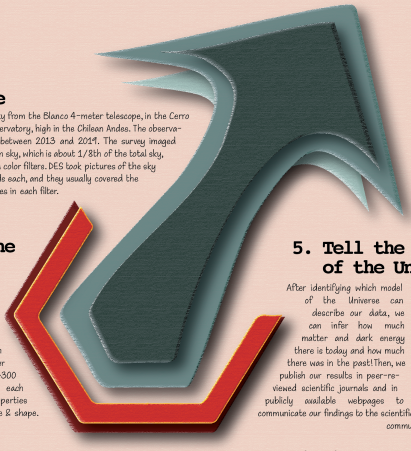


1. Observe

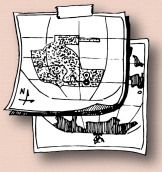
DES observed the night sky from the Blanco 4-meter telescope, in the Cerro Tololo Inter-American Observatory, high in the Chilean Andes. The observations lasted 758 nights between 2013 and 2019. The survey imaged 5000 Deg² of the southern sky, which is about 1/8th of the total sky, in five optical broad-band color filters. DES took pictures of the sky that lasted for 90 seconds each, and they usually covered the same spot around 10 times in each filter.





2. Detect the galaxies

DECam is the Dark Energy Camera, and is the primary workhorse of DES. It has 570 Megapixels and it can detect more than 150000 galaxies in a single shot! A single raw DECam exposure is ~0.5 GB after compressing and DES collects ~300 science exposures per night. For each detected galaxy, we measure as many properties as we can, such as its position, color, distance & shape.



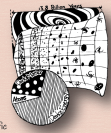
3. Make a map of the Universe

After the galaxies have been detected and characterized, we can make maps of the Universe. If we have also been able to measure the distance to the galaxies (not an easy task!) we can even learn how these maps change as the Universe grows older. Remember: When we look further into space, we are also looking back earlier in time. A huge amount of information is contained in these maps, including how much matter and dark energy there is in the Universe today and how they evolved in time.



4. Statistics and interpretation

To extract and interpret the information contained in the maps of the Universe, we compute several statistical properties of the galaxy maps, such as two-point correlation functions, which measure how clustered galaxies are. These statistical tools allow us to compress the information and compare these synthesized measurements with different models of the Universe. We use Bayesian statistics to obtain the values and uncertainties of the parameters of our model.



5. Tell the (hi)story of the Universe

After identifying which model of the Universe can describe our data, we can infer how much matter and dark energy there is today and how much there was in the past! Then, we publish our results in peer-reviewed scientific journals and in publicly available webpages to communicate our findings to the scientific community.

What do cosmologists in the Dark Energy Survey do?

The Dark Energy Survey (DES) is an international, collaborative effort to map hundreds of millions of galaxies, detect thousands of supernovae and find patterns of cosmic structure that will shed light on the nature of dark energy, a new hypothetical form of energy introduced in the 1990s to explain the accelerating expansion of the Universe.

International Collaboration

More than 400 scientists from over 25 institutions from 7 different countries are part of the DES collaboration, including USA, Brazil, Australia, Spain, UK, Germany and Switzerland.



DES Sky Observing Area

The DES observing area has a weird shape (see below in red). This avoids contamination from the Milky Way and its satellites and maximizes overlap with other surveys. The full oval represents all the sky.



Large Field of View

The collaboration has built an extremely sensitive 570-Megapixel digital camera, DECam, covering 3 deg² of the sky with each exposure, ~8 times larger than the size of the moon on the sky!

