Fig. 5: Camera mounted for afocal photography.

Fig. 6: A daytime view of the system, here set up for solar photography, showing a section of the Sun's disk on the computer screen.

The camera used is a Canon EOS 550D mounted with a T-piece, fitted to the eyepiece of the telescope (Fig. 5). The camera lens used is a 50mm fixed focal length lens. The camera is controlled from a computer in the observatory. (Fig. 6). The connection is by means of a USB cable.

It was realised that, due to the confusion with the timing, that the fact that the shadows were captured was more due to luck. It would seem that the transit was seen 1h 25m later than the estimated time of the shadow entering the planet, as predicted by the animation. Whether this is a correction that could be applied to the values derived from SkyMap Lite for Jupiter should be tested. The *Sky Guide* publishes a most helpful monthly table of the times of the occultations and transits of the Galilean moons and their shadows. ☆

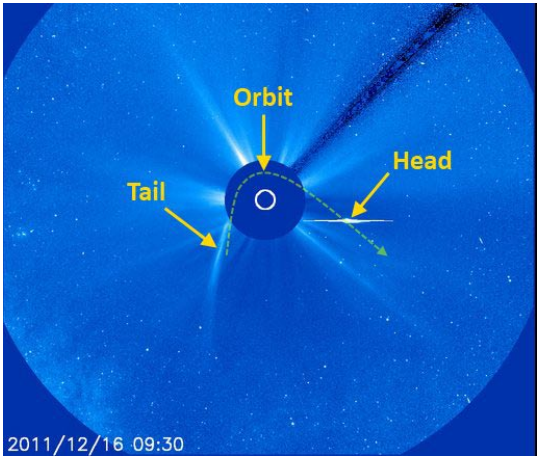
Comet Lovejoy, the Great Christmas Comet of 2011

Willie Koorts

As with a gift you never expected to get for Christmas, so surprised were southern hemisphere observers around 21-28 December 2012 when a bright naked-eye comet, sporting a tail some 30 degrees long, graced the morning skies in a brief, but excellent performance.

Designated C/2011 W3 (Lovejoy), it was discovered on 27 November 2011 by amateur astronomer Terry Lovejoy of Thornlands, Queensland, during a comet survey using a 20 cm Schmidt–Cassegrain telescope, fitted with a CCD camera. He described the comet as "a rapidly moving fuzzy object" of 13th magnitude. After confirmation by the Mount John University Observatory in New Zealand, Comet Lovejoy was formally announced on 2 December 2011, exactly on the 16th anniversary of the SOHO satellite's launch. The comet was therefore also referred to as "The Great Birthday Comet of 2011".

Lovejoy is quite a remarkable comet. Unlike most Kreutz-comets which end up being consumed by the Sun, Lovejoy survived after passing approximately 140 000 kilometres above the Sun's surface! This is about one third the lunar distance from Earth, and effectively inside the Sun's corona where temperatures are a few million degrees Centigrade. Before perihelion, the nucleus of Comet Lovejoy had been estimated to be up to 500 metres in diameter. During the coronal passage, it is believed that a significant fraction of the comet's mass was burned off.



The small central white circle in this SOHO frame indicates the Sun behind an occulting disk (the dark blue central circle), resulting in a permanent solar eclipse which makes it possible to see objects very close to the Sun. The remains of Comet Lovejoy's tail can still be seen disappearing behind the occulting disk (left) while the head of the comet (right) is well clear of the disk already (the horizontal line structure radiating from the bright comet head is a CCD saturation artefact).

The Kreutz-group comets are a family of sungrazing comets, characterized by orbits taking them extremely close to the Sun at perihelion. Believed to be fragments of one large comet that broke up several centuries ago, they are named for German astronomer Heinrich Kreutz, who, in a paper in 1888, first demonstrated their relationship. Several members of the Kreutz family have become Great Comets, occasionally visible near the Sun in the daytime sky. The most recent of these was Comet Ikeya–Seki in 1965, one of the brightest comets in the last millennium, reaching visible magnitude −11. Of particular interest to South Africa is that the Great Comet of 1882 is also a member. This comet was photographed from the Royal Observatory in the Cape and eventually put David Gill on the idea of employing photography in astronomy. Good news for comet watchers is the possibility that another cluster of bright Kreutz system comets may begin to arrive in the inner Solar System in the next few years to decades.

Since the launch of the SOHO satellite in 1995, it has been possible to observe comets very close to the sun at any time of year. The satellite provides a constant view of the immediate solar vicinity. SOHO has now discovered hundreds

of new sungrazing comets, some just a few metres across. About 83% of the sungrazers found by SOHO are members of the Kreutz group. Before Lovejoy, none of the sungrazers seen by SOHO has survived their perihelion passage. Some may have plunged into the Sun itself, but most are likely to have simply evaporated away completely.

On Christmas morning the author observed the comet from the lovely setting of the Strandveld Museum at Franskraal, overlooking the ocean, unfortunately not in perfect conditions.

More than 75% of the SOHO sungrazers have been discovered by amateur astronomers analysing SOHO's observations via the Internet. Terry Lovejoy's discovery is the first Kreutz-group comet discovered by ground-based observation in 40 years. This discovery also makes him the only person to have discovered Kreutz sungrazers both from ground based observation and from images obtained by spatial telescopes. He discovered his first comet on 15 March 2007, designated C/2007 E2 (Lovejoy), using one of his cameras. This was followed by C/2007 K5 (Lovejoy), a mere two months later.

From the (unfair ad)vantage point of the International Space Station, astronaut Dan Burbank got one of the best pictures of Comet Lovejoy. Credit: NASA

It is quite fascinating to watch the SOHO footage of Lovejoy's near-death plunge. The comet actually lost its tail as it passed behind the satellite's occulting disk but grew it back soon after it popped out the other side. It was also observed in detail by NASA's STEREO satellites, actually showing the comet's tail wiggling wildly in transit through the solar corona.

Even Lovejoy's appearance in the sky was strange as Fiona Hobson remarked: "I got up early one morning to see Comet Lovejoy. I saw a long straight diffuse white tail reaching up towards Alpha Centauri – but the comet had no distinct head. Most unusual I thought. I waited at least an hour outside in the dark hoping for something to rise, but after a while realised that this comet had no bright head at all. Never seen a comet like that before!"

The comet was widely observed from South Africa although cloudy weather countrywide did hamper visibility. Probably most fortunate was Simon Fishley, IT Systems Administrator at SAAO, who managed to photograph the comet while it was still bright. He wrote: "I found myself in Sutherland for the Christmas weekend, on standby duty at SAAO, so I was able to photograph the comet early this morning [23 December 2011]. I did not have a long window as a bank of cloud rolled in shortly after I began setting up." Simon managed to get his best shots on Christmas morning (see cover picture).

The comet was even captured in the all-sky camera at SAAO in Sutherland. One of the most striking pictures of Lovejoy was taken by NASA astronaut Dan Burbank from the vantage point of the International Space Station. ☆

Simon Fishley got his best pictures on Christmas morning. Here he framed Lovejoy next to the 20-inch telescope dome in Sutherland, with the Milky Way as a backdrop.