SOME COMMENTS ON COMET C/2002 C1 (IKEYA-ZHANG)

Mark Kidger

There is considerable interest in Comet C/2002 C1 (Ikeya-Zhang) which appears to be the first confirmed return of a comet with a period greater than 155 years (the current record holder is **Comet Herschel-Rigollet**, last seen in 1939 and originally discovered by Caroline Herschel). Suntoro Nakano suggested initially that the comet might be identical to C/1532 R1 but, more recently, showed that C/1661 C1 offers an even better linkage. This linkage is now close to definitive.

Although C/1532 R1 was observed from September 2nd to December 30th. C/1661 C1 was less well observed. It was discovered by Johannes Hevelius (Gdansk) on 1661 Feb. 3 in the dawn sky, just after passing perihelion, with a tail already 6º long. The comet faded rapidly and was last seen on March 28th. The orbit used for the former in the IAU/CBAT/MPC "Catalogue of Cometary Orbits" is that of Olbers, calculated in 1787. The orbit is not completely determined, despite the long visibility of the comet and a 1785 solution by Méchain gave a rather different solution, with an inclination of 42º, and an Ascending Node of 126º. For C/1661 C1 the orbit used is the one calculated in 1785 by Pierre Méchain. These orbits are compared below to that of Comet Ikeya-Zhang. As we can see, the similarity with the Olbers orbit of C/1532 R1 is quite impressive. The similarity with C/1661 C1 is less so; its longitude of perihelion is very close to the corresponding value for Ikeya-Zhang, although other parameters are not quite so close.

	C/2002 C1 (Ikeya-Zhang)	C/1532 R1	C/1661 C1
T	2002 Mar. 18.9388	1532 Oct. 18.832	1661 Jan. 27.381
q	0.507200	0.51922	0.442722
z+	0.017337		
ω	34º.5777	24º.53	33º.450
Ω	93º.4156	93º.81	86º.562
e	0.991207	1.0	1.0
i	28º.1110	32º.59	33º.015

On seeing this similarity, the overwhelming impression is that the three objects may all be related and that both C/1532 R1 and C/1661 C1 may be fragments of a single object that split in the past.

C/1532 R1 was evidently an exceptional object. David Hughes's 1987 catalogue of cometary absolute magnitudes from 568 - 1978 assigns it an absolute magnitude of +1.8, one of just 12 comets that has an absolute magnitude of +2 or brighter, putting it into the "giant comet" class, almost 100 times intrinsically brighter than the average long-period comet. In contrast, C/1661 C1 is a more normal object. David Hughes lists its absolute magnitude as +4.6, much closer to that of Ikeya-Zhang, particularly as the observations suggest that the comet became diffuse and faded out rapidly. Light curve fits to C/2002 C1 (Ikeya-Zhang) suggest an absolute magnitude of 6.8, slightly fainter than average for a "new" comet.

The data archive from the Spanish “Cometas_obs” mailing list is shown in figure 1. It shows a sustained and rapid rate of brightening in all three data sets, although the knee in the total visual magnitude during mid-February appears to be genuine. The brightening seems not to be as fast has

been suggested. Seiichi Yoshida finds a good fit with m1 = 6.8 + 5 log Δ + 10 log r. If we take the archetypal active evolved object, 1P/Halley, the brightening rate at r < 1.7AU was found by Daniel Fischer to be 9.1 log r. C/1995 O1 (Hale-Bopp), also an active multiple-return object, brightened at 7.5 log r for most of its inbound passage. C/2002 C1 is brightening slightly faster than these comets, but not spectacularly so. Even so, it seems to be an unusually gassy object.

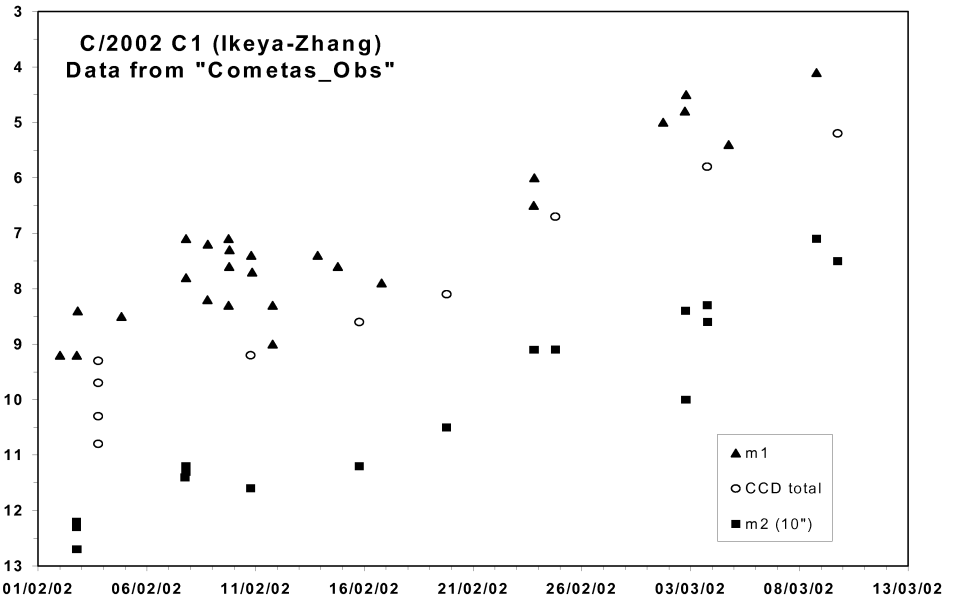

Figure 1: Comet C/2002 C1 (Ikeya-Zhang) data from 'Cometas Obs'

ON THE PAST ORBIT OF COMET C/2002 C1 (IKEYA-ZHANG)

Graeme Waddington

As Mark has pointed out, there is a remarkable similarity between the orbits of C/1532 R1, C/1661 C1 and C/2002 C1. The possibility of a connection between the comets of 1532 and 1661 seems first to have been appreciated by Halley, in his "A Synopsis of the Astronomy of Comets" of 1705, who suggested that they were, in fact, one and the same comet. Current orbital solutions of C/2002 C1 favour an identity with C/1661 C1. Indeed, on February 21 and 25 Nakano produced two separate orbital solutions linking the observations of 1661 and 2002. But what then of the initially favoured identification with C/1532 R1? Could the comet of 1532 and the 1661-2002 comet be fragments that split from each other in the distant past? The similarity of the orbital elements seems to suggest so.

Nakano's 2002 Feb 25 solution incorporates 304 observations from 2002 together with 7 from 1661 and he specifies the osculating orbital elements for epochs in both 2002 and 1661. Using the RADAU integrator to follow the orbit back in time from 2002 leads to the following sequence of perihelion passages: 2002 Mar 18.98, 1661 Jan 28.6, 1273 May 2, 878 Nov 18, 429 July 14, 91 June 7. At this stage this sequence must be regarded as being still somewhat negotiable. Even so, it does not stop us using it to look into the possible connection of 1532 and 1661-2002 as separate components of a once single cometary nucleus.

In this sequence the largest change in z = 1/a is from 0.0205 to 0.0170, which occurs during the 429 apparition. This jump occurs as a result of an approach to within 0.52au of Jupiter in 430 July. If at this time the comet consisted of two separate entities following the same basic orbit (but with different