STU PARKER - A NEW ZEALAND SUPERNOVA HUNTER

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It's 4:00 am, on a cool summer morning and in the predawn light, Stu Parker, amateur astronomer, dairy farmer and supernova hunter, methodically closes-up the two shed observatories on his farm as Holstein cows graze silently nearby. Two reflector telescope systems housed in the observatories have worked all night capturing a thousand galaxy images while Stu and his wife Lynn were sound asleep.

Before beginning the morning milking chores, Stu ensures that the electrical power is off on the CCD cameras and robotic mounts and that all the images have been downloaded to his computer in the house. After breakfast, he will begin the task of checking the previous night's pictures, a routine he has performed a few hundred times before. Later that day in one of the images, Stu will spot a new type la supernova in spiral galaxy ESO 509-G108. The date is February 12, 2015, and this discovery would turn out to be Stu's 100^{th} supernova discovery!

Supernovas are very luminous objects. A moderate sized telescope with a CCD can easily detect one that is 500 million light years away! Supernovas are also very rare; on average, a spiral galaxy will produce about one per century. Thousands of galaxy images have to be taken to find just one supernova. Scripting software can largely automate the entire search operation; on a clear night, the software can run the telescope/mount, the camera, and even the focuser with no human intervention necessary. This sophisticated software does away with most but not all of the drudgery associated with supernova hunting. Each image still has to be examined, one at a time, using the blink compare method. Blinking a thousand galaxy images after a night's run can be tedious and time consuming and in Stu's case, this is time away from his demanding farm work.

Stu's interest in science and astronomy followed a path that would lead to his becoming a serious amateur astronomer. Given a small telescope as a youngster, he explored the moon and bright planets. As a young man, he moved up to a larger telescope and sought out more difficult targets, and eventually began a low-key visual supernova search program (without a camera).

After meeting Lynn while both were taking a farm management course, they married and together ran two dairy farms in the southern part of the South Island of New Zealand. Eventually they moved farther north and bought a farm in Oxford which offered darker skies and better observing conditions than in the previous two locations.

Shortly after moving to Oxford in the early 2000s, Stu pursued a new passion, which was observing already discovered supernovae with his new Meade 30 cm telescope. Sometimes he used an eyepiece to look at these bright new discoveries and at other times he imaged the host galaxies with a CCD. Often he would image a galaxy that did not have a supernova, hoping he might get lucky. As time went on, observing these supernovae boosted his resolve that someday he would find his own exploding star.

Late in 2008, Stu Parker together with an Australian friend, Peter Marples, formed a small group of amateurs who searched for supernovae. They called themselves the "Backyard Observatory Supernova Search" or BOSS. Each BOSS team member owned a telescope and searched independently for supernovae. When discoveries were made, team members helped each other with the confirmation process. A math whiz in the group often did the exacting computations necessary for the discovery reports.

During the New Zealand summer of 2008-2009, Stu built a slide-off-roof observatory, installed a 35 cm Celestron telescope with a CCD on a robotic mount, and began a systematic search for supernovas.

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A supernova hunter's first discovery is always very special and memorable and this was especially true for Stu Parker. He had setup his telescope system to run on "autopilot" one night while he was away visiting friends in June 2009. The next day, still socializing, Stu downloaded his images via the internet and noticed a new object in the beautiful edge-on spiral galaxy NGC 134. With some help from the BOSS team, the "suspect" was confirmed to be a new supernova and later designated SN2009gj. Stu had joined the supernova discovery club!

2009 was a fairly productive year for Stu with six more discoveries by December. In April 2010, an article in *Australian Sky and Telescope* featured Stu and his seven supernova discoveries in 2009. Stu's discovery numbers dropped off a little in 2010 but then rebounded a little in 2011.

By 2012, Stu had installed a second telescope, a 30 cm Astro Tech reflector with similar mount and camera equipment used with the Celestron. At the outset of his search program, the number of different galaxies imaged on a clear night rarely exceeded 300. In contrast, with two telescopes operating simultaneously, the image totals were often several hundred and sometimes more than 1000 per night. Why so many? All supernova hunters are familiar with the simple equation: more images= more discoveries. Stu averaged more than two discoveries per month in 2013 and 2014 - both bountiful years! 2015 was the milestone year – he finally reached his discovery goal of 100!

Most supernovae are triggered by one of two basic mechanisms. The first mechanism is the gravitational collapse of a massive star's core and subsequent explosion of the star which is termed a core collapse supernova. The other mechanism involves the detonation of a white dwarf star in a binary system. When the dwarf reaches critical mass after taking material from a companion, it sets off a thermal nuclear runaway– a type la explosion. Obviously, there is not enough space in this article to detail all of Stu Parker's discoveries, so I will spotlight two that are particularly notable – one of each supernova type.

On February 2, 2013, Stu discovered a very luminous type la supernova in galaxy NGC 5643. This supernova was named SN2013aa. It was, in fact, the brightest supernova discovered in 2013, and one of brightest spotted in the past two decades. Why so bright? With some exceptions, type la supernovae are more luminous than the core-collapse supernovae. In addition, the host galaxy, NGC 5643 is relatively close to us at 50 million light years. Interestingly enough, SN2013aa was almost as luminous as SN2011fe, a type la supernova discovered in galaxy M101 two years earlier. M101 is less than half the distance to NGC 5643. So, how then was this possible if all type la supernovae are supposed to have similar intrinsic luminosities? The answer lies in where SN2011fe was sitting in M101; obscuring dust and gas has blocked some of its light. On the other hand, SN2013aa was spotted in an open area of NGC 5643 where there is minimal light attenuation.

While blink comparing images taken on the night of July 24, 2013, Stu noticed a new object in spiral galaxy NGC 6984. Before allowing himself to get too excited, he began the normal protocol of checks that are made when something new is found. Step one is to see if this is an already discovered supernova. He went to Dave Bishop's Supernova site on the web and sure enough, a supernova had been discovered a year earlier in the same galaxy, and in the same spot – it was supernova SN2012im. Stu consequently dismissed his candidate as being new, and continued blinking the rest of his images. Later that day, he thought again about the object he found in NGC 6984 and some questions popped up in his mind. Would a supernova discovered in a galaxy 200 million light years away, still be visible a year later? Could he have made a mistake calculating the position coordinates of his new candidate? Stu did the math again and both SN2012im and the new object were within a fraction of an arc second from each other.

Over the years Stu has collaborated with several professional astronomers. Some of whom have written scientific papers based upon the dairy farmer's discoveries. One of the astronomers is Dan Milisavljevic, an expert on supernova matters who is associated with the Harvard-Smithsonian Center for Astrophysics. Upon receiving an email from Stu explaining the "double-take" discovery in NGC 6984, Milisavljevic sprang into action. Less than an hour after Stu's contact, the South African Large Telescope (SALT) was pointing at the new transient in NGC 6984 and getting its spectrum. It was classified as a stripped core-collapse supernova of the type lb/c and later

designated SN2013ek. This was actually a new discovery rather than the remnants of SN2012im which was also a stripped core-collapse supernova. Milisavljevic contacted several of his colleagues who arranged follow-up observations with the SWIFT Space Telescope and numerous land-based telescopes. Were the two explosions, SN2012im and SN2013ek related or did they appear to be close to one another because both were, by chance, along the same line of sight? Milisavljevic believed Stu's rare discovery warranted a closer look with a telescope that could produce extremely sharp images – the Hubble. After two Hubble Space Telescope visits spaced a year apart, the data suggest that both supernovae are related and have originated from the same source. How can this be? Milisavljevic will publish his findings in a paper that is scheduled to be released soon.

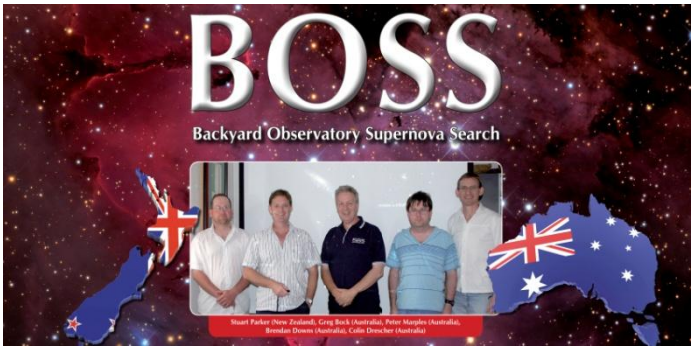
In October, 2013, Stu visited me at my home in the United States. After so many emails and telephone calls it was a pleasure to meet this friendly young man in person. We had much to talk about! In the course of one of our conversations, I had asked him when he thought he would stop looking for exploding stars. How many is enough? At the time he had around 50 discoveries. He told me that his goal was 100 discoveries – then he would retire. Seemed reasonable to me - 100 is a nice round number and with all the hard work involved and the increased competition, why continue looking? Could he stop at 100? Well, after reaching his milestone, he's slowing down a little but the last time I checked, Stu had 115 supernova discoveries to his name!

Link to the BOSS group website: http://www.bosssupernova.com

Images:
1. Stu Parker with 35 cm Celestron Schmidt Cassegrain Telescope on a Paramount Robotic Mount.
2. Stu and Lynn on the farm with a Holstein dairy cow.
3. The BOSS Supernova Search Team.
4. Stu's first discovery – SN2009gj in NGC 134, a type IIb supernova
5. Bright type la supernova SN2013aa in NGC 5643.
6. Hubble Space Telescope image of SN2013ek in NGC 6984, a stripped core-collapse supernova.

Number 1

Number 2



Number 3

Number 4

Number 5

Number 6

STU PARKER - UN VÂNĂTOR NEOZEELADEZ DE SUPERNOVE

Stu Parker, astronom amator şi fermier la o fermă de lapte din Noua Zeelandă, este cel mai cunoscut "vânător" de supernove.

Înainte de începerea mulsului de dimineaţă şi muncile casnice, Stu se asigură dacă nu s-a întrerupt curentul în camerele CCD şi monturile robotice şi dacă imaginile au fost descărcate în computerul din casă. După micul dejun, el va începe corvoada verficării imaginilor din noaptea precedentă, o rutină pe care a mai făcut-o de câteva sute de ori mai înainte. Stu va identifica un nou tip de supernovă în galaxia spirală ESO 509-G108. Este 12 februarie 2015 şi se va dovedi a fi pentru Stu descoperirea supernovei cu numărul 100!

Supernovele sunt obiecte foarte luminoase. Un telescop de mărime medie cu o cameră CCD poate uşor detecta una care este la o depărtare de 500 milioane de ani lumină. Supernovele sunt, totuşi, foarte rare. În medie, o galaxie spirală va produce cam una la un secol.

Interesul lui Stu pentru ştiinţă şi astronomie a urmat un traseu care l-a condus spre a deveni un serios astronom amator. Imediat după mutarea la Oxford, la începutul anului 2000, Stu şi-a continuat noua pasiune, datorită căreia a observat de multe ori cu noul său telescop Meade de 30 cm supernove deja descoperite. Cu trecerea timpului, observarea acestor supernove i-a susţinut hotărârea că într-o zi ar putea descoperi propria sa stea explozivă.

Târziu, în anul 2008, Stu Parker împreună cu prietenul său australian Peter Marples au format un mic grup de amatori care căutau supernove, BOSS (Observatorul de căutare a supernovelor din spatele casei). Fiecare membru al echipei BOSS posedă un telescop şi caută în mod independent supernove. Când se făceau descoperiri, membrii echipei se ajutau reciproc în procesul de confirmare. O primă descoperire a unui vânător de supernove este întotdeauna foarte specială şi de neuitat şi aceasta a fost în mod special adevărat şi pentru Stu. A descoperit o supernovă în galaxia NGC 134, denumită mai târziu SN2009gj. Anul 2009 a fost cât se poate de productiv pentru Stu, cu încă şase descoperiri până în decembrie. În următorii ani, Stu a ajuns la o medie de mai mult de două supernove pe lună. În anul 2015 a fost proba de hotar - el a atins în sfârşit ţinta descoperirii sale - 100!

În octombrie 2013, Stu m-a vizitat acasă la mine în Statele Unite. A fost o plăcere să întâlnesc acest om prietenos, în persoană. Am avut atâtea să ne spunem! În timpul uneia dintre convorbiri, l-am întrebat când va înceta să caute stele explozive. Câte ar fi de ajuns? La acel moment el avea în jur de 50 de descoperiri. Mi-a spus că ţinta sa era de 100 de descoperiri, apoi se va retrage. Mi se părea rezonabil, 100 este o cifră rotundă frumoasă şi, cu toată munca grea implicată şi competiţia în creştere, de ce ar mai fi continuat să caute? Ei bine, după ce a atins punctul culminant, a încetinit ritmul un pic, dar ultima dată când am verificat Stu avea 115 supernove descoperite în numele său!