COINCIDENTAL SUPERNOVAE IN SPIRAL GALAXY NGC 772

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The Heavens always finds interesting ways to surprise and amaze even the most seasoned observers. This event is certainly one of those ways.

On September 30, fellow member Roland Prevost noticed an extra object in his image of the spiral galaxy NGC 772 in Aries. He determined that this new object was the supernova SN2003HL that had been detected by the Lick Observatory and Tenagra Observatory Supernova Searches (LOTOSS) on August 20. Roland's independent discovery of the supernova piqued my curiosity, since I had recently purchased a new SBIG ST-9XE CCD camera and was in the process of testing it. I did not expect to be looking at supernovae with it, but decided that it would not take much time to take a few images of this new supernova for the purpose of determining its light curve over time.

I took my first image of the supernova on the evening of October 2nd and figured that its magnitude was nearly +16.5, which is quite bright, given that NGC 772 is at a distance of 105 million light years! If the same supernova had occurred 10 parsecs (32.6 light years) from Earth, we would have seen a brilliant new star with about twenty-five times the brightness of the full moon!

On October 10th, I was analyzing images of SN2003HL taken on the evening of October 8th, when I noticed a new object on the southern edge of the galaxy that looked out of place. Out of curiosity, I checked my previous images of the galaxy, and found that they did not contain any object in that same location. I looked at several more images of the galaxy taken on that day to make sure that the extra object was not a CCD camera artefact or a random cosmic ray hit. The object was indeed new to me, but it was uncertain at that time whether it had already been seen. At that moment, I was thinking that it would have been too good to be true to have two supernovae flare up in the same galaxy a mere seven weeks apart from each other. Besides, many short-period variable stars can seem to appear out of nowhere when reaching their maximum apparent brightness. So, I checked my USNO A2.0 star catalogue and my RealSky images to make sure that the new object was not simply a local variable star. It was not!

After finally excluding all other possible reasons for the extra object, I checked an up-to-date supernova web site and found that a new supernova had indeed been discovered at the same location in the galaxy about 48 hours before I noticed it. At least I found out that my new equipment had the capability of

discovering new supernovae! I then determined that the new supernova had a preliminary brightness of about 17th magnitude.

The amazing thing about this new supernova, designated SN2003IQ, was that it was located in the same galaxy as SN2003HL. The following night (on October 11th), I found that the newer supernova had brightened by nearly a full magnitude to 16th, outshining SN2003HL by at least half a magnitude.

The supernovae were seen to appear about seven weeks apart as seen from our unique position in space. This does not mean that they actually exploded within that same time frame. Since the speed of light is finite (thank you Einstein), there is a time variable involved here as well.

First, the galaxy's distance from us is estimated at 105 million light years. This means that the light of both supernovae needed 105 million years to reach human eyes. In other words, both supernovae actually exploded about 105 million years ago! Right now, both supernovae have long since extinguished, but their light is still travelling through space, and happened to finally reach us during our lifetimes. We're pretty lucky to see them if you think about it!

Second, the observed time between the detections of the supernovae changes when seen from different locations in space. If Earth were located at some other location in space relative to NGC 772, the supernovae flare-ups could have been seen many generations apart! If we could see NGC 772 as a face-on galaxy, there would be a much better chance that the two supernovae had actually happened within the same time span apart as they were seen to be from Earth. From Earth's location, however, NGC 772 is seen to be inclined 54 degrees from the face-on position and 7.2 arc-minutes in diameter. This translates into an actual diameter of about 225,000 light years, more than twice the diameter of our own Milky Way galaxy. From our viewing location, the supernovae are seen to be located approximately 39 arc-seconds apart. Using some basic trigonometry, and assuming that both supernovae were located within the galactic equatorial plane, the actual time between the supernova explosions is more like 27,000 years! To sum it up, we are literally in the right place at the right time to see these two supernovae occur at nearly the same time!

Just imagine one star exploding violently some 105 million years ago. 27,000 years (or so) later, the light of this supernova just passes the position of another star when it also explodes, sending its brilliant light across the universe and toward Earth just behind its predecessor by a mere seven weeks in time!

Also imagine if Roland and myself were the first humans to see SN2003HL and SN2003IQ respectively. It might have been the first time two members of the same chapter of the same club had discovered two supernovae in the same galaxy at nearly the same time! We were so close! Maybe next time!

Figure 1: Image of the Spiral Galaxy NGC 772 Before the 2003HL and 2003IQ Supernovae Explosions were Detected. This image was taken from the Digitized Sky Survey (DSS) that was created by scanning Palomar photographic plates originally obtained in 1953. The galaxy NGC 770, which is interacting with NGC 772, can be seen as a small hazy patch to the south-southwest. The compass directions were added to the original image using Paint Shop Pro.

Figure 2: Image of NGC 772 Taken on September 30, 2003 by Roland Prevost Indicating the Supernova SN2003HL he had Independently Discovered. The light of the second supernova had not yet reached Earth when this image was taken, but unknown to anyone at the time, it was only nine days away. The compass directions were added to the original image using Paint Shop Pro.

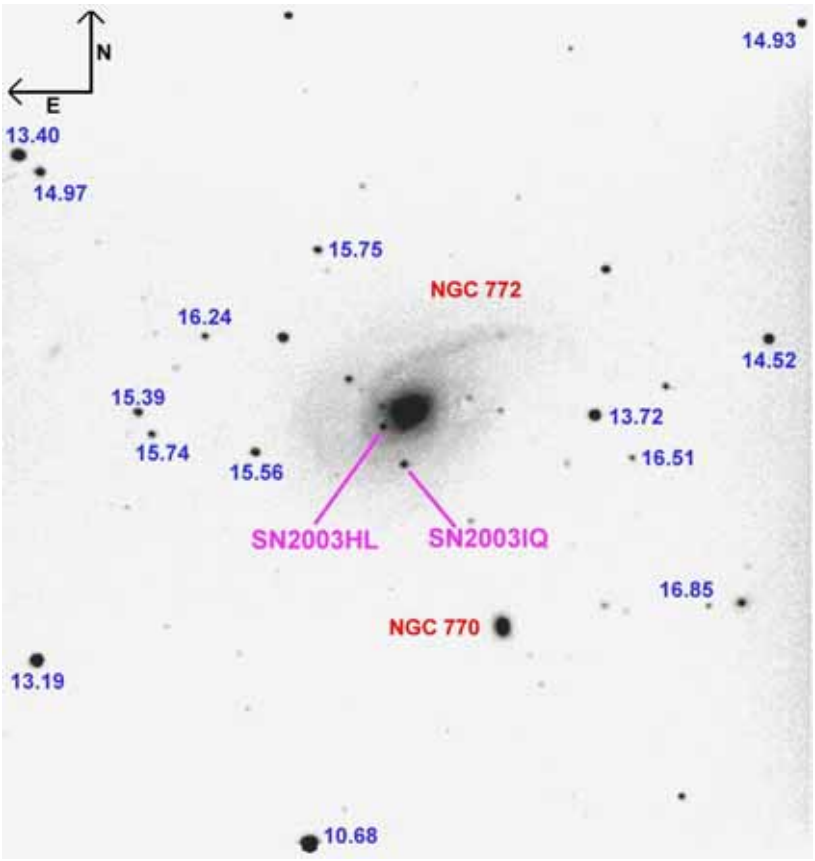

Figure 3: Galaxy NGC 772 with Supernovae SN2003HL and SN2003IQ. The numbers next to some of the stars are USNO A2.0 star catalogue magnitude (brightness) values of the 14 calibration stars used to determine the brightness of both supernovae. The image was obtained by Mike Earl with a Celestron NexStar 11-inch GPS Schmidt-Cassegrain reflecting telescope and SBIG ST-9XE CCD camera in Orleans, Ontario at 02:46 U.T.C. October 14, 2003. The exposure time was 30 seconds. The limiting magnitude is about 19.0. This is a negative of the original image. All labels were added to the original image using Paint Shop Pro.

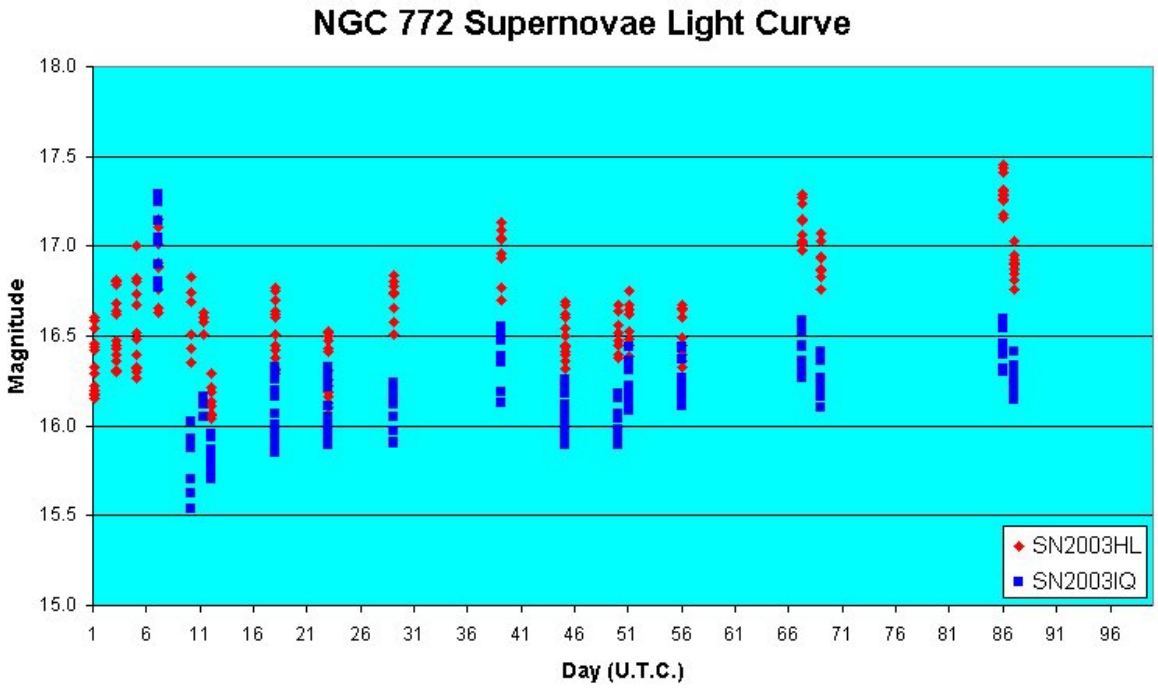

Figure 4: Light Curves of Supernovae SN2003HL and SN2003IQ for 87 Days. Day 1 corresponds to October 3, 2003 (U.T.C.). The many brightness values for each Day corresponds to the 14 stars used to determine the apparent brightness of the supernovae. It can be seen that the brightness of SN2003IQ increased significantly from Day 7 to Day 10 (October 9 to 12). For some days, not all of the 14 calibration stars could be used, especially when the full Moon interfered with the imaging on Day 11.

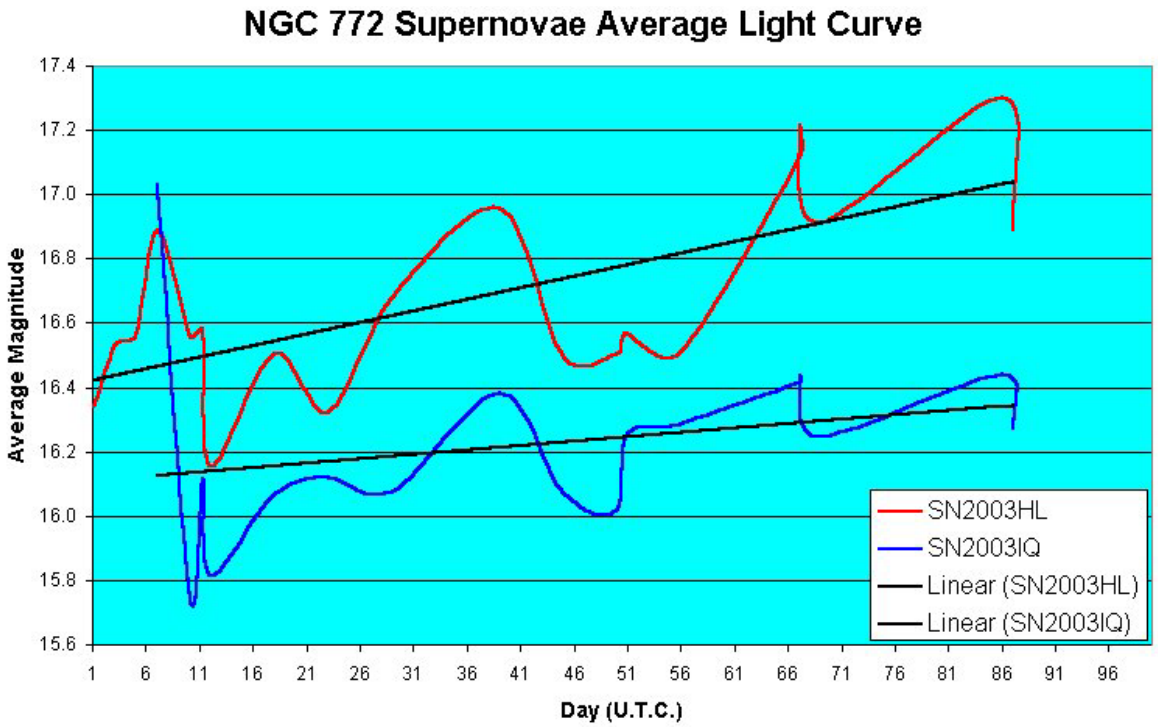

Figure 5: Average Light Curves of Supernovae SN2003HL and SN2003IQ for 87 Days. Day 1 corresponds to October 3, 2003 (U.T.C.). The linear trend line for each light curve has been plotted to indicate the dimming of each supernova over time.