The Big Eye

The Newsletter of the Friends of Palomar Observatory September 2011

We celebrate two Birthdays this month at Palomar Observatory
by Dan McKenna

Happy birthday 11kly !

On the 24th of August the Samuel Oschin 48 inch Schmidt telescope at Palomar Observatory spotted an object in M101, the Pinwheel Galaxy. I received an email entitled 11kly on 08/24 at 12:51 pm entitled; **M101 has given birth to 11kly**. The body of the text was simple and exciting **Check it out, alert the troops!!!** One never knows what we will find. The original name of this object is PTF11kly as it was found by the Palomar Transient Factory (PTF) and is also now known by the astronomical community as SN2011fe.

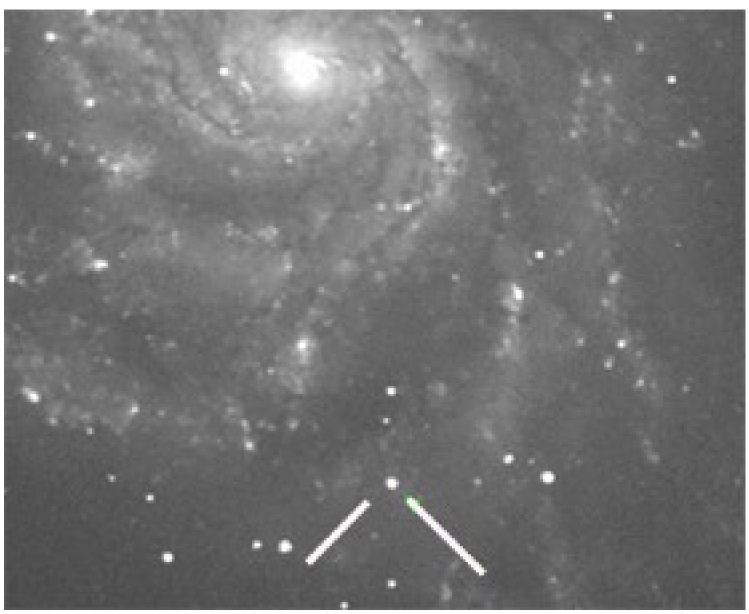


Image taken with the Samuel Oschin Telescope
11KLY is at intersection of the white lines

Since the discovery, a flurry of activity around the world has resulted. At the time of this writing the Palomar Transient Factory has discovered 1276 supernova since the first detection on 11 March 2009. The stunning success of our program using the robotic 48 inch Samuel Oschin and 60 inch telescopes is due in part to the “pipe line” or series of computer programs that control, schedule and analyze the telescope data stream.

The exciting part is that not only did the PTF perform its robotic mission, but it delivered the news quick enough so that we can observe the unfolding story earlier, and with more instruments, than any other previously observed Type 1A supernova. Some members of the PTF team feel that they know the time that the supernova detonated to about 3 minutes and our first image was 13 hours after the initial explosion.

Of the 1,276 Supernovae discovered, 865 of them are type 1A, the object that 11kly is most likely to be. Even though I call this a "Birthday" due to its early discovery, it is actually the result of a stellar system in its later stages of life. The story of stellar evolution is a fascinating combination of detective work and the resulting way to understand how hydrogen becomes every element known. Yes, our building blocks of life as we know it are forged from the simplest element, hydrogen. I suggest that if you have not yet taken the journey, you start as soon as possible by looking up information available on the ever expanding web. Search for topics like *stellar evolution*, *Nucleosynthesis* , *1A supernova*, or just *nova.*

Nova, short for Latin Stella nova, means "new star". A really bright nova is called a supernova and for a brief time, outshines all the other stars in its galaxy.
A famous supernova discovered by astronomer Tycho Brahe in 1572 could be seen in daylight at its peak and visible to the naked eye for about 16 months before it faded out. A really neat x ray energy picture of this object is at www.physorg.com/news/2011-04-tycho-supernova-remnant-evidence-supernovas.html

Besides the spectacular cosmic display of fireworks, the type 1A supernova reveals many secrets to those who can decipher its coded energy. Because they are bright enough to be viewed in distant galaxies, they have been used to determine the distance to the host galaxy and are often referred to as a "standard candle". Encoded in its energy is the signature of the deep physics within. We are made of stardust. The elements composing our planet and ourselves are believed to have been formed for the most part by the type 1A super nova such as was observed by PTF this last month.

The success of PTF is being noted by the teams deploying and building newer generation of telescopes like the Large Synoptic Survey Telescope or LSST. As a telescope becomes larger its light gathering power grows with the square of the diameter. For example the 200 inch telescope collects over 17 times the amount of light that the 48 inch Samuel Ochin Telescope used by the PTF for the discovery of 11kly does. This means the light gathered by the 48 inch Samuel Ochin Telescope in its 2 minute exposure would take only 7 seconds for the 200 inch. So the newer telescopes like LSST with its 8.4 meter mirror will find more objects than PTF in a given night, weather permitting. Such larger survey telescopes will also produce more data than other projects.

The PTF offers a glimpse of what it is like to deal with a large volume of image data efficiently and in almost real time. PTF is providing the necessary experience so that larger projects can start thinking about our lessons learned, and in doing so, is better prepared for even larger challenges.

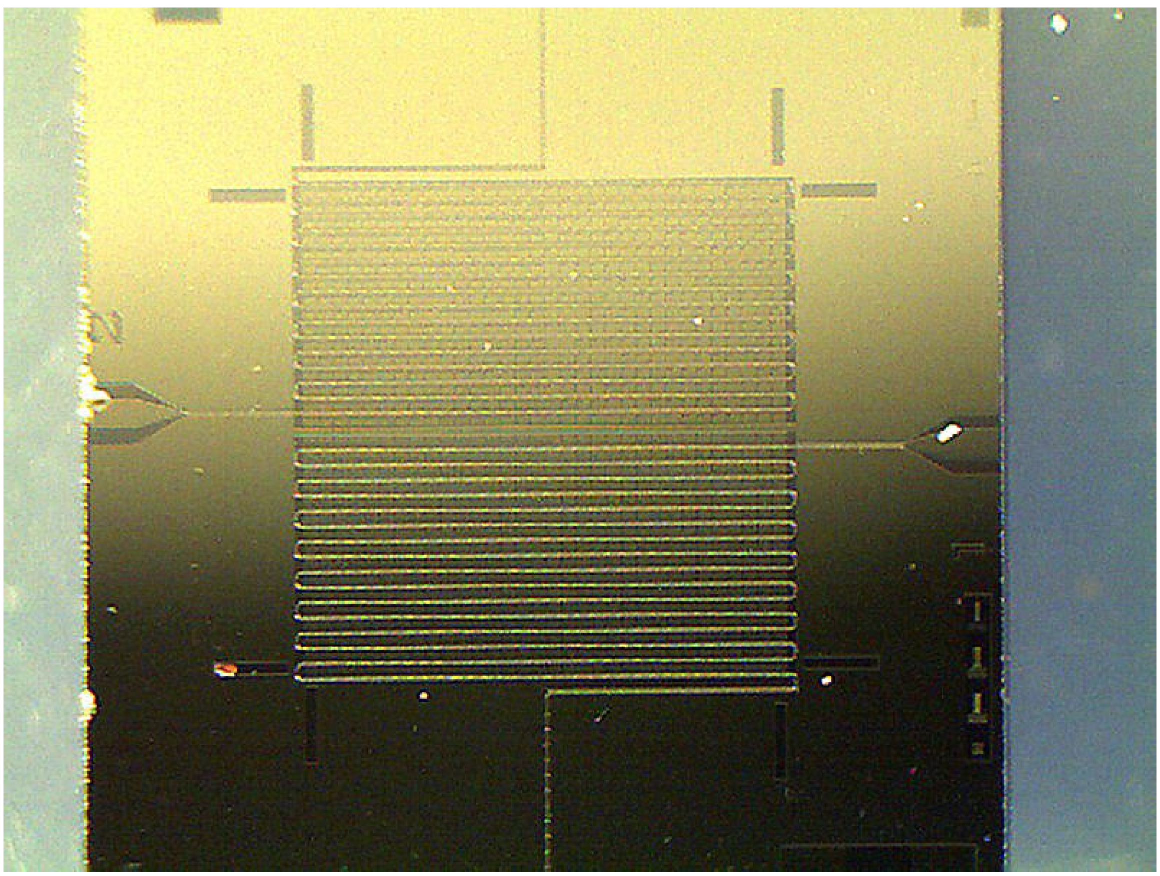
You can get to the PTF website from www.astro.caltech.edu/ptf/ to find out more about our team and the PTF program.

UPDATE

I just recently learned that the evolving spectra from 11kly lacks hydrogen typically associated with a late type star as the source of mass transfer to the white dwarf. This ***may*** be evidence that 11kly is a result of two white dwarfs coalescing!!

Happy Birthday or first light night ARCONS

ARCONS stands for, get ready, **AR**ray **C**amera for **O**ptical to **N**ear-IR **S**pectrophotometry. It is described by the principle investigator Ben Mazin of UC Santa Barbara as, a "unique, highly multiplexed low temperature detector technology known as Microwave Kinetic Inductance Detectors (MKIDs). If that is not enough to spin your head then try to get behind the concept that it operates at a temperature of 0.128 degrees above absolute zero in a magnetic field produced by a superconducting magnet. How about that!



Microphotograph of ARCONS chip

What are MKIDs and how do they work? Thanks for asking. Light as you know can be described as particles called photons. A blue photon has more energy than a red one.

Imagine a tuning fork and hit it with a hammer, lightly as not to break it. It will ring at a fixed frequency. Now if you bounce a rubber ball off of it some energy will be transferred by the ball if you hit the fork right and even though the frequency will be the same the amplitude will change and if you were following the motion of the forks you will be able to see it change as well. Now make the tuning fork in to a one sided fork and make it small enough so that a photon can change the energy of the fork tine. Some people call these quantum dot resonators and they can be made in different lengths to be at different frequencies. Hold on, we are almost there. Make a bunch of them and in the case of ACRONS, they are in an array of 32 by 32 forming an array of 3.2 millimeters square. Each of the 1024 resonators are of a different size and thus at a different pitch so we can relate frequency of the ringing to the position in the array. Now all we need to do is cool this to about 0.1 degrees above absolute zero and apply a “comb” of frequencies to make the array sing. A software defined radio, that is, a radio receiver programmed by software listens to the ringing of the 1024 resonators or “pixels”. (A “pixel” is short for pixel element). This ringing signal is then processed to track each pixel and report when and by how much energy was detected. This technique is a way to count photons and measure their color one at a time. It really works; I saw it, touched it and, have one of the chips on my desk.

To put this in prospective, a color digital camera uses three to four pixels each with a different color filter to combine the information and measure the color for the region of the picture. It takes hundreds of photons (light particles) to make a good estimate of color. With ARCONS we can measure a color with one photon!

What makes this exciting is that this is the first time we have been able to do this on a telescope and in doing so open up another window to the universe. The first peek through this window was from Palomar Observatory! Congratulations to Ben and his team with a little help from his friends on Palomar.