Dark Energy Survey set to seek out supernovae

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View of Blanco Telescope (centre) at night. Credit: Fermilab Visual Media Services

(Phys.org) —The largest ever search for supernovae – exploding stars up to 10 billion times brighter than the Sun – is beginning this August. For the next five years, the Dark Energy Survey (DES) will look for these cosmic explosions, which can be used to measure precisely the growth of the universe over time. The aim of the survey is to improve understanding of Dark Energy, the mysterious force causing the

expansion of the universe to accelerate. A status update on the project and candidate supernovae found during the commissioning phase will be presented by Dr Chris D'Andrea at the National Astronomy Meeting in St Andrews on Tuesday, 2 July.

DES is operated by an international collaboration of researchers from 25 institutions and consortia, including six universities in the UK. It will use a massive new 570 Megapixel camera (DECam) installed on the four-meter diameter Blanco telescope, high in the mountains of Chile. The instrument was commissioned in September and October 2012, and this was followed by a period of science verification from November through February 2013.

"Thanks to the extreme sensitivity of the camera and to the large area of sky that can be imaged through the telescope at once (about 15 times the size of the full moon), we expect DES to find more supernovae than any previous experiment. During the verification phase, we have already identified at least 200 good candidates," said Dr D'Andrea, a researcher at the University of Portsmouth's Institute of Cosmology and Gravitation.

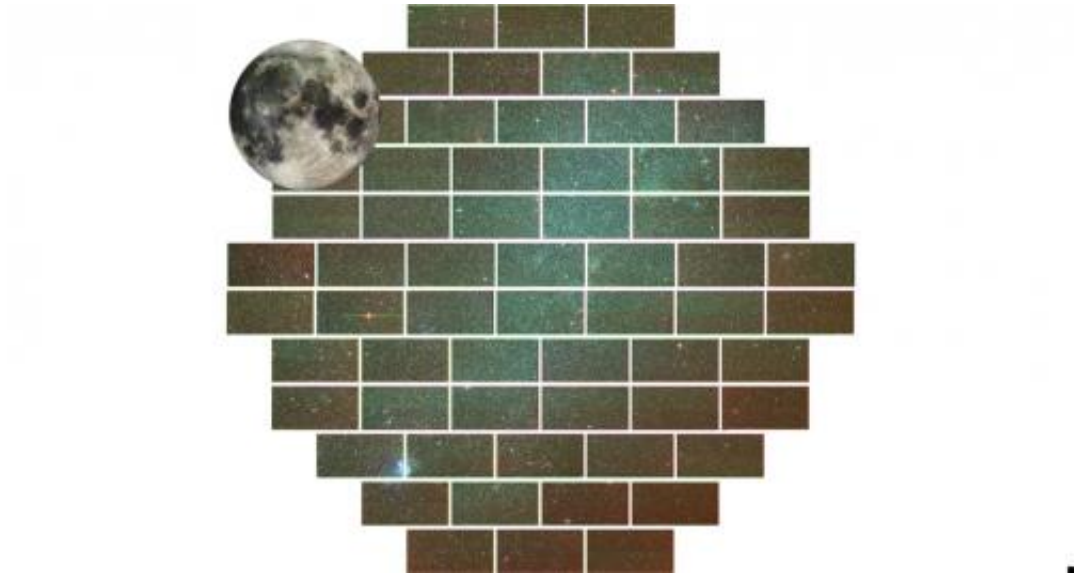
More than just numerous, these supernovae are very old, with the light from the most distant having travelled towards Earth for over 8 billion years. Of particular interest are Type Ia supernovae, which all have nearly the same luminosity when they reach their brightest phase. By comparing the brightness of Type Ia supernovae, scientists in DES will be able to determine accurately the distance to the supernovae and measure how the universe has expanded over time. This method was used in the Nobel Prize-winning research that led to the discovery of the accelerated expansion of the universe 15 years ago. While those researchers used a few dozen supernovae in their study, DES will find over 3500 of these objects. This glut of data poses a challenge for the team to analyse.

Aerial view of Cerro-Tololo Inter-American Observatory, with the most prominent dome belonging to the 4m diameter Blanco telescope, where the Dark Energy Camera is installed and from where DES operates. Credit: NOAO/AURA/NSF

"Traditionally, astronomers have identified supernovae by analysing the spectrum of light from candidates. Because DES will give us so many candidates – we already have hundreds just from the commissioning phase – we don't have the resources to do this for each individual candidate supernova. We need to use other techniques to confirm which of the objects we observe really are exploding stars," said D'Andrea

An alternative method for identifying supernovae is to monitor changes in the brightness and colour of their light over time. However, the

scientists also need to know how much the universe has expanded since the star exploded. This information can be gathered by analysing the spectra of light from galaxies in which supernovae have occurred – unlike a supernova, a galaxy does not quickly fade away.



False-colour image of the Small Magellenic Cloud, Moon overplotted to scale. Credit: Dark Energy Survey Collaboration

"DES is a long-term survey – we may not know whether some of our candidates are 'real' supernovae until the end of the project. However, in collaboration with Australian researchers, our team has recently been awarded 100 nights of time on a telescope in Australia over the next five years. The Anglo-Australian Telescope has the ability to take spectra of nearly 400 galaxies at the same time. With the first of these nights scheduled for September, it won't be that long before we can start to accurately classify the supernovae candidates discovered in DES," said Dr D'Andrea.

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