Light Curves of Comets in 2003

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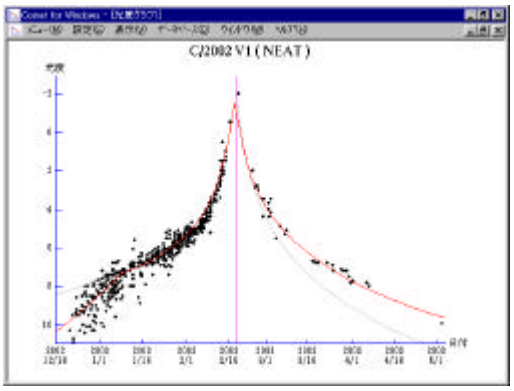
1. Overview

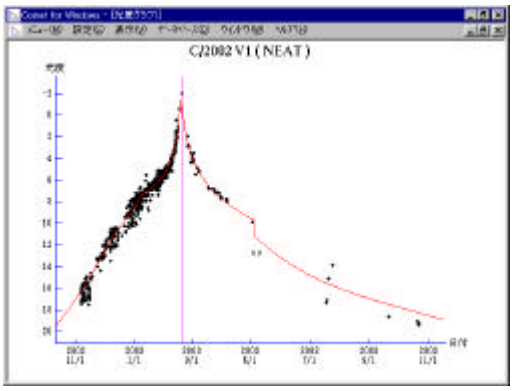
In this paper, I introduce the light curves of comets, bright comets or interesting comets with peculiar light curves, observed during a year between 2003 March and 2004 February.

My web page "Comet Catalog" also introduces the light curves of comets, including ones not described in this paper.

2. Bright Comets

2-1. C/2002 V1 (NEAT)





It approached close to the Sun, and brightened to -2 mag at best.

The brightening evolution has changed some times.

Absolute Magnitude	Coefficient of log r	Period	Days from Perihelion	Perihelion Distance
2.5	35	to 2002 Dec.6	to -74	to 1.85 AU
5.8	22.5	to 2003 Jan. 9	to -40	to 1.20 AU
7.0	8.5	to 2003 Feb. 18	to 0	to 0.10 AU
5.8	6.6	to 2003 May 4	to +75	to 1.86 AU
4.2	18	from 2003 May 4	from +75	from 1.86 AU

Before the perihelion passage, it was switched on at the heliocentric distance of 1.20 AU, from the rapid brightening to slow brightening. At the same time, it also changed apparently from diffused to well condensed.

Although the perihelion distance is so small as 0.1 AU, the light curve can be expressed by one formula from 1.20 to 0.10 AU before the perihelion passage, and from 0.10 to 1.86 AU after the perihelion passage.

After the perihelion passage, it had been fading very slowly until it reached to 1.86 AU, far from the Sun. The pace was slower than pre-perihelion. Maybe it got some earnings at the perihelion passage. By the way, it was extremely diffused at 1.86 AU, so the reported observations have large scatter depending on the conditions.

After 2003 May, it has been fading rapidly, but slower than pre-perihelion.

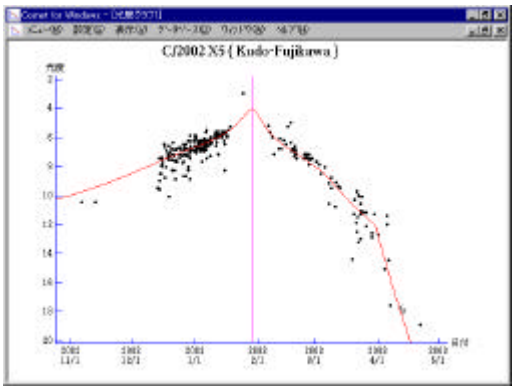
The turning points at the same distance of 1.85 AU are found both before and after the perihelion passage. I do not know if it is by chance.

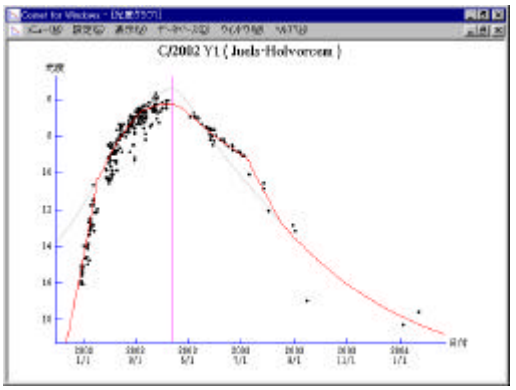
2-2. C/2002 X5 (Kudo-Fujikawa)

The brightening was so slow as an asteroid, along the formula of 4.5 log r. After the perihelion passage, it had been fading very slowly at first, then it faded out suddenly.

Absolute Magnitude	Coefficient of log r	Period	Days from Perihelion	Perihelion Distance
7.0	4.5	to 2003 Jan. 29	to +0	to 0.19 AU
8.4	6.5	to 2003 Mar. 6	to +36	to 1.04 AU
8.3	15.0	to 2003 Mar. 31	to +61	to 1.54 AU
-6.6	95	from 2003 Mar. 31	from +61	from 1.54 AU

The light curve looks like as if it collapsed. But actually, the nucleus of this comet did not collapse.





2-3. C/2002 Y1 (Juels-Holvorcem)

It behaved similar to C/2002 V1.

Absolute Magnitude	Coefficient of log r	Period	Days from Perihelion	Perihelion Distance
-7.0	70	to 2003 Jan. 16	to -87	to 1.73 AU
6.5	13.7	to 2003 Mar. 9	to -35	to 1.00 AU
6.5	8.0	to 2003 July 10	to +88	to 0.71 AU to 1.74 AU

When the heliocentric distance became down to 1.00 AU, the brightening pace became slow down. At the same time, it also changed apparently from diffused to well condensed, same as C/2002 V1.

The turning points at the same distance of 1.74 AU are found both before and after the perihelion passage, same as C/2002 V1. I do not know if it is by chance.

It is interesting that light curve from January to March can also satisfy the fading after August if we extend the curve.

2-4. 2P/Encke

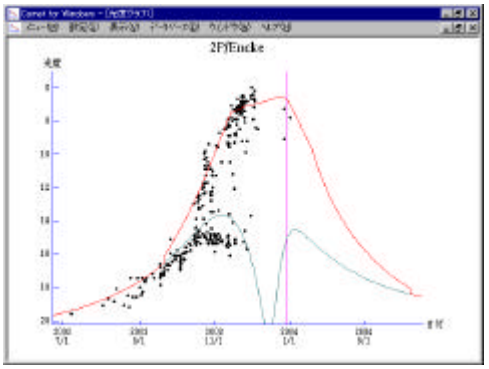
The light curve in this return was almost same as the curve obtained from the past four appearances from 1990 to 2000. The overview is as follows.

- It is switched on and starts brightening rapidly at the early point before the perihelion passage.
- After it brightens and becomes visible visually, the brightening becomes slow around the perihelion passage.
- It fades out immediately after the perihelion passage.

No evident fading of the absolute magnitude was found in the last 14 years.

This comet behaves as if it were an asteroid with an absolute magnitude of 14.2 mag when it is far from the Sun. The CCD observations reported with astrometry had been well along the light curve as an asteroid until late October in 2003 when the comet was 12 mag visually. After that, the CCD observations became a bit different from the light curve, however, it kept 14-15 mag until early December when the comet reached to 6 mag visually. In this period, the predicted light curve as an asteroid shows the beginning of rapid fading due to wane like the Moon.

This comet was extremely diffused with a large gas coma. Probably the gas coma was not detected and the nuclear magnitude was measured by the CCD observations. The comet kept faint by the CCD observations even when it showed rapid brightening visually. Maybe it implies that the CCD observations caught the wane effect of the nucleus or the dusts.



3. Collapsed Comets

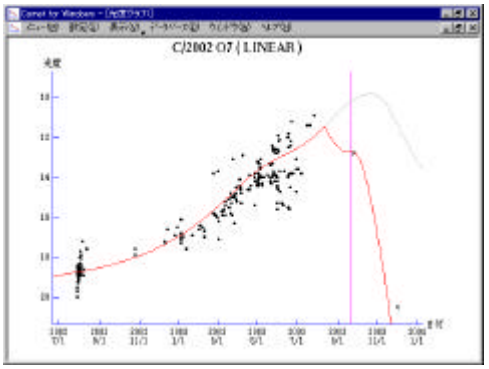
3-1. C/2002 O7 (LINEAR)

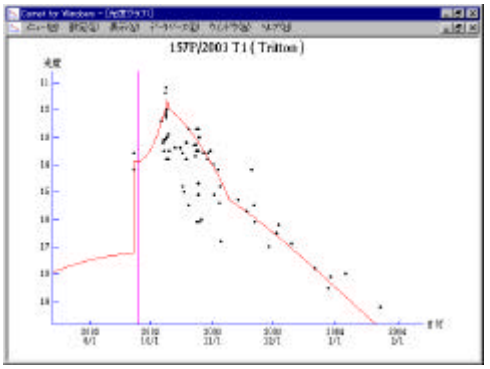
This comet was expected to reach to 7 mag at the discovery, however, it actually collapsed and disappeared at the end.

The brightening pace had been very slow (7.5 log r) after the discovery, so the maximum brightness was modified down to 10 mag, not 7 mag as expected at first, at the early point.

After 2003 May, the comet brightened well along 10 log r visually, on the other hand, the brightening had almost stopped, along 1.5 log r, by CCD observations.

Maybe these behaviors are related to the collapse, but I do not know.





4. Outburst Comets

4-1. 157P/Tritton

This comet was recovered when it was in extreme outburst and reached to 11 mag. Then it had been fading rapidly.

This comet was so faint as 19-20 mag in 1978. They say it was also in outburst at that time despite of the faintness. In this appearance, the comet was not detected by NEAT before the outburst. Therefore, it must be a comet nobody can observe without outbursts, like 18D.

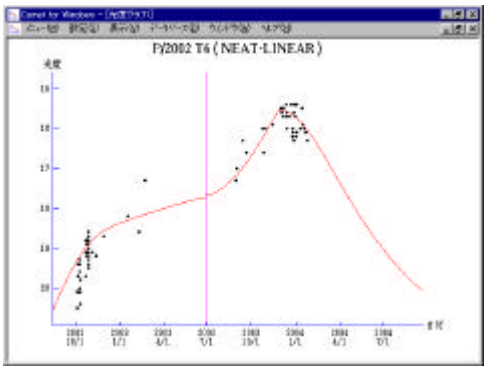
5. Comets which Brightened After the Perihelion Passage

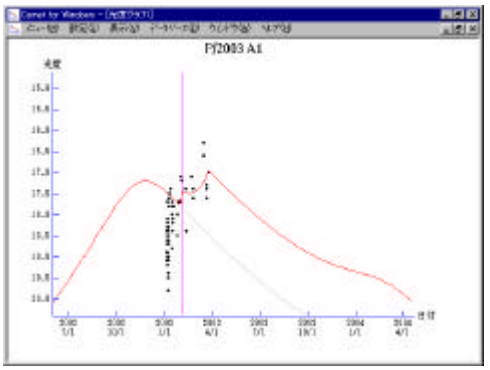
5-1. P/2002 T6 (NEAT-LINEAR)

It was expected to be 18.5 mag at best at the discovery. However, it brightened on and on after the perihelion passage and reached to 15.5 mag. It was 150-200 days after the perihelion passage when it became brightest.

5-2. P/2003 A1

This comet also kept brightening after the perihelion passage. I do not know if it is related to the possible identification with D/Pigott.



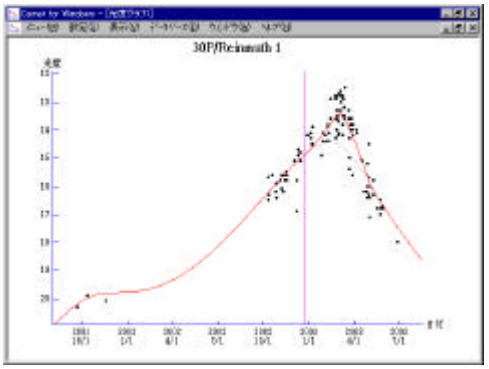


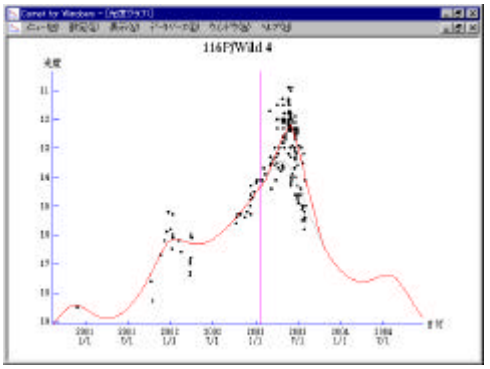
6. Periodic Comets which Became Brighter At the Peak

Some periodic comets become brighter than expected around the apparent peak of brightness when they approach to the earth, not around the perihelion passage. I do not know if the reason is because they become in outburst by chance around the apparent peak of brightness, or because they have features to become brightest some days before or after the perihelion passage and they approach to the earth at the same time by chance, or because of other reasons.

In 2003, the following comets showed that feature.

- 30P/Reinmuth 1
- 116P/Wild 4

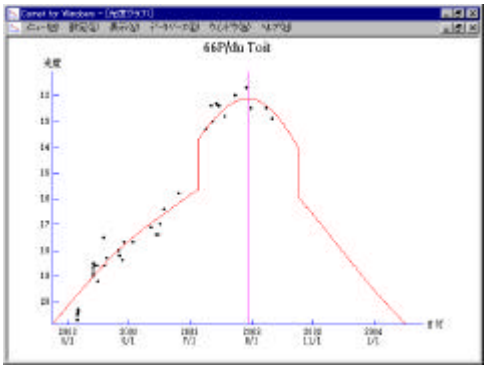


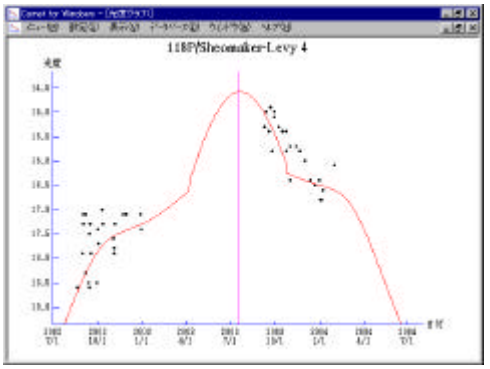


7. Periodic Comets which Showed Rapid Brightening and Fading Only Around the Perihelion Passage

7-1. 66P/du Toit

It was observed visually at 12 mag, but very diffused.





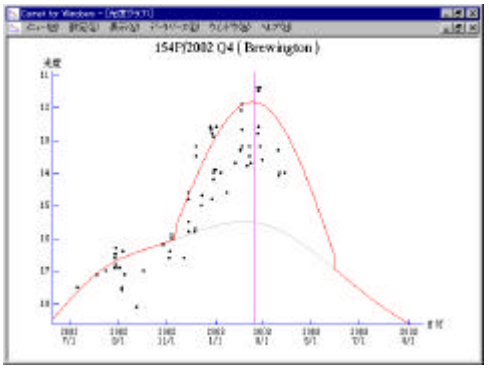
7-2. 118P/Sheomaker-Levy 4

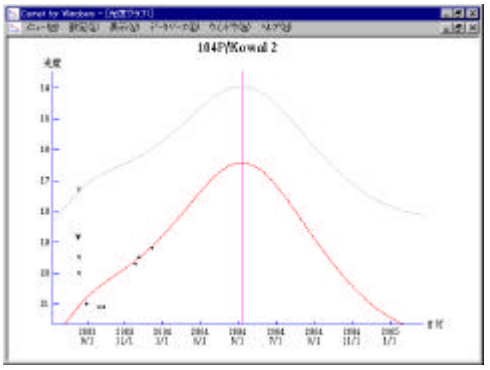
In its last return in 1997, it brightened and faded rapidly only within +/- 100 days around

the perihelion passage. That peculiar feature was also found in this return.

7-3. 154P/2002 Q4 (Brewington)

It was expected to reach to 10 mag based on the observations at the discovery. Actually it did not become so bright, however, reached to 11 mag. Probably this comet was not in outburst at the discovery, but it tends to brighten rapidly only around the perihelion passage.





8. Comets Fainter Than Expected

8-1. 104P/Kowal 2

It reached to 13 mag in its last return in 1998, however, it was 3-4 mag fainter than expected in this return. It seems to reach only to 17 mag at best.

This comet was recovered at 14 mag in 1991. However, it must have been 10 mag in 1991 based on the brightness observed in 1998. The brightness in this return is almost same as that in 1991. Therefore, this comet was probably in outburst in its last return and became 3-4 mag brighter than usual.

This comet was revealed to have been observed in 1973 at 9.5 mag. It was in outburst at that time, too.

Probably this comet has a habit of outburst, does not have an evident usual state, like 41P.

9. Comets Affected by Wane like the Moon

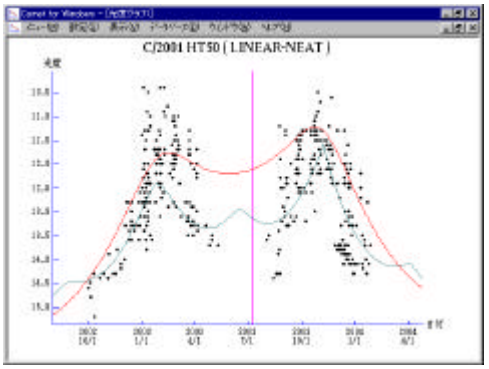
Akimasa Nakamura has pointed out that some comets are observed faint at small elongation, but observed bright at the opposition. Maybe this is because the brightness of a comet is affected by wane like the Moon or an asteroid.

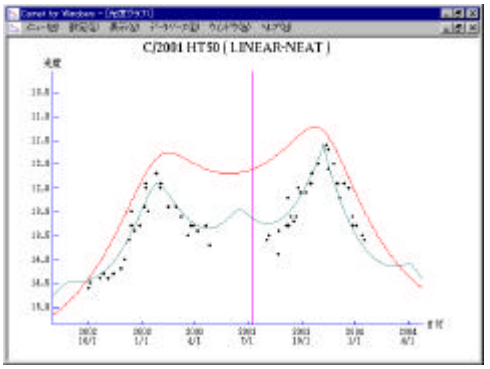
In the case of following comets, the actual light curve was expressed by a formula as an asteroid including the wane effect better than a formula as a typical comet.

9-1. C/2001 HT50 (LINEAR-NEAT)

It looked like a typical comet, however, the CCD observations by Akimasa Nakamura and Ken-ichi Kadota are well along a formula as an asteroid with H=7.5. But no wane effect was found in the visual observations.

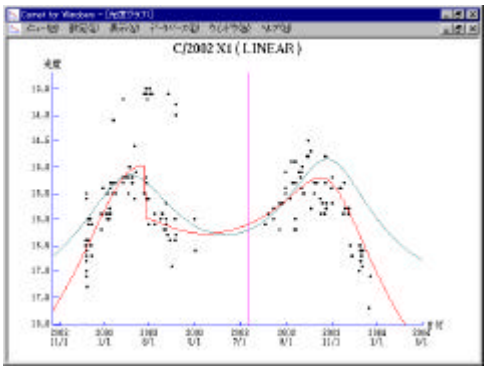
Maybe the wane effect was not found in the visual observations because they reflected the gas. On the other hand, maybe the wane effect was found in the CCD observations because they reflected the dust, and the dust size of this comet was big.

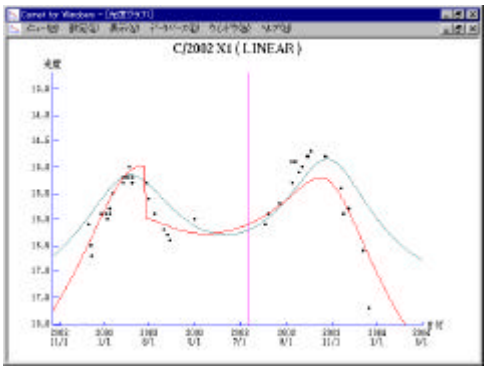




9-2. C/2002 X1 (LINEAR)

A possible wane effect was found in the CCD observations by Akimasa Nakamura and Ken-ichi Kadota, as same as C/2001 HT50.

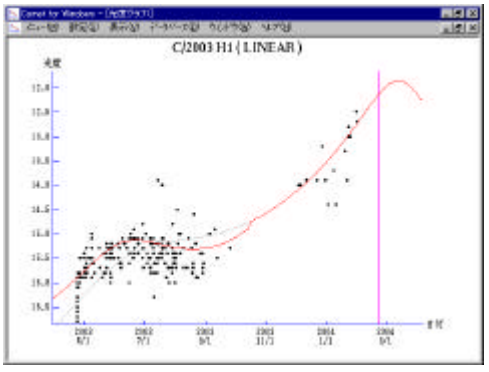




9-3. C/2003 H1 (LINEAR)

It had been at 15.5 mag, did not brighten, since the discovery. That stagnation can be expressed well by the wane effect. The light curve as an asteroid with H=9.4 was well along the actual brightness.

However, this comet turned to show the light curve as a typical comet in 2004.



10. Far Comets Observable Long Time

Now many comets with large perihelion distance become to be discovered when they are very far from the Sun. Those comets have been observed for years.

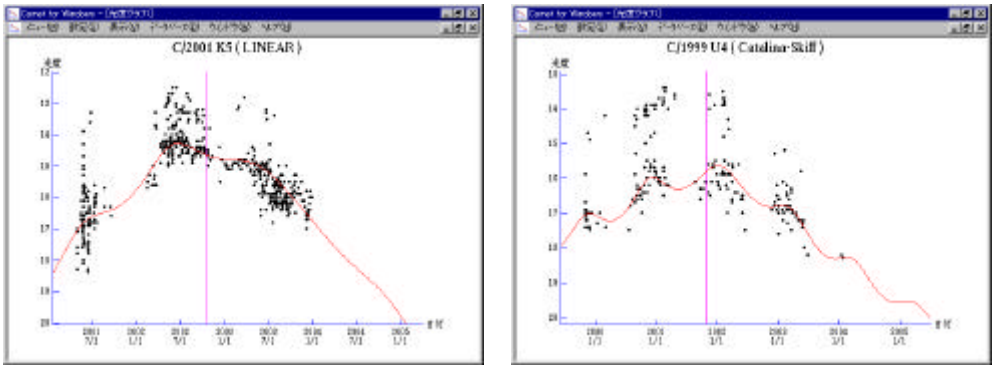
Many of those far comets observable for years tend to fade out rapidly after the perihelion passage. Although they are expected to be observable for years in calculation, they actually become too faint to observe soon.

In addition, some of them tend to become a bit fainter after the perihelion passage than before.

10-1. C/2001 K5 (LINEAR)

We feel this comet has been fading slowly because it is far away. But actually, it has been fading rapidly along 25 log r.

C/1999 J2 was similar to this comet, whose fading pace was along 25 log r, too.



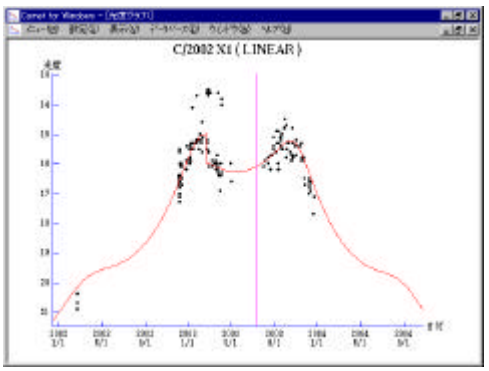
10-2. C/1999 U4 (Catalina-Skiff)

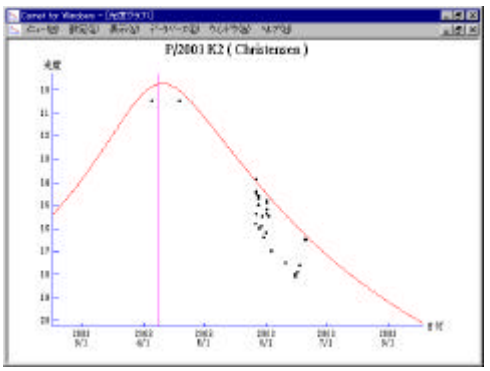
This far comet unusually changed the brightness very slowly. The brightening before the perihelion passage was along 3.5 log r. It was also slow in fading along 7.5 log r after the perihelion passage, too.

10-3. C/2002 X1 (LINEAR)

It became 1 mag fainter after the perihelion passage than before. It was observed visually at the opposition before the perihelion passage, however, no visual observations were reported in 2003 autumn.

C/2000 SV74 was similar to this comet. The magnitude formulas of these two comets are along 12.5 log r.





11. Other Comets

11-1. P/2003 K2 (Christensen)

This is a short periodic comet with a very small perihelion distance of 0.55 AU. It had been close to the Sun, but it showed rapid change of brightness along 15 log r.

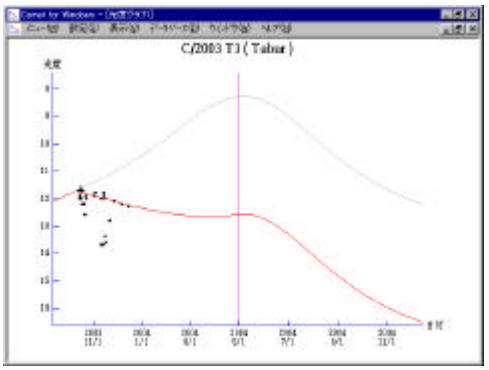
96P is similar to this comet, which has a very small perihelion distance (0.12 AU) and shows rapid change of brightness along 14 log r.

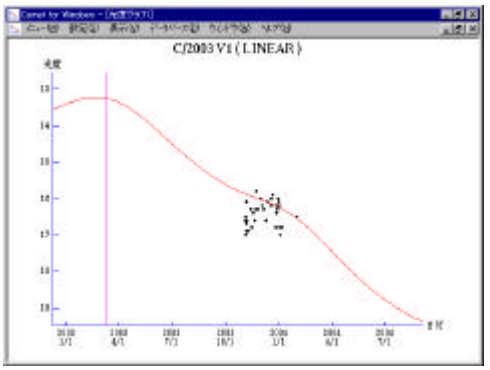
11-2. C/2003 T3 (Tabur)

It had been fading since the discovery. It will be observable after May, however, maybe we cannot observe it.

[Supplement on Aug. 31, 2004]

That fading was due to the observational selection effect. The further observations revealed that the comet had been actually brightening. It reached to 9.5 mag in 2004 May.





11-3. C/2003 V1 (LINEAR)

It must have located at 25 deg high in the evening sky at 13 mag in winter of 1 year ago, but it was not discovered at that time. This comet has been fading slowly along 7.5 log r.