Cometography: A Catalog of Comets

7P/Pons–Winnecke

Recovered: 1983 January 12.51 (Δ = 1.90 AU, r = 1.60 AU, Elong. = 58°)
Last seen: 1983 October 6.65 (Δ = 1.46 AU, r = 2.33 AU, Elong. = 141°)
Closest to the Earth: 1983 August 6 (1.2315 AU)

1983 IV=1983b

Calculated path: SER (Rec), OPH (Jan. 20), SER (Feb. 21), SCT (Feb. 26), AQL (Mar. 8), SGR (Mar. 12), CAP (Mar. 25), AQR (Apr. 2), CAP (Apr. 10), AQR (Apr. 23), CET (May 29), FOR (Aug. 4), SCL (Sep. 9)

Two predictions were published for the return of this comet. J. V. Carey (1981) applied planetary perturbations to the predicted orbit for the 1976 apparition. The integration revealed a perihelion date of 1983 April 7.51. S. Nakano (1982) took 43 positions from the period spanning 1951 to 1976, included planetary perturbations, and solved for nongravitational effects. He predicted the next perihelion date would occur on April 7.50.

E. Everhart (Chamberlin Observatory field station, Bailey, Colorado, USA) and T. Seki (Geisei, Kochi, Japan) independently recovered this comet. Everhart photographed the comet with a 41-cm reflector on 1983 January 12.51 and gave the position as $\alpha = 15^{h}\ 51.3^{m}$, $\delta = -1^{\circ}\ 59'$ (2000). He noted the comet's appearance was definite, but extremely faint, with a magnitude of 19. Seki first photographed the comet on January 14.85 using a 60-cm reflector. He described it as diffuse, with condensation, and also estimated the magnitude as 19. Confirming observations were obtained on January 19.50 by Everhart and January 20.84 by Seki, at which time the magnitude was given as 19 and 18.5, respectively. A. C. Gilmore (Mt. John University Observatory, Lake Tekapo, New Zealand) photographed the comet on April 16 and May 22, but no descriptive information was provided.

Following an alert by R. J. Bouma suggesting that the comet may be brighter than predicted, A. R. Pearce and M. L. Clark (Western Australia, Australia) made several visual observations during May and June. Using a 41-cm reflector, Pearce gave the magnitude as 12.3 and the coma diameter as 1.2′ on May 16. He saw the comet again on May 19, 20, and 24 with the aid of a 15-cm reflector, estimating magnitudes of 11.9–12.0 and coma diameters of 0.9–1.0′. Clark first observed the comet on May 16, using his 41-cm reflector, judging the magnitude as 12.3 and the coma diameter as 1.2′. Clark gave the magnitude as 12.1 on May 19 and 12.6 on June 9, noting the coma diameter as 2′ and 1.5′, respectively.

While visiting T. A. Cragg (Siding Spring Observatory New South Wales, Australia), A. Hale observed the comet through a 32-cm reflector on June 15. He estimated the magnitude as 12.6 and gave a very approximate estimate of the coma diameter as about 1–2′, indicating that it was diffuse and slightly condensed. The final visual observation was by Hale (California, USA) who marginally detected the comet through his 20-cm reflector on June 22, but because of the comet's low elevation and a rapidly brightening sky, no formal magnitude estimate was made.

Everhart photographed the comet on September 5. It then reached a maximum elongation of 142° on September 30 and attained its most southerly declination of −33° on October 3.

The comet was last detected on October 6.61 and October 6.65, when astronomers at Siding Spring Observatory imaged it using the 122-cm Schmidt telescope. They gave the magnitude as 19. The position on the last date was given as $\alpha = 1^{h}\ 12.7^{m}$, $\delta = -32^{\circ}\ 58'$ (2000).

Multiple apparition orbits have been calculated by T. Kobayashi (1989), S. Nakano (1993, 1999, 2005), and B. G. Marsden (2005). All of these calculations applied full planetary perturbations and solved for nongravitational effects. The result was a perihelion date of April 7.51 and a period of 6.36 years. The nongravitational terms were within the following ranges: $A_1 = 0.00$ to +0.05 and $A_2 = +0.0021$ to +0.0034. The orbit of Nakano (2005) is given below.

T	ω	Ω (2000.0)	i	q	e
1983 Apr. 7.5079 (TT)	172.3365	93.4307	22.3070	1.253985	0.634716

ABSOLUTE MAGNITUDE: H_{10} = 9.88 (Bortle, from visual estimates by Pearce, Clark, and Hale)

FULL MOON: 1982 Dec. 15, 1983 Jan. 28, Feb. 27, Mar. 28, Apr. 27, May 26, Jun. 25, Jul. 24, Aug. 23, Sep. 22, Oct. 21

SOURCES: J. V. Carey, *BAA Handbook for 1982* (1981 Aug.), p. 79; S. Nakano, *Nakano Note*, No. 414 (1982 Apr. 5); E. Everhart and T. Seki, *IAUC*, No. 3765 (1983 Jan. 24); M. L. Clark, *ICQ*, **5** (1983 Jul.), p. 68; A. C. Gilmore and E. Everhart, *MPC*, No. 8088 (1983 Sep. 22); A. R. Pearce and M. L. Clark, *ICQ*, **5** (1983 Oct.), p. 95; J. Bortle, *ST*, **66** (1983 Nov.), p. 473; A. C. Gilmore, *MPC*, No. 8219 (1983 Nov. 20); T. Kobayashi, *CCO*, 6th ed. (1989), pp. 30, 63, 69; S. Nakano, *Nakano Note*, No. 588 (1993 Apr. 7); S. Nakano, *Nakano Note*, No. 695 (1999 Oct. 31); B. G. Marsden, *CCO*, 16th ed. (2005), pp. 100–1; S. Nakano, *Nakano Note*, No. 1207 (2005 Jul. 20); A. Hale correspondence with D. A. J. Seargent (2014).

140P/1983 C1 (Bowell–Skiff)

Prediscovery: 1983 February 8.65 (Δ = 0.99 AU, r = 1.98 AU, Elong. = 176°)
Discovered: 1983 February 11.28 (Δ = 0.99 AU, r = 1.97 AU, Elong. = 175°)
Last seen: 1983 June 10.22 (Δ = 1.94 AU, r = 2.14 AU, Elong. = 86°)

1983 II=1983c *Closest to the Earth*: 1983 February 16 (0.9835 AU)
Calculated path: LEO (Pre), CNC (Feb. 28), LEO (Mar. 17), SEX (May 28), LEO (Jun. 3)

E. L. G. Bowell (Lowell Observatory, Arizona, USA) discovered this comet on exposures obtained by B. A. Skiff (Lowell Observatory, Anderson Mesa Station, Arizona, USA) using the 33-cm photographic telescope on 1983 February 11.28 and February 15.26. For the first date, the position was given as $\alpha = 9^{h}\ 28.6^{m}$, $\delta = +18^{\circ}\ 24'$ (2000). The magnitude was given as 16.2 and 16.5, respectively, and the comet was described as diffuse, with slight condensation, but exhibiting no tail. C. S. Shoemaker and E. M. Shoemaker (Palomar Observatory, California, USA) located the comet on a photographic plate exposed using the 46-cm Schmidt telescope on February 15.26. A prediscovery image was found on a plate exposed on February 8.65 by S.-L. Wei (Purple Mountain Observatory, China). The comet was at a maximum elongation of 176° on the 8th.

Several observations were made during the remainder of February. R. E. McCrosky and G. Schwartz (Oak Ridge Observatory, Massachusetts, USA) obtained a 27-minute exposure on the 16th, using the 155-cm reflector, and estimated the nuclear magnitude as 18. E. S. Barker (McDonald Observatory, Texas, USA) acquired a photograph using the 272-cm reflector on the 17th and estimated the magnitude as 18. He noted that the spectrum revealed a weak emission of cyanogen. That same night, T. Seki (Geisei, Kochi, Japan) gave the magnitude as 17 and described the comet as diffuse, with condensation. On the 19th, Skiff gave the magnitude as 16.5. On the 20th, A. C. Gilmore and P. M. Kilmartin (Mt. John University Observatory, Lake Tekapo, New Zealand) estimated the magnitude as 17. Seki gave the photographic magnitude as 16.5 on the 21st.

Four photographic magnitude estimates were reported in March. A. Mrkos and Z. Vávrová (Klet Observatory, Czech Republic) gave the magnitude as 16.5 on the 4th. Skiff gave the magnitude as 16.8 on the 9th and 17.0 on the 17th. On the 18th, Seki estimated the magnitude as 18.

Only two observatories managed to photograph the comet from April onward: Oak Ridge Observatory and Chamberlin Observatory field station (Bailey, Colorado, USA). At Oak Ridge Observatory, Schwartz used the 155-cm reflector to photograph the comet on April 12, June 6, and June 9. At Chamberlin, E. Everhart photographed the comet with the 41-cm reflector on May 16 and estimated the magnitude as 19.

The comet was last detected on June 10.22, when Everhart photographed it using the 41-cm reflector. The position was $\alpha = 11^{h}\ 03.5^{m}$, $\delta = +3^{\circ}\ 57'$ (2000).

The first published orbit was by B. G. Marsden on 1983 February 22. He took 13 positions obtained during the period spanning February 11–20 and calculated an elliptical orbit with a perihelion date of 1983 March 15.11 and

a period of 15.2 years. Marsden acknowledged that the short-period nature had been confirmed by similar orbits by Bowell and T. Urata, but noted that the period was "still somewhat uncertain." The elliptical orbit was confirmed on March 28, when Marsden used 16 positions from the period spanning February 11 to March 9. The resulting perihelion date was March 15.33, while the period was 15.66 years.

After the final observations of this comet were obtained, both Marsden and S. Nakano independently calculated orbits using most of the available positions and included perturbations by Mercury to Pluto. The result was a perihelion date of March 15.17 and a period of 15.67 years.

Multiple apparition orbits have been calculated by Nakano (1999), P. Rocher (2000), K. Kinoshita (2001), and T. Kobayashi (2012). All of these calculations used positions from the 1983 and 1999 apparitions and applied full planetary perturbations. The result was a perihelion date of March 15.19–15.21 and a period of 15.70–15.71. Interestingly, despite only two apparitions being available, Rocher did determine nongravitational terms, which were given as A_1 = +8.36 and A_2 = +7.4596. Kinoshita's orbit is given below.

T	ω	Ω (2000.0)	i	q	e
1983 Mar. 15.1961 (TT)	169.0041	346.3051	3.7989	1.945100	0.689962

ABSOLUTE MAGNITUDE: H_{10} = 13.8 (Kronk)
FULL MOON: 1983 Jan. 28, Feb. 27, Mar. 28, Apr. 27, May 26, Jun. 25
SOURCES: R. E. McCrosky and G. Schwartz, *HOPL* (1983); E. L. G. Bowell and B. A. Skiff, *IAUC*, No. 3773 (1983 Feb. 16); R. E. McCrosky, G. Schwartz, E. S. Barker, T. Seki, B. A. Skiff, A. C. Gilmore, P. M. Kilmartin, and B. G. Marsden, *IAUC*, No. 3775 (1983 Feb. 22); E. L. G. Bowell, B. A. Skiff, R. E. McCrosky, G. Schwartz, T. Seki, A. C. Gilmore, P. M. Kilmartin, and B. G. Marsden, *MPC*, Nos. 7727–8, 7773 (1983 Mar. 28); C. S. Shoemaker, E. M. Shoemaker, T. Seki, A. Mrkos, Z. Vávrová, and B. A. Skiff, *MPC*, No. 7796 (1983 Apr. 27); T. Seki and E. Everhart, *MPC*, No. 7878 (1983 May 26); E. Everhart, *MPC*, No. 7997 (1983 Jun. 25); B. G. Marsden, *MPC*, No. 8052 (1983 Jul. 24); S. Nakano, *Nakano Note*, No. 435 (1983 Sep. 11); S.-L. Wei, *MPC*, No. 9602 (1985 May 4); G. V. Williams, *IAUC*, No. 7076 (1998 Dec. 28); S. Nakano, *CCO*, 13th ed. (1999), pp. 82–3; P. Rocher correspondence with G. W. Kronk (2000); K. Kinoshita correspondence with G. W. Kronk (2001); T. Kobayashi, *Nakano Note*, No. 2313 (2012 Jul. 30).

C/1983 H1 (IRAS–Araki–Alcock)
1983 VII=1983d

Prediscovery: 1983 April 17.05 (Δ = 0.60 AU, r = 1.15 AU, Elong. = 88°)
Discovered: 1983 April 25.85 (Δ = 0.39 AU, r = 1.08 AU, Elong. = 90°)
Last seen: 1983 October 4.64 (Δ = 2.06 AU, r = 2.31 AU, Elong. = 91°)
Closest to the Earth: 1983 May 11 (0.0312 AU)
Calculated path: LYR (Pre), CYG (Apr. 21), DRA (Apr. 24), UMi (May 9), DRA–UMa (May 10), LYN–CNC (May 11), HYA (May 12), PUP (May 13), CAR (Aug. 12), PIC (Sep. 11), DOR (Sep. 28)

This comet made one of the closest known approaches to Earth, but in an era of easy international communications, the confusion surrounding its discovery was reminiscent of the old days.

The Infrared Astronomical Satellite (IRAS) was launched from Vandenberg Air Force Base (California, USA) on 1983 January 25. Its purpose was to provide the most complete picture of the sky in the infrared wavelength, a wavelength that can only be poorly observed from Earth's surface. Since it was expected that IRAS could be in an ideal position to detect fast-moving minor planets, the IRAS Preliminary Analysis Facility was established at the University of Leicester (England). Using special software, the images would be analyzed shortly after being received from IRAS to try and find moving objects.

J. Davies and S. F. Green (University of Leicester), as well as B. Stewart (Rutherford Appleton Laboratory, England), were examining IRAS images on 1983 April 26, when they recognized a moving object on images obtained on April 25.85 and April 25.93, which represented two consecutive orbits. The object was thought to be a fast-moving minor planet and from the first image, Davies gave the position as $\alpha = 19^{h}\ 07.6^{m}$, $\delta = +48^{\circ}\ 43'$ (2000).

The Leicester group had formed a worldwide network of observatories to help in the confirmation of fast-moving objects, and telegrams were soon dispatched. T. Oja (Kvistaberg, Sweden) provided the first confirmation, but his three photographs obtained during April 27.89 to April 27.94 revealed a comet instead of a minor planet. The diameter of the nucleus was 15–20″.

The initial request for observations sent out by the Leicester group did not include a message to the Central Bureau for Astronomical Telegrams (CBAT), the clearinghouse for comet information. CBAT did, however, know of the discovery through other sources. First, H. Rickman (Uppsala Observatory, Sweden) had left an unclear message on the bureau's answering machine, which did not give positions. Second, a conversation between B. G. Marsden (CBAT) and J. B. Gibson (Palomar Observatory, California, USA) took place on May 2, and the latter astronomer told Marsden that, at the request of a secondhand source, he had exposed several plates in the region of the supposed minor planet found by IRAS, but had not yet developed the plates.

Meanwhile, G. E. D. Alcock (Peterborough, England), a previous discoverer of four comets and four novae, had decided to conduct his routine nova search from inside his home on May 3. He was sweeping with 15×80 binoculars, through a closed window, when he located a large, diffuse object in Draco on May 3.92. Alcock quickly alerted several British amateur astronomers, one of whom was G. S. Keitch, who, in turn, telephoned C. S. Morris (Cambridge, Massachusetts, USA). Morris then alerted CBAT. Shortly thereafter, on May 3.96, G. M. Hurst (Wellingborough, England), another British amateur alerted by Alcock, reported that he had confirmed

the comet and determined its magnitude as 6.2. He added that the coma was 12′ across.

CBAT now had two comet reports: Alcock's comet situated in Draco, and the IRAS object, for which they had no idea of its position in the sky. Marsden suspected these were the same. His suspicion was based on the facts that Alcock's comet was situated about 90° from the Sun and IRAS was restricted to only observing objects 90° from the Sun. Marsden telephoned Gibson, knowing he must have had positions to search for the "minor planet," and found out that the plates of May 2.46 and May 2.49 had revealed a comet. Gibson said the six-minute and four-minute exposures revealed trails, which exhibited a strongly condensed nucleus and a faint asymmetric coma about 2′ across. The coma was denser on the northeast side, but no tail was visible.

The discovery saga did not end with Gibson's confirmation. While Marsden was trying to contact Davies to acquire the discovery observations, word came from Tokyo Observatory that G. Araki (Yuzawa, Niigata, Japan) had discovered a comet on May 3.61. He estimated the comet's magnitude as 7.

Prediscovery images were later found. T. Kumamori (Muro, Nara, Japan) found the comet on a photograph exposed on April 20.70, while the comet was found by H. Huth, P. Kroll, and G. A. Richter (Sonneberg Observatory, Germany) near the plate limit of two simultaneous exposures obtained on April 17.05. They estimated the magnitude as 12.

Several experienced observers provided observations on May 4, with the magnitude given as 5.9 by Morris, 6.0 by D. W. E. Green (Cambridge, Massachusetts, USA), and 6.3 by J.-C. Merlin (Le Creusot, France). Morris was observing with a 4-cm refractor and noted the coma was 15′ across and fan-shaped toward PA 55°. He noted, "nonstellar condensation near focus of parabolic hood." Green observed with 20 × 80 binoculars and said the coma was 18′ across. Merlin used 7 × 50 binoculars for the magnitude estimate. Switching to his 15-cm reflector, he said the coma was slightly condensed and 14′ across, while a tail extended 15′ in PA 100°.

Observations during the next few days revealed a rapid brightening, as well as a rapid growth of the coma, as the comet approached both the Earth and Sun. The comet reached a maximum elongation of 93° on May 5, at which time J. E. Bortle (Stormville, New York, USA) gave the magnitude as 6.1, using his 20 × 80 binoculars. Most observers were noting a slightly condensed coma 15′ to 21′ across. Bortle reported a "column structure" in PA 90°. V. Smith (McDonald Observatory, Texas, USA) visually observed the comet using the 272-cm reflector and noted a stellar nucleus, but no other structure within the coma; however, Smith also examined the spectrum of the comet and noted some faint diatomic carbon emission from a "very faint extension 5 [arc seconds] to the northeast." The magnitude estimates on the 6th ranged from 5.2 to 5.9, with the average near 5.6. Most observers had reported little change in the coma, as estimates of its

diameter ranged from 16′ to 20′ and it was moderately condensed. Green (Oak Ridge Observatory, Cambridge, Massachusetts, USA) became the first observer to see the comet with the naked eye on May 6.27. On May 7, observers were reporting magnitudes ranging from 4.5 to 6.3, with the average near 5.0. Naked-eye observations were becoming more numerous. Observers with small binoculars or no optical aid were reporting coma diameters between 20′ and 53′. A 15-minute exposure with a 205-mm telephoto lens and Kodak VR1000 film was obtained by M. W. Buie (Sonoita, Arizona, USA), which indicated a diameter of about 30′.

The comet seemed to have undergone rather drastic changes by May 8. The coma diameter was being estimated as 18′ to 86′ across, depending on the transparency of the atmosphere at various observers' locations. Subsequently, the magnitude estimates also varied considerably and ranged from 2.5 to 5.9, with the average near 4.4. Naked-eye magnitude estimates by Bortle, Green, and Keitch revealed values of 4.6, 4.4, and 3.7, respectively. Keitch also noted that his 20 × 80 binoculars revealed two tails: one extending 0.33° in PA 167° and the other extending 0.80° in PA 329°.

The large number of naked-eye observations on the 9th revealed the coma diameter was 40′ to 126′. Magnitude estimates ranged from 1.9 to 5.1, with an average near 3.4. Estimates of the coma's level of condensation became almost useless as descriptions ranged from very little to very strong condensation. Buie obtained a 30-minute exposure of the comet using a 14-cm Schmidt camera and 2415 Kodak film. This revealed a tail >3° long, which extended off the edge of the frame.

The comet attained its most northerly declination of +74° on May 10. Naked-eye estimates of the magnitude ranged from 1.9 to 3.5, with an average near 2.8. Naked-eye estimates of the coma diameter ranged from 90′ to 168′, with an average near 130′. Merlin said his 7 × 50 binoculars revealed a tail extending 1° in PA 286°.

The comet was closest to Earth on May 11. Its rapid motion took it out of Ursa Major, through Lynx, and almost halfway across Cancer, amounting to a distance of just over 44° in 24 hours. Naked-eye estimates of the magnitude ranged from 1.6 to 4.4, with an average near 2.4. Naked-eye estimates of the coma diameter ranged from 50′ to 210′, with an average near 122′. C. E. Spratt (British Columbia, Canada) said his 20-cm reflector revealed a tail extending 0.25° in PA 270°, while Keitch said his 30-cm reflector revealed a tail extending 0.07° in PA 253°. J. R. Johnson and S. M. Larson (Catalina Station, Mt. Bigelow, Arizona, USA) directly observed the comet using the 154-cm reflector at powers up to 1000×. They noted the nuclear condensation was magnitude 10.5. They also reported that direct images of the inner coma "show a sunward-directed fan indicative of a slowly-rotating nucleus… and a faint extension [protruding] 300 km in the antisolar direction."

The comet was apparently at its best on May 12. Naked-eye estimates of the magnitude ranged from 1.5 to 3.8, with an average near 2.2. Naked-eye

estimates of the coma diameter ranged from 72′ to 240′, with an average of 156′. Using 7 × 50 binoculars, Bortle noted tail extensions of 2.5° in PA 250° and 3° in PA 230°. B. Magaw (Brewster, New York, USA) photographed the comet and noted a coma just over 1° in diameter.

R. Nolthenius (Lockwood Valley, California, USA) observed the nuclear region of this comet occult the star SAO 98040 on May 12.19, using a 20-cm reflector and a power of 275×. He noted that the condensation was "not quite resolved, distinctly fuzzy, [and] ~1.3 mag fainter than the star." The occultation "lasted 0.8 [second] (corresponding to 31 km at the comet's distance), during which the combined image slowly faded by 0.5 mag, then brightened, with no obvious interval of constant light."

The comet showed definite signs of fading on May 13, with a significant drop in the number of naked-eye observations. Bortle estimated the magnitude as 3.1 and noted an uncondensed coma 60′ across. R. J. Bouma was visiting D. A. J. Seargent (The Entrance, New South Wales, Australia) and gave the magnitude as 2.2. He noted a slightly condensed coma 85′ across. T. Smith (Australia) saw the comet using 7 × 50 binoculars and reported a tail extending 20′ in PA 180°.

The final days of naked-eye visibility came during May 14–18. Seargent gave the magnitude as 3.2 on the 14th, 3.4 on the 15th, and 4.8 on the 16th. M. L. Clark (Australia) gave the magnitude as 4.4 on the 14th, 4.7 on the 15th, 5.0 on the 16th, and 5.2 on the 17th. Clark made the final naked-eye observation on May 18, when he gave the magnitude as 5.4. Throughout this period, naked-eye observers described the coma as slightly condensed, while observers using some optical aid described it as moderately condensed. On average, the coma was about 30′ across. Bouma was using 10 × 50 binoculars on the 16th and noticed a tail extending about 1.5° in PA 170°. A. R. Pearce (Woodlands, Western Australia, Australia) noted an extension of 0.11° in PA 194° on the 17th and 0.1° in PA 323° on the 18th.

Observations continued to dwindle during the remaining days of May. J. da S. Campos (South Africa) followed the comet using his 12-cm refractor and said it faded from magnitude 6.1 on the 19th to 8.7 by the 31st. He added that the coma was initially moderately condensed with a diameter of 12′, but ended the month as slightly condensed and 5′ across. T. Lovejoy (Australia) observed using his 8 × 30 binoculars and reported the comet faded from magnitude 6.8 on the 19th to 8.3 by the 31st. He noted the coma remained moderately condensed throughout the period, but shrank from 7′ to 4′.

The comet was continuing its southward motion as June began and was quickly becoming an object only visible to Southern Hemisphere observers. The last two observations made in the Northern Hemisphere came from Bouma on the 4th and P. Poitevin (Belgium) on the 8th, with both observers giving the magnitude as 7.9. Bouma added that the moderately condensed coma was 4′ across. The two most prolific observers in the Southern Hemisphere during June were A. F. A. L. Jones (New Zealand) and

Pearce. Jones mostly used his 32-cm reflector and noted a magnitude range 9.4–10.9 during the 1st to the 6th and 10.9–11.4 during the 13th to the 17th. Using his 8-cm refractor, Jones noted a general fading from magnitude 8.2 on the 2nd to 10.2 by the 15th. The refractor revealed a coma diameter of 3–4′. Pearce said his 20 × 65 binoculars revealed the magnitude generally faded from 7.3–7.6 between the 3rd and the 12th, while the moderately condensed coma shrank from 5.5′ to 3.5′ during the same period.

Only a handful of visual observations were obtained in July. Pearce saw the comet with his 15-cm reflector from the 1st to the 5th and noted it faded from 9.6 to 10.2. The coma remained slightly condensed and generally shrank from 3.5′ to 2.5′. Clark also saw the comet on the 4th, using his 41-cm reflector. He gave the magnitude as 10.9 and said the slightly condensed coma was 2.8′ across.

From June onward, the only professional astronomer to follow the comet was A. C. Gilmore (Mt. John University Observatory, Lake Tekapo, New Zealand), who managed to obtain photographs using a 61-cm reflector on June 16, July 11 and 12, and August 14. He estimated the magnitude as 16 on July 11 and 12. The comet also reached a minimum elongation of 67° on the 12th.

The comet was last detected on October 4.60 and October 4.64, when Gilmore obtained photographs of the comet which revealed a nuclear magnitude of 18.6. The position on the last date was $\alpha = 5^{h}\ 48.9^{m}$, $\delta = -65^{\circ}\ 24'$ (2000).

B. L. Lutz and R. M. Wagner (1983) first analyzed the comet's spectrum using the 175-cm reflector at Lowell Observatory (Arizona, USA) on 1983 May 5 and 6. They detected cyanogen, triatomic carbon, diatomic carbon, the amidyl radical, and oxygen. It was noted that, "The nuclear region, which appeared highly condensed, showed a strong reflective continuum superimposed on the gaseous emissions." Johnson and Larson (1983) observed the spectrum using the 154-cm reflector on May 6, 7, and 11, noting emission lines of the hydroxyl radical, the imidyl radical, cyanogen, diatomic carbon, triatomic carbon, the amidyl radical, ionized carbon monoxide, and ionized carbon dioxide. There were also lines consistent with diatomic sulfur. They added, "The emissions, including those of the ions, were brighter on the sunward side." Interestingly, C. B. Cosmovici and S. Ortolani (1984) obtained four spectra using the 182-cm reflector at Asiago Astrophysical Observatory (Italy) on May 9 and noted "about 50 unknown lines." They also detected the formyl radical and hydrogen sulfide, and strongly suspected formaldehyde, diatomic sulfur, deuterated formylium, and ammonium.

Astronomers turned the International Ultraviolet Explorer (IUE) satellite toward the comet on several occasions during the first half of May. On May 6 and 8, M. Festou, P. Benvenuti, C. Cacciari, A. Cassatella, A. Talavera and W. Wamsteker (1983) detected diatomic sulfur, noting that it was confined to the region within 100 kilometers of the nucleus and was weak in

intensity. IUE also detected Lyman α, very strong emissions of carbon sulfide, very weak emissions of carbon dioxide, and moderate emissions of the hydroxyl radical. These emissions were all rather typical for comets, except for the carbon sulfide emissions, which were also greater than normal. M. A'Hearn and R. L. Millis (1983) used IUE to observe the comet on May 7 and detected cyanogen and the hydroxyl radical. P. D. Feldman and A'Hearn (1983) observed the comet during May 11.8–13.0 and identified sulfur emission "confined to a region of diameter no larger than 100 km (5″) around the comet's nucleus."

Nolthenius' observation of the comet occulting a star was mentioned above, including the indication that the nucleus was about 30 kilometers across; however, several other observers made observations of the nucleus at other times with large telescopes. Larson said that observations using the 154-cm reflector at magnifications up to 1000× revealed a nuclear condensation about 12 kilometers across that was "unlike nearby star images of the same brightness, appeared to have a sharp edge and uniform brightness." J. K. Harmon, D. B. Campbell, A. A. Hine, I. I. Shapiro, and B. G. Marsden (1989) observed the comet on May 11 using the Arecibo Radio Telescope (Puerto Rico) and their analysis revealed a diameter ranging from "5 km for a solid-ice surface to 16 km for a surface of loosely packed snow." R. M. Goldstein, R. F. Jurgens, and Z. Sekanina (1984) used the 64-m Goldstone radio telescope to study the comet on May 11 and 14. They concluded, "The shape of the nucleus probably departs greatly from a sphere with average radii near 3–4 km." Sekanina (1988) also published an in-depth analysis of the nucleus based on the "optical, radar, infrared, ultraviolet, and microwave-continuum observations made during the week of the object's close approach to Earth" and established nuclear dimensions of 16 km × 7 km × 7 km and determined a rotation period of 2.14 days.

J. D. Drummond (1983) announced that this comet might produce a meteor shower on May 10.1. He gave the probable radiant as $\alpha = 289^\circ$, $\delta = +44^\circ$. Marsden reported on *IAU Circular* number 3811, "P. M. Millman, Herzberg Institute of Astrophysics, reports that preliminary analysis by A. F. Cook and himself of meteor radio data in Ottawa shows no evidence of unusual meteor activity: low power data were obtained over a 72-hr interval centered on May 10.08 UT, high power data over 24 hr. Visual and photographic monitoring by S. Clifton at Marshall Space Flight Center during May 10.0–10.4 also gave negative results." Drummond writes that his visual observations indicated a definite minor meteor shower associated with the comet. He gave zenithal hourly rates of 5.1 on May 9.47, 3.1–4.1 during May 10.32–10.44, and 2.4–3.2 during May 11.36–11.44.

Davies sent the IRAS discovery positions to Marsden, as well as the positions measured by Oja. Combining these with the positions measured by Gibson allowed the calculation of a preliminary orbit on May 4. The resulting perihelion date was 1983 May 21.24. It indicated the comet would pass very close to Earth on May 11. Marsden revised his calculations a