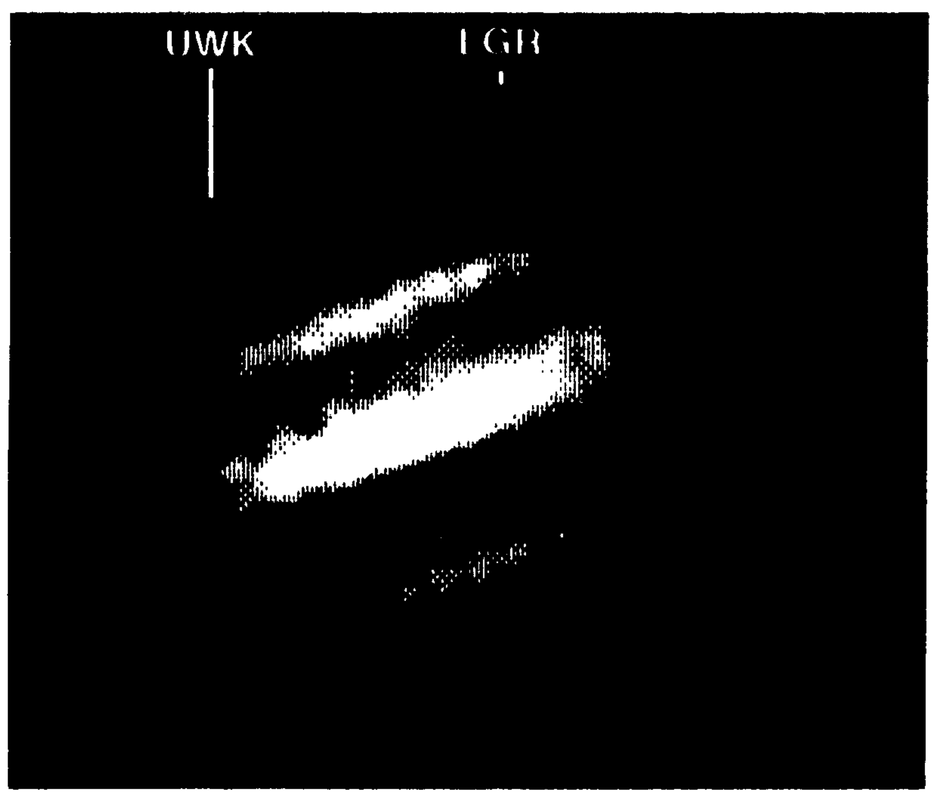

Fig. 11. 6. 8. 94. at 19:04:27 UT.

Fig. 12. The same as in Fig. 11, enlarged. Note the dark belt-like structure along the impact latitude parallel, i.e. south from South Temperate Belt.

structure as well as the very extended in longitude LG impact complex at the East (R probably being behind the limb) look like parts of a new belt of dark clouds among the existing ones, Fig. 12. So, here one does have an impression that formation of a new dark belt, "SL-9 belt", in the atmosphere of Jupiter takes place.

8. 8. 94.

At 18:38 UT, Fig. 13, an elongated dark structure is seen east from the central meridian. It comprises the impact traces U, W and K. The age of K trace is 488.3 hours.

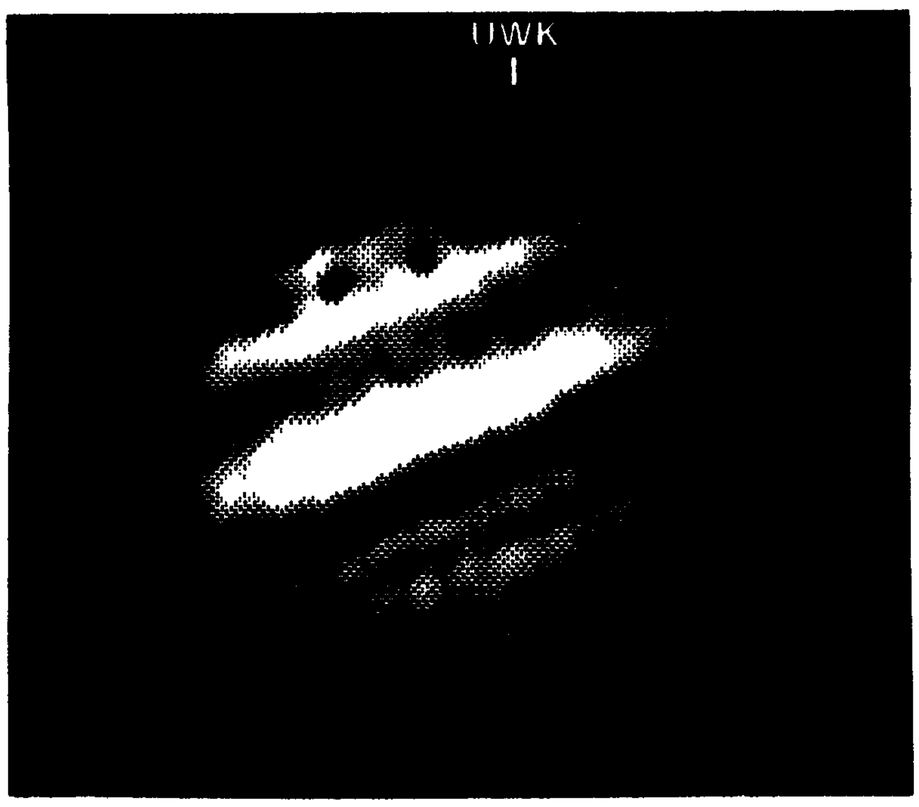

Fig. 13. 8. 8. 94. at 18:38:10 UT.

4. DISCUSSION AND CONCLUSION

On the basis of the inspection of our CCD images we can conclude:

– All observed traces of fragments in V spectral region were darker than the surrounding Jupiter's atmosphere. For the medium-size impact traces we obtained a considerably lower contrast in R spectral region.

– Scrutinizing all obtained images we were not able to detect small impact traces like e.g. D, N, or Q2. According to the marvelous images taken by Hubble Space Telescope (Macchetto, 1994) our estimation of the angular sizes of these impact spots were approximately 0″.6, 0″.3 and 0″.2, respectively. Slightly bigger one as, for example, Q1 being about 1″.1 was detected in our images of Jupiter. We consider this as an indication that our overall realised resolution (atmosphere + telescope + CCD + displaying facility) is somewhere around 1″. Obviously, the nominal CCD resolution of about 0.5 arc sec per pixel was not achieved because of the other contributors – most probably the Earth's atmosphere, especially taking into account the low declination of Jupiter.

– None of the large observed spots disappeared during the present period of observation. They gradually lost their individuality by extending in longitude, merging with neighboring impact traces and behaving as though they were taking part in building a "new" dark belt in Jupiter's atmosphere. This "SL-9 belt" was not yet completed till the end of our observational campaign (8. 8. 1994).

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БЕОГРАДСКА ПОСМАТРАЊА ЈУПИТЕРА У ПЕРИОДУ ЊЕГОВОГ СУДАРА СА КОМЕТОМ SL–9

Л. Ч. Поповић, А. Кубичела, Ј. Арсенијевић, Д. Јевремовић и И. Винце

Астрономска опсерваторија, Волгина 7, 11050 Београд, Југославија

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Предходно саопштење

У раду су представљани резултати посматрања (CCD камером) поремећаја проузрокованих ударом фрагмената комете SL–9 са Јупитером. У V области спектра снимљене су појаве и развој "тамних пега".